UAM | IfiMAC Condensed Matter Physics Center | EXCELENCIA MARÍA DE MAEZTU

IFIMAC

# CONDENSED MATTER PHYSICS CENTER

# ACTIVITY REPORT | 2021


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# 1. OUR CENTER

## 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. 2021 has been a year of change. The research and hiring plans associated with our second award, at the end of 2019, as a "Maria de Maeztu" (MdM) research unit of excellence, were severely affected by the COVID-19 pandemic. In 2021, these plans have been fully implemented, we have managed to recover in-person interactions with a hybrid format for many of our seminars and outreach activities, and held the election of a new Director in October. It has been also a year of celebration, with different awards for several young and senior IFIMAC researchers, including the Blas Cabrera National Award 2021 to our founding director, Prof. Francisco Jose García Vidal.

Under the leadership of Prof. García Vidal and his team, IFIMAC has become a Spanish center of reference in Condensed Matter Physics, 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. IFIMAC membership is awarded to individual researchers, based on the scientific excellence achieved at the different levels of the academic career. IFIMAC had 80 members in 2021, including 65 permanent research and teaching staff from our host institution, the Universidad Autónoma de Madrid (UAM), and 15 young researchers associated with different programs of international talent attraction. These young researchers are supported by national (8 Ramon y Cajal contracts), regional (2 Atracción de Talento Comunidad de Madrid modalidad 1 fellows) and private (3 Junior Leader La Caixa grants) programs, as well as by our own MdM funds (2 young international research leaders). We are particularly proud of this action, 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 have secured Ramón y Cajal contracts, and two of them have been awarded ERC starting grants. Apart from its members, IFIMAC hosted in 2021 the research activity and training of 26 post-doctoral researchers (almost 60% of them, non-spaniards), and 117 PhD students. They contribute significantly to the achievement of the IFIMAC's mission.

Our research production has increased again in 2021, with the publication of 197 articles --85,8% (67.0%) in Q1, 71,6% (32.0%) in D1 according to Scopus (WoS)-- and the application for three patents. This activity is mainly supported by 93 active projects (12% EU) developed by IFIMAC researchers, representing a total budget of 6.9 million € in 2021 (18.4 % 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 high school and university students 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 are strongly focused on reducing the underrepresentation of women in STEM fields, particularly acute in the case of Condensed Matter Physics.

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. In order to sustain the international excellence of our research and to attract more young talent, we have to grow as institution. This requires work along different directions, to strengthen the administrative and technical support to both our experimental and theoretical activities, to meet the urgent needs of office and lab space, and to complement our current research infrastructure with shared experimental and computational facilities. Securing funding for these efforts is not an easy task, particularly in these dire economic times, and when a war at the doorsteps of the European Union carries risks for a world that has not yet recovered from the pandemic shock. Nevertheless, I am confident in the competitiveness of IFIMAC, of its individual researchers and of the institution as a whole, in our ability to secure funding and to transfer the basic knowledge that we have accumulated through collaborations with industry. These goals are intrinsically linked with the need to improve the gender balance, to promote and sustain open science, and to increase our outreach and transfer to society.

As the new Director, I am really honored to face, together with the Steering Committee and all of the IFIMAC researchers, the challenging and exciting times ahead.

**Ruben Perez**

*IFIMAC Director*

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## OVERVIEW

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

The Condensed Matter Physcis 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 five researchers constitute its permanent staff with fifteen young resarchers (RyC, talent grant, Junior leader, IFIMAC positions) and up to one hundred and fourty postdoctoral researchers and Ph.D students.

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

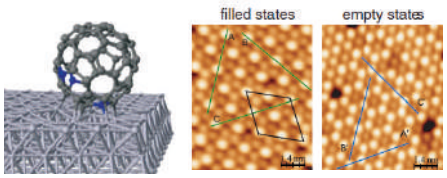
- Advanced Materials
- First Principles Simulations and Modeling
- Nanophysics
- Nano and Quantum Optics
- Soft Condensed Matter and Biophysics

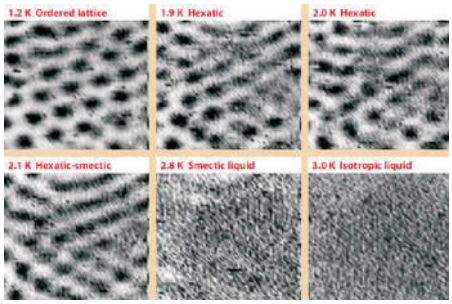
## RESEARCH LINES

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

### Advanced materials

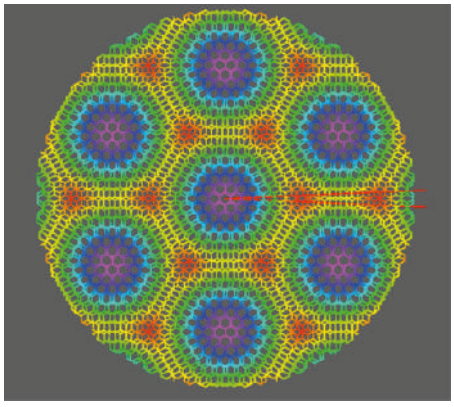
Advanced materials are responsible in a large part for the continuous transformation of our daily life technology. New graphene based materials with improved strength and fatigue resistance open possibilities for transport industry, organic molecular devices allow optical applications for communications, 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 temperatures down to 7 mK and magnetic fields up to 13 T. 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.



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.

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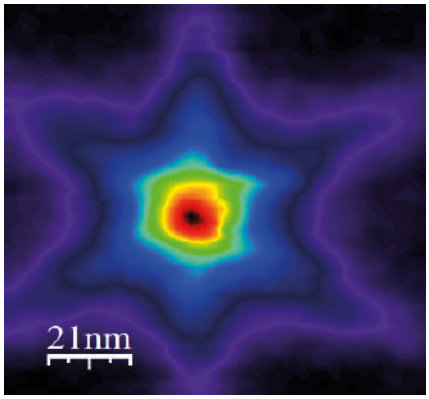
A very important topic is also the study of interfaces of organic semiconductors and the atomic, electronic and dynamical properties of semiconductors.

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.

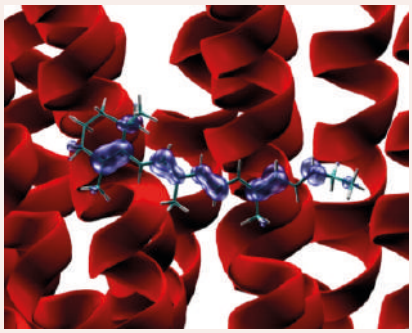



## First Principles Simulations and Modeling

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.

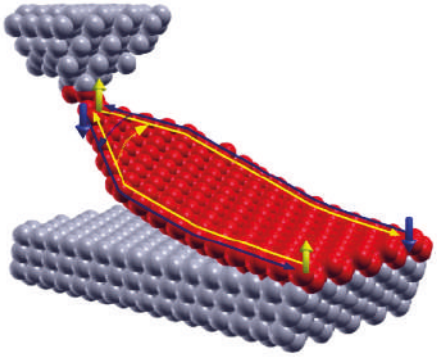


**This is a list of codes and computational techniques being developed and implemented:**

- 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.



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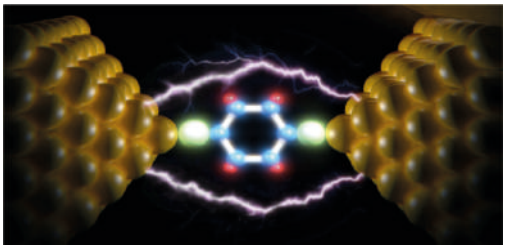
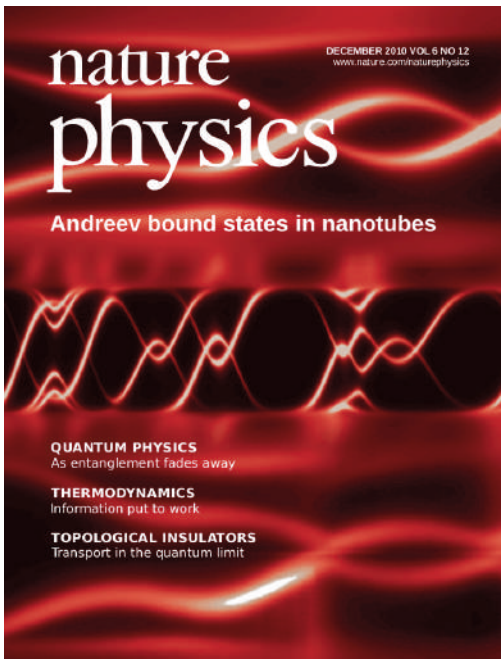
## Nanophysics

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 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.


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 is 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.

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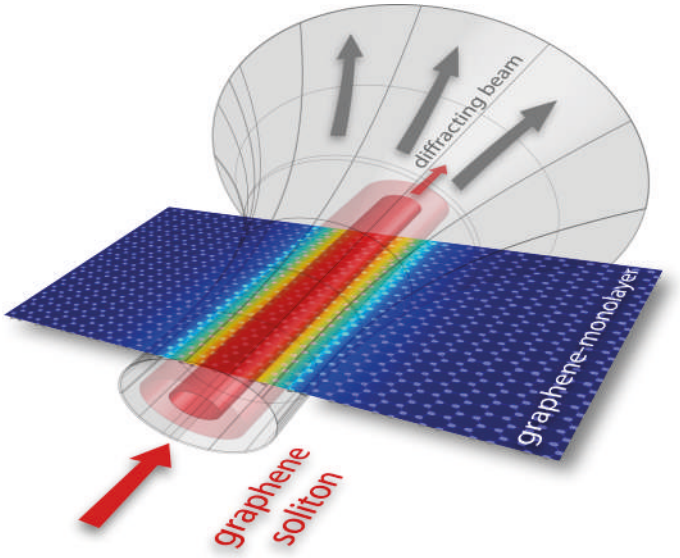
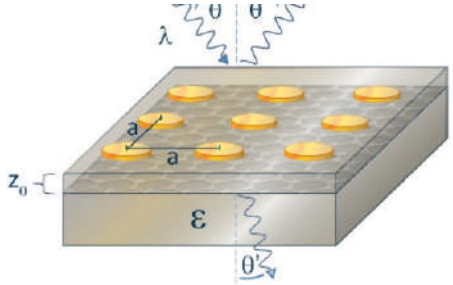
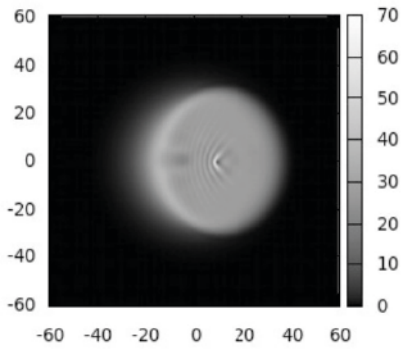
Another very active subject in IFIMAC is the analysis of non-conservative optical forces on small particles. From the study of basic fundamental aspects to different applications to the manipulation of nanoparticles by optical tweezers and also pushing and pulling nanoparticles by radiation pressure 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.

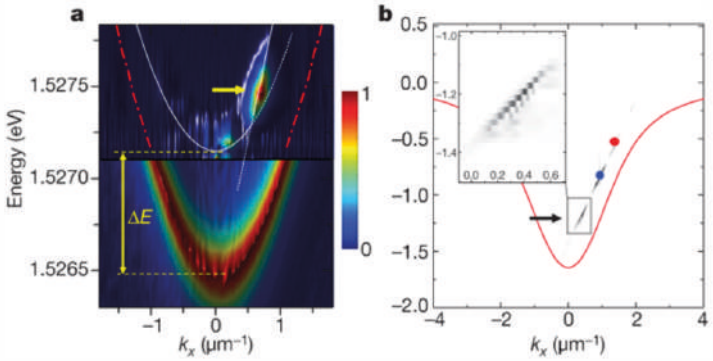
On the other hand, theorists at IFIMAC have produced seminal contributions to the understanding of light emission and absorption spectra in low-dimensional semiconductor structures. We have worked in the quantum optics produced by interacting bosonic complexes describing cavity polaritons and contributed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



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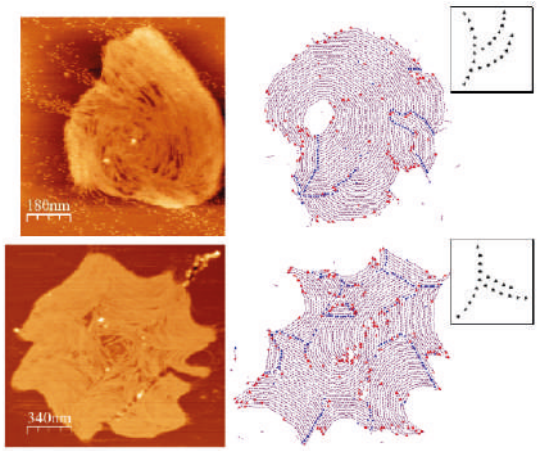
## Soft Matter and Biophysics

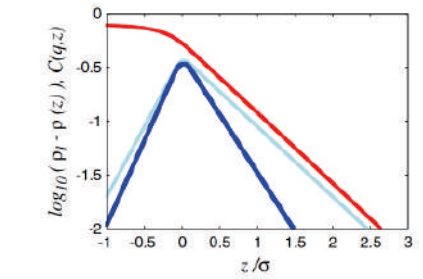
Soft condensed matter includes liquids, colloids, polymers, liquid crystals, gels, membranes, foams, etc. Each of these dense phases appears as the result of a finely tuned balance between the thermal fluctuations and the molecular attractions. The qualitatively different aspects and properties of soft 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.

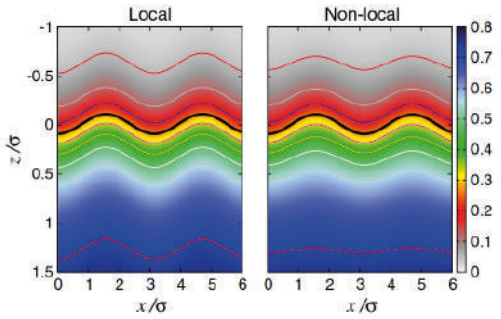
The amazing complexity of biological systems is built on that variety of soft condensed matter mesoscale structures, and it sets the most outstanding challenge in our goal to understand the spontaneous self-assembly of matter. The connection between soft condensed matter physics and the study of biological 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.

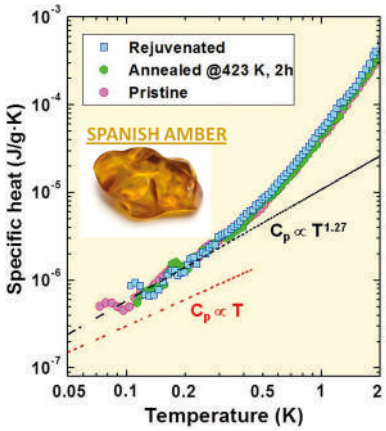
Soft condensed matter and biophysics are very active areas of activity at IFIMAC. The theory and simulations of liquids and their interfaces has already a long tradition among some of the members of the institute, with the younger researchers bringing new ideas and perspectives to cover more complex 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.



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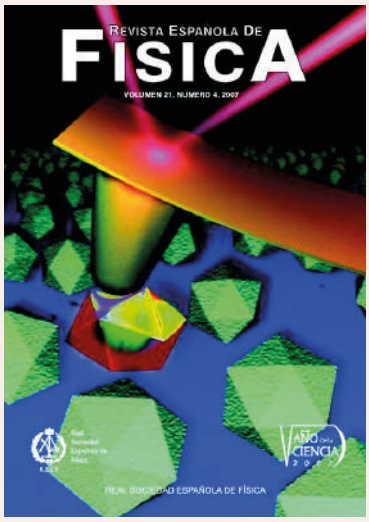
### Physical Virology

The basic architecture of a virus consists of the capsid, a shell made up of repeating protein subunits, packing within the viral genome. Far or 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 endorsed 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.

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## 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 I. Fernández-Domínguez**

**Member**

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

**Cristina Gómez-Navarro González**

**Member**

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

**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.

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## Scientific Advisory Board

**Prof. Paul C. Canfield**
Researcher at Ames Laboratory (USA).

**Prof. Daan Frenkel**
Professor at University of Cambridge (United Kingdom).

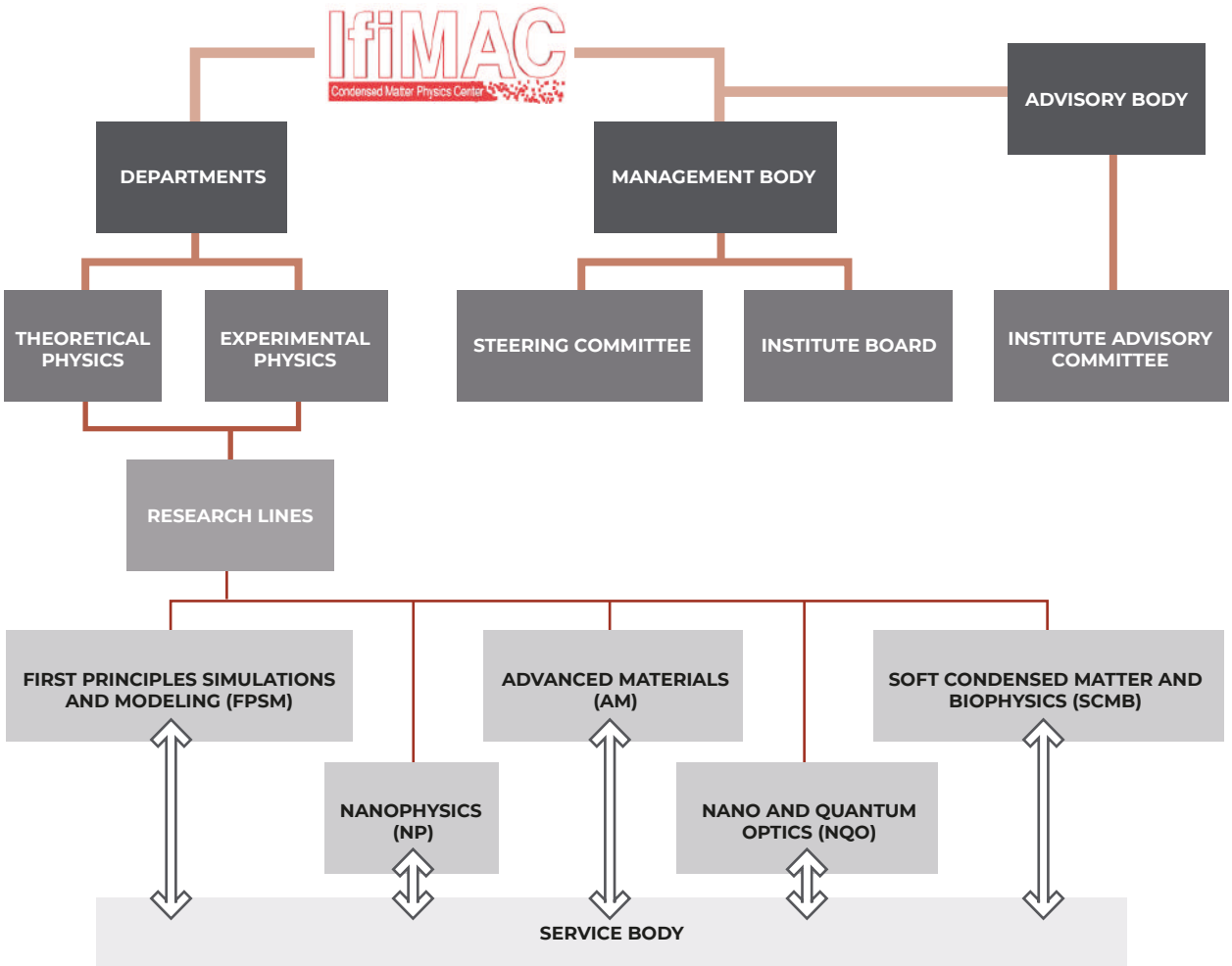
**Prof. Emilio Artacho**
Research Professor at Ikerbasque at CIC Nanogune (Spain).

**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



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## GENDER EQUALITY COMMITTEE

On April 2021 we created the **Gender Equality Committee at IFIMAC**. The main task of this Committee is to generate a good practices and specific activities targeted at promoting and 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.

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 these months 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.

**Stablishing the first edition of a mentoring program for female students**. one of the first initiatives of this committee will be to set up a mentoring program for undergraduate female physics students. This program aims at-offering a close and friendly contact with research activities. In addition, it will:

- promote the scientific career of women students of the graduate and master's degree,
- provide female role models,
- empower mentors,
- build a strong network between women in the academic field of physics

The first edition of this program is currently being setting-up to start in September 2022.

**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

**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 seminars

# 2. IFIMAC AT A GLANCE AND KEY INDICATORS

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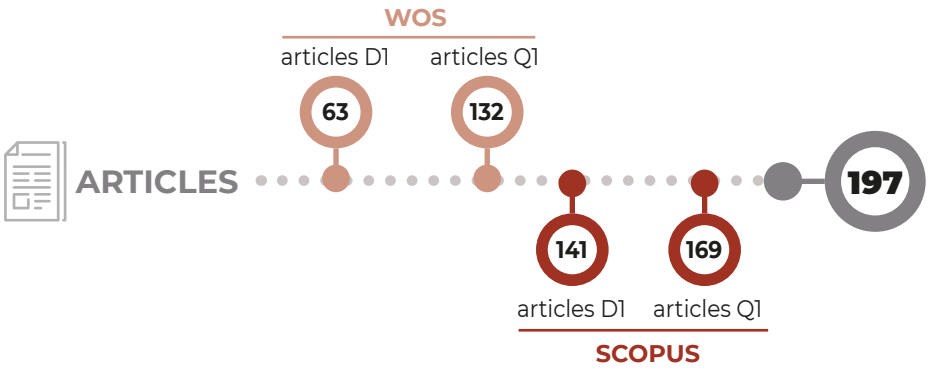
# 2. IFIMAC AT A GLANCE (2021)




**PROJECTS** 93

- **12** International projects
- **59** national projects
- **18** regional project

**RESEARCHERS** 80

- **19** full Professor
- **20** Professor
- **20** Associate Profesor
- **2** Assistant Professor
- **15** Young researcher (RyC, Talent Grant, Junior Leader)
- **4** emeritus Professor

| | |
|---|---|
| PHD STUDENTS | 117 |
| POST DOC RESEARCHERS | 26 |
| DOCTORAL THESES DEFENDED IN 2021 | 14 |

## INDICATORS

### Publications


SCOPUS

**Q1 (169)**
**%Q1 85,79%**
**D1 (141)**
**%D1 71,57%**


WOS

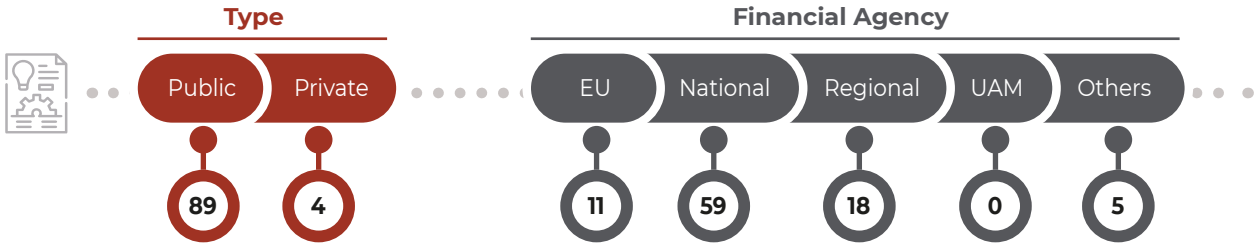
**Q1 (132)**
**%Q1 67,01%**
**D1 (63)**
**%D1 31,98%**

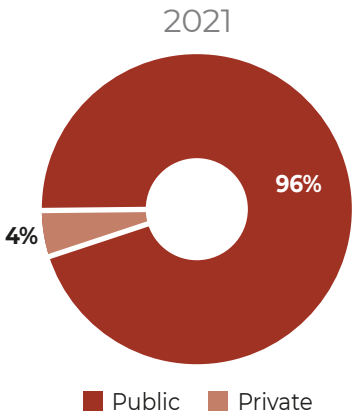
AVERAGE IF: 9.23

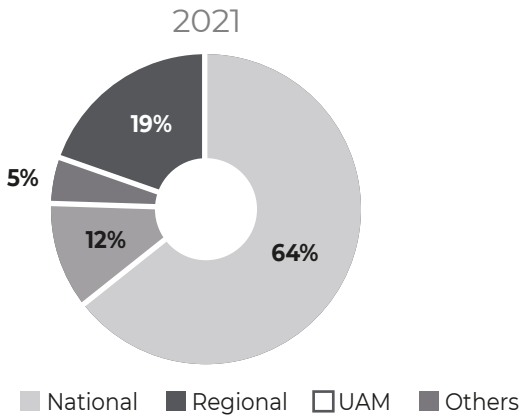
# 2. IFIMAC AT A GLANCE (2021)

## Projects

**93 PROJECTS** YEAR 2021 - ACTIVE PROJECTS

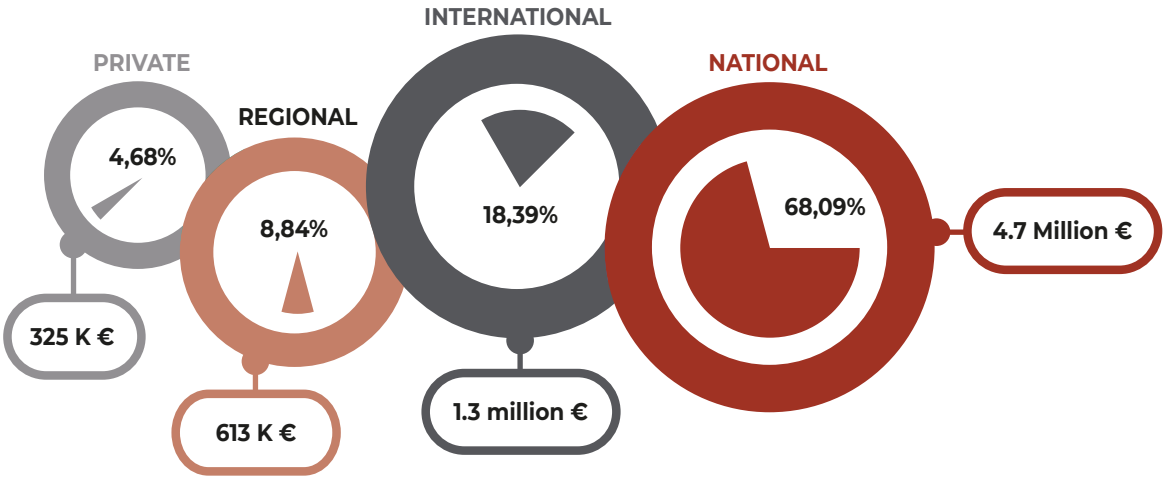


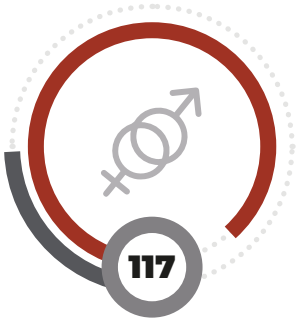

## Funding

**6.9 Million €** TOTAL FUNDING



# 2. IFIMAC AT A GLANCE (2021)

## Human resources




**PREDOC**
GENDER

**Male (93)**

**Female (24)**


**PREDOC**
NATIONALITY

**SP (99)**

**Non-SP (17)**

## Doctoral thesis defended

**14** ▷ **THESIS DEFENDED** YEAR 2021

## Invited lectures

**41** ▷ **INVITED LECTURES** YEAR 2021

IfiMAC
Condensed Matter Physics Center

# 3. RESEARCH

IfiMAC
Condensed Matter Physics Center

# 3. RESEARCH

## MAIN RESEARCH ACTIVITIES

### IFIMAC COLABORATIVE PROJECTS

As a part of our strategic program (2019-2023) within the Maria de Maeztu Excellence Accreditation, IFIMAC have 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 were:

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

Isabel Guillamón / Hermann Suderow

Miguel Ángel Ramos

Roberto Otero

Juan José Palacios

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

Juan. L. Aragonés

Laura. R. Arriaga

Salvatore Assenza

José. V. Alvarez

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 Martin Rodero

Miguel Angel Ramos Ruiz

Jose Gabriel Rodrigo Rodriguez

Isabel Guillamón Gómez

***SECOND CALL:***

**Single-photon generation in 2D crystalsfor 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

# 3. RESEARCH

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 has been able to offer three new four-years contracts plus an additional money to develop their research group to these three researchers:

### Saül Vélez:

**Saül Vélez** pursed 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.

### Akashdeep Kamra:

**Akash** 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.

### Pablo Ares:

**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.

# 3. RESEARCH

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 Sklodowska-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.

In a previos call in the frame of the first Maria de Maeztu unit of excellence areditation, IFIMAC atracctec other thre top young resarchers:

**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 FEIS**T: The theoretical research that he conduct 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

## SEMINARS

After the summer of 2020, and in the middle of the COVID pandemic, we realized that we needed to re-launch our program of research seminars, which had functioned continuously, and with great success, since the birth of the institute. We also saw clearly that the seminar format had to be accommodated to the social situation. Thus, together with our colleagues at the Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), we initiated an online seminar series on Condensed Matter Physics: https://sites.google.com/view/ifimac-icmm-joint-seminars/. 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. Since December 2020, 50 talks have taken place within this initiative, and currently, more than 650 people have joined the email list used to circulate the seminar announcements. When the speakers grant permission, the talks are uploaded into youtube at https://www.youtube.com/c/IFIMACICMMJointSeminarSeries. At the moment, we are facing the challenge to recover the onsite character of the seminars without giving up the advantages that the online format have brought.

**Leni Bascones**

***Instituto de Ciencia de Materiales de Madrid, ICMM-CSIC***

**Electronic correlations in moiré heterostructures: the ABC trilayer graphene/hBN**
December 16th (**Thursday**), 2021
12:00 CET

*Hybrid, on-line-on-site*

**David Zueco**

***Instituto de Nanociencia y Materiales de Aragón, Univesidad de Zaragoza, Spain***

**Matter in non-perturbative cavity QED**
December 9th (**Thursday**), 2021 16:00 CET

*Hybrid, on-line-on-site*
*Recorded talk in youtube:*
*https://youtu.be/ns3lcRnCTTM*

# 3. RESEARCH

### Alexey Yulin

***Department of Nanophotonics and Metamaterials ITMO University, Saint-Petersburg (Russia)***

**Bound states in the continuum, hybrid modes and pattern formation in one dimensional nonlinear resonators**

December 2 (**Thursday**), 202112:00 CET

*Hybrid format, celebrated at the Facultad de Ciencias of the Universidad Autónoma de Madrid*
*Recorded talk in youtube:*
*https://youtu.be/wI6jKHPyg_4*

### Jacobo Santamaría

***Universidad Complutense de Madrid***

**Extremely long range Josephson effect across a half-metallic ferromagnet**

November 25 (**Thursday**), 2021 12:00 CET

*Hybrid format, celebrated at Instituto de Ciencia de Materiales de Madrid, Sor Juana Inés de la Cruz 3, 28049 Madrid.*
*Recorded talk in youtube:*
*https://youtu.be/JXBzeqPngZc*

### Simone De Liberato

***School of Physics and Astronomy, University of Southampton***

**Cavity-induced single-photon wavefunction engineering**

November 18 (**Thursday**), 2021 12:00 CE

*Recorded talk in youtube:*
*https://youtu.be/hYnG8jTgWp4*

### Hugo Terças

***Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Universidade de Lisboa***

**Plasmonic Instabilities in two-dimensional Dirac Materials**

November 11 (**Thursday**), 2021,12:00 CET

*Recorded talk in YouTube:*
*https://www.youtube.com/watch?v=RY4FHZu5yfI*

### Rui E. F. Silva

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

**High Harmonic Spectroscopy of Strongly Correlated and Topological Materials**

November 04 (**Thursday**), 2021, 12:00 CET

*On-line*
*Recorded talk in YouTube:*
*https://youtu.be/_J0pEW9gTMc*

### Timur Shegai

***Department of Physics, Chalmers University of Technology, Gothenburg, Sweden***

**Strong light-matter coupling: from transition metal dichalcogenides to Casimir self-assembly**

October 28 (**Thursday**), 2021, 12:00 CEST

*On-line*
*Recorded talk in youtube:*
*https://youtu.be/ajCDAtmpB0Q*

### Andreas Hüttel

***Institute for Experimental and Applied Physics, University of Regensburg, Germany***

**Quantum devices and quantum materials: Single nanotube mechanics and quantum electronics**

October 21 (**Thursday**), 2021, 12:00 CEST

*On-line*
*Recorded talk in youtube:*
*https://youtu.be/UejnDHgAFeg*

# 3. RESEARCH

### Jose Lado

***Department of Applied Physics, Aalto University, Espoo, Finland***

**Correlated twisted spinorbitronics and heavy-fermions in van der Waals heterostructures**
October 14 (**Thursday**), 2021; 12:00 CEST

*On-line*
*Recorded talk in youtube*
*https://youtu.be/gviF-p3sTV8?t=2*

### Hugo Dil

***Institute of Physics, Ecole Polytechnique Fédéral de Lausanne***

**Exploring spin physics with topological materials**
September 30 , 2021; 12:00 CEST

*On-site venue (also online)*
*Sala de Conferencias, Módulo 0, Facultad de Ciencias, Universidad Autónoma de Madrid*

### Mathias Kläui

***Institute of Physics, Johannes Gutenberg-University Mainz, Graduate School of Excellence Materials Science in Mainz, Germany; Centre for Quantum Spintronics, NTNU, Norway***
****IEEE Magnetics Society Distinguished Lecturer***

**Antiferromagnetic Insulatronics: Spintronics without magnetic fields**
September 27 (**Monday**), 2021; 12:00 CEST

*On-site venue (also online)*
*Salón de Actos, Instituto de Ciencia de Materiales de Madrid, ICMM-CSIC.*
*Recorded talk in youtube:*
*https://youtu.be/v7VMvhN5Jpo*

### Juan MR Parrondo

***Dep. Estructura de la Materia, Física Térmica y Electrónica, Universidad Complutense de Madrid, Spain***

**Scattering and thermalization: wave-particle duality hits quantum thermodynamics**
June 24, 2021

*Recorded talk in YouTube:*
*https://youtu.be/1FA-3YbTBqY*

### María José Martínez-Pérez

***INMA-CSIC, Universidad de Zaragoza, Spain***

**NanoSQUID magnetometry of multishaped individual nanoparticles**
June 17, 2021

*Recorded talk in YouTube:*
*https://youtu.be/Yjlqu7SZWfo*

### Stephen Hughes

***Department of Physics, Queen's University, Kingston, Ontario, Canada***

**Quasinormal modes, Purcell factors and corrected Fermi's golden rule for spontaneous emission in absorptive and amplifying media**
June 10, 2021

### Jesper Nygard

***Niels Bohr Institute, University of Copenhage***

**Hybrid nanowires, dots and bound states - elements for quantum devices**
June 3, 2021

# 3. RESEARCH

### Victor Pardo

***Universidade de Santiago de Compostela, Spain***

**Electronic structure of the superconducting layered nickelates**
May 27, 2021

*Recorded talk in YouTube:*
*https://youtu.be/epdGieWfjgI*

### Maia G. Vergniory

***Max Planck for the Chemical Physics of Solids, Germany Donostia International Physics Center, Spain***

**Beyond Topological Quantum Chemistry**
May 20, 2021

*Recorded talk in YouTube:*
*https://youtu.be/O2HM17naGi0*

### Jelena Klinovaja

***University of Basel, Switzerland***

**Majorana bound states in topological insulators without a vortex**
May 13, 2021

### Xiao Mi

***Google Research Santa Barbara, USA***

**Catching the quantum butterfly: Thermalization and information scrambling on a 53-qubit quantum processor**
May 6, 2021

*Recorded talk in YouTube:*
*https://youtu.be/B8psYr36OFM*

### Markus Müller

***RWTH Aachen University and Forschungszentrum Jülich, Germany***

**Topological Quantum Error Correction: From Theoretical Concepts to Experiments**
April 29, 2021

*Recorded talk in YouTube:*
*https://youtu.be/tbrTOemjxow*

### Enrique Burzurí

***IMDEA Nanoscience***

**Molecule-based magnetic heterostructures for spintronics and quantum computing**
April 22, 2021

*Recorded in YouTube:*
*https://www.youtube.com/watch?v=vZsnyTg1IiU*

### Attila Geresdi

***Chalmers University***

**Andreev bound states: detection and the road towards quantum technologies**
April 15, 2021

*Recorded talk in YouTube:*
*https://youtu.be/_4KdV-xpxVs*

### Manuela Garnica

***IMDEA Nanoscience***

**Epitaxial growth of 2D materials: Insights from scanning tunneling microscopy**
April 8, 2021

# 3. RESEARCH

**Fernando González Zalba**

***Quantum Motion Technologies***

**Scaling silicon-based quantum computers using CMOS technology**
March 25, 2021

*Recorded talk in YouTube:*
*https://youtu.be/l1E9nmz70nY*

**Rafael Sánchez**

***Universidad Autónoma de Madrid, Spain***

**Quantum thermoelectrics: using interference, entanglement and non-equilibriumness**
March 11, 2021

*Recorded talk in YouTube:*
*https://youtu.be/sAkRfYG1i5s*

**Peter Schall**

***Institute of Physics, University of Amsterdam, Netherlands***

**Colloidal design: bulding "molecules" and materials at the micro- and nanometer scale**
March 4, 2021

*Recorded talk in YouTube:*
*https://youtu.be/z7qPWHoJegE*

**Félix Zamora**

***Universidad Autónoma de Madrid***

**Evolution in uses of Antimony: from ancient Egyptian queen make-up to new 2D-materials**
February 25, 2021

*Recorded talk in YouTube:*
*https://youtu.be/_u1Na_5NFCo*

**Miguel M. Ugeda**

***DIPC, CSIC-UPV-EHU, Ikerbaske, San Sebastián, Spain***

**Unconventional superconductivity in two-dimensional Van der Waals materials**
February 18, 2021

*Recorded talk in YouTube:*
*https://youtu.be/WhoQHfHXaps*

**Elsa Prada**

***Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC)***

**From Andreev to Majorana bound states in hybrid superconductor-semiconductor nanowires**
February 11, 2021

*Recorded talk in YouTube:*
*https://youtu.be/QXf4BiWPwWw*

**Lucas Lamata**

***Universidad de Sevilla***

**Quantum simulations of condensed matter systems with quantum technologies**
February 4, 2021

*Recorded talk in YouTube:*
*https://www.youtube.com/Z3eHSy5ePkM*

**Alberto Fernandez-Nieves**

***Universitat de Barcelona***

**Toroids, Active Nematics and Topological Defects**
January 28, 2021

*Recorded talk in YouTube:*
*https://youtu.be/Tk6br6BbAk0*

# 3. RESEARCH

**Anna Böhmer**

***Ruhr-University Bochum***

**Iron-based superconductors Materials, magnetism and tuning methods**
January 21, 2021

*Recorded talk in YouTube*
*https://youtu.be/nXCRtnUE5kk*

**Andrés Castellanos**

***Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC)***

**Straintronics with 2D materials**
January 14, 2021

*Recorded talk in YouTube:*
*https://youtu.be/9N33DEQpuNs*

## PhD POSITIONS AT THE IFIMAC WITHIN THE PREDOCTORAL FELLOWSHIPS PROGRAM OF THE SPANISH AEI

We welcame 3 new PhD students, one in each Strategic research line

- **Daniel Gallego Fuente** **(Experimental condensed matter physics line)**

- **Francisco Jesús Matute Fernández-Cañadas** **(Theoretical condensed matter physics line)**

- **Mario Gómez Gutierrez** **(Nanoscience and quantum technologies line)**

# RESEARCH PROJECTS

## International R&D projects:

1. **ANDREEV QUBITS FOR SCALABLE QUANTUM COMPUTATION- ANDQC**
   Reference: GA 828948
   Funding institution: COMISION EUROPEA
   Period: 01/04/2019-31/03/2023
   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. **MISTI GLOBAL SEED FUND PROGRAM**
   Reference:
   Funding institution: Massachusetts Institute of Technology
   Period: 01/09/2021-31/08/2022
   PI: PRINS, FERRY

5. **MODIFICATION OF MOLECULAR STRUCTURE UNDER STRONG COUPLING TO CONFINED LIGHT MODES – MMUSCLES**
   Reference: GA 714870
   Funding institution: COMISION EUROPEA
   Period: 01/04/2017-31/03/2022
   PI: FEIST, JOHANNES MAXIMILIAN

6. **MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES (IGC AS)**
   Reference: 300023
   Funding institution: Ice Guard Coating AS
   Period: 01/09/2019-31/08/2021
   PI: FARIAS TEJERINA, DANIEL

7. **MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES (NORCE)**
   Reference: 300023
   Funding institution: NORCE Norwegian Research Centre AS
   Period: 01/09/2019-31/08/2021
   PI: FARIAS TEJERINA, DANIEL

# 3. RESEARCH

8. **NANOSCALE COHERENT HYBRID DEVICES FOR SUPERCONDUCTING QUANTUM TECHNOLOGIES**
   Reference: CA 16218
   Funding institution: COST ASSOCIATION
   Period: 18/10/2017-17/10/2021
   PI: SUDEROW RODRIGUEZ, HERMANN JESUS

9. **PROTEIN NANOCAGES AS SINGLE MOLECULAR REACTORS TO UNDERSTAND BIOCATALYSIS IN CROWDED ENVIROMENTS**
   Reference: RGP0012/2018
   Funding institution: THE INTERNATIONAL HUMAN FRONTIER SCIENCE PROGRAM ORGANIZATION
   Period: 01/06/2018-31/08/2021
   PI: DE PABLO GOMEZ, PEDRO JOSE

10. **QUANTUM INTERFERENCE ENHANCED THERMOELECTRICITY -QUIET**
    Reference: GA 767187
    Funding institution: COMISION EUROPEA
    Period: 01/02/2018-31/07/2021
    PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

11. **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

12. **USING EXTREME MAGNETIC FIELD MICROSCOPY TO VISUALIZE CORRELATED ELECTRON MATRIALS – PNICTEYES**
    Reference: GA 679080
    Funding institution: COMISION EUROPEA
    Period: 01/03/2016-28/02/2022
    PI: GUILLAMON GOMEZ, ISABEL

## National R&D Projects:

1. **ACOPLAMIENTO CUANTICO DE LUZ Y MATERIA EN SISTEMAS DE DOS DIMENSIONES**
   Reference: MAT2017-83722-R
   Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
   Period: 01/01/2018-31/12/2020
   PI: VIÑA LISTE, LUIS MARIA ANTONIO

2. **CARACTERIZACIONA ESCALA ATOMICA DE NUEVOS MATERIALES 2D FUNCIONALIZADOS CON MOLECULAS ORGANICAS Y BIOMOLECULAS MEDIANTE MICROSCOPIAS DE PROXIMIDAD**
   Reference: MAT2017-83273-R
   Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
   Period: 01/01/2018-31/12/2020
   PI: PEREZ PEREZ, RUBEN

3. **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

4. **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: 01/09/2021-31/08/2024
   PI: BRIHUEGA ALVAREZ, IVAN

5. **CORRELACIONES CUÁNTICAS E INTERFERENCIA DE FOTONES INTERACTÚANTES 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

6. **CUANDO LAS INTERACCIONES ADHESIVAS CONTROLAN EL MOVIMIENTO CELULAR**
   Reference: RTI2018-101953-A-I00
   Funding institution: AGENCIA ESTATAL DE INVESTIGACION
   Period: 01/01/2019-31/12/2021
   PI: ARAGONES GOMEZ, JUAN LUIS

7. **CUANTIFICACIÓN DEL PAPEL DE LA VÍA DE SEÑALIZACIÓN TGFBETA EN LA REGULACIÓN DE LA NEUROGÉNESIS DE VERTEBRADOS**
   Reference: RTI2018-096953-B-I00
   Funding institution: AGENCIA ESTATAL DE INVESTIGACION
   Period: 01/01/2019-31/12/2021
   PI: MIGUEZ GOMEZ, DAVID

8. **DEFECTOS Y HETEROUNIONES BIDIMENSIONALES DE DICALCOGENUROS CON METALES DE TRANSICIÓN**
   Reference: PGC2018-093291-B-I00
   Funding institution: AGENCIA ESTATAL DE INVESTIGACION
   Period: 01/01/2019-31/12/2021
   PI: LOPEZ VAZQUEZ DE PARGA, AMADEO

9. **DESARROLLO DE UN MICROSCOPIO DE EFECTO TUNEL EN CONDICIONES DE UHV, TEMPERATURA REALMENTE VARIABLE CON POSICIONAMIENTO MICROMETRICO Y VOLTAJE DE PUERTA PARA MATERIALES 2D**
   Reference: MAT2016-80907-P
   Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
   Period: 30/12/2016-29/12/2020
   PI: BRIHUEGA ALVAREZ, IVAN

10. **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

# 3. RESEARCH

11. **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: 01/01/2019-31/12/2021
PI: ALIEV KAZANSKI, FARKHAD

12. **DINAMICA, SUPERCONDUCTIVIDAD Y TOPOLOGIA EN NANOESTRUCTURAS HIBRIDAS**
Reference: FIS2017-84860-R
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2020
PI: LEVY-YEYATI MIZRAHI, ALFREDO

13. **DISEÑO DE MATERIALES 2D PARA APLICACIONES DE ENERGÍA: MEMBRANAS Y BATERÍAS**
Reference: PID2019-106268GB-C32
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2020-31/12/2022
PI: ZAMORA ABANADES, FELIX JUAN

14. **DISEÑO DE MATERIALES 2D PARA APLICACIONES EN ENERGÍA: NANOELCTROMECANICA**
Reference: PID2019-106268GB-C31
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2020-31/12/2022
PI: GOMEZ-NAVARRO GONZALEZ, CRISTINA

15. **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

16. **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

17. **ESTRUCTURAL LOCAL DE MATERIALES NANO-POROSOS EN ACCIÓN**
Reference: EUR2020-112294
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2020-30/11/2022
PI: PLATERO PRATS, ANA EVA

18. **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: 01/01/2018-31/12/2021
PI: DE PABLO GOMEZ, PEDRO JOSE

19. **EXPLORANDO LA INTERACCIÓN ENTRE PARTÍCULAS VÍRICAS Y MATERIALES: FUNDAMENTOS Y APLICACIONES PROFILÁCTICAS (INFRAESTRUCTURA)**
Reference: VIRMAT
Funding institution: CONSEJERIA CIENCIA, UNIVERSIDADES E INNOVACIONPeriod: 01/02/2020-31/12/2022
PI: DE PABLO GOMEZ, PEDRO JOSE

20. **EXPLORANDO LA INTERACCIÓN ENTRE PARTÍCULAS VÍRICAS Y MATERIALES: FUNDAMENTOS Y APLICACIONES PROFILÁCTICAS**
Reference: VIRMAT
Funding institution: CONSEJERIA CIENCIA, UNIVERSIDADES E INNOVACIONPeriod: 01/02/2020-31/12/2022
PI: DE PABLO GOMEZ, PEDRO JOSE

21. **EXTENDIENDO LOS LÍMITES DE LA FÍSICA DE ATTOSEGUNDOS: 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

22. **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

23. **FISICA DE MOTT PARA NUEVAS APLICACIONES EN COMPUTACION NEUROMORFICA**
Reference: FIS2017-82415-R
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2020
PI: GARCIA MICHEL, ENRIQUE

24. **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-TENDERO VICTORIA, SERGIO

25. **FOTOGENERACIÓN DE H2 MEDIANTE SEMICONDUCTORES EMERGENTES Y AJUSTABLES Y SU COMPRENSIÓN A PRESIONES ULTRAALTAS MEDIANTE HIDRUROS METÁLICOS**
Reference: RTI2018-099794-B-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2019-31/12/2021
PI: ARES FERNANDEZ, JOSE RAMON

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**26. 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

**27. 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

**28. 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: PEREZ PEREZ, RUBEN

**29. LIGHT MANAGEMENT IN PLASMONIC NANOPORES**
Reference: EUR2019-103826
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/10/2019-30/09/2020
PI: PRINS, FERRY

**30. 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

**31. 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

**32. MODELIZACION DE MATERIALES COMPLEJOS: BIOMOLECULAS Y SISTEMAS BIDIMENSIONALES**
Reference: MAT2017-88258-R
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2021
PI: ORTEGA MATEO, JOSE

**33. MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES**
Reference: PCI2019-103586
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2019-31/08/2021
PI: FARIAS TEJERINA, DANIEL

**34. 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

**35. NUEVAS MICROSCOPIAS DE DISPOSITIVOS PARA VISUALIZAR MATERIALES CUENTICOS CONTROLADOS**
Reference: FIS2017-84330-R
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2020
PI: SUDEROW RODRIGUEZ, HERMANN JESUS

**36. NUEVOS FENÓMENOS Y APLICACIONES DE MATERIALES TOPOLÓGICOS 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

**37. 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

**38. ÓPTICA DE LUZ MAGNETO-ELÉCTRICA EN MEDIOS NANOESTRUCTURADOS DIELÉCTRICOS**
Reference: PGC2018-095777-B-C22
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2019-31/12/2022
PI: MARQUES PONCE, MANUEL IGNACIO

**39. 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

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**40. 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

**41. PREPARACIÓN Y CARACTERIZACIÓN DE NANO-LÁMINAS DE ANTIMONIO Y GERMANIO**
Reference: PCI2018-093081
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 02/10/2018-01/10/2021
PI: ZAMORA ABANADES, FELIX JUAN

**42. 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

**43. PROPIEDADES CUÁNTICAS DE LA LUZ EMITIDA POR UNA UNIÓN TÚNEL**
Reference: PGC2018-096047-B-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2019-31/12/2021
PI: OTERO MARTIN, ROBERTO

**44. PROPIEDADES DINAMICAS Y DE EQUILIBRIO DE MATERIA BLANDA**
Reference: FIS2017-86007-C3-1-P
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2020
PI: VELASCO CARAVACA, ENRIQUE

**45. PROPIEDADES OPTOELECTRONICAS Y TERMOELECTRICAS DE MATERIALES BIDIMENSIONALES**
Reference: MAT2017-88693-R
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018-31/12/2020
PI: RUBIO BOLLINGER, GABINO

**46. 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

**47. 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: 01/01/2019-31/12/2021
PI: PLATERO PRATS, ANA EVA

**48. 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

**49. 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

**50. 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

**51. SUPERCONDUCTIVIDAD EN LA NANOESCALA: 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

**52. TECNOLOGÍAS CUÁNTICAS A TEMPERATURA AMBIENTE**
Reference: PCI2018-093145
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/03/2018-28/02/2021
PI: GARCIA VIDAL, FCO. JOSE

**53. TECNOLOGÍAS POLARITONICAS CUÁNTICAS**
Reference: RTI2018-099737-B-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2019-31/12/2021
PI: FEIST, JOHANNES MAXIMILIAN

**54. 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: 01/03/2019-28/02/2022
PI: POLOP JORDA, CELIA

**55. TERMOMETRÍA DE LUMINISCENCIA CON NANOPARTÍCULAS COMO HERRAMIENTA PARA EL DIAGNÓSTICO PRECOZ DE UNA ENFERMEDAD DISTRÓFICA DE LA RETINA**
Reference: PID2020-118878RB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2021-31/08/2024
PI: HERNANDEZ JUAREZ, BEATRIZ

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56. **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: 01/01/2018-31/12/2021
PI: BARANDIARAN PIEDRA, ZOILA

57. **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

58. **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

59. **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

## Regional R&D Projects:

1. **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

2. **AYUDA PARA LA REALIZACION DE DOCTORADO INDUSTRIAL EN LA COMUNIDAD DE MADRID.**
Doctorando Jaime Carracedo Cosme
Reference: IND2017/IND-7793
Funding institution: COMUNIDAD DE MADRID
Period: 01/04/2018-31/03/2021
PI: PEREZ PEREZ, RUBEN

3. **AYUDA PARA LA REALIZACION DE DOCTORADO INDUSTRIAL EN LA COMUNIDAD DE MADRID.**
Doctorando Jesús López Molina. 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: 29/11/2021-31/12/2022
PI: GOMEZ HERRERO, JULIO

5. **EXCELENCIA PROFESORADO UNIVERSITARIO CATEDRÁTICO DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2020-31/12/2022
PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

6. **EXCELENCIA PROFESORADO UNIVERSITARIO CATEDRÁTICO/A DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2021-31/12/2023
PI: ALIEV KAZANSKI, FARKHAD

7. **EXCELENCIA PROFESORADO UNIVERSITARIO CATEDRÁTICO/A DE UNIVERSIDAD - QUÍMICA INORGÁNICA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2021-31/12/2023
PI: ZAMORA ABANADES, FELIX JUAN

8. **EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR CONTRATADO DOCTOR - FÍSICA DE LA MATERIA CONDENSADA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2020-31/12/2022
PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

9. **EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR CONTRATADO DOCTOR - FÍSICA TEÓRICA DE LA MATERIA CONDENSADA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2020-31/12/2022
PI: LEVY-YEYATI MIZRAHI, ALFREDO

10. **EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR TITULAR DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA**
Reference:
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2020-31/12/2022
PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

11. **EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR/A CONTRATADO/A DOCTOR/A - FÍSICA DE LA MATERIA CONDENSADA**
Funding institution: COMUNIDAD DE MADRID
Period: 01/01/2021-31/12/2023
PI: JAAFAR RUIZ-CASTELLANOS, MIRIAM

# 3. RESEARCH

12. **EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR/A TITULAR DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA**
    Reference:
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2021-31/12/2023
    PI: OTERO MARTIN, ROBERTO

13. **MICROSCOPÍA MAGNÉTICA MULTIPARAMÉTRICA CON ALTA SENSIBILIDAD**
    Reference: SI1/PJI/2019-00055
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2020-31/12/2021
    PI: JAAFAR RUIZ-CASTELLANOS, MIRIAM

14. **NANOFOTÓNICA PARA COMPUTACIÓN CUÁNTICA**
    Reference: Y2020/TCS-6545 (NanoQuCo-CM) Grupo: QNanoLight
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/07/2021-30/06/2024
    PI: GARCIA VIDAL, FCO. JOSE

15. **NUEVOS MATERIALES BIDIMENSIONALES: CARACTERIZACIÓN, PROPIEDADES Y APLICACIONES - G2-UAM**
    Reference: S2018/NMT-4511
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2019-31/12/2022
    PI: BRIHUEGA ALVAREZ, IVAN

16. **SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES – 287**
    Reference: S2018/NMT-4321
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2019-31/12/2022
    PI: RAMOS RUIZ, MIGUEL ANGEL

17. **SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES – LASUAM**
    Reference: S2018/NMT-4321
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2019-31/12/2022
    PI: MIRANDA SORIANO, RODOLFO

18. **SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES - LBT-UAM**
    Reference: S2018/NMT-4321
    Funding institution: COMUNIDAD DE MADRID
    Period: 01/01/2019-31/12/2022
    PI: SUDEROW RODRIGUEZ, HERMANN JESUS

## Private Funding:

1. **CONVENIO BANCO SANTANDER-UAM-IFIMAC**
   Reference: SANTANDER UNIVERSIDADES
   Funding institution: BANCO DE SANTANDER CENTRAL HISPANO SA
   Period: 18/06/2016-17/06/2020
   PI: GARCIA VIDAL, FCO. JOSE

2. **NANO-OPTICA CUANTICA DE TRANSFORMACION**
   Reference: FBBVA BECA LEONARDO
   Funding institution: FUNDACION BBVA
   Period: 30/09/2019-30/03/2021
   PI: FERNANDEZ DOMINGUEZ, ANTONIO ISAAC

3. **NANOSEEK / NANOTECH-BASED PCR-FREE SARS-COV-2 QUANTITATIVE DETECTION KIT**
   Reference: NANOSEEK
   Funding institution: BANCO DE SANTANDER CENTRAL HISPANO SA
   Period: 01/09/2020-31/08/2021
   PI: MIRANDA SORIANO, RODOLFO

4. **NUEVOS TEJIDOS PROFILÁCTICOS EFICIENTES CONTRA SARS-COV-2 BASADOS TEXTILES NO-TEJIDOS MODIFICADOS CON GRAFENO Y DERIVADOS**
   Reference: TEXGRAF
   Funding institution: BANCO DE SANTANDER CENTRAL HISPANO SA
   Period: 01/07/2020-01/07/2021
   PI: ZAMORA ABANADES, FELIX JUAN

# 3. RESEARCH

## SCIENTIFIC RESULTS

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192. Zahl, Percy; Yakutovich, Aliaksandr, V; Ventura-Macias, Emiliano; Carracedo-Cosme, Jaime; Romero-Muniz, Carlos; Pou, Pablo; Sadowski, Jerzy T.; Hybertsen, Mark S.; Perez, Ruben, *Hydrogen bonded trimesic acid networks on Cu(111) reveal how basic chemical properties are imprinted in HR-AFM images*, 2021, **Nanoscale**; 13 (44) 18473-18482

193. Zambudio, Aitor; Gnecco, Enrico; Colchero, Jaime; Perez, Ruben; Gomez-Herrero, Julio; Gomez-Navarro, Cristina; *Fine defect engineering of graphene friction*, 2021, **Carbon**; 182, 735-741

# 3. RESEARCH


194. Zamora, Felix; *Inorganic Materials and Metal-Organic Frameworks: Editorial Announcement*, 2021, **Nanomaterials**; 11 (12), 3279

195. Zettergren H; Domaracka A; Schlathölter T; Bolognesi P; Díaz-Tendero S; Łabuda M; Tosic S; Maclot S; Johnsson P; Steber A; Tikhonov D; Castrovilli MC; Avaldi L; Bari S; Milosavljević AR; Palacios A; Faraji S; Piekarski DG; Rousseau P; Ascenzi D; Romanzin C; Erdmann E; Alcamí M; Kopyra J; Limão-Vieira P; Kočišek J; Fedor J; Albertini S; Gatchell M; Cederquist H; Schmidt HT; Gruber E; Andersen LH; Heber O; Toker Y; Hansen K; Noble JA; Jouvet C; Kjær C; Nielsen SB, *Roadmap on dynamics of molecules and clusters in the gas phase*, 2021, **European Physical Journal d**; 75 (5), 152

196. Zotti, Linda A.; *Molecular Electronics*, 2021, **Applied Sciences-Basel**; 11 (11), 4828

197. 197. Beierlein, J.; Rozas, E.; Egorov, O. A.; Klaas, M.; Yulin, A.; Suchomel, H.; Harder, T. H.; Emmerling, M.; Martin, M. D.; Shelykh, I. A.; Schneider, C.; Peschel, U.; Vina, L.; Hoefling, S.; Klembt, S., *Propagative Oscillations in Codirectional Polariton Waveguide Couplers*, 2021, **Physical Review Letters**, 126, 075302

# 3. RESEARCH

## National and International congresses: invited lectures

1. "*Magnon-Polarons in different flavors: (anti) ferromagnetic to topological*". A. Kamra, **Spring Meeting of the German Physical Society (DPG)**, virtual event. 27 September - 1 October 2021 *https://skm21.dpg-tagungen.de/*
2. "*Plasmon-molecule coupling: Electromagnetic field quantization and effect of vibrational modes*". A. I. Fernández-Domínguez, **9th International Conference on Photonics, optics and laser Technology (Photoptics 2021)**, virtual event, 11-13 February 2021, *https://photoptics.scitevents.org/CallForPapers.aspx?y=2021#A3*
3. "*Plasmon-exciton coupling: light-forbidden transitions and quasi-chiral interactions*". A. I. Fernández-Domínguez, **11th International Conference on Metamaterials, Photonic Crystals and Plasmonics (Meta 2021)**, University of Warsaw, Warsaw, Poland, hybrid event, 20-23 July 2021. *https://metaconferences.org/ocs/index.php/META18/META21#.YfepzOrMJPY*
4. "*Plasmon-molecule coupling: Electromagnetic field quantization and effect of vibrational modes*" A. Fernández-Domínguez, **SPIE Optics+Photonics 2021**, San Diego Convention Center/San Diego, California, United States, 2-5 August 2021, *https://spie.org/conferences-and-exhibitions/optics-and-photonics?utm_id=ropstmcaw&SSO=1*
5. "*Helium atom scattering, a suitable tool for studying electron-phonon coupling, bending rigidity and substrate coupling strength of 2D materials*" D. Farías, **New Trends In Materials Science and Engineering**, Virtual Conference, Italy, 14-18 June 2021
6. Quantum Nanophotonics Torun Poland. **Diego Martín Cano**
7. NANOQUCO Kickoff meeting **Diego Martín Cano**
8. "*Interfacial Spin-Orbit Coupling: A Platform for Superconducting Spintronics*" Farkhad G. Aliev, **Symposium on Spintronics and Quantum Information**, Poznan, Polonia, online conference, 21-23 October 2021.
9. "*Superconducting spintronics with spin-orbit coupling and symmetry filtering*" César González-Ruano, Diego Caso, Lina G. Johnsen, Petra Högl, Isidoro Martínez, Coriolan Tiusan, Michel Hehn, Niladri Banerjee, Jaroslav Fabian, Igor Žutić, Jacob Linder and Farkhad G. Aliev, : **7th INTERNATIONAL CONFERENCE ON SUPERCONDUCTIVITY AND MAGNETISM**, Bodrum, Turkey, 21-27 October 2021
10. "*Interfacial Spin-Orbit Coupling: A Platform for Superconducting Spintronics*" Farkhad G. Aliev, **International Conference on Magnetosm and Spintronics SOL-SKYMAG 2021**, online conference, San Sebastian, España, 21-24 June 2021.
11. "*Proximity effects in epitaxial ferromagnet-superconductor hybrids: towards superconducting spintronics with spin-orbit interaction*". César González-Ruano, Diego Caso, Lina G. Johnsen, Coriolan Tiusan, Michel Hehn, Niladri Banerjee, Jacob Linder, Farkhad G. Aliev, **Nanoengineered Superconductors – NES21 Young investigator's online workshop**, online conference, University of Viena, 10-12 May 2021
12. . "*Nanoscale control of new properties added to graphene: Superconductivity, Magnetism and Electronic Gap*". Iván Brihuega, **Atomic scale quantum materials Colloquim** On-line conference, 25th May 2021
13. "*Nanoscale control of new properties added to graphene: Superconductivity, Magnetism and Electronic Gap*" I. Brihuega **EWEG2D 21**, Online Lectures, 21st September 2021
14. "Nanoscale control of new properties added to graphene: Superconductivity, Magnetism and Electronic Gap". I. Brihuega, **Graphene 2021 International conference**. Grenoble, France. 27th October 2021
15. "*Manipulating the emission of rare earth quantum emitters by plasmonic chains*" J. Fernandez-Martínez, L. Sanchez-Garcia, S. Carretero-Palacios, P. Molina, J. López-Fernández, N. J. J. van Hoof, J. Gómez Rivas, Mariola Ramírez, and L.E. Bausá, **International Conference on Advanced Ceramics and Composites, (ICACC 2021). Symposium on Crystalline Materials for electrical, optical and medical applications**, online conference, USA, 8-12 February 2021
16. "*Plasmon-assisted coherent optical sources at the nanoscale*" L.E. Bausá **International Workshop Nanomaterials for Photoenergy Conversion - Light Generation and Sensing**, online conference, NIMS, Tsukuba, Japón 24 November 2021
17. "*Controlling nonlinear interactions in solid state platforms by periodical arrays of plasmonic chains*" Gómez-Tornero, P. Palacios-Alonso, P. Molina, S. Carretero-Palacios, L.E Bausá and M.O Ramírez **45th Virtual International Conference on Advanced Ceramics and Composites (ICAAC'21)**, online conference, February 2021.
18. "*Mechanics of 2D materials - Virtual mini-conference series*" Cristina Gomez-Navarro **Nano-Flatlands 2021**, Universidad Autónoma de Madrid, Spain. 11November 2021
19. "*Visualizing Exciton Transport in 2D Metal-Halide Perovskites*" F. Prins **Graphene 2021, 2DHAPES symposium**. Grenoble, France (hybrid online), 3-4 November 2021
20. "*Ultrafast molecular polaritonics in lossy plasmonic & hybrid cavities*", Johannes Feist, **SCOM 2021**, online conference, Gothenburg, Sweden, 27April 2021

# 3. RESEARCH

21. "*Using strong light-matter coupling to modify energy transfer*", Johannes Feist **European Optical Society Annual Meeting**, EOSAM 2021, hybrid format, Rome, Italy, 17 September 2021
22. "*Ultrafast molecular polaritonics in lossy plasmonic & hybrid cavities*", **Johannes Feist CEN (Conferencia Española de Nanofotónica)**, online conference, Vigo, Spain, 21 September 2021
23. "*Phase separations and asymmetries in emulsion-templated vesicles*". L.R. Arriaga 1st **Symposium on Colloidal and Interfacial Topics**, Virtual Event, 31 May – 4 June 2021
24. "*Phase separations in emulsion templated vesicles*" L.R. Arriaga, **85th New England Complex Fluids (NECF) Workshop**,. Virtual Event. December 4th, 2020
25. "*Engineering the thermoelectric properties of single-molecule Junctions*" **Nicolás Agrait, The International Chemical Congress of Pacific Basin Societies PACIFICHEM 2021**, Honolulu (Hawaii, USA).16-21 December, 2021.
26. "*Scanning-Probe-Assisted Nanowire Circuitry*" P. Ares. **IEEE International Conference on Nano/Micro Engineered & Molecular Systems IEEE-NEMS 2021**, Xiamen, China, April 2021.
27. "*Andreev-Coulomb drag in coupled quantum dots*" R. Sánchez, **The European Conference Physics of Magnetism 2021 (PM'21)**, Online/Poznan, Poland, 28 June - 2 July, 2021
28. "*Interference-induced extrinsic thermoelectrics*" R. Sanchez **Frontiers of Quantum and Mesoscopic Thermodynamics FQMT'21**, Online/Prague, Czech Republic, 18-24 July, 2021
29. "*Extrinsic thermoelectric response of quantum conductors*" R. Sanchez **International Symposium on Novel maTerials and quantum Technologies, ISNTT 2021**, Online/Atsugi, Japan, 14-17 December, 2021
30. "*Electrical manipulation of magnetic insulators*", S. Vélez, **7th International Conference of Superconductivity and Magnetism (ICSM) 2021**, Milas-Bodrum, Turkey, 21 – 27 October 2021.
31. "*Dynamic acousto-optoelectric manipulation of quantum light states in GaN/InGaN nanowire quantum dots*" **S. Lazić, XXI Semana del IICO: Fronteras de la Óptica (XXII IICO WEEK),** San Luis Potosi (Mexico), September 2021
32. "*Anisotropic superconductivity and the spin-vortex antiferromagnetism in Ni-doped CaKFe4As4*", I. Guillamón, **Strongly Correlated Electron Systems**, online, Brazil, 20 May 2021. *https://sces2020.org/*
33. "*Scanning tunneling spectroscopy of bound states in superconductors*", **Hermann Suderow**, 27th May to 4th June, *https://www.iitk.ac.in/vortex2021/*
34. "*AC Josephson scanning tunneling microscopy*". H. Suderow, **Microscience microscopy congress 2021 (mmc2021). Vortex 2021**, online, July 2021, *https://www.mmc-series.org.uk/mmc2021/*
35. "*ON THE "ANOMALOUS" PROPERTIES OF GLASSES AT LOW TEMPERATURES*", M. A. Ramos, **XXVII International Summer School "Nicolás Cabrera": Ultrastable glasses: New perspectives for an old problem,** Miraflores de la Sierra (Madrid), 5-10 September 2021
36. Superconductors and magnets studied by scanning tunneling microscopy at very low temperatures. H. Suderow, **CDT-CMP Annual conference 2021**, September 2021, *https://www.cdt-cmp.ac.uk/news/events/cmp-annual-conference-2021/*
37. "*Engineering single and N-photon emission from frequency resolved correlations*" E. del Valle, **2021 Workshop on Entanglement Assisted Communication Networks (EACN)**, online, Munich (Alemania), 10-12 March
38. "*Engineering single and N-photon emission from frequency resolved correlations*" E. del Valle, **Non-Hermitian Physics conference organised by ICTS-TIFR**, Bangalore (online). Bangalore (India), 22-26 March
39. "*Tuning photon statistics*" E. del Valle, **Stochastic electromagnetism and coherence: theory and applications organised by the IOP Optical Group** (online). Cambridge (U.K.), 6 September
40. "*Detection and manipulation of Andreev states in hybrid nanowire Josephson junctions using cQED techniques*" A. Levy, **WE-Heraeus-Seminar: Hybrid Solid State Quantum Circuits, Sensors, and Metrology** Bad Honned (Germany)
41. "*On the theory of Andreev states in hybrid nanowire Josephson junctions*", A. Levy **Low dimensional superconducting hybrids for novel quantum functionalities.** Paris, College de France (France)

# 3. RESEARCH

## Organization of congresses

1. **Symposium on Crystalline Materials for electrical, optical and medical applications** at the International Conference on Advanced Ceramics and Composites, ICACC 2021. (USA, 8-12 de febrero de 2021, participacion online). Co- organized by Luisa Bausá
2. **Symposium on Crystalline Materials for Electrical, Optical and Medical Applications** at the 14th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 14) (Vancouver, December 2021, online) Co-organized by Luisa Bausá
3. **PATAS 2021 "Processes in Atmospheric and Astrochemical Environments"** Conference associated to the MD-GAS COST Action (CA 18212) Virtual meeting, January 18th - 21st 2021. Sergio Díaz Tendero Co-chair
4. **School on New Computational Methods for Attosecond Molecular Processes**. The objective of this school is disseminating simulation methodologies and codes developed in the research group, and other collaborating groups, providing users with basic training necessary for their use, Zaragoza (ES), 26-29 March 2021. *https://www.cecam.org/workshop-details/1058* Co-organized by Fernando Martín y Alicia Palacios
5. **Low dimensional superconducting hybrids for novel quantum functionalities**,12 – 14 October 2021, Paris, *https://nanocohybri.eu/low-dimensional-superconducting-hybrids-for-novel-quantum-functionalities-12-14-october-2021/*, co-organized by H. Suderow.
6. **Superconducting Hybrids @ Extreme – hybrid online in-person meeting** 28th June to 02 July 2021, (Slovakia), *https://nanocohybri.eu/superconducting-hybrids-extreme-hybrid-online-in-person-meeting-slovakia-28th-june-to-02-july-2021/*, H. Suderow promoter and advisory committee.
7. **Toposuper2021 – Online conference on emergent topological superconductivity**, 7-9 June 2021, *https://nanocohybri.eu/toposuper2021-online-conference-on-emergent-topological-superconductivity-7-9-june-2021-2/*, H. Suderow promoter and advisory committee.
8. **Nanoengineered Superconductors - NES21, Young Investigator's online workshop**, May 10-12, 2021, *https://nes21.univie.ac.at/*, H. Suderow promoter and advisory committee.
9. **Mini workshop "Towards strong correlations in van der Waals heterostructures and 2D materials"**, 25 March 2021, *https://nanocohybri.eu/mini-workshop-towards-strong-correlations-in-van-der-waals-heterostructures-and-2d-materials/*, H. Suderow promoter and advisory committee.
10. **Ultrastable Glasses: New perspectives for an old problem. N. Cabrera Summer School**, *https://www.inc.uam.es/summer-school-2021-ultrastable-glases-new-perspectives-old-problem/*, co-organizer MA Ramos.
11. **IFIMAC+ICMM Joint Seminar Series** IFIMAC+ICMM Joint Seminar Series focuses on cutting-edge research on condensed matter physics, bringing speakers from all over the world to our Cantoblanco Campus. Laura R. Arriaga, Iván Brihuega, Antonio Fernández-Domínguez, Isabel Guillamón
12. **INC, Young Researchers Meeting 2021** The Young Researchers Meeting is dedicated to those PhD students and young doctors whose research work has been or is being performed at the Institute Nicolás Cabrera. Iván Brihuega

# 3. RESEARCH

## Sponsorships

1. **Virtual conference SPPM2021 "Spintronics, Photonics, Phononics, Magneto-Optics"** (10 de junio 2021), organizada por Fundacion Phantoms/ IFIMAC/NTC/Universitat Rovira I Virgila/ICFO *http://confstreaming.archivephantomsnet.net/SPPM2021/index.php*

2 Support to the **9th edition of the GEFES awards for the best doctoral thesis in condensed Matter Physics**. *https://gefes-rsef.org/convocatoria-premio-tesis-gefes-9a-edicion/*

## PATENT applications

1. **DISPOSITIVO CON UNIÓN TÚNEL MAGNÉTICA HÍBRIDA**
F.G. Aliev, C. Gonzalez-Ruano
Application number: N. P202130765
Date of application: 05.08.2021
Universidad Autónoma de Madrid (N/REF.-P21329ES00)

2. **MÉTODO DEDETERMINACIÓN DE LA CONDUCTANCIA TÉRMICA**
Nicolás Agrait
Application number: P202130798
Date of application 19-08-2021
Universidad Autónoma de Madrid

3. **SISTEMA PARA ANALIZAR CUANTITATIVAMENTE IMÁGENES DE MUESTRAS BIOLÓGICAS**
Mario Ledesma Terron; Diego Perez Dones; **David Míguez Gómez**
Application number: P202130485
Date of application: 24/05/2021
Universidad Autónoma de Madrid

## Awards

### Francisco José García Vidal, Blas Cabrera National Prize 2021

Francisco José García Vidal, Full Professor at the Theoretical Condensed Matter Physics Department of the Universidad Autónoma de Madrid, and IFIMAC member, has been awarded the **Blas Cabrera national prize in Physical, materials and earth Sciences**, in its 2021 edition.

F. J. García-Vidal started this activity during his postdoctoral stay at Imperial College of London and continued when he returned to Universidad Autónoma de Madrid at the end of 1996. During its scientific career has published 274 peer-reviewed articles. His citation record stands at more than 26.000 and the H-index is 77(WoS). The average citation per article is more than 96, and has been included in Clarivate compilation of most influential authors. Since 2004, Prof. Garcia Vidal has supervised 14 PhD theses.

This prize recognize the exceptionality and impact of his research career and the relevance of his contributions in the field of Nanophotonics, Plasmonics and Metamaterial. The jury highlighted the international recognition of his career, his leadership qualities and his training work.

The Blas Cabrera National Award is one of the 2021 National Research Awards, granted by the Ministry of Science and Innovation. These awards are the most important recognition in Spain in the field of scientific research. Their objective is to recognize the merit of Spanish researchers who are developing outstanding professional work of international relevance in their respective research areas and scientific fields, and exceptionally exceptionally contributing to the advancement of science.

# 3. RESEARCH

## Rodolfo Miranda Soriano Miguel Catalán Awards 2021

Prof. Rodolfo Miranda Soriano has a PhD in Physical Sciences, is a professor in the **Department of Condensed Matter Physics** at the Autonomous University of Madrid, director of the **IMDEA Nanoscience Foundation** and **IFIMAC's** member. His research has contributed decisively to the development of Nanotechnology in Spain, creating a school in our country in the field of Surface Physics by introducing for his study Scanning Tunnel Microscopy – STM, Magnetism in low dimensional systems or Surface Physics-Chemistry in Ultra High Vacuum.

Prof. Rodolfo Miranda Soriano has received Miguel Catalán 2021 Award of the Comunidad de Madrid – CAM for his scientific contributions.

## Miriam Jaafar, IFIMAC member, awarded the CEMAG First Prize for Emerging Research in Magnetism

Miriam Jaafar, associate profesor at the **Department of Condensed Matter Physics** and IFIMAC researcher have been awarded the **First Prize for Emerging Research in Magnetism** granted by the Spanish club of magnetism( CEMAG).

The jury has decided to grant her this recognition for her outstanding career in scientific research and technological development, as well as for its wide impact and its future projection.

## Ana E. Platero Awarded the "Young Researcher-group Leader" Prize of RSEQ

Ana E. Platero received one of the prizes of RSEQ 2021, in the category Young reasercher "Group leader". She obtained her MSc in Crystallography in 2009 and her PhD in Chemistry in 2011 from UAM. She developed her PhD work at Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), under supervision of Prof. Gutiérrez-Pubela and Dr. Snejko. She spent three months at Institute Lavoisier de Versailles (CNRS) with Dr. Horcajada in France and one month in Università degli Studi di Milano with Prof. Proserpio in Italy.

In 2012 she joined the Stockholm University (Sweden) as postdoctoral researcher within the Berzelii Center EXSELENT on Porous Materials.

In 2014, she joined the Argonne National Laboratory (USA) as Beatriu de Pinós fellow. In November 2017, she was awarded with an InterTalentum MSCA-grant to join the UAM. In 2018, she was awarded with a TALENT-CM Modality-1 grant (310.000 EUR) to start her independent career. Since March 2019, she is a member of the Condensed Matter Physics Center (IFIMAC). Ana is recipient of a prestigious Ramón y Cajal Fellowship since November 2020.

## Francisco José García-Vidal Included In Clarivate 2021 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 2021, fewer than 6,700, or about 0.1%, of the world's researchers, in 21 research fields and across multiple fields, have earned this exclusive distinction.

In the list of Physics, in which Prof. García-Vidal has been selected for his 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™**. [See the list]

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# 4. TRAINING AND OUTREACH ACTIVITIES

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# 4. TRAINING AND OUTREACH ACTIVITIES

## 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 yNanotecnología
- Química Teórica y Modelización Computacional
- Química Aplicada

## IFIMAC'S MASTER FELLOWSHIPS

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

**2020/2021 course: Six Master grants awarded to the following students:**

1.- de Pedro Embid, Ismael (Master en Materiales Avanzados, Nanotecnología y Fotónica)
*Tutor TFM: Snezana Lazic*

2.- Diaz Sánchez, Jesús (Master en Física de la Materia Condensada y los Sistemas Biológicos (NANOFISICA))
*Tutor TFM: Celia Polop, Enrique García Michel*

3.- Fernández Martínez, Javier (Master en Materiales Avanzados, Nanotecnología y Fotónica)
*Tutor TFM: Luisa Bausá*

4.- Matute Fernández-Cañadas, Francisco Jesús (Master en Física de la Materia Condensada y los Sistemas Biológicos (NANOFISICA))
*Tutor TFM: Alfredo Levy*

5.- Murillo Vidal, María (Master en Materiales Avanzados, Nanotecnología y Fotónica)
*Tutor TFM: Félix Zamora*

6.- Vega Martín, Jorge (Master en Física de la Materia Condensada y los Sistemas Biológicos (NANOFISICA))
*Tutor TFM: Enrique Velasco*

**2021/2022 course: five Master grants awarded:**

1.- Martínez Martínez, Pablo (Máster en Física de la Materia Condensada y de los Sistemas Biológicos BIOFÍSICA)
*Director TFM: David Miguez"*

2.- Ocio Moliner, Mikel (Máster en Física de la Materia Condensada y de los Sistemas Biológicos BIOFÍSICA)
*Director TFM: David Miguez"*

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

4.- Sagasta Beltran de Guevara, Ander (Master en Química Teórcia y Modelización Computacional)
*Director TFM: Fernando Martín*

5.- Osuna Bris, Eva (Master en Física de la Materia Condensada y los Sistemas Biológicos (NANOFISICA))
*Director TFM: Cristina Gómez-Navarro González.*

# 4. TRAINING AND OUTREACH ACTIVITIES

## 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 2021 edition are:

- Arranz Jiménez, Marcos

- de la Peña Ruiz, Sebastián

*https://www.inc.uam.es/wp-content/uploads/premiosestudiantes2.pdf*

## OUTREACH

- Dissemination talk, "Ecuaciones de Maxwell: Nanofotónica y óptica cuántica", Jornadas de divulgación de investigación del FTMC. **Diego Martín Cano**.
- Invited talk "*¿Qué hace un físico en un laboratorio un viernes por la tarde?*" at the Pint of Science Festival, On-line, 17th May 2021. **Iván Brihuega**
- Orgaization of interviews to young researchers, https://nanocohybri.eu/category/meet-some-of-us/" **H. Suderow**
- Managing the RealScientists Nano (@RealSci_Nano) account for a week in July (Jul 12 - Jul 18), which included also a podcast series: http://thesciencetalk.com/2021/07/22/ferry-prins/ **F. Prins**
- Dissemination talk "Dispositivos de estado sólido para computación cuántica" (https://gefes-rsef.org/universo-gefes-dispositivos-de-estado-solido-para-computacion-cuantica-eduardo-lee-21-de-abril-de-2021/) in a seminar series organized by GEFES https://gefes-rsef.org/universogefes/ that is directed to undergraduate students in Physics. The idea is to attract them to Condensed Matter. **Eduardo Lee**
- Course "AI for Scientists Bootcamp 2021", of introduction to the application of artificial intelligence techniques in scientific research. Fundación Universidad Autónoma de Madrid. 14- 24 june, 2021. **Jorge Bravo**
- Participation in the programme of Radio 5 "Entre Probetas", edition, talking bout 2021 Nobel Prizes. https://www.rtve.es/play/audios/entre-probetas/entre-probetas-modelos-fiables-predecir-cambio-climatico/6224921/ **Rubén Pérez**
- 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://100tifiques.cat/, organized by a consortium of research institutes. She gave talk at Collegi Sagrada Família Sant Andreu de Barcelona on February 11th.
- **Celia Gonzalez** *"Acercando 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.
- Outreach videos in collbaoratin with Quantumfracture:

# 4. TRAINING AND OUTREACH ACTIVITIES

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 6 videos that have received 3 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 enfría al sol"
- "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, very recently, we have been awarded a FECYT grant entitled "La física de la materia condensada sale al encuentro", within the "Convocatoria de Ayudas para el foment de la cultura científica, tecnológica y de la innovación". This funding will be employed to support the generation of new outreach audiovisual materials in the near future.

IfiMAC
Condensed Matter Physics Center

# 5. HUMAN RESOURCES

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# 5. HUMAN RESOURCES

## NEW RESEARCHERS AFFILIATED DURING 2021

**YOUNG SCIENTISTS CALL:**

### Saül Vélez:

**Saül Vélez** pursed 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.

### Akashdeep Kamra:

**Akash** 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.

### Pablo Ares:

**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 Sklodowska-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.

# 5. HUMAN RESOURCES

**New members proposed by IFIMAC Researchers:**

### Pablo Burset (Talent grant)

**Pablo Burset** is a research fellow at the Autonomous University of Madrid within the "Atracción de Talento" Program of the Community of Madrid. Pablo is a theoretical physicist working on the fields of electronic transport in mesoscopic systems, superconductivity, and their applications for developing quantum technologies. He specializes in novel materials such as quantum dots, graphene, and topological insulators, and their interplay with superconductivity and magnetism in hybrid junctions. In 2012, Pablo obtained his PhD in Condensed Matter Physics at the Autonomous University of Madrid, under the supervision of Prof. Levy Yeyati. His thesis analyzed the superconducting proximity effect in carbon-based materials like graphene and carbon nanotubes. He next became a postdoctoral researcher at Würzburg University in the group of Prof. Trauzettel. In 2015, the Japan Society for the Promotion of Science awarded him with a postdoctoral fellowship in Nagoya University, to work in the group of Prof. Tanaka. In 2017, he became a Marie Skłodowska-Curie fellow at Aalto University in the group of Prof. Flindt. During his postdoctoral career, Pablo has developed novel theoretical methods to detect unconventional superconductivity in topological materials and to explore the symmetries of proximity-induced Cooper pairs. His research focuses on designing applications of superconducting hybrid junctions as sources of quantum entanglement or as platforms for engineering exotic effects like spin-polarised supercurrents or topological superconductivity.

### Enrique Burzurí (RyC)

**Enrique Burzurí** obtained his BSc (2006) and MSc (2007) in Physics from the Universidad de Zaragoza in Spain. He obtained his PhD diploma in 2011 at the Instituto de Ciencia de Materiales de Aragón (ICMA, CSIC) working on quantum phenomena in magnetic molecular crystals. Thereafter he moved to Delft University of Technology (The Netherlands) to join the vanderZant Lab as a VENI fellow. There, he worked in the field of single-molecule electronics and spintronics, and he unveiled the subtle interaction between charge and the complex magnetic properties of molecules. In January 2017 he joined IMDEA Nanoscience in Madrid as postdoc first and soon after as Assistant Research Prof. During this period, he was awarded with a Marie Sklodowska-Curie fellowship and an Atracción del Talento Investigador fellowship to work on low-dimensional magnetic heterostructures and their potential applications on spintronics and quantum information. In 2021, Enrique joined the Ifimac as Ramón y Cajal fellow.

## IFIMAC MEMBERS

| Surname and name | Professional category | Department | Research line/s |
|---|---|---|---|
| AGRAÏT DE LA PUENTE, Nicolás | Full Professor | FMC | NP |
| ALIEV KAZANSKI, Farkhad | Full Professor | FMC | AM |
| ÁLVAREZ ALONSO, Jesús | Professor | FMC | NP AM |
| ÁLVAREZ CARRERA, José Vicente | Associate Professor | FMC | FPSM,NP |
| ARAGONÉS GÓMEZ, Juan Luis | RyC Researcher | FTMC | SCMB |
| Ares García, Pablo | Assistant Professor | FTMC | AM, NP |
| ASSENZA, Salvatore | La Caixa Junior Leader | FTMC | SCMB |
| BARANDIARÁN PIEDRA, Zoila | Professor | Q | FPSM |
| BAUSÁ LÓPEZ, Luisa E. | Full Professor | FM | AM, NQO |
| BRAVO ABAD, Jorge | Associate Professor | FTMC | NQO |
| BRIHUEGA ALVAREZ, Iván | Associate Professor | FMC | AM,NP |
| Burset Atienza, Pablo | Research Fellow CM-Talent | FTMC | NP, AM |
| BURZURÍ LINARES, Enrique | RyC Researcher | FMC | |
| CINACCHI, Giorgio | Associate Professor | FTMC | SCMB,AM |
| CORTIJO ALBERTO | RyC Researcher | FMC | FPSM |
| CUEVAS RODRÍGUEZ, Juan Carlos | Professor | FTMC | NP,NQO |

# 5. HUMAN RESOURCES

| Surname and name | Professional category | Department | Research line/s |
|---|---|---|---|
| DELGADO BUSCALIONI, Rafael | Associate Professor | FTMC | SCMB |
| DIAZ-TENDERO VICTORIA, Sergio | Associate Professor | Q | FPSM |
| FARIAS TEJERINA, Daniel | Professor | FMC | NP |
| FEIST Johannes | RyC Researcher | FTMC | NQO |
| FERNÁNDEZ DOMÍNGUEZ, Antonio I. | Associate Professor | FTMC | NQO |
| FLORES SINTAS, Fernando | Emeritus Proffesor | FTMC | NP,FPSM |
| GARCÍA GONZÁLEZ, Pablo | Professor | FTMC | FPSM,NQO |
| GARCÍA MICHEL, Enrique | Full Professor | FMC | AM,NP |
| GARCÍA MOCHALES, Pedro | Associate Professor | FMC | FPSM |
| GARCÍA VIDAL, Francisco José | Full Professor | FTMC | NQO |
| GÓMEZ HERRERO, Julio | Full Professor | FMC | NP,AM |
| GÓMEZ-NAVARRO GONZÁLEZ, Cristina | Professor | FMC | AM,NP |
| GÓMEZ MÍGUEZ, David | Associate Professor | FMC | SCMB |
| GÓMEZ SANTOS, Guillermo | Professor | FMC | FPSM |
| GUANTES NAVACERRADA, Raúl | Associate Professor | FMC | SCMB |
| GUILLAMÓN GÓMEZ, Isabel | Associate Professor | FMC | AM |
| Hernandez Juárez, Beatriz | Associate Professor | QcaFca Aplicada | AM SCMB |
| Jaafar Ruiz-Castellanos, Miriam | Associate Professor | FMC | AM NP |
| Kamra, Akashdeep | Young researcher | FTMC | AM, NP |
| LAZIC, Snezana | Associate Professor | FM | NP |
| LEE, Eduardo Jian Hua | RyC Researcher | IFIMAC | NP, AM |
| LEVY YEYATI, Alfredo | Full Professor | FTMC | NP,AM |
| LÓPEZ VÁZQUEZ DE PARGA, Amadeo | Full Professor | FMC | NP |
| MARCHETTI, Francesca María | Associate Professor | FTMC | NQO |
| MARQUÉS PONCE, Manuel | Professor | FM | NQO |
| MARTÍN CANO, Diego | La Caixa Junior Leader | FTMC | NQO |
| MARTÍN GARCÍA, Fernando | Full Proffesor | Q | NP, FPSM |
| MERINO TRONCOSO, Jaime | Professor | FTMC | AM |
| MIGUEL LLORENTE, Juan José de | Professor | FMC | AM,NP |
| MIRANDA SORIANO, Rodolfo | Full Professor | FMC | NP,AM |
| MONREAL VÉLEZ, Rosa | Full Professor | FTMC | NP,NQO |
| MORENO SORIANO, Esteban | Professor | FTMC | NQO |
| MORI SÁNCHEZ, Paula | Associate Professor | Q | FPSM |
| ORTEGA MATEO, José | Full Professor | FTMC | FPSM |
| OTERO MARTÍN, Roberto | Professor | FTMC | AM, NP |
| PABLO GÓMEZ, Pedro José de | Professor | FMC | SCMB,NP |
| PALACIOS BURGOS, Juan José | Full Professor | FMC | NP,FPSM |
| PÉREZ PÉREZ, Rubén | Full Professor | FTMC | NP,FPSM |
| Platero Prats, Ana Eva | Research Fellow CM-Talent | QI | AM |

# 5. HUMAN RESOURCES

| Surname and name | Professional category | Department | Research line/s |
|---|---|---|---|
| POLOP JORDÁ, Celia | Professor | FTMC | AM, NP |
| PORTO ORTEGA, Juan Antonio | Associate Professor | FTMC | NQO |
| POU BELL, Pablo | Associate Professor | FTMC | FPSM,NP |
| PRINS, Ferry | RyC Researcher | FMC | NQO |
| RAMÍREZ HERRERO, Mariola | Associate Professor | FM | AM, NQO |
| RAMOS RUIZ, Miguel Ángel | Professor | FMC | AM,SCMB |
| RODRIGO RODRIGUEZ, José Gabriel | Professor | FMC | AM |
| RODRÍGUEZ ARRIAGA, Laura | RyC Researcher | FTMC | SCMB |
| RUBIO BOLLINGER, Gabino | Full Professor | FMC | NP AM |
| Sánchez Rodrigo, Rafael | RyC Researcher | FTMC | NP |
| SEGOVIA CABRERO, Pilar | Professor | FMC | AM,NP |
| SANCHEZ MUÑOZ, Carlos | La Caixa Junior Leader | FTMC | NQO |
| SEIJO LOCHÉ, Luis | Full Professor | Q | FPSM |
| SOLER TORROJA, Jose María | Full Professor | FMC | FPSM |
| SUDEROW RODRÍGUEZ, Hermann | Professor | FMC | AM,NP |
| TARAZONA LAFARGA, Pedro | Full Professor | FTMC | SCMB |
| TEJEDOR DE PAZ, Carlos | Full Professor | FTMC | NQO |
| VALLE REBOUL, Elena del | Associate Professor | FTMC | NQO, NP |
| VIEIRA DÍAZ, Sebastián | Emeritus Professor | FMC | AM |
| VIÑA LISTE, Luis | Full Professor | FM | NQO |
| VELASCO CARAVACA, Enrique | Professor | FTMC | SCMB |
| Velez Centoral Saul | Young researcher | FMC | |
| YNDURAIN MUÑOZ, Félix | EmeritusProfessor | FMC | FPSM |
| ZAMORA ABANADES, Félix | Professor | QI | AM |
| ZOTTI, Linda Ángela | Assistant Professor | 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

**IFIMAC**
Facultad de Ciencias, Calle Francisco Tomás y Valiente, 7,
Universidad Autónoma de Madrid, Ciudad Universitaria
de Cantoblanco, 28049, Madrid, Spain.
E-mail: ifimac(at)uam.es
Phone: +34 91 497 2433

# 5. BUDGET

# 6. BUDGET

| GASTOS | TOTAL (€) | INGRESOS | |
|---|---|---|---|
| **a) Gastos de personal**<br>Akashdeep Kamra ..... 36872,55€<br>Almudena Conde ..... 37172,04€<br>Beatriz Souto ..... 12692,23€<br>Stefan Bilan ..... 47386,68€<br>Diego A. Aldave Valle ..... 14392,16€<br>Galor Geva ..... 4788,98€<br>Saul Velez Centoral ..... 28676,76€<br>Noel Fructuoso Bonet ..... 822,08€<br>Manuel A. García Blázquez ..... 1138,8€<br>José A. Moreno Flores ..... 1138,8€<br>Ayudas de Master ..... 29400€<br>Complementos salariales ..... 18178,54€ | **232.659,62** | **Estimación de ingresos por actividad propia**<br><br>Acreditación de excelencia 2ª anualidad Costes Directos ..... **434782€**<br><br>Remanente 1ª anualidad Acreditación de Excelencia Costes Directos ..... **224922,5€**<br><br>Costes indirectos ..... **38181,22€**<br><br>Remanente Costes Indirectos ..... **28461,22€** | **726.346,94** |
| **a) gastos corrientes de funcionamiento**<br>Proyectos colaborativos ..... 2021,21€<br>Jóvenes investigadores ..... 3794,60€<br>Otros: Seminarios, outreach, esposorizaciones, servicios ..... 77822,40€<br>Retenciones ..... 4872,43€ | **93.888,15** | | |
| **a) equipamiento e inversiones** | **33.780,93** | | |
| **TOTAL GASTOS (€)** | **360.328,70** | | **726.346,94** |