CIC nanoGUNE

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Activity Report 2023-2024

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Jose M. Pitarke
Director

2024 MARKS THE 15TH ANNIVERSARY OF nanoGUNE'S OFFICIAL OPENING. WHAT HAVE BEEN THE KEY MILESTONES THAT HAVE DEFINED THE CENTER'S JOURNEY SO FAR?

Jose M. Pitarke: Over the past 15 years, we've made significant progress in all fronts: cutting-edge research, industry collaboration, and the creation of new start-up companies. I would particularly emphasize the fact that we have been able to combine state-of-the-art fundamental research with specific activities of industrial research and experimental development, aimed at exploiting at all times the opportunities we have been finding along the way.

We've been publishing in the very best journals research of very high impact worldwide. We've filed a substantial number of patents, many of which have already been licensed to both local and international companies. We've been conducting contract research, thus transferring our knowledge to industry. We've been training a large number of researchers, some of them (both local and international) now working at Basque companies. And to date, we've launched seven start-up companies.

WE HAVE BEEN ABLE TO COMBINE STATE-OF-THE-ART FUNDAMENTAL RESEARCH WITH SPECIFIC ACTIVITIES OF INDUSTRIAL RESEARCH AND EXPERIMENTAL DEVELOPMENT

"ONE FOCUS WILL BE THE TRANSLATION OF NANOMEDICINE AND QUANTUM TECHNOLOGIES TO THE MARKET"

WHERE IS THE CURRENT FOCUS OF nanoGUNE'S RESEARCH NOW?

J. M. P. : Over the past few years, our research has primarily focused in the fields of Quantum Nanoscience, Nanomaterials, and Nanomedicine. For the translation of our knowledge and technology to industry and society in general, we have been particularly successful in the area of nanomaterials, and now, with a focus on applications, we are strengthening our efforts in the areas of Quantum Nanoscience and Nanomedicine with the opening last year of two new research groups led by Ikerbasque Research Professors Mariana Medina-Sánchez and Fernando González-Zalba. Mariana, who joined us from Germany, is heading the new Nanobiosystems group, while Fernando, coming from the UK, is leading a new group on Quantum Hardware.

TO WHICH SOCIETAL CHALLENGES CAN NANOSCIENCE REALLY CONTRIBUTE?

J. M. P. : What are at least some of the major challenges of our society? Sustainability, energy, water, medicine, aging. Nanotechnology has the potential to contribute to all of them.

Thanks to the ability we have nowadays to structure matter at the nanoscale, now we have better materials for industrial manufacturing processes that should become more sustainable. Indeed, nanotechnology is well-known to have emerged as a powerful tool for a sustainable development. And nanotechnology has also the potential to contribute to the energy sector, for example, for the conversion of energy from one type to another one.

Then we have healthcare and medicine with important emerging applications. Here, much progress has been made already, and the impact of nanotechnology is expected to be huge with significant advances in the diagnosis, treatment, and prevention of diseases.

And then we have quantum technologies, which are being developed, to a large extent, thanks to the ability we have nowadays to do science and technology at the nanoscale. Quantum computing, in particular, has the potential to tackle problems that are currently beyond the reach of classical computers, such as the design of new drugs or the production of new sustainable materials; but we still have a long way to exploit the full potential of quantum technologies.

WHAT WILL BE THE FOCUS OF THE NANOBIOSYSTEMS GROUP?

J. M. P. : Mariana Medina-Sánchez and her research group are working mainly in the field of nanobiomedical engineering, with a focus on the development of nanotools for diagnostics and therapeutics and the translation of fundamental research into clinical applications. This includes the design of microfluidic nanobiosensors, microrobotic tools for cell manipulation and drug delivery, smart sensor-actuators for organ-on-a-chip platforms, *in vivo* imaging, and, in particular, the development of nanotools for the transport and release of gametes with the aim of assisting *in vivo* reproduction in cases of infertility, which is planned to be done in collaboration with the Basque Fertility Institute (IVF) in San Sebastian.

QUANTUM TECHNOLOGIES SEEM TO ANTICIPATE A NEW SCIENTIFIC REVOLUTION. HOW WILL THE QUANTUM HARDWARE GROUP STRENGTHEN nanoGUNE's QUANTUM NANOSCIENCE RESEARCH?

J. M. P. : We have always been working in the field of quantum nanoscience, and now the new research group, led by Fernando González-Zalba, is focused on the integration of silicon quantum dots in silicon platforms as qubits for quantum computing and quantum technologies in general, in the framework of a collaboration with the British scale-up company Quantum Motion. And all this will be done at the new tower, the Quantum Tower, that we have started to build right here, as an extension of the existing nanoGUNE building, and will house the laboratories of the new research group on Quantm Hardware.

APPART FROM THE NEW INDUSTRIAL COLLABORATIONS, nanoGUNE HAS LAUNCHED A NEW COMPANY, OPTEC4LIFE, IN 2024. WHAT IS THE SCOPE OF THIS NEW SPIN-OFF?

J. M. P. : We have just launched this new spin-off company, in the framework of the so-called Basque Tek Ventures initiative of the Basque Government, on the development of a medical device for a non-invasive, continuous, real-time diagnosis of perinatal asphyxia based on photonics and machine learning. This research was initiated a few years ago, in the framework of a collaboration with Biogipuzkoa, a health research institute in San Sebastian, in order to address what at the time was a market gap. We patented our technology, and now we are developing the device for commercialization.

LOOKING TO THE FUTURE, WHAT ARE THE NEXT STRATEGIC STEPS FOR nanoGUNE?

J. M. P. : Now we need to keep doing cutting-edge research in the fields of Quantum Nanoscience, Nanomaterials, and Nanomedicine with a special focus on the consolidation of what we have been doing so far and also the translation of nanomedicine and quantum technologies to the market, thus discovering, I hope, unknown territories and responding at all times to our commitment to society and to industry: the industry of the present and, above all, the industry of the future. That is the big challenge of the small.

nanoGUNE in Numbers · 2023-2024

138*
Employees

42*
Students and Guests

11
Research groups

186
ISI publications

12 508
Citations

9.7
Average impact factor

73*
Grants in place

54
Invited talks

77
Seminars

7
Patents submitted

18
Patents licensed

7
Start-ups ongoing

935
Times in the media

12
Conferences and workshops organized

38 800
Participants reached in outreach activities

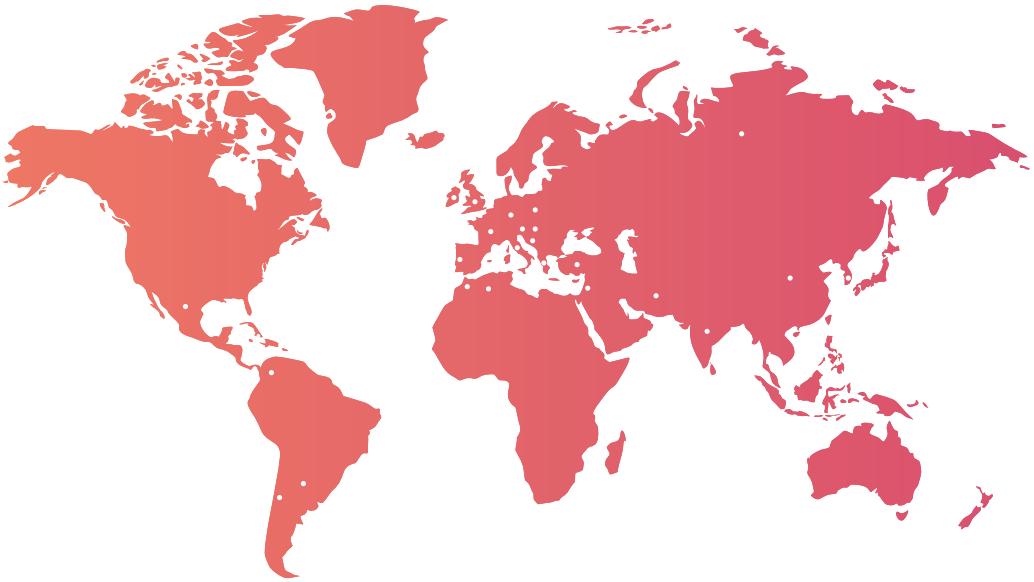
11
PhD theses accomplished

53*
PhD theses ongoing

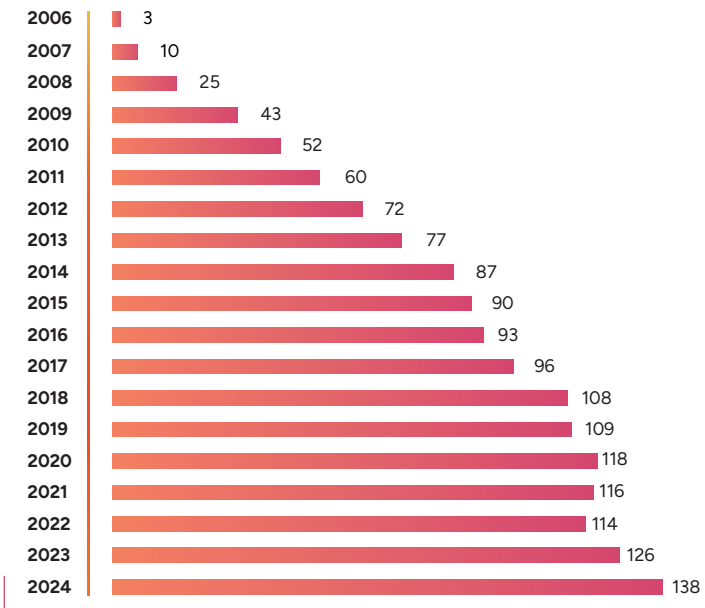
* On 31 December 2024

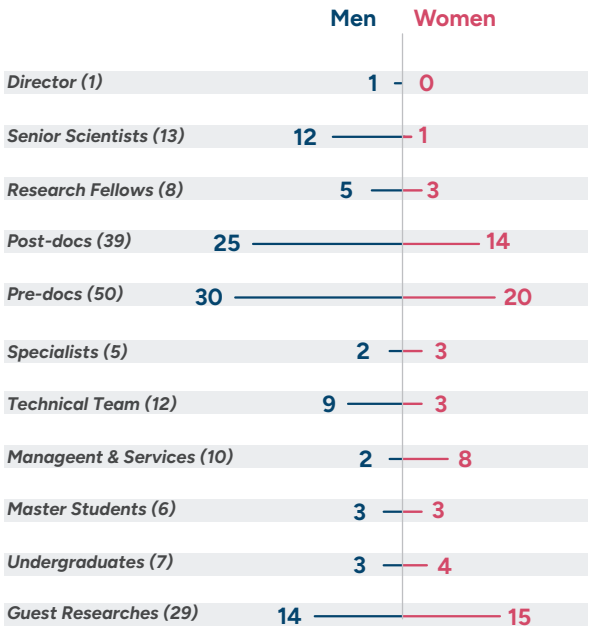
People from 30 countries

Spain	80
Italy	14
Germany	12
China	11
Russia	11
India	10
France	4
Poland	4
Chile	3
Iran	3
Turkey	3
Austria	2
Croatia	2
Greece	2
Morocoo	2
Portugal	2
United Kindom	2
Algeria	1
Argentina	1
Colonbia	1
Cuba	1
Czech Republic	1
Ireland	1
Korea	1
Lebanon	1
Mexico	1
Sweden	1
Switzerland	1
Syria	1
Vietnam	1



nanoPeople





On 31 December 2024 (not including students and guests)

RESEARCH ACTIVITY

Interview

NANOTECHNOLOGY PROMISES SIGNIFICANT ADVANCES IN MEDICINE

HOW HAVE THE FIELDS OF GYNECOLOGY AND INFERTILITY EVOLVED IN RECENT YEARS, AND WHERE ARE WE NOW?

Mariana Medina-Sánchez: Collaborations between research groups and clinics are driving progress across various disciplines to enhance results in assisted reproduction. Multiple research lines are advancing in parallel —including novel approaches in molecular biology and genetic testing, medical devices for gamete and embryo handling, innovative cell and embryo culture technologies (such as 3D models and organoids), and artificial intelligence— collectively contributing to improved outcomes in assisted reproduction and gynecological healthcare. Technologies such as time-lapse imaging, combined with artificial intelligence, now allow more accurate embryo assessment. Preimplantation genetic testing has also improved implantation success by assessing the genetic integrity of the embryo before transfer. Research into endometrial receptivity and the microbiome is expanding, recognizing their critical role in implantation. In addition, innovations such as microfluidics for sperm sorting are helping to select sperm with high DNA integrity. Of course, there are still many hurdles, but there has been notable improvement, especially in the last years.

Mariana Medina-Sánchez
Group Leader of the Nanobiosystems group

IN THE NANOBIOSYSTEMS GROUP, YOU ARE DEVELOPING INNOVATIVE MICROROBOTS FOR THIS APPLICATION AREA. COULD YOU EXPLAIN WHAT THESE TOOLS ARE AND HOW THEY WORK?

M. M. S. : In the Nanobiosystems Group, we are developing innovative microtools for both early disease diagnosis and non-invasive targeted therapies. For diagnosis, we are developing biosensors based on microfluidics and electrochemical readouts to assess parameters such as metabolites, oxidative stress, and other parameters to evaluate the quality of gametes and embryos prior to assisted reproduction techniques. On the other hand, we are also developing microrobots that can be controlled externally by magnetic fields or acoustic waves. These medical devices can be used to reach difficult locations in the body to deliver drugs or cells, for example, to treat ovarian cancer by delivering anti-cancer drugs locally, or to assist sperm in the fertilization process.

WHAT ARE THE MAIN CHALLENGES OF THESE KINDS OF TECHNOLOGIES?

M. M. S. : One of the main challenges is navigating the regulatory pathways to the clinic, as there are different stages that the technologies must go through. We need to validate our technologies first in *in vitro* systems, in organ-on-chip devices, then in small animals, large mammals, and finally in humans. This is a long road for any new medicine or therapy. In the field of reproductive medicine, there are ethical concerns about the use of new technologies because a life is involved in the process. It is important to ensure that the materials and technologies we use are safe. The procedures must also be non-invasive and should not cause additional problems to the patient. We must weigh the risks against the benefits that these technologies can provide and identify scenarios where these technologies can truly make a difference.

BEYOND GYNECOLOGY AND INFERTILITY, WILL THE RESEARCH OF THE GROUP SEEK SOLUTIONS FOR OTHER GLOBAL MEDICAL CHALLENGES?

M. M. S. : These diagnostic devices and microrobotic technologies are also applicable to other biomedical fields, because the main goal is to achieve highly sensitive, very precise and personalized diagnosis and, with microrobotics, targeted and non-invasive therapy. This can be applied to other medical needs, such as the treatment of infectious diseases and tissue engineering. For example, there is the possibility to use these microrobots as scaffolds to promote tissue growth and regeneration at the site of injury by transporting them remotely to the organ site.

IN THE LONG TERM, HOW DO YOU EXPECT THESE TECHNOLOGIES TO IMPACT THE FUTURE OF PERSONALIZED MEDICINE AND DIAGNOSTICS?

M. M. S. : In the future, I expect that these technologies will generally improve healthcare by addressing the individual, personalized needs of patients through comprehensive diagnosis: a multi-parametric diagnosis that looks at the disease holistically. Additionally, these technologies aim to reduce the invasiveness of current surgical and therapeutic approaches, thereby reducing side effects and improving the quality of life of patients. That is the ultimate goal.

> ***MICROROBOTS CAN REACH DIFFICULT PLACES IN THE BODY TO DELIVER DRUGS***

Interview

"SCALABILITY IS THE NEXT BIG CHALLENGE OF QUANTUM TECHNOLOGIES"

Fernando González-Zalba
Group Leader of the Quantum Hardware group

QUANTUM TECHNOLOGIES SEEM TO BE ADVANCING UNSTOPPABLY AND AT FULL SPEED. WHERE ARE WE REALLY, AND WHAT ARE THE MAIN CHALLENGES THAT REMAIN TO BE SOLVED?

Fernando González-Zalba: Quantum technologies are advancing at an unprecedented rate, with significant progress being made in several areas, in particular in quantum computing. This rapid development has generated excitement in both academia and industry, as quantum computers promise to solve some of society's most challenging problems. However, despite these rapid developments, the technology is still in its infancy and faces several critical challenges that must be addressed before quantum computing can reach its full potential. Currently, many research groups and institutions around the world are exploring different quantum-computing architectures and methods, with promising results. Still, one of the main obstacles remains the scalability of these systems. Our goal is to scale up these technologies and develop more robust quantum computing architectures that can efficiently handle large-scale computations. Once these operational challenges are overcome, quantum computers will have the potential to revolutionize several fields.

YOU ARE NOW LEADING nanoGUNE's QUANTUM HARDWARE GROUP. WHAT WILL BE YOUR IMMEDIATE RESEARCH PRIORITIES, AND HOW DO YOU SEE THIS EVOLVING OVER THE NEXT FIVE TO TEN YEARS?

F.G.Z.: As head of this group, my immediate priority is to establish a state-of-the-art research infrastructure that will serve as the foundation for our work in quantum computing. Over the next year, we will focus on setting up our laboratories and equipping them with advanced low-temperature systems and high-precision electronic instrumentation necessary for the design, fabrication, and characterization of quantum hardware. Our goal is to build one of the most advanced quantum research facilities in Southern Europe, positioning nanoGUNE as a key player in the field. Looking ahead over the next five to ten years, our focus will shift toward the development of cutting-edge quantum-hardware technologies.

WHAT ARE THE MAIN SCIENTIFIC AND TECHNICAL ADVANTAGES OF SILICON-BASED QUANTUM TECHNOLOGIES?

F.G.Z.: The main advantage of using silicon for quantum technologies, and quantum computing in particular, is the scalability it promises. Silicon leverages the well-established semiconductor manufacturing infrastructure, the same infrastructure used to make the microprocessors in our cars, phones, and laptops. By taking advantage of this infrastructure, we aim to scale the technology up to a sufficient number of qubits to perform computations that are not possible today. We aim to increase the complexity of our quantum processors, moving from a small number of qubits to a large enough number that should allow us to run some of the most promising quantum algorithms.

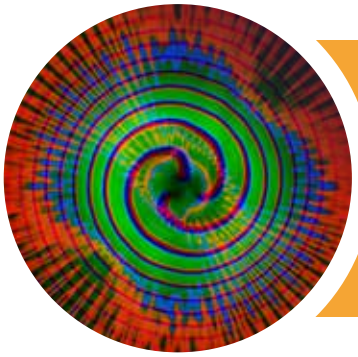
WHAT ARE THE MAIN CHALLENGES YOU FORESEE IN SCALING SILICON-BASED QUANTUM TECHNOLOGIES?

F.G.Z.: The challenges of scaling up silicon-based quantum computing involve working very closely with semiconductor manufacturers. These large companies have the expertise to develop classical electronic circuits, and now we need to collaborate with them to enable this technology to produce silicon-based quantum processors. One of my goals is to work much more closely with the semiconductor industry to make this technology a reality.

ONCE WE ARE ABLE TO BUILD QUANTUM COMPUTERS THAT ARE MORE POWERFUL THAN TODAY'S SUPERCOMPUTERS, WHAT CAN WE EXPECT?

F.G.Z.: Quantum computers promise to help us solve some of the most challenging societal problems we face today. For example, in theory, quantum computers will be able to improve online security. They will also assist with online searches and searches in unordered databases. There are applications in cancer detection and DNA sequencing as well. Additionally, quantum computers excel at solving optimization problems, which can be applied to weather forecasting or financial market predictions. However, what excites me most about developing this technology is the possibility of using quantum computers to simulate nature. If we can simulate nature, we may be able to create new molecules, medicines, and materials that will improve the quality of life for people and society in general.

> *"WHAT EXCITES ME MOST IS THE POSSIBILITY OF USING QUANTUM COMPUTERS TO SIMULATE NATURE*



NANOMAGNETISM

Our primary goal is to conduct world-class fundamental and applied research on magnetism and magneto-optics at the nanoscale.

MAGNETO-PLASMONICS

We conduct investigations on magneto-plasmonics, an emerging area aiming at merging magnetism and plasmonics to either control localized plasmons, confined electromagnetically-induced collective electronic excitations, using magnetic properties, or vice versa.

» *In recognition of our leadership in the field, we were invited to write a Perspective article in which we reviewed the current state of the art, challenges, and future opportunities within the field of magneto-plasmonics in confined geometries [Applied Physics Letters, 2023].*

TWISTED LIGHT FOR MAGNETISM

We are exploring the use of twisted light, namely electromagnetic waves possessing orbital angular momentum (OAM), for high-resolution and time-resolved magnetic microscopy. In particular, we are employing OAM beams to detect peculiar helical dichroic effects due to topological spin textures as, for example, those emerging in chiral magnetic nanostructures.

» *We participated in a collaborative project conducted at the Elettra synchrotron facility (Italy) to perform single shot ptychography on a nanostructured object using extreme ultraviolet OAM beams of different topological charge orders (i.e., different orbital momenta). We demonstrated that OAM beams significantly improve the image resolution with respect to conventional Gaussian beam illumination. This result extends the capabilities of coherent diffraction imaging techniques and paves the way for achieving time-resolved high-resolution (below 100 nm) microscopy on large-area samples [Optica, 2024].*

EXPERIMENTAL STUDIES OF DYNAMIC PHASE TRANSITIONS

We are conducting detailed investigations of the Dynamic Phase Transition (DPT) in thin magnetic films that are specifically designed to allow for precise experimental observations in the appropriate dynamic phase space.

» *We have demonstrated that the dynamic order parameter exhibits critical scaling in the vicinity of the dynamic critical point and that the critical exponents for ultrathin uniaxial films are consistent with 2D Ising model predictions [Physical Review Letters, 2023].*

» *We have verified that the anomalous metamagnetic fluctuations ocurring in the paramagnetic dynamic phase near the DPT are truly random and do not exhibit any multicycle correlations or memory [Physical Review E, 2023].*

» *We have demonstrated the viability of the conjugate field concept for experimental cases in which the anti-symmetry of the applied field sequence is not preserved [Physical Review E, 2024]*

ELLIPSOMETRIC MAGNETO-OPTICAL MEASUREMENTS

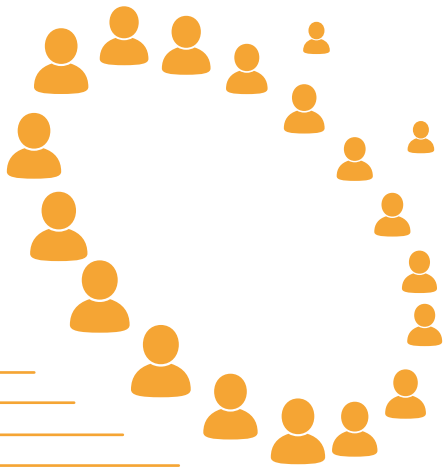
We have utilized our advanced and home-built magneto-optical ellipsometry capabilities to demonstrate full vector magnetometry using just a single light reflection experiment.

» *We have shown that it is possible to conduct precise three-dimensional (3D) vector magnetometry of a magnetic sample, using Generalized Magneto-optical Ellipsometry (GME) and employing only one single light reflection setup [Physical Review B, 2023].*

» *We have demonstrated that by means of GME measurements one can even achieve layer-resolved vector magnetometry within a multilayer sample, which is otherwise not accessible experimentally [Applied Physics Letters, 2024].*

» *We have utilized this layer-resolved vector magnetometry capability of GME to identify and quantify interlayer Dzyaloshinskii-Moriya interactions across Ag-layers in magnetic multilayer structures [Nature Communications, 2023].*

Group members



Andreas Berger
Research Director
Group Leader

Paolo Vavassori
Ikerbasque Research Professor
Group Coleader

Post-docs

Terunori Kaihara
Chandan Pandey
Mikel Quintana

Pre-docs

Luciano Bravo
Carmen Martín
Matteo Menniti
Ignacio Radic
Pablo Rodríguez
Nageswar Sanamreddy
Yoav Urbina

Technician

Cesar Rufo

Undergraduates

Rodrigo De Las Heras
University of the Basque Country (Spain)

Paula Guerrero
University of Seville (Spain)

Simeon Kägi
Technical University Freiberg (Germany)

Master Students

Iratxe Garmendia
University of Oviedo (Spain)

Guest Researchers

for at least one month

Mikel Anzola
BCMaterials (Spain)

Jose M. Porro
BCMaterials (Spain)

María Jauregui
CIC energiGUNE (Spain)

Julian Milano
INN CNEA-CONICET (Argentina)

Benjamin Mimica
Federico Santa María Technical University (Chile)

Augusto Roman
INN CNEA-CONICET (Argentina)

Anastasiia Sapunova
University of Milano Bicocca (Italy)

Aritz Villar
BCMaterials (Spain)

Hiromi Yuasa
Kyushu University (Japan)

HIGHLIGHTS

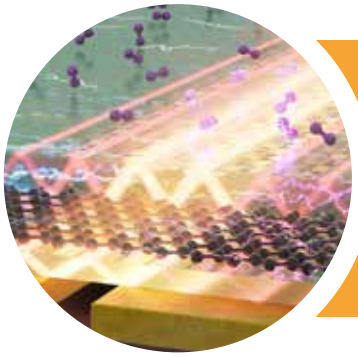
COST Action

We participate in the Management Committee of the COST Action CA23136 "Magnetism and chirality: twisting spins, light, and lattices for faster-than-ever spintronics **(CHIROMAG)**", representing Spain. This Action targets disruptive achievements in ultrafast chiral magnetism by coordinating the existing expertise and capabilities of scientific communities across Europe dealing with ultrafast magnetism and spintronics.

The ultimate objective is to discover ultrafast and energy-efficient ways to control magnetic topological states.

Extraordinary Doctorate Award

In July 2024, our Ph.D. student Mikel Quintana was awarded the Extraordinary Doctorate Prize 2024 in the area of Sciences by the University of the Basque Country for his thesis Phase Transitions in Nanoscale Designed Magnetic Thin Films, which he defended in 2023.



NANOOPTICS

We develop near-field optical nanoscopy techniques and apply them for exploring novel materials and nanophotonic phenomena.

INSTRUMENTAL AND METHODS DEVELOPMENTS

We continuously improve and expand our near-field techniques (s-SNOM and nano-FTIR) for unprecedented nanoscale imaging and spectroscopy in the visible to terahertz frequency range.

» *We have solved the puzzle of negative phase contrasts in s-SNOM images of non-absorbing materials on highly reflective substrates and have described simple correction methods [Optica Express, 2023].*

» *We have coupled a grating spectrometer to an IR s-SNOM, allowing for detecting sum-frequency generation in molecule-filled nanoparticle-on-mirror nanocavities [Light: Science & Applications, 2025].*

MATERIALS CHARACTERIZATION

We apply our near-field techniques for nanoscale mapping of chemical composition, mobile carrier concentration, and optoelectronic properties in functional materials and devices.

» *Nano-FTIR spectroscopy has revealed a 50 nm-thin crystalline surface layer on extruded polymer membranes designed for gas filtration, absent in solvent-cast membranes, explaining their significantly reduced gas permeation [Journal of Membrane Science, 2024].*

PLASMONICS AND PHONONICS

We explore plasmon and phonon polaritons in two-dimensional (2D) and three-dimensional (3D) materials for the development of ultracompact nanophotonic devices and for uses in molecular sensing, among other uses.

» *We have observed mid-infrared phonon polaritons in wafer-scale multilayer hexagonal boron nitride prepared by chemical vapor deposition [Advanced Materials, 2023].*

» *Applying s-SNOM, we have visualized ultraconfined in-plane anisotropic acoustic terahertz plasmon polaritons [Nature Materials, 2023].*

» *We have applied nano-FTIR spectroscopy to demonstrate that the vibrational signature observed in surface-enhanced infrared absorption (SEIRA) spectroscopy of molecules in the vicinity of plasmonic antennas can be equally well explained by field-enhanced molecular scattering [Nature Communications, 2024].*

» *We have developed an on-chip surface-enhanced infrared absorption (SEIRA) spectroscopy platform that integrates an h-BN/graphene/h-BN heterostructure, serving simultaneously as phononic SEIRA substrate and room-temperature infrared detector [Nature Communications, 2024].*

HIGHLIGHTS

EU Project

ENSEMBLE Phase II (GA 857543). We are participating in the creation and strategic growth of a Center of Excellence (ENSEMBLE3) located in Poland, which focuses on research excellence and innovation in crystal growth-based technologies, novel functional materials with innovative electromagnetic properties, and applications in nanophotonics, optoelectronics, and medicine.

Industrial collaboration

In collaboration with the Nanoscale Analytics department of the German company **Attocube Systems GmbH** (formerly Neaspec GmbH), our cutting-edge near-field nanoscopy developments have been implemented into the neaSCOPE product line that nowadays can be found worldwide in state-of-the-art nanoscale analytics laboratories.

Group members

Rainer Hillenbrand
Ikerbasque Research Professor
Group Leader

Pre-docs
Andrei Bylinkin
Irene Dolado
Iker Herrero
Jan Krpensky
Carlos Maciel
Florina Marxer
Divya Virmani

Post-docs
Eugenio Calandrini
Shu Chen
Monika Goikoetxea
Théo Hannotte
Iris Niehues
Elizaveta Nikulina
Philippe Roelli
Edoardo Vicentini

Technician
Carlos Crespo

Research Fellow
Martin Schnell
Ikerbasque Fellow

Undergraduates
Jiri Kabat
Brno University of Technology (Czech Republic)

Leire Zufia
University of the Basque Country (Spain)

Specialist
Iban Amenabar

Master Students
Felix Begemann, *University of Bonn (Germany)*
Samuel Garcia-Diaz, *University of Oviedo (Spain)*
Priyansu Sahu, *Mumbai University (India)*
Naia Soler, *University of Barcelona (Spain)*
Jakub Štastný, *Brno University of Technology (Czech Republic)*

Guest Researchers
for at least one month

Kateryna Domina
Donostia International Physics Center (Spain)

Igor Getmanov
King Abdullah University of Science and Technology (Saudi Arabia)

Victor Krivenkov
Materials Physics Center (Spain)

Adam Olejniczak
Materials Physics Center (Spain)

Nicolas Pajusco
Le Mans University (France)

Isabel Pascual
Materials Physics Center (Spain)

Samuel Raetz
Le Mans University (France)

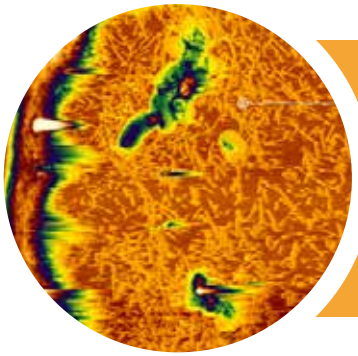
Elham Talvari
Goethe University (Germany)

Marita Wagner
CIC biomaGUNE (Spain)

Daniel Wigger
University of Münster (Germany)

Patent application

In collaboration with ICFO, we have submitted a patent application describing "An optical fluid sensor and an optical fluid sensor arrangement" for ultrasensitive detection of fluids and gases via on-chip SEIRA spectroscopy.



SELF-ASSEMBLY

We synthesize and analyze biomolecular nanofibers.

PEPTIDE NANOFIBERS

Doctoral candidates in our Marie Sklodowska-Curie network NANOREMEDI have established a range of electrospun fibers composed solely of peptides.

» *We have published the synthesis and electrospinning of novel peptidomimetics, based on the pyrrolo-pyrazole moiety [Biomacromolecules, 2024].*

WATER IN VIRUSES

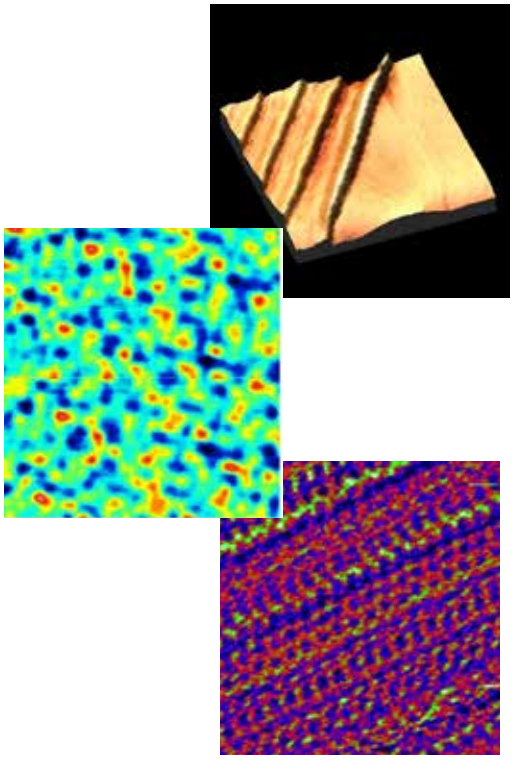
Neutron reflectometry has elucidated the adsorption of ultrathin water layers on viruses.

» *We have successfully tested a novel wet atmosphere setup in the "FIGARO" beamline (ILL Grenoble) on adsorbed plant viruses [Experiment 8-02-1036].*

ELECTROSPINNING, ELECTROWRITING, 3D PRINTING

Data is encoded in DNA sequences and encapsulated in fibers.

» *We have encoded the word "nanogune" in DNA, stored it in electrospun polymer nanofibers, and demonstrated data retrieval [Materials Today Bio, 2024].*



HIGHLIGHTS

EU Innovation Council (EIC) project

We have started the EIC pathfinder project "**TextaDNA**" for data storage in DNA in collaboration with Eurofins Genomics GmbH. The project is embedded in the portfolio "DigNA" (digital storage in nucleic acid). It is based on DNA synthesis and on its encapsulation in polymer fibers

Collaborations on strong cell scaffolds

Our melt electrowritten polymer scaffolds combine biocompatibility, biodegradability, and high mechanical strength. They are now being investigated as scaffolds for tissue in infarcted hearts and for muscle/tendon regeneration.

Group members

Alexander Bittner
Ikerbasque Research Professor
Group Leader

Post-docs
Mohammad Amini
Diana Soukarie
Cecilia Wetzl

Research Fellow
Ibon Santiago
Gipuzkoa Fellow

Specialist
Javier Latasa

Pre-docs
Matteo Bottiglieri
Nursu Erdogan
Konstantina Mitropoulou
Ali Qassem
Jokin Yeregui

Undergraduates
Jan Schneider
University of the Basque Country (Spain)
Josu Gómez
University of the Basque Country (Spain)
Maider Ortiz
University of the Basque Country (Spain)

Guest Researchers
for at least one month
Aitziber Eleta
University of the Basque Country (Spain)

Technician
Raquel Olmos

Imaging techniques based on nanoscale forces

We employ a new Atomic Force Microscope in a wide range of modes to scan surfaces, to resolve biomolecular structures, and to measure highly localized forces.

NANOBIOSYSTEMS

The Nanobiosystems group strives to develop cutting-edge micro and nanotechnology-based solutions for early and personalized diagnosis, as well as advanced, minimally invasive, and supervised therapies.

MICROFLUIDIC NANOBIOSENSORS AND ADVANCED DIAGNOSTIC TECHNOLOGIES

Utilizing advanced microfabrication techniques, highly compact and miniaturized sensors are developed to study biological cells and tissue development under applied physical and/or chemical cues. These sensors are designed to detect extremely low concentrations of relevant analytes, such as cancer biomarkers, infectious agents, and single cells in real samples and in a non-destructive way, enabling an early and personalized disease diagnosis.

» *We have developed a simple and reliable early diagnostic tool for detecting low pathogen loads before symptoms appear [Biosensors and Bioelectronics, 2023].*

MICROROBOTIC TOOLS FOR MINIMALLY INVASIVE MEDICAL INTERVENTIONS

Medical microrobots are microscopic functional structures, either tethered or untethered, designed for non-invasive diagnosis and therapy at the cellular scale. Inspired by nature or integrating living cells and microorganisms with smart materials and structural designs, these microrobots are envisioned to operate autonomously in physiologically relevant fluids. Their functionalities include locomotion, sensing, decision-making, micromanipulation, targeted cargo release, and enhanced contrast for bioimaging, among others.

» *We have developed a multifunctional, biodegradable soft microcapsule for targeted drug delivery, which can be manipulated using external magnetic fields under ultrasound and photoacoustic imaging [Advanced Intelligent Systems, 2024].*

INTELIGENT SENSOR-ACTUATOR PLATFORMS FOR ORGAN-MIMICKING TRAINING AND SIMULATION

This research integrates lab-on-a-chip technology with tissue engineering principles to replicate key functions and anatomies of human organs using primary cells and dynamic cell co-culture systems. The goal is to enable the validation of novel, non-invasive theragnostic tools for precise and personalized medicine while reducing reliance on animal models.

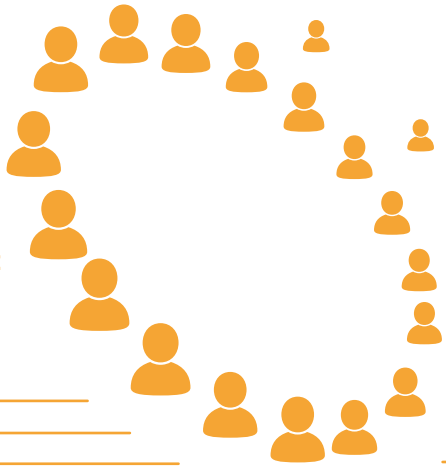
» *We have developed tubular microelectrodes with integrated microfluidics capable of supporting stem cell growth, differentiation, migration, and division [Small, 2024].*

IMAGING AND ADVANCED CONTROL SYSTEMS

Medical microdevices have been demonstrated for a variety of non-invasive biomedical applications, such as tissue engineering, drug delivery, and assisted fertilization, among others. However, most of these demonstrations have been carried out *in vitro* or in *ex vivo* tissues, differing from the clinical scenario. Thus, medical imaging techniques with high spatiotemporal resolution and advanced feedback control are required to operate such microrobots in complex biological environments to reliably perform their intended function.

» *We have pioneered, within the microrobotics scientific community, a real-time magnetic control of untethered microscopic microrobots in living mice, demonstrating potential applications in targeted drug delivery and embryo transfer.*

Group members



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Hongyu Zhao

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Silvia Moreno
University of Alcalá (Spain)

Technician
Dane Ruscuklu

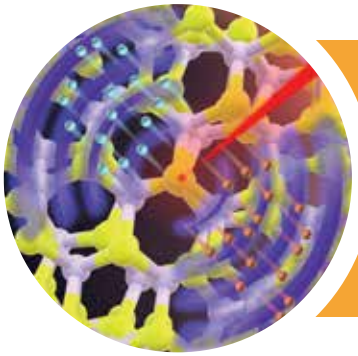
HIGHLIGHTS

MicroGIFT project

The Nanobiosystems group leader Mariana Medina-Sánchez holds an ERC Starting Grant by the European Research Council to work on her **MIcroGIFT** project: "Robotic intrafallopian transport of gametes/zygotes for improved embryo implantation rates". The project aims at developing microrobots to assist in reproductive techniques.

Collaboration with Biogipuzkoa

The Nanobiosystems group has established a shared animal laboratory in collaboration with Biogipuzkoa, thus enabling experiments on living mice using the developed medical micro/nanotools.



NANODEVICES

Our goal is to study the electronic and optoelectronic properties of systems in reduced dimensions and symmetries.

APPLIED SPINTRONICS

We use spin-based devices as an alternative computational architecture in which the combination of memory and logic leads to a high-energy efficiency.

» *We have developed, in the framework of our collaboration with Intel, a fully integrated magnetoelectric spin-orbit (MESO) device [Nature Communications, 2024].*

SPINTRONICS IN LOW-DIMENSIONAL MATERIALS

Low-dimensional van der Waals materials show broken symmetries and can be stacked in heterostructures, giving rise to proximity effects that can be exploited in spintronics.

» *We have twisted a graphene/WSe_2 heterostructure in order to control the spin texture of the system, giving rise to unconventional spin-charge interconversion effects [Nature Materials, 2024].*

» *We have combined graphene and a two-dimensional (2D) magnetic material, $CrGeTe_3$, making graphene ferromagnetic by proximity and achieving a seamless all-graphene spin valve [Nature Electronics, 2024].*

HYBRID FUNCTIONAL MATERIALS

We combine different classes of materials (molecules, 2D materials, metals, etc.) to manipulate and enhance their functionalities.

» *We have produced circularly polarized light by using chiral molecules in a hybrid organic/inorganic material [Advanced Optical Materials, 2024].*

» *We have been able to tune the magnetism of 2D materials by intercalating molecules in between their inorganic layers [Advanced Functional Materials, 2024].*

NON-LINEAR EFFECTS

We study quantum transport arising from symmetry breaking (magnetochiral anisotropy, non-linear conductivity, bulk photovoltaic effect) in different systems.

» *We have observed non-linear conductivity in chiral Te, with the first quantification of this effect in any material, and have confirmed that the effect is odd under inversion symmetry. We have applied this effect in Te for wireless RF rectification, which can be amplified by the application of an electrostatic gate [Physical Review Letters, 2024; Advanced Materials, 2024].*

» *We have observed the intrinsic bulk photovoltaic effect in ReS_2 free from spurious effects through lateral device engineering. The intrinsic effect is in agreement with theoretical calculations based on a noncentrosymmetric ReS_2 bilayer [Nano Letters, 2024].*

HIGHLIGHTS

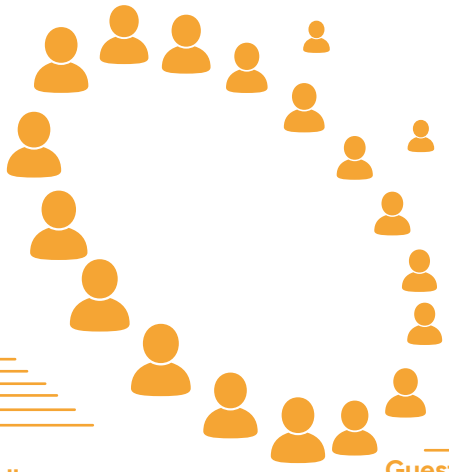
EU Projects

We have been coordinating the **SPEAR** project (MSCA-ITN EU Project) that seeks to explore new materials for the next generation of computer memories and processors. We participate in the **SINFONIA** and **INTERFAST FET** Open projects, in the **MULTISPIN** Flag ERA project, and in the **FantastiCOF** EIC Pathfinder project.

Industrial collaboration

We have renewed our industrial collaboration with the multinational company **Intel**, with which we are working on the development of a disruptive technology for the electronics of the future, the so-called MESO technology, a new technology that combines memory, interconnects, and logic requirements for future computing needs.

Group members



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Fèlix Casanova
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Cristina Campos, *University of the Basque Country (Spain)*
Alejandro Herrero, *University of Salamanca (Spain)*
Alejandro Martín, *University of Salamanca (Spain)*
Asier Ribechini, *University of the Basque Country (Spain)*

Guest Researchers

for at least one month

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David Caldevilla
Materials Physics Center (Spain)
Sara Catalano
Materials Physics Center (Spain)
Safeer Chenattukuzhiyil
University of Oxford (UK)
Federico Fagiani
Polytechnic University of Milan (Italy)
Patricia Ferrer
University of Alicante (Spain)
Marco Gobbi
Materials Physics Center (Spain)
Niklas Kercher
ETH Zürich (Switzerland)
Sergio Leiva
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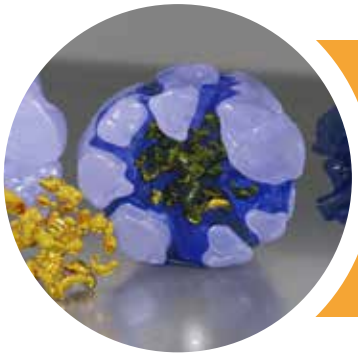
Pablo Levy
INN CNEA-CONICET (Argentina)
Maider Ormaza
University of the Basque Country (Spain)
Ferry Prins
Autonomous University of Madrid (Spain)
Paolo Sgarro
Spintec (France)
Witold Skowronski
AGH University of Krakow (Poland)

Fèlix Casanova, 2022 Intel outstanding research award

This award represents a recognition of research excellence as an essential motor for technological advances. Awarded in March 2023.

New AZPITEK equipment

Funded by the AZPITEK program of the Basque Government, a new PPMS has been installed, which improves the capabilities of the group for the characterization of the electronic and magnetic properties of materials and devices.



ELECTRON MICROSCOPY

The Electron-Microscopy Laboratory is aimed at providing high-level research support to scientific communities with a broad variety of electron and ion microscopy techniques.

LIQUID-PHASE TEM

Simulation and experimental work and specific know-how developed on their base have led to the implementation of a new nanoreactor design for Liquid-Phase Transmission Electron Microscopy (TEM), which has proven its efficiency in several application areas [Ultramicroscopy, 2023; Current Opinion in Electrochemistry, 2023; Small Methods, 2024; Nature Communications, 2024].

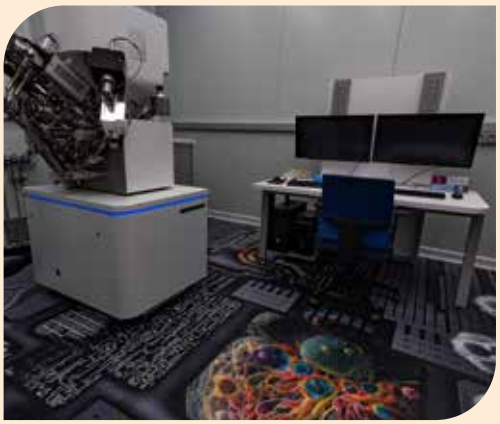
3D IMAGING

Volume imaging techniques established at the laboratory provide three-dimensional (3D) structural information in such application cases as viral particles distribution in infected cells, polymer component distribution in multicomponent waterborne latexes, and percolation networks in hybrid electrolytes for battery cells.

HIGHLIGHTS

Unique FIB expands the electron microscopy facility

The CRYO Plasma FIB is a new exciting tool, one of a few in Europe, installed at nanoGUNE in 2023 to provide high-end electron-microscopy and FIB nanofabrication support to research institutions and industry in the Basque Country and worldwide. This new equipment, funded by the Spanish Ministry of Science, Innovation, and Universities, is becoming a new tool of the Basque Electron Microscopy infrastructure and has strengthened its capabilities.



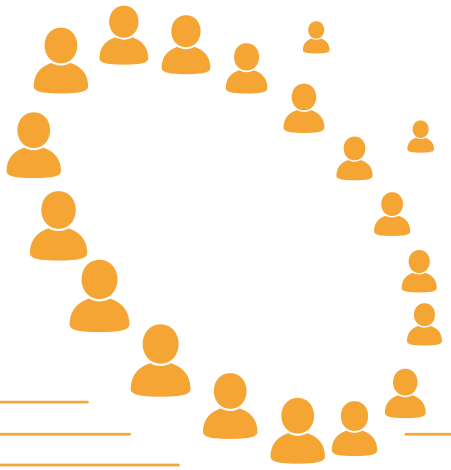
Patent application

We have submitted a patent application for the design of a liquid flow cell for Liquid-Phase TEM allowing for ultrafast exchange dynamics of reagents in an *in-situ* nanoreactor.

External service

The combination of high-end equipment and a highly-qualified personnel at our laboratory ensures a reliable and industrially relevant external scientific service resulting in a substantial annual income from the private sector.

Group members



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Technician
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Specialists
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Oksana Iurkevich

Master Student
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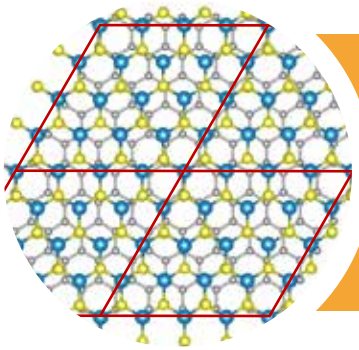


THEORY

Our main aim is furthering the understanding and knowledge of nanosystems by means of computational simulation and physical models based on fundamental quantum physics.

ATOMISTIC SIMULATIONS OF LOW-DIMENSIONAL SYSTEMS FOR SUSTAINABLE ENERGY GENERATION

We employ both numerical and analytical techniques to investigate mechanical, optoelectronic, and transport properties of various low-dimensional materials and the interface between them.

In collaboration with an experimental team from the Silesian University of Technology in Poland, our multiscale calculations have demonstrated how to control the chirality of small semiconducting nanotubes, overcoming a key obstacle in their application across electronics, photonics, and medicine [Advanced Science, 2024; Nanoscale Horizons, 2024; Materials Horizons, 2024; Small, 2023; Nanoscale Horizons, 2023].

Using ab initio methods, together with mathematicians from the University of California, Santa Barbara (USA), nanoscale charge and heat switches based on nanoribbons have been devised, demonstrating that their thermoelectric properties can be finely tuned by twisting rectangular top flakes [Nanoscale, 2024].

ATOMISTIC MACHINE LEARNING AND SIMULATION

We develop and apply machine-learning tools for molecular simulation in order to understand a broad range of processes relevant to natural sciences and engineering. Machine learning allows us to perform large-scale simulations with quantum-mechanical accuracy, extend the time accessible to simulations in order to tackle rare events, and analyze microscopic processes through dimensional reduction and classification.

We are working on understanding phenomena relevant to climate change mitigation, such as the formation of carbonate rocks in natural environments and the nucleation of ice in the atmosphere [Proceedings of the National Academy of Sciences, 2022; Faraday Discussions, 2024], and problems connected to energy and sustainability, such as obtaining microscopic insight into electrochemical interfaces [Nature Communications, 2024].

PHYSICS OF VAN DER WAALS INTERFACES AND HETEROSTRUCTURES

In materials made of nanometrically thin two-dimensional (2D) layers joined by weak Van der Waals interactions, various properties of interest to a variety of applications in electronics, spintronics, and energy are studied from first principles. Some of these properties can stem from the individual layers or be determined by the whole material; but there is also great interest and work on heterostructures (materials made by stacking layers of different composition) and their interfaces. In particular, we study the properties related to the transport of light and charge transfer, as well as the physics of excitons and magneto-optics.

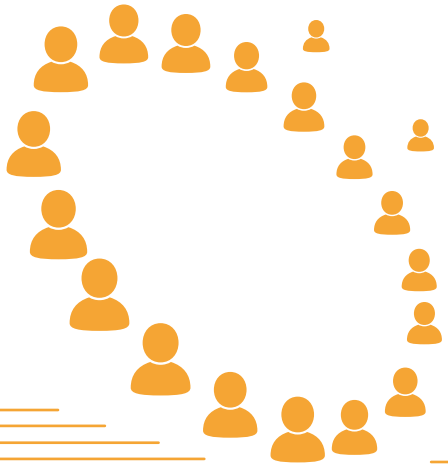
ELECTRON DYNAMICS

Within a context of non-equilibrium quantum processes, we study the dynamics of electrons in nanosystems and condensed matter when subjected to external agents acting on a very short time scale (ultrafast phenomena). We do this with first-principles simulations using time-dependent quantum mechanics.

We are studying the effect of antiproton (Physical Review Letters, 2025) and secondary-electron projectiles (Royal Society Open Science, 2022) in radiation damage processes, the latter of relevance to proton therapy of cancer.

We have made formal developments for simulations in ultrafast phenomena that connect them formally to the treatment of gravity in general relativity and geometric phases in condensed matter physics [Physical Review Research, 2021, SciPost Physics, 2022].

Group members



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Guerda Massillon
National Autonomous University of Mexico (Mexico)

HIGHLIGHTS

Connection to the 2024 Physics Nobel Prize

Pioneering work by members of the Theory Group has been cited as an important achievement in the announcement of the 2024 Physics Nobel Prize. In this work, machine-learning-augmented molecular simulation has been leveraged to study the formation of ice with quantum-mechanical accuracy, a feat which was considered impossible until a few years ago.

Outstanding results

Pristine short and thin carbon nanotubes have been revealed to act as one-dimensional (1D) amphiphiles, stabilizing water/oil emulsions with potential applications in electroconductive textronic paints. Experiments from European partners support nanoGUNE's computational simulation findings [Advanced Materials Interfaces, 2023].

We have calculated the excitonic properties of transition-metal dichalcogenide interfaces with graphene, using state-of-the-art many-body perturbation theory [npj 2D Materials and Applications, 2024; Nano Letters, 2023].

NANOMATERIALS

We focus on developing processes and functional materials for applications across various industrial and societal sectors.

ADVANCED PACKAGING MATERIALS

We create processes to enhance the mechanical properties and environmental resistance of paper-based food packaging and to introduce functionalities for the antimicrobial protection of the packaged goods.

» *We have developed a process for significantly improving the characteristics of packaging materials.*

» *We have demonstrated the scalability of the improvement process to batch production.*

CONSERVATION OF CULTURAL HERITAGE

We explore strategies to protect cultural heritage artefacts from degradation through innovative materials and techniques.

» *We have developed functional self-healing coatings for stone artifacts, antimicrobial and antifungal coatings for wooden objects, and effective cleaning strategies for bronze artifacts.*

TEXTILE ENHANCEMENT

We innovate by integrating functional inorganic materials into textiles, creating advanced functional textile materials with new properties.

» *We have successfully produced textiles that are simultaneously breathable, antimicrobial, odor-resistant, water-repellent, and mechanically robust.*

HIGHLIGHTS

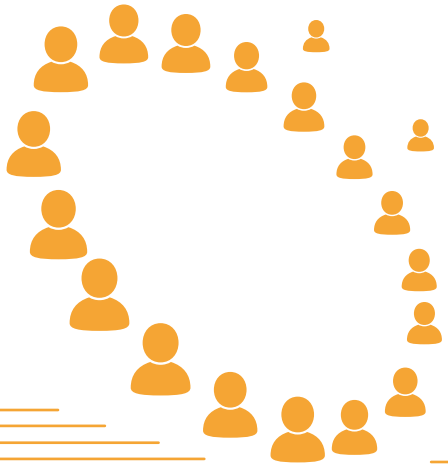
Patent

We have submitted a patent application with a method for producing self-healing organic-inorganic materials.

La Caixa Junior Leader grant

Research Fellow Aranzazu Sierra received the prestigious La Caixa Junior Leader grant to develop new methodologies for conserving cultural heritage artifacts.

Group members



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Iva Saric
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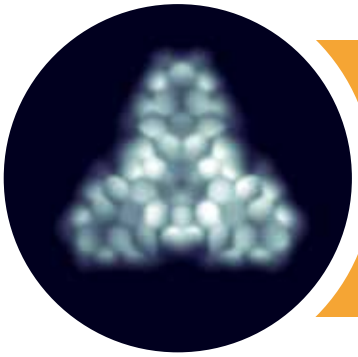
Karlo Velican
University of Rijeka (Croatia)
Bixin Zhang
Shaanxi University (China)

EU Projects

We are active members of the M-ERA.NET consortium **THERMOS**, working on the fabrication of tellurium-free thermoelectric materials, and we actively participate in the COST-action **NETPORE**, contributing to Europe-wide training initiatives on the fabrication and functionalization of porous materials.

Industrial collaborations

In collaboration with **Marvel Fusion GmbH**, we work on the development of nanocoatings for innovative energy conversion strategies. We collaborate with **Huawei**, partnering to develop advanced permeation barrier coatings. With **Oerlikon**, we work on coatings for applications in the medical sector.



QUANTUM-PROBE MICROSCOPY

Our research focuses on fundamental quantum phenomena at the scale of single molecules and atoms.

NANOSCALE MOLECULAR MATERIALS

We explore the emergence of magnetism in graphene nanostructures engineered on surfaces with atomic precision, and we also explore their potential in quantum spintronics applications.

» *We have revealed diode effects on transport through nanoribbons [Advanced Materials, 2024], have unveiled spin-polarized edge states in graphene nanoribbons [Nature Communications, 2023], have constructed azatriangulenes with large spin ground state [Angewandte Chemie, 2023], and have demonstrated the tunability of magnetic interactions in diradicals [ACS Nano, 2024].*

SUPERCONDUCTING PHENOMENA AT THE NANOSCALE

We develop new methods and models to understand superconductivity at the nanometer scale, as well as to understand its interaction with magnetic atoms and molecules and the proximity effect.

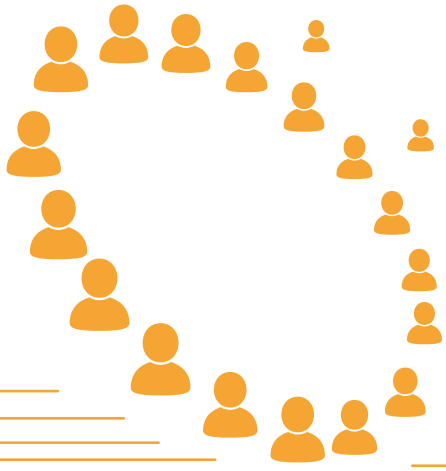
» *We have demonstrated and manipulated the proximity effect in graphene [Small, 2023] and in gold layers [Physical Review B, 2023], and have demonstrated a novel excitation with tunneling electrons appearing in systems that combine superconductivity and magnetism [Physical Review Letters, 2023].*

HIGHLIGHTS

CONSPIRA project

The Quantum-Probe Microscopy group leader Jose Ignacio Pascual holds an ERC Advanced Grant by the European Research Council to work on his **CONSPIRA** project "Coherent control of spin chains in graphene nanostructures" for the realization of quantum control operations using the nuclear spin states of graphene nanostructures.

Group members



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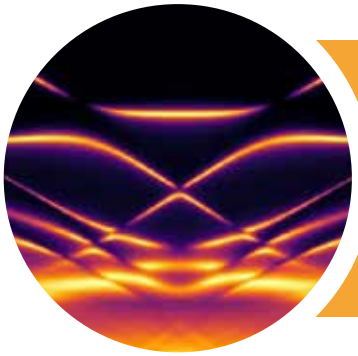


NANOENGINEERING

We integrate artificial intelligence with photonic data to unlock innovative approaches to environmental monitoring, transform medical diagnostics, and pioneer advanced detection methods for food quality control.

CELL-CULTURE MONITORING

We have developed a novel fluidic chip for cell-culture monitoring by Raman spectroscopy, for which a European patent application has been filed. The technology was selected for funding by Basque Tek Ventures to establish the new spin-off company Prospect Biotech.

PHOTONIC MEDICAL DIAGNOSTICS

» *We have shown that Alzheimer's disease can be detected at a preclinical stage by analyzing just a microliter drop of body fluids using Raman spectroscopy and machine learning [International Journal of Molecular Sciences, 2024].*

» *We have demonstrated that lung cancer can be identified with a high accuracy of over 90% by vibrational spectroscopy in vitro using advanced machine-learning techniques [Microchemical Journal, 2024; ACS Omega, 2024; International Journal of Molecular Sciences, 2024].*

HIGHLIGHTS

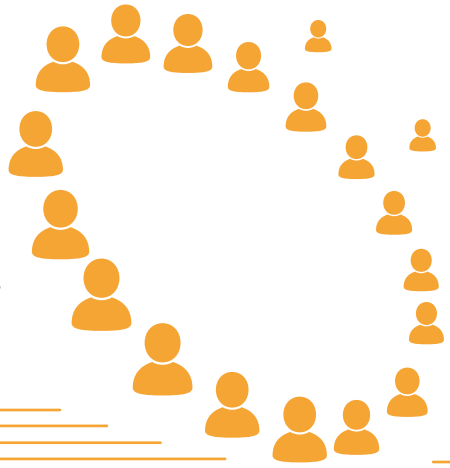
Spin-off company launched

With seed capital from the Basque Tek Ventures initiative, the spin-off company Optec4Life has been founded based on a technology developed over the previous 7 years in our research group. The business model is based on a patented in-house technology for the detection of perinatal asphyxia by machine-learning assisted Raman spectroscopy.

International Conference on Optical MEMS and Nanophotonics - OMN 2024

We chaired and organized this conference with more than 100 participants from 22 countries.

Group members



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Mounir Guesbaya
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Uxue de la Quintana
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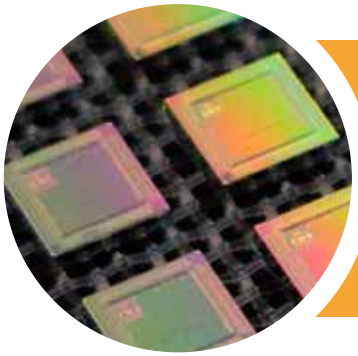
Yunfeng Li
Renata Matekalo
Hongshu Pu

EU project

We have been granted a Horizon Digital Emerging project that aims to improve air-pollution detection limits through highly integrated photonic circuits. The photonic data will be analyzed by artificial intelligence on a chip level.



QUANTUM HARDWARE

We develop quantum-computing and quantum-sensing technologies based on semiconducting and superconducting materials.

SILICON-BASED QUANTUM COMPUTING

We develop quantum-computing hardware based on silicon technology and, more particularly, electron spin qubits in metal-oxide-semiconductor (MOS) quantum-dot nanostructures.

» *We have demonstrated single- and two-qubit gates in devices manufactured using industry compatible processes based on 300-mm wafer technology.*

» *We have shown the rapid cryogenic characterization of 1024 quantum-dot devices manufactured using industry standard processes.*

QUANTUM SENSING

We design quantum sensors for the sensitive readout of single charges and single spins, aimed particularly for applications in quantum computing. Furthermore, we develop fast and local cryogenic thermometers.

» *We have demonstrated the most compact and sensitive sensor for spin qubits enabling the highest spin readout fidelity to date.*

» *We have shown a range of cryogenic thermometers that can be readily integrated within industry-standard CMOS technology.*

LOW-POWER QUANTUM-DOT-BASED CRYOGENIC ELECTRONICS

We use semiconductor quantum dots at microwave frequencies to demonstrate new and more efficient electronic devices and circuits such as amplifiers, multipliers, and sensors.

» *We have demonstrated a power-efficient quantum-dot cryogenic modulator enabling us to construct a frequency multiplier for frequency conversion and a parametric amplifier for low-noise signal amplification.*

» *We have created quantum-dot compact models for their efficient simulation at high frequencies and in conjunction with classical electronics devices.*

HIGHLIGHTS

Advanced quantum research facilities

NanoGUNE is building a 1 500 m² expansion -known as the Quantum Tower – to house the Quantum Hardware research group's laboratories dedicated to the development of silicon-based quantum chips. The reseach facilities will include low-temperature systems and high-precision electronic instrumentation.

Group members

Fernando González-Zalba
Ikerbasque Research Professor
Group Leader

Pre-doc
Gorka Aizpurua

Strategic partnership with Quantum Motion

A collaboration agreement was signed in June 2024 between the British scale-up company Quantum Motion and nanoGUNE, to closely work on the development of silicon-based quantum chips. In this framework, the Quantum Hardware group is expected to recruit a team of at least 50 highly qualified researchers over the next years.

Highlighted Publications

Magnetoplasmonics in confined geometries: current challenges and future opportunities

Applied Physics Letters **122**, 120502 (2023)

N. Maccaferri, A. Gabbani, F. Pineider, **T. Kaihara**, T. Tapani, and **P. Vavassori**

In this Perspective article, we review the current state of the art, challenges, and future opportunities in nanoscale magnetoplasmonics, an emerging area aiming to merge magnetism and plasmonics in confined geometries to control either plasmons, electromagnetic-induced collective electronic excitations, using magnetic properties, or magnetic phenomena with plasmons. We conclude the Perspective by giving our outlook on the future of this thriving research field, showcasing new possible directions to achieve a full control of magneto-optical effects and their enhancement by using nanoscale materials, as well as drive magnetic phenomena with plasmons at the atomic length scale and sub-femtosecond time scales.

Plasmonics represents a unique approach to confine and enhance electromagnetic radiation well below the diffraction limit, bringing a huge potential for novel applications, for instance in energy harvesting, optoelectronics, and nanoscale biochemistry. To achieve novel functionalities, the combination of plasmonic properties with other material functions has become increasingly attractive. In this connection, magnetoplasmonics in confined geometries is an emerging area aiming to merge magnetism and plasmonics to either control localized plasmons, confined electromagnetic-induced collective electronic excitations, using magnetic properties, or vice versa.

In this Perspective, we venture into the new trends in the field. One relevant example is depicted in Figure 1, where hybrid plasmonic and magnetic nanostructures are shown to enable hybridization between the optical dipole of the magneto-optical active nanodisk with a multipolar dark mode of the surrounding plasmonic nanoring. Noteworthy, such multipolar dark mode is a case of bound-state-in-the-continuum (BIC), which is an emerging concept in nanophotonics with a great potential impact in applications. In the case illustrated below, such BIC mode is exploited to achieve a manyfold enhancement of the magnetic control of the polarization of the light reflected by a metamaterial based on this kind of hybrid magnetoplasmonic nanostructures.

We then provide our vision of other raising research directions in hybrid magnetoplasmonics to overcome radiation losses, including the quest for novel materials, such as transparent conductive oxides and hyperbolic metamaterials.

We conclude with a brief survey the latest advances in plasmon-driven magnetization dynamics where the orbital angular momentum of light is used to achieve a superior ultrafast control of magnetism and spintronics.

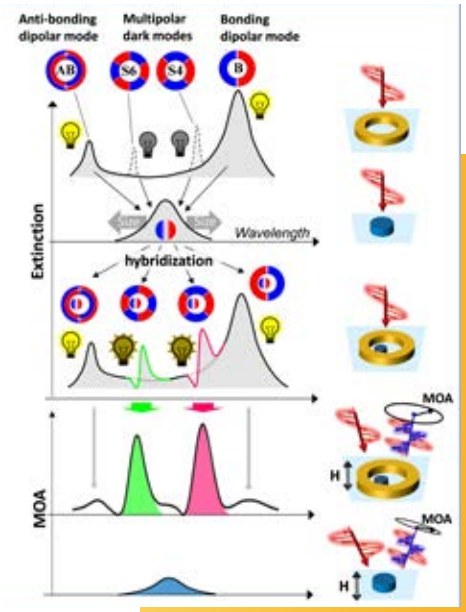


Figure 1. General concept of hybridization with dark modes to boost the magneto-optical response, illustrated utilizing a hybrid ring-dot structure. The hybridization between the bright dipolar mode of the ferromagnetic dot with multipolar dark modes (bound-states-in-the-continuum) of a surrounding noble-metal ring results in Fano-like low radiant modes (see "Extinction" plots). The excitation of one of these hybrid modes results in a strong magneto-optical activity (MOA), namely a magnetic field (H) induced change in the polarization of reflected light, which is manyfold enhanced with respect to that achievable with the bare magneto-plasmonic antenna (compare the "MOA" plots in the bottom panels).

Cooper pair excitation mediated by a molecular quantum spin on a superconducting proximitized gold film

Physical Review Letters **130,** 136004 (2023)

S. Trivini, J. Ortuzar, K. Vaxevani, J. Li, F. S. Bergeret, M. A. Cazalilla, and **J. I. Pascual**

Superconductors host exotic quantum states with potential applications in quantum technologies. In this study, we explore the interplay between superconductivity and magnetism in a proximitized gold thin film decorated with iron porphyrin molecules. Using scanning tunneling spectroscopy, we reveal that a single tunneling electron can excite Cooper pair-breaking states, thus challenging conventional wisdom. Our findings provide a new avenue to probe fermion parity transitions in hybrid superconducting systems, offering insights into fundamental quantum phenomena.

The interplay between superconductivity and magnetic impurities gives rise to rich quantum phenomena, particularly in hybrid nanoscale systems. In conventional superconductors, breaking a Cooper pair requires an even number of electrons providing at least twice the superconducting gap energy, Δ. However, our study demonstrates that a single tunneling electron can excite Cooper pair-breaking states in a proximitized gold film with magnetic molecules. Using scanning tunneling spectroscopy, we map the excitation spectrum of iron porphyrin molecules on Au/V(100), revealing a manifold of entangled Yu-Shiba-Rusinov (YSR) and spin excitations.

Our results show that pair-breaking excitations emerge in tunneling spectra only in the strong coupling regime, where the presence of a bound quasiparticle in the ground state ensures even electron parity during the excitation with tunneling electrons. This discovery provides new insights into fermion parity transitions and the quantum nature of magnetic impurities in superconductors. The findings have implications for the design of superconducting quantum states and the development of novel quantum technologies based on engineered superconducting heterostructures. By unveiling an unexpected excitation mechanism, our work expands the fundamental understanding of superconducting hybrid systems and their potential applications.

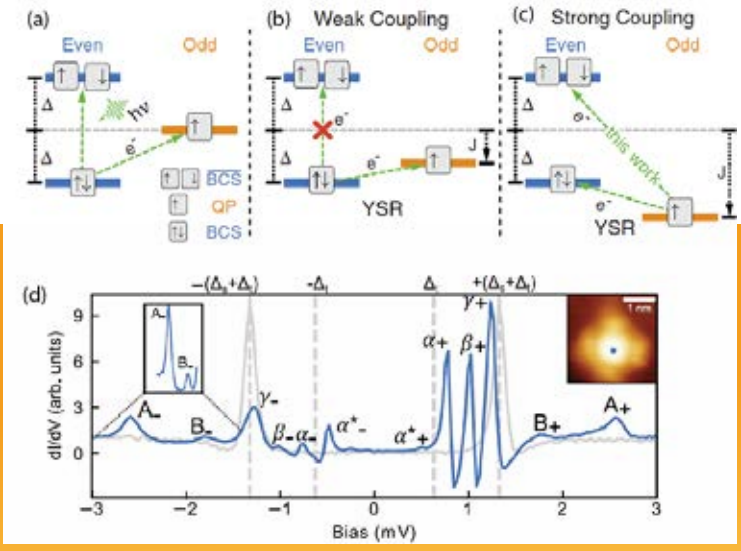


Figure. *(a-c) Scheme of the excitations of a superconductor with energy gap Δ. Pair-breaking excitations of the BCS condensate are excitations between two states of even parity, and can be probed by microwaves. Tunneling electrons can excite Bogoliubov quasiparticles, which is odd in parity. The arrow boxes refer to the number of quasiparticles involved and, hence, their party. (b) The exchange J induces Yu-Shiba-Rusinov (YSR) bound states below Δ. Because of parity conservation, single electrons cannot excite pair-breaking excitations but only YSR states. (c) Increasing J to amount more than Δ, the odd parity YSR excitation becomes the ground state, and the even pair-breaking state becomes accessible to tunneling electrons. (d) Spectra measured on a Cl-FeTPP molecule, which has a spin S=5/2 and axial anisotropy. The subgap features are YSR states (labeled with Greek letters). The faint peaks B are pair-breaking excitations. The peaks A are spin-flip excitations.*

Real-space observation of ultraconfined in-plane anisotropic acoustic terahertz plasmon polaritons

Nature Materials **22**, 860-866 (2023)

S. Chen, P. L. Leng, A. Konecna, **E. Modin**, M. Gutierrez-Amigo, **E. Vicentini**, **B. Martin-Garcia**, **M. Barra-Burillo**, **I. Niehues**, **C. Maciel-Escudero**, X. Y. Xie, **L. E. Hueso**, **E. Artacho**, J. Aizpurua, I. Errea, M. G. Vergniory, **A. Chuvilin**, F. X. Xiu, and **R. Hillenbrand**

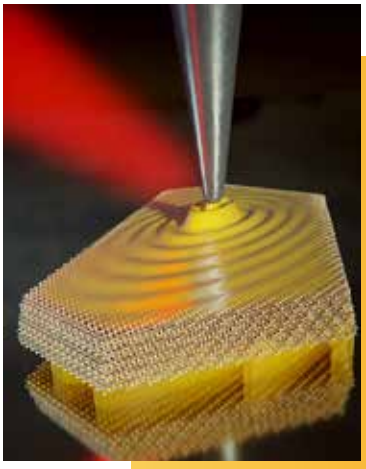
We have imaged and analyzed THz waves that propagate in the form of plasmon polaritons along thin anisotropic semiconductor platelets with wavelengths reduced by up to 65 times compared to THz waves in free space. What is even more intriguing is that the wavelengths vary with the direction of propagation. Such THz waves can be applied for probing fundamental material properties at the nanometer scale and pave the way to the development of ultra-compact on-chip THz devices.

Polaritons are hybrid states formed by coupling of light with matter excitations, such as collective electron oscillations (plasmon polaritons) or crystal lattice vibrations (phonon polaritons). They enable applications like ultrasensitive optical spectroscopy and chemical sensing, as well as ultracompact light modulators. In thin layers, polaritons can propagate with wavelengths up to 100 times shorter than photons, allowing nanoscale light manipulation. While most ultra-confined polaritons are observed as phonon polaritons in the mid-infrared range, plasmon polaritons offer broader spectral ranges but often suffer from high damping, limiting their propagation lengths.

Using a THz nanoscope, we have imaged plasmon polaritons in thin platelets of the low-symmetry crystal silver telluride (Ag_2Te). These polaritons exhibit wavelengths up to 65 times shorter than photons and display anisotropic propagation due to the material's monoclinic crystal structure, which causes directional variation in the effective electron mass. Coupling the polaritons with their mirror image in a nearby metal substrate significantly increases their propagation lengths, forming acoustic plasmon polaritons with preserved anisotropic behavior and elliptical wavefronts.

The extended propagation lengths allow a precise nanoscale measurement of the material's anisotropic effective electron mass at room temperature, introducing a unique method for studying directional carrier masses.

Beyond fundamental materials research, these ultra-confined acoustic plasmon polaritons hold potential for on-chip THz applications, including enhanced molecular sensing and strong light–matter coupling with molecules, two-dimensional (2D) electron gases, or quantum materials.



Artistic illustration of in-plane elliptical acoustic THz plasmon polaritons propagating along a thin Ag_2Te platelet above an Au mirror, excited and probed by a sharp THz-illuminated metal tip (Credit: Scixel. Copyright: CIC nanoGUNE).

Experimental observation of critical scaling in magnetic dynamic phase transitions

Physical Review Letters **131**, 116701 (2023)

M. Quintana and **A. Berger**

Analogous to the behavior of matter in thermodynamic equilibrium, cyclical dynamic phenomena can be described in terms of non-equilibrium or dynamic phases. Nonetheless, experimental characterization of such dynamic phases is still in its infancy if compared to thermodynamic properties. In the present study, we have achieved a crucial experimental advancement associated with dynamic phase transitions (DPTs) by detecting and quantifying critical scaling in its vicinity for the very first time, and in doing so we put existing model calculations on solid footing, given that the experiments revealed two-dimensional (2D) Ising model type behavior, just as prior theoretical work predicted.

The study of dynamic behavior and kinetic pattern formation in interacting systems is a crucially important aspect of science, given that they are almost omnipresent in such diverse areas as laser emission, the formation of sand dunes, or brain activity. Correspondingly, the study of non-equilibrium dynamic phenomena is of utmost importance. Its detailed and quantitative understanding crucially relies on appropriate models, from which the consensus emerged that the properties of DPTs are truly analogous to those of thermodynamic phase transitions (TPTs), including their critical scaling behavior. However, these conclusions were based on theoretical investigations only, given that no comparable experimental results was available until now. Key experimental advances in our present work, however, have enabled such an experimental verification, based upon a highly sensitive detection of real-time magnetization behavior by means of a unique magneto-optical detection system and the fabrication of suitable ultrathin samples with in-plane uniaxial anisotropy, which mimic the Ising model symmetry and avoid metamagnetic anomalies, commonly found near the DPT. Another key advance of the present study is the postulation of an equation-of-state for the dynamic system in analogy to the Arrott-Noakes equation in equilibrium, allowing for a quantitative exploration of the entire phase space. Its correctness can be seen from the excellent agreement of the experimental data (Fig. 1a) with the equation-of-state prediction (Fig. 1b). Accordingly, a scaling plot of all data (Fig. 2) corroborates the 2D Ising model scaling behavior, which is theoretically expected for this type of ultrathin uniaxial sample.

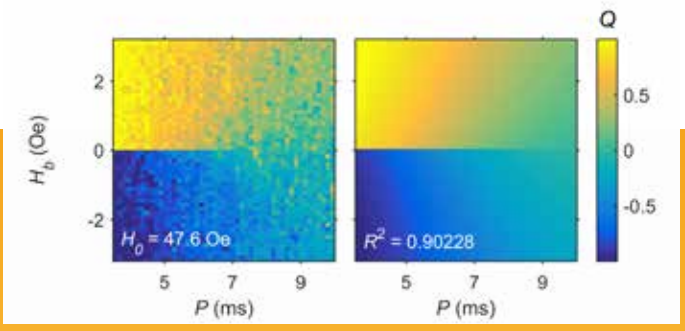


Figure 1. *The two figures show as color-coded maps the phase space behavior of the dynamic magnetic order parameter Q (in the presence of a sinusoidal magnetic field H_0), as a function of the two relevant phase space parameters, the field oscillation period P, and the constant bias field H_b, which is the conjugate field of Q (the color code legend appears on the right-hand side and is valid for both figures). The color-coded map in (a) displays experimental data collected for an in-plane uniaxial Co(10$\underline{1}$0) film of 0.8 nm thickness, while the plot in (b) shows the theoretically expected behavior, postulated by the application of the dynamic analog of the Arrott-Noakes equation. The fit quality of the dynamic Arrott-Noakes equation is indicated by the value of the coefficient of determination R^2.*

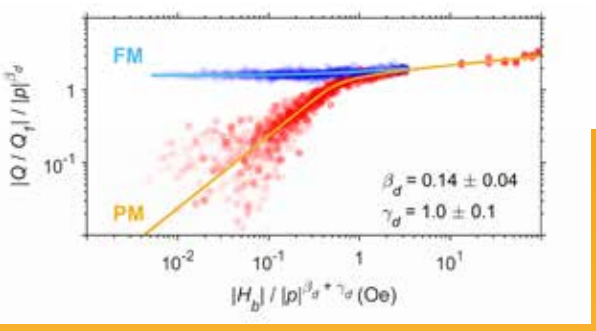


Figure 2. *This figure displays the experimental data of Fig. 1a by means of an Arrott-plot, i.e. by displaying the renormalized order parameter $|Q/Q_1|/|p|^{\beta_d}$ as a function of the renormalized field $|H_b|/|p|^{\beta_d+\gamma_d}$, showing the collapse of all data onto only two curves, one corresponding to the dynamic FM (blue) phase and one for the dynamic PM (red) phase. The cyan and orange lines represent the theoretically expected ideal behavior; Q_1 is a sample specific constant, β_d and γ_d are dynamic critical exponents, and $p = (P_c-P)/P_c$ is the reduced period of the oscillating field driving the non-equilibrium dynamics.*

In situ investigation of thermally induced surface graphenization of polymer-derived ceramic (PDC) coatings from molecular layer (MLD) deposited silicon-based preceramic thin films

Chemistry of Materials **35**, 8092-8100 (2023)

K. Ashurbekova, E. Modin, H. Hano, K. Ashurbekova, I. S. Jankovic, R. Peter, M. Petravic, **A. Chuvilin,** A. Abdulagatov, and **M. Knez**

Silicon-based polymer-derived ceramics (PDCs) are characterized with high strength, superior hardness, corrosion protection, and heat dissipation, which promote their application in extreme environments, e.g. at high temperatures or in chemically reactive plasma conditions. The *in situ* free carbon formation in PDCs is essential for its microstructure evolution and resulting unique characteristics. This study advances the phenomenon of surface graphenization with the first silicon-based conformal preceramic polymer thin films deposited by molecular layer deposition (MLD).

We have developed a pioneering approach toward the synthesis of silicon-based preceramic precursor films by MLD, which is followed by its transformation into a PDC. A siloxane-alumina (SiAlCHO) hybrid film was deposited with tetramethyltetravinylcyclotetrasiloxane and trimethylaluminum as precursors.

The resulting preceramic precursor films of SiAlCHO were turned into quaternary SiAlCO ceramics by high temperature postprocessing. *In situ* annealing in a transmission electron microscope (TEM) was performed to study the evolution of carbon at the nanoscale during high-temperature post processing of the hybrid SiAlCHO in vacuum. The e-beam exposure during annealing induced a knock-on damage process, i.e. direct displacement/emission of an atom upon collision with a fast electron. The emission of hydrogen from the preceramic film determined the first stage of the observed phenomenon, the carbonization of the film. The relatively high annealing temperature provided the carbon sufficient mobility to form an energetically favourable sp^2-bonding arrangement, which favoured the formation of graphene layers (Figure 1).

The amount of carbon in the preceramic, being the source for the graphene formation, determined the number of surficial graphene layers. It could be reduced by increasing the process temperature to form even a single layer. Micro-Raman mapping was performed to confirm the chemical nature of the graphene.

It showed considerable amounts of defects, likely due to: (1) the presence of edges and intrinsic structural defects; (2) the curvature of the graphene layers; and (3) the presence of sp^3-hybridized carbon. Upon annealing at temperatures as high as 1200 °C, the resulting PDCs showed excellent thermal stability and resistance to crystallization.

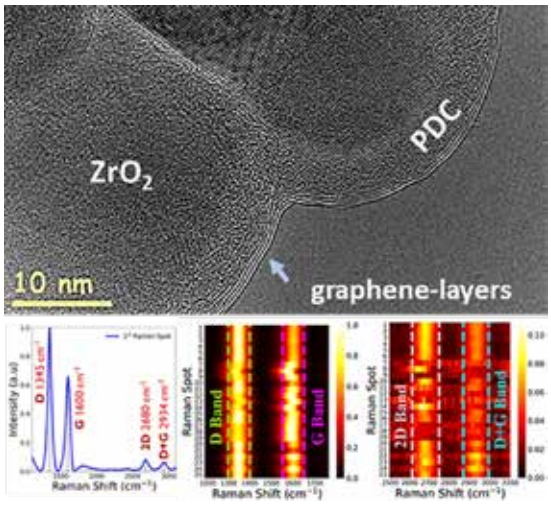


Figure. TEM image of the PDC film deposited on ZrO_2 nanoparticles; Raman spectrum exhibiting detailed spectral features; heatmap of the D and G band; 2D and D+G band distributions.

DNA data storage in electrospun and melt-electrowritten composite nucleic acid-polymer fibers

Materials Today Bio **24**, 100900 (2024)

D. Soukarie, L. Nocete, **A. M. Bittner**, and **I. Santiago**

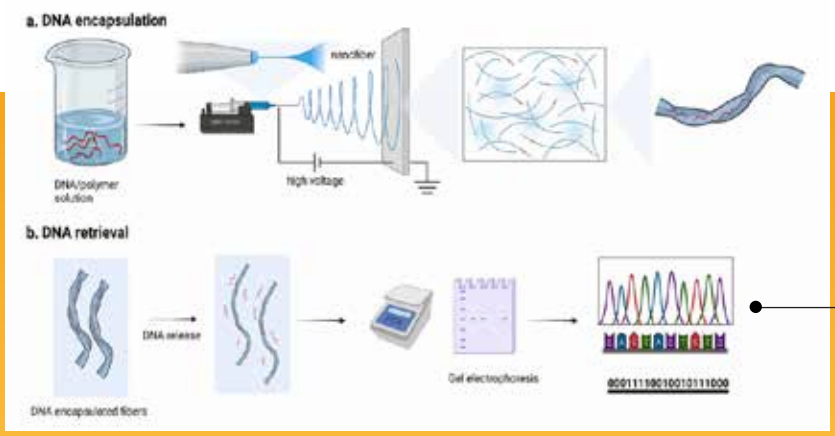
Using DNA to store digital data is an attractive alternative to conventional information technologies, due to its high information density and long lifetime. However, developing an adequate DNA storage medium remains a significant challenge in permitting the safe archiving and retrieval of oligonucleotides. This work introduces composite nucleic acid-polymer fibers as matrix materials for digital information-bearing oligonucleotides. It presents a complete workflow for the stable storage of DNA in various polymer fibers by employing two electrohydrodynamic processes to produce nanofibers with embedded oligonucleotides. The on-demand retrieval of messages is afforded by non-hazardous chemical treatment and subsequent PCR amplification and DNA sequencing.

Incorporating biomolecules like DNA into computational systems is a cutting-edge challenge in biotechnology. DNA offers remarkable potential for data storage, due to its high density, durability, and minimal maintenance requirements. Unlike conventional storage methods, DNA can theoretically store 215 petabytes per gram, far surpassing magnetic or optical media. However, creating a reliable medium for safe DNA archiving and retrieval remains challenging. This study introduces composite nucleic acid-polymer fibers as storage matrices for DNA. Solution electrospinning embeds oligonucleotides into polymers like PEO, PVA, and PCL, creating nanofibers that protect DNA under ambient conditions.

Retrieval of data is achieved using mild chemical treatments, PCR amplification, and DNA sequencing. Additionally, melt-electrowriting was employed to produce programmable microfiber geometries, expanding application possibilities.

DNA's resilience is well documented, with ancient samples surviving millennia in fossilized matrices. Building on this, fibers offer a biodegradable, non-toxic alternative to traditional silica-based storage methods, eliminating the need for harsh chemicals during DNA recovery. By overcoming temperature-related stability challenges, DNA integrity is ensured in melt-electrowritten fibers, even at relatively low melting points.

This approach represents a step towards "warm" storage solutions, offering a scalable, eco-friendly platform for next-generation data storage. Combining advanced polymer engineering with DNA technology opens new horizons in sustainable information archiving.



A) *DNA encapsulation process through solution electrospinning: polymer and DNA are both dissolved in a liquid. The solution is electrospun with an apparatus for fiber production, consisting of a syringe pump with a spinneret, connected to a high-voltage power supply, and a grounded collector. The electrospun mesh contains fibers embedded with oligonucleotides.*

B) *Retrieval and sequencing of oligonucleotides encapsulated inside fibers: DNA encapsulated fibers undergo a degradation process (e.g. heat, pH, sonication) to release oligonucleotides into solution; retrieved oligonucleotides are amplified by PCR; products are analyzed by gel electrophoresis. Recovered samples are sequenced and decodified.*

Electrical control of magnetism by electric field and current-induced torques

Reviews of Modern Physics **96**, 015005 (2024)

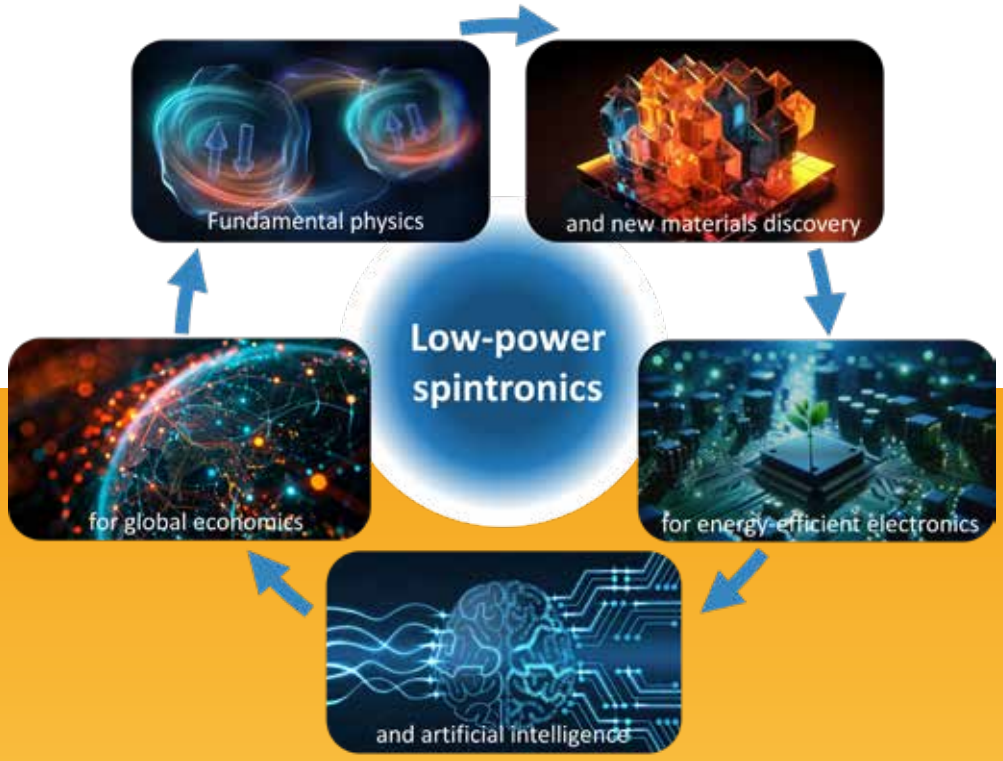
A. Fert, R. Ramesh, V. Garcia, **F. Casanova,** and N. Bibes

In this review article, the state of the art of electrical control of magnetism is reviewed and scientific and technological future perspectives are given.

In this review, recent advances in the electrical control of magnetism (either by electric fields or by current-induced torques) are covered. Fundamental concepts in these two directions are reviewed first, their combination is then discussed, a number of families of devices harnessing the electrical control of magnetic properties for various application fields are addressed, and perspectives are then given in terms of both emerging concepts in fundamental physics and new directions in materials science.

The story of the electrical switching of magnetization, which is discussed in this review, is that of a dance between fundamental research (in spintronics, condensed matter physics, and materials science) and technology (MRAMs, MESO transistors, microwave emitters, spin diodes, skyrmion-based devices, components for neuromorphics, etc.).

This *pas de deux* has led to major scientific and technological breakthroughs in recent decades, such as the conceptualization of pure spin currents, the observation of magnetic skyrmions, and the discovery of spin-charge interconversion effects.



Toward sub-second solution exchange dynamics in flow reactors for liquid-phase transmission electron microscopy

Nature Communications **15**, 2522 (2024)

S. Merkens, C. Tollan, G. De Salvo, K. Bejtka, M. Fontana, A. Chiodoni, **J. Kruse, M. A. Iriarte-Alonso,** M. Grzelczak, **A. Seifert,** and **A. Chuvilin**

Liquid-phase electron microscopy (LP-EM) is revolutionizing our ability to observe nanoscale dynamics in liquids with unprecedented detail. The development of microfluidic reactors has enabled controlled solution environments, but achieving fast, reliable fluid dynamics remains challenging. Here, we introduce a novel liquid cell (LC) design that leverages enhanced diffusive transport. By integrating on-chip bypasses, the *diffusion cell* improves mixing timescales by 2-3 orders of magnitude, enabling sub-second solution exchanges. This advancement holds transformative potential for studying fast nanoscale processes and correlating *in situ* results with *ex-situ* experiments.

LP-EM has emerged as a pivotal tool for nanoscale imaging in dynamic liquid environments. Traditional LCs reliant on laminar flow and convective transport have struggled with limitations such as slow mixing rates and high pressure-induced membrane bulging. Addressing these issues, the diffusion cell concept introduces bypass channels that reroute flow around the imaging area (IA), where diffusion dominates. This innovative design mitigates pressure buildup while enhancing solution replacement dynamics.

The diffusion cell was developed in a rapid prototyping process integrating numerical simulations and experimental testing to balance convective and diffusive transport, enabling a rapid solution exchange with minimal flow interference in the IA. A solution replacement within seconds was achieved, drastically outperforming conventional LP-EM setups, which often require minutes. The new system reduces operating pressures and fluid velocities in the IA, preserving sample stability and imaging quality.

By overcoming the constraints of conventional flow systems, diffusion cells facilitate advanced *in situ* studies of nanoscale phenomena, including nucleation, crystal growth, and nanoparticle assembly. Furthermore, the system's compatibility with existing LP-EM holders allows seamless integration into established workflows, broadening its application potential.

Virtual prototyping and experimental validations underscore the efficacy of diffusion cells in achieving sub-second mixing times. This breakthrough opens avenues for studying fast chemical reactions and dynamic processes in real-time, bridging the gap between LP-EM observations and findings obtained in "traditional" chemistry laboratories. The diffusion cells redefine the boundaries of nanoscale research.

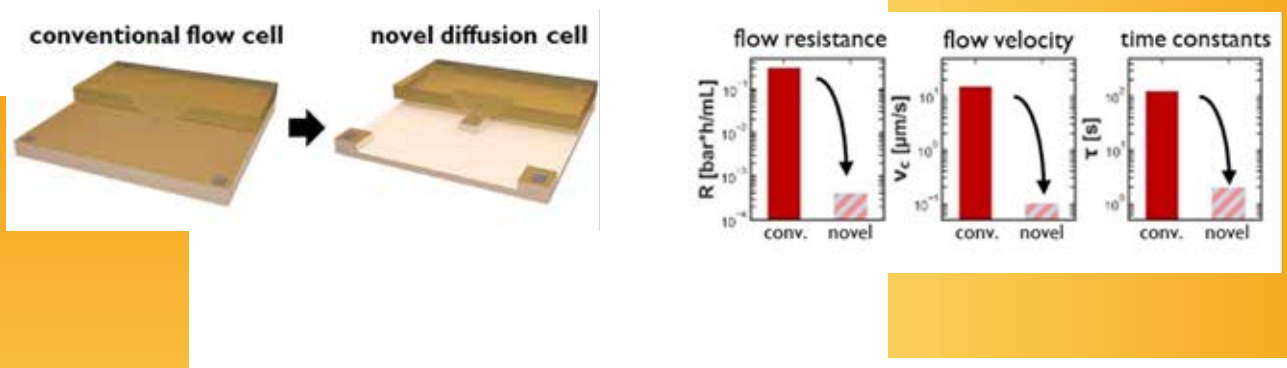


Figure. Illustration of the novel diffusion cell concept and the 2-3 orders of magnitude improvement in characteristic hydrodynamic parameters.

Twist-angle-tunable spin texture in WSe_2/graphene van der Waals heterostructures

Nature Materials **23**, 1502-1508 (2024)

H. Yang, B. Martin-Garcia, J. Kimak, E. Schmoranzerova, **E. Dolan, Z. D. Chi,** M. Gobbi, P. Nemec, **L. E. Hueso**, and **F. Casanova**

Twist engineering has emerged as a powerful approach for modulating electronic properties in van der Waals heterostructures. By performing spin precession experiments, it has been demonstrated the tunability of the spin texture and associated spin-charge interconversion with twist angle in WSe_2/graphene heterostructures. For specific twist angles, a spin component radial with the electron's momentum has been detected, in addition to the standard orthogonal component. These results show that the helicity of the spin texture can be reversed by twist angle, highlighting the critical role of the twist angle in the spin-orbit properties of WSe_2/graphene heterostructures.

A new complex material has been designed with emerging properties in the field of spintronics. This discovery opens up a range of fresh possibilities for the development of novel, more efficient, and more advanced electronic devices, such as those that integrate magnetic memories into processors.

The discovery of two-dimensional (2D) materials with unique characteristics has led to a boom in research into these materials as new effects are produced when two layers are stacked to form a heterostructure. It has recently been observed that minute rotations of these layers can significantly change the properties of the heterostructure. In this work, the stacking of two layers of graphene and tungsten selenide (WSe_2) has been studied. When the two layers are placed one on top of the other and rotated at a precise angle, a spin current is generated in a desired specific direction.

Spin is normally transferred in a direction perpendicular to the electric current. Handling these spin currents is one of the main limitations of spintronics, i.e. the electronics that uses spin to store, handle, and transfer information. However, this work shows that this limitation disappears when suitable materials are used.

By simply stacking two layers and applying a 'magic' twist, new spin-related properties that do not exist in the initial materials can be obtained. The more flexibility we have in the choice of materials, the greater the design possibilities are for next-generation devices.

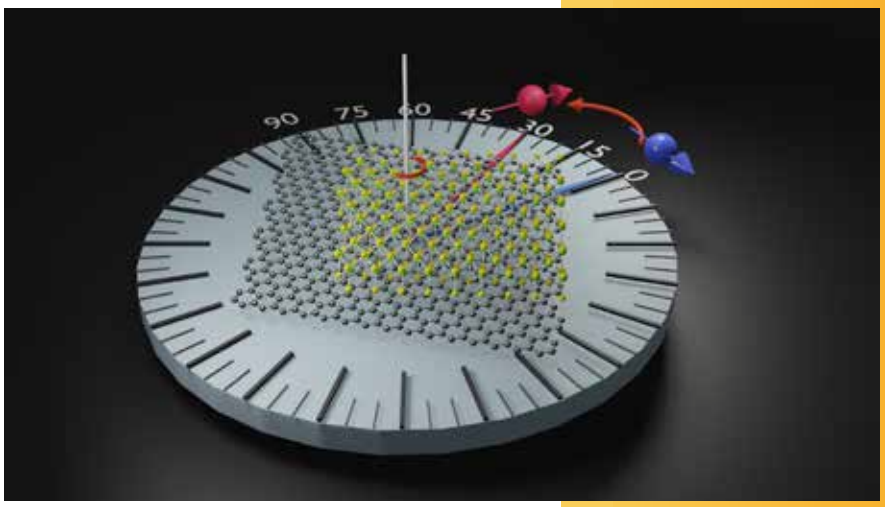


Figure. Artistic view of a van der Waals heterostructure where a flake of WSe_2 is placed on top of graphene with a twist angle, allowing the generation of spins parallel to the momentum of the electrons.

Microscale chiral rectennas for energy harvesting

Advanced Materials **36**, 2400729 (2024)

M. Suarez-Rodriguez, B. Martin-Garcia, W. Skowronski, K. Staszek**, F. Calavalle,** A. Fert, M. Gobbi, **F. Casanova,** and **L. E. Hueso**

Wireless rectifiers offer a way to power billions of "Internet of Things" (IoT) devices by harvesting ambient electromagnetic radiation. Current technologies rely on Schottky diodes, which perform poorly with high-frequency and low-power signals. As a result, these devices require antennas to amplify incoming signals, limiting their miniaturization. Here, a microscale rectifier has been developed using single chiral Tellurium that operates at GHz frequencies with very low power, thus paving the way to the development of self-powered microscale devices.

The number of IoT devices is expected to exceed 30 billion by 2025. Additionally, the electromagnetic (EM) radiation in the radiofrequency (RF) range around us is increasing exponentially. Therefore, effectively harnessing and recycling this ambient EM energy to power battery-free IoT devices presents an ideal solution to reduce global energy consumption. In this context, wireless rectifying antennas (rectennas), which convert ambient EM radiation into direct currents, are key devices.

Current RF rectifiers mostly rely on Schottky diodes, which have a threshold input voltage below which they do not operate. As a result, Schottky diodes require an antenna to capture the incoming EM signal and boost the power above the threshold, increasing the antenna size to at least the millimeter scale.

Materials with a non-centrosymmetric crystal structure exhibit inherent non-linear electrical transport characteristics, which can be leveraged for wireless RF rectification. Here, we report RF wireless rectification in chiral Te. The rectified signal originates from the material's non-linear transport properties, as previously demonstrated at nanoGUNE [Physical Review Letters, 2024], and can be amplified by applying an electrostatic gate. We have achieved rectification in a microscale device whose dimensions are at least six orders of magnitude smaller than typical state-of-the-art devices, thus opening the path to develop tunable microscale rectennas by using a single material.

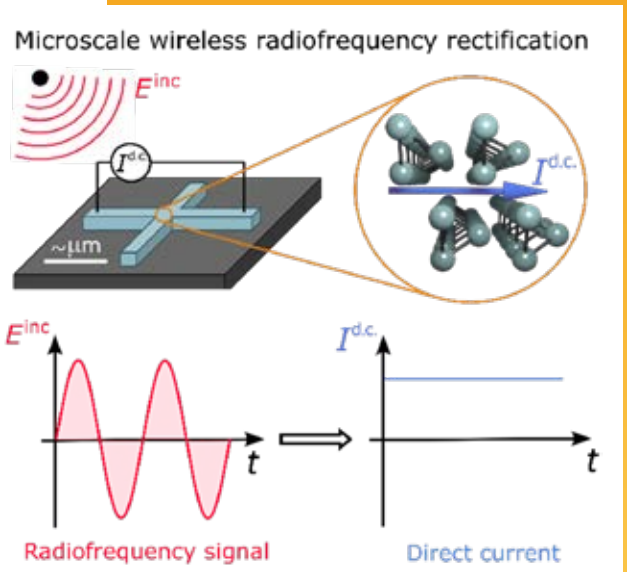
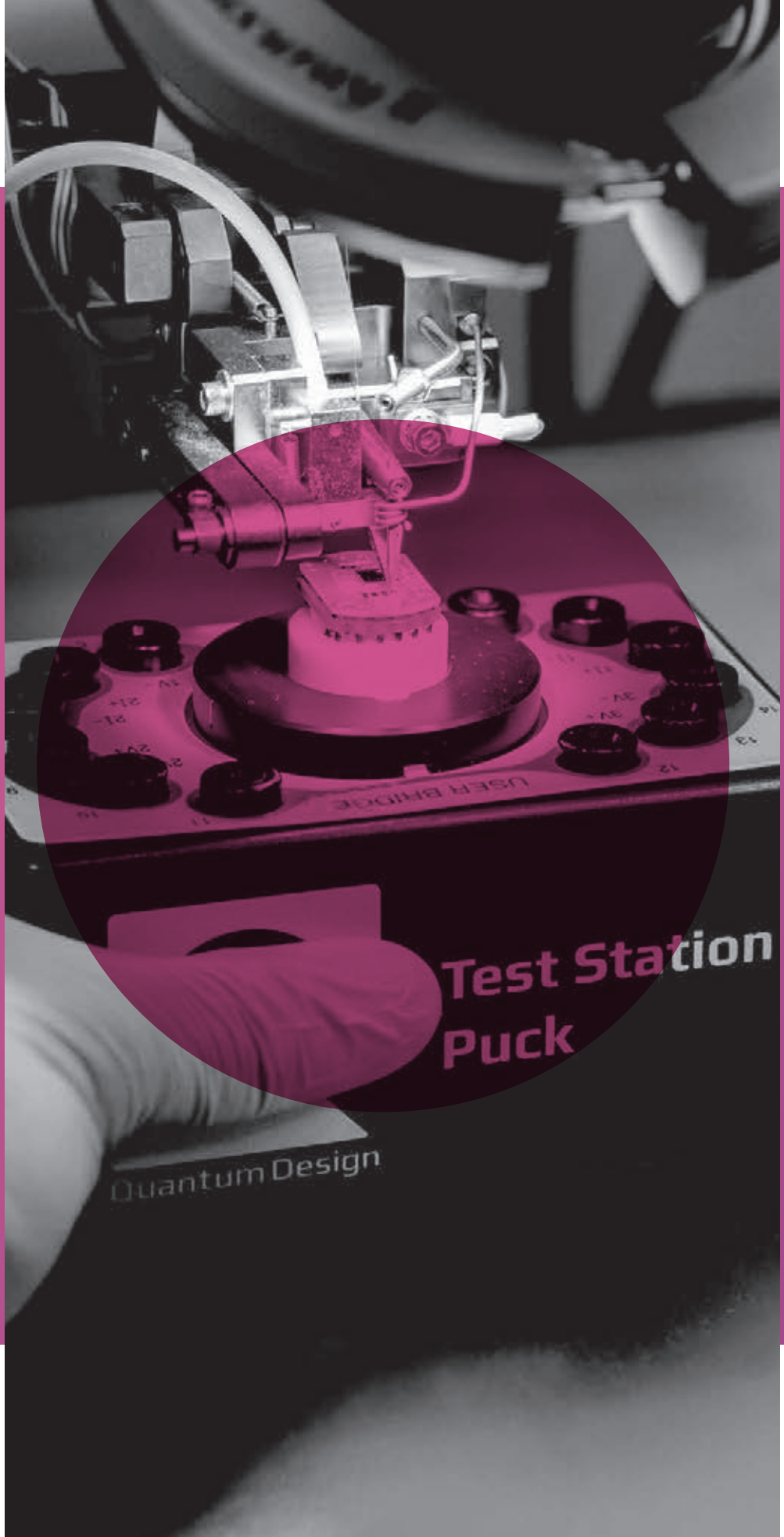


Figure. *Chiral Te devices capture and convert ambient radiofrequency radiation (E^{inc}) into direct current ($I^{d.c.}$), providing a new way to self-power IoT devices in the microscale range.*


Test Station
Puck
Quantum Design

BUSINESS CONNECTION

BUSINESS CONNECTION

The exploitation of our research represents an important pillar of our activity, as clearly stated at the Technology-Transfer Plan that we developed and implemented in 2020. This endeavour is achieved through three main channels: contract research, patent licensing, and the creation of spin-off companies.

In the period 2021-2022, our contract research and patent licensing were consolidated, and in the period 2023-2024 our efforts have been focused on the promotion of new spin-off companies. Highlights include the launch in January 2024 of the spin-off company Optec4Life and two new business proposals that are being supported by the Basque Tek Ventrures initiative.

Also, in the period 2023-2024 the majority of shares of our spin-off company Evolgene Genomics were acquired by the Basque company Myruns Engineering Sports, S.L. dedicated to the development of digitalization solutions using Radio Frequency Identification (RFID) technology. All this is having a positive impact on the economic activity of the Basque Country and contributes to the promotion of an innovation pole based on disruptive technologies. Indeed, it is our aim to position our center as an international reference not only in knowledge generation but also in the realm of technology transfer.

Patents in portfolio

36

Patents licensed

18

New spin-offs

1

New business proposals

2

Strategic collaboration with Quantum Motion

QUANTUM MOTION

In June 2024, we formalized a collaboration agreement with the British scale-up company Quantum Motion, leader in the development of quantum hardware, to collaborate with nanoGUNE's newly created Quantum Hardware research group on the integration of silicon quantum dots in silicon platforms as qubits for quantum computing and quantum technologies in general.

In the framework of this agreement, Quantum Motion is incorporating a Basque subsidiary with headquarters at the Quantum Tower that we have started to build to house not only the company but also our newly created Quantum Hardware research group.

Contract Research

Basque companies

cemosa
OptecForLife
ctechnano coating technologies
CULTZYME
ekin thinking together
Evolgene
Graphenea
i+Med
INDART 3D
Myruns SMART CONTROL
SIMUNE ATOMISTICS
das·nano

Others companies

attocube WITTENSTEIN group
BASF We create chemistry
ThermoFisher SCIENTIFIC
HUAWEI
Integra therapeutics
intel
MarvelFusion
NORDEX We've got the power.
oerlikon balzers
QUANTUM MOTION

Research Centers & Organizations

Donostia International Physics Center
Valdecilla Instituto de Investigación Sanitaria IDIVAL
Obra Social Fundación "la Caixa"
جامعة الملك عبدالله للعلوم والتقنية King Abdullah University of Science and Technology
LORTEK MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE
Tekniker MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE
Mondragon Unibertsitatea
CSIC Spanish Council of Research
tecnalia MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE
CFM Centro de Física de Materiales Materials Physics Center

Alliances

The path that leads us to bridging the gap between research and industry cannot possibly be built alone. Of particular importance is to establish alliances between academia, policy makers, and industry, so that our knowledge and technology can be translated into industrial competitiveness, new services, and new products.

Basque Tek Ventures, key iniciative to boost deeptech business

In the 2023-2024 period, three business proposals were submitted within the new Basque Tek Ventures program, which have all been prioritized.

Basque Tek Ventures is an initiative led by the Basque Government and SPRI, in collaboration with a public Basque venture capital, the Basque Research and Technology Alliance BRTA, and the network of BICs (aimed at supporting and accompanying the creation of new technology-based companies) for the launching of new deeptech start-up companies in the Basque Country. The first call was launched in 2023.

In the framework of the Basque Tek Ventures program, nanoGUNE has submitted three business proposals so far:

OptecForLife

Optec4Life, on the development of a medical device for a non-invasive, continuous, real-time diagnosis of perinatal hypoxia.

Business initiative for proteomics and food analysis platform.

PROSPECT BIOTECH

Prospect, on the monitoring of cell therapies.

These three business initiatives have in common a highly innovative character that provides solutions to existing market gaps and have benefited from an acceleration process with the support of specialized consulting firms, all in the framework of the Basque Tek Ventures program.

Services for biotechnology

i+Med is a biomedical-engineering company devoted to the research, development, and manufacturing of biomedical devices and innovative medicines with high added value. They work with our External Services department in the characterization of samples by FTIR and SEM, thus obtaining key information for their research and development activities.

"There is a good collaboration with the nanoGUNE team. Their technical support and the access to their infrastructure happens to be very useful for the development of our projects."

Marta Castilla
Projects Manager

New materials for clean energy

Nordex Energy Spain is a prominent wind turbine manufacturer that supplies products and services around the globe to create a cleaner and more sustainable planet. NanoGUNE and Nordex have collaborated successfully on the physical and chemical analysis of composite materials used in wind blades.

"Our joint efforts have yeld valuable insights into materials compatibility, long-term weathering stability, and the quality of fiber-reinforced laminates, among other topics, employing high-resolution imaging techniques"

Sergio H. Díaz-Valdés
Senior Engineer

Partnering with industrial and technological clusters and platforms

Start-up Companies

New spin-off with technology for a safer childbirth

In January 2024, we launched our seventh spin-off company: Optec4Life. The company is developing a medical device to provide hospitals with a non-invasive, continuous, real-time diagnosis of perinatal asphyxia, thus preventing unnecessary cesarean sections and improving perinatal outcomes.

This disruptive technology was initiated in the framework of a collaboration with the Basque Health Research Institute Biogipuzkoa, in order to address what at the time was a market gap. We patented our technology and now we are developing the device for commercialization. This device will not only allow a non-invasive monitoring of perinatal lack of oxygen but also other vital signs during childbirth.

The medical device to be developed by Optec4Life is underpinned by a new in-house technology based on Raman spectroscopy, which involves combining a specific Raman probe with machine-learning algorithms that take into account the overall clinical picture of any physiological variations or abnormalities.

The technology has received several awards: winner of the 2020 "Pitch me up" program of the European Technology Platform Nanomedicine (ETPN) and the HealthTechTAB initiative of the same platform; finalist of the Manuel Laborde Award and winner of the BBK Venture Philanthropy Award, both organized by the University of the Basque Country (UPV/EHU), each in their 2020 editions. Under the name "Intrapartum monitoring", the project was selected to participate in a qualitative assessment study and has recently been awarded a Txekintek-Ekintzaile grant, both with the support of BIC Gipuzkoa.

Myruns becomes the majority partner of Evolgene Genomics

In June 2023, Myruns Engineering Sports, S.L. (Myruns), a Basque company dedicated to the development of solutions for the digitalization of companies using Radio Frequency Identification (RFID) technology, acquired 80% of nanoGUNE's spin-off company Evolgene Genomics. With this acquisition, Myruns became a majority partner of Evolgene Genomics, with the aim of also advancing in the treatment of biomass, the development of high-added-value biomaterials, and the development of next-generation biofuels for clean energy production.

Biotech Foods finalizes the construction of a cultivated-meat pilot plant in San Sebastian

Biotech Foods, launched at nanoGUNE in 2017, has finalized the construction of a 11,000 m^2 cultivated-meat pilot plant in Eskuzaitzeta (San Sebastian). This pilot plant, which houses R&D activities as well as the process equipment for cultivated-meat production, will allow the company to release soon the product into the market. Biotech Foods, with more than 50 professionals, including biologists, biochemists, biotechnologists, process engineers, and cell-culture specialists, seeks to continue increasing its workforce in a short term to over 100 employees.

Filed patents 2023-2024

MATERIALS

Acceleration unit for high-mass ions and high-mass ion detector

R. Blick, R. Zierold, and S. Haugg

Priority date: 22/02/2023

Flow cells for liquid-phase transmission electron microscopy and methods

A. Chuvilin, S. Merkens, C. Tollan, and M. Grzelczak

Priority date: 24/07/2023

Composite nucleic acid-fiber material for data storage

I. Santiago and A. M. Bittner

Priority date: 04/08/2023

ESEM and AFM structural characterization of short peptide electrospun fibers

M. Reches, A. M. Bittner, and K. Mitropoulou

Priority date: 08/09/2023

An optical fluid sensor and an optical fluid sensor arrangement

F. Koppens, S. Castilla, V. Pusapati, R. Hillenbrand, and A. Bylinkin

Priority date: 03/06/2024

HEALTH

Cell culturing system optimized for Raman spectroscopy imaging

J. Plou, E. Lopez, A. Seifert, S. Merkens, and M. Marquez

Priority date: 25/04/2024

QUANTUM TECHNOLOGIES

Superconducting system and method for quantum Cooper pair currents in superconducting electronics and diodes

J. I. Pascual, S. Trivini, and J. Ortuzar

Priority date: 10/05/2024

Towards DNA data storage

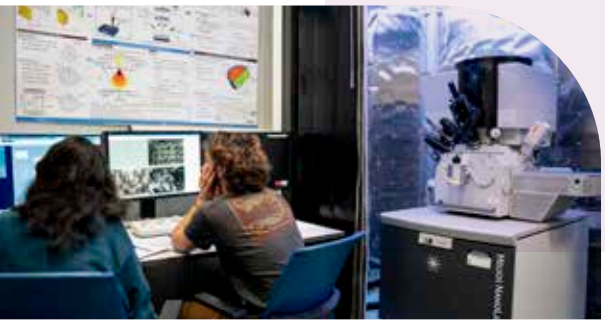
Our patent-protected technology, based on new materials for the storage of DNA containing digital information, is being developed within the framework of a European Union (EU) EIC Pathfinder project coordinated by nanoGUNE, with the participation of the German company Eurofins Genomics, a major European corporation in the field of DNA synthesis and sequencing.

Intellecual Property (IP) on quantum-hardware manufacturing

A patent application protects the manufacturing process of a quantum device designed in-house as part of our commitment to the development of quantum technologies.

External Services

Our external-services department represents a tool to contribute with our know-how and state-of-the-art infrastructure to the innovation processes of industrial and technological companies, especially in the following three areas.



Electron Microscopy

By providing a detailed understanding of nanostructured materials, electron microscopy can enable knowledge-based production processes with enhanced quality-control measures. This allows for the development of materials and products that meet precise specifications, ensuring consistent performance and reliability over time.

Moreover, electron microscopy has diverse scientific applications, enabling researchers to study the fundamental properties of materials and explore new frontiers in fields such as materials science, nanotechnology, and biotechnology.

Nanofabrication

Our film fabrication services offer the possibility to grow films of a wide variety of materials, such as metals, semiconductors, and dielectrics on various types of substrates with precise thicknesses. On the other hand, our nanostructurization services allow us to shape different structures at the nanoscale. We fabricate nanomembranes for chemical sensors and biosensors, patterns for microfluidics, and electronic devices. We also produce samples for equipment calibration and quality control of microscopes and other systems.

Physical and chemical characterization

We provide nanoscale physical and chemical characterization services based on s-SNOM, RAMAN, EDX, and EELS techniques, as well as a number of monochromatic and broadband infrared lasers. We have recently revealed hidden properties of polymer membranes fabricated for gas permeation, thus allowing for the development of new-generation films with unprecedented properties. We can also analyze the electrical and magnetic properties of devices and materials using cutting-edge equipment (e.g. PPMS and four-point probes) to characterize the behavior and properties of samples for the final user.

Connection with business is achieved through contract research, patent licensing, and the creation of spin-off companies


laservision

DISSEMINATION AND OUTREACH

Dissemination and Outreach

We aim at spreading an egalitarian scientific culture in order to inspire a critical society, capable of building a sustainable future. With this objective in mind, we participate in the organization of several science outreach activities, events, and projects.

25
Outreach events & projects

38 800
Participants

Passion for knowledge - Encounters

We collaborated with the Donostia International Physics Center in the organization of the Passion-for-Knowledge science festival that took place in October 2023. More specifically, we participated very actively in one of the star activities of the event, the "top@DIPC - Zientziarekin solasean!" encounters, an event that offered hundreds of secondary school students the opportunity to meet and talk to Nobel laureates and front-line scientists.

School visit program — *All year*

February

April

May

June

October

November

Itsasample

The ITSASAMPLE exhibition showcased the hidden beauty of marine life through stunning images captured by nanoGUNE's Electron Microscopy group. Running for a month from 8 October to 9 November 2024, in the Aquarium of San Sebastian, the exhibition featured cutting-edge technology that revealed intricate details of marine organisms, such as fish scales and lobster claw filaments.

This was a collaborative effort of the Aquarium and nanoGUNE, with contributions from the Plentzia Marine Station (PiE-UPV/EHU) in analyzing and interpreting the images. The exhibition offered educational value through guided tours and family activities, engaging visitors and providing deeper insights into advanced microscopy and marine biology.

NanoGUNE's specialist Oksana Yurkevich was in charge of capturing and post-processing most of the images that made up the exhibition.

Women's leadership in physics dialogue

We participated in the organization of a special dialogue within the 2024 Physics Biennial conference of the Spanish Physical Royal Society, with Ursulla Keller (ETH Zurich) and Irene Abril (University of Cambridge). The dialogue focused on the central challenges to achieving equality in science, reviewing data, and analyzing institutional strategies, with a focus on the importance of male allies and inclusive leadership models.

In the media

Effectively communicating our activities to a wide audience —including academia, industry, and the general public— is essential for bridging the gap between science and society. Our strong partnerships with both local and international media allow us to reach diverse audiences. We are especially grateful to the editors and journalists who help turn scientific discoveries into captivating stories.

Media impacts

935

www.nanogune.eu

@CICnanoGUNE

36 | SOCIEDAD | Martes 03.01.23 EL CORREO

Un grupo vasco busca nuevas terapias en proteínas de hace 2.600 millones de años

El trabajo, liderado por el laboratorio CIC nanoGUNE, abre vías para la manipulación del ADN y el tratamiento de graves enfermedades

FERMÍN APEZTEGUIA

BILBAO. Las respuestas a las enfermedades que devastan a la Humanidad hoy podrían estar en proteínas rescatadas de hace 2.600 millones de años. Un grupo de investigación internacional liderado por el laboratorio vasco CIC nanoGUNE, con sede en San Sebastián, ha reconstruido por primera vez los ancestros del sistema de edición genética CRISPR-Cas y ha estudiado su evolución a lo largo del tiempo. Los resultados de ese trabajo, que se publica hoy en la reconocida revista científica 'Nature Microbiology' están llamados a tener «aplicaciones revolucionarias» en el diagnóstico y tratamiento de enfermedades que devoran hoy al ser humano como el cáncer, la diabetes e incluso otras, como la esclerosis lateral amiotrófica.

«Pasarán más de diez años antes de que todo esto tenga una aplicación clínica, pero hemos dado un paso importante en el conocimiento de nuestra evolución desde el punto de vista molecular», ha explicado a EL CORREO el investigador de Ikerbasque Raúl Pérez-Jiménez, que ha dirigido los trabajos. El proyecto ha contado con el apoyo de grupos especializados del Consejo Superior de Investigaciones Científicas, la Universidad de Alicante, el Centro de Investigación Biomédica de Enfermedades Raras (CIBERER), el hospital Ramón y Cajal-IRYCIS y otras instituciones nacionales e internacionales. La tecnología CRISPR-Cas, definida por el español Francis Mojica, científico de la Universidad de Alicante, revolucionó la edición genética hace aproximadamente una década. Gracias a ella es posible cortar el genoma y repararlo donde se quiera mediante el uso de una especie de tijeras moleculares.

REFLEXIÓN
Raúl Pérez-Jiménez, Líder del estudio
«Hemos dado un gran paso, pero todavía faltan más de diez años antes de que asistamos a su utilidad clínica»

Imagen representativa de la tecnología CRISPR-Cas, que ha posibilitado la realización del estudio. EL CORREO

10 | AL DÍA | CIENCIA | Viernes 31.03.23 EL DIARIO VASCO

El investigador Nacho Pascual, en un laboratorio de Nanogune. GORKA ESTRADA

«Muchas veces pienso que la investigación es un arte»

Nacho Pascual Investigador de Nanogune

Manipula átomos como si fueran «un Lego» para almacenar información cuántica. Ha recibido de la UE tres millones de euros para lograrlo

JAVIER GUILLENEA

CONSPIRACIÓN
«Conspiramos en el mundo atómico para ver cómo funciona la mecánica cuántica en la escala de átomos»

CIENCIA
«La ciencia es divertida, interesante, útil y un conocimiento esencial en una sociedad que quiere evolucionar»

INFRAESTRUCTURA
«El ordenador cuántico de Donostia es el principio de un camino, es esencial para generar aquí un polo de atracción»

8 | AL DÍA | INVESTIGACIÓN | Sábado 22.04.23 EL DIARIO VASCO

Félix Casanova, en las instalaciones de Nanogune. GORKA ESTRADA

CONSUMO
«Se calcula que el 8% de la electricidad del mundo se emplea en las tecnologías de información»

RESULTADOS
«Por primera vez hemos conseguido escribir y leer la información en un solo circuito. Es un paso más allá»

«Vivimos rodeados de transistores que consumen continuamente energía»

Félix Casanova Investigador de Nanogune

El investigador Ikerbasque ha recibido por segunda vez el premio Intel por su trabajo para lograr chips más eficientes

JAVIER GUILLENEA


Sábado 06.07.24
EL DIARIO VASCO
INVESTIGACIÓN | AL DÍA | 11

Fotomontaje con la torre, a la izquierda, que albergará el nuevo grupo de investigación en tecnologías cuánticas.

Una nueva torre en Nanogune albergará un grupo de investigación cuántica

El centro donostiarra cierra un acuerdo con la empresa británica Quantum Motion, que abrirá una filial en Donostia

JAVIER GUILLENEA

LA FRASE
José María Pitarke
Director de Nanogune
«Para nosotros la creación del nuevo grupo es un paso de gigante»


Tecnología

CIC nanoGune revaloriza las 'nano' en la industria

Su grupo de investigación de nanomateriales demostrará en el corto plazo algunos avances importantes en conversión energética y textil


INNO-TECH

Cuatro CIC crean una alianza para fortalecer la microscopía electrónica en Euskadi

Estrategia Empresarial

Andrey Chuvilin y José María Pitarke, ante el nuevo equipo CRYO Plasma FIB. > CIC nanoGUNE

El CRYO Plasma FIB es un instrumento singular de nanofabricación avanzada y microscopía electrónica, uno de los pocos que hay en Europa

Diseño "a la carta"

Conexión plena


EUSKAL HERRIA

Nanogunek bi ikerketa talde berrirekin ospatuko ditu 15 urteak

2009ko urtarrilaren 30ean inauguratu zen CIC Nanogune Donostian, nanozientziako puntako ikerketa egiteko, jendarteaen mesedetan. 15 urte geroago, «baikor eta harro» daude misio hori betetzen ari direlako, nanozientziaren arloan. Bi ikerketa talde berri abiatzen ari dira orain: nanomedikuntzarena eta teknologia kuantikoena.

ERREPORTAJEA
Maider IANTZI GOIENETXE


Datu digitalak DNAn modu seguru, egonkor eta jasangarrian gordetzeko metodoak aurkitu nahi ditutze Nanoguneko ikerlariek. Informazioa DNA sintetikoan gordetzeko prozesua errazteko prozesua lortu nahi dute TextaDNA izeneko proiektuan, ahalik eta informazio gehiena DNAn gordetzeko.

Etorkizuneko disko gogorra


30 | BIZIGIRO

«Mikrorobotika oso gaztea da oraindik, baina ikerketa askoren ateak irekitzen ditu»


38 | BIZIGIRO

Optec 4 Life: erditze seguruagoaren bila

Conferences and Workshops organized

SPEAR Workshop 2023

Date: 20-22 March 2023

Place: Donostia / San Sebastian

Chair: Luis Hueso and Fèlix Casanova

NanoRemedi Workshop

Date: 20-21 April 2023

Place: Donostia / San Sebastian

Organizers: *Alexander Bittner (Chair), Matteo Bottiglieri, and Konstantina Mitropoulou*

Near-field Optical Nanoscopy School

Date: 6-9 June 2023

Place: Donostia / San Sebastian

Chair: *Rainer Hillenbrand and Monika Goikoetxea*

2D materials for spintronics: Mini Colloquium at CMD30 (Conference of the Condensed Matter Division of the European Physical Society)

Date: 4-8 September 2023

Place: Milan (Italy)

Organizers: *Jagoda Sławińska, Christian Rinaldi, and Fèlix Casanova*

SPRING23 International Workshop

Date: 18-20 September 2023

Place: Donostia / San Sebastian

Chair: *José Ignacio Pascual and Thomas Frederikssen*

Equality in Science and Technology: for a paradigm change

Date: 23-24 October 2023

Place: Donostia / San Sebastian

Member of the scientific committee: *Itziar Otegui*

Dynamo 2nd School "nano-plasmonics and applications"

Date: 23-25 April 2024

Place: Online

Organizers: *Paolo Vavassori and Nageswar Sanamreddy*

Microbots Imaging: Are we on the way towards the clinics? (I-II), session at MARSS (International Conference on Manipulation, Automation, and Robotics at Small Scales)

Date: 01-05 July 2024

Place: Delft (Germany)

Organizers: *Mariana Medina-Sánchez, Veronica Lacovacci, and Salvador Pané*

Materials and Methods for Quantum Technologiess: Symposium at the Biennial Conference of the Spanish Physical Royal Society

Date: *16-18 July 2024*

Place: Donostia / San Sebastian

Organizers: *Hermann Suderow, Edwin Herrera, Katerina Vaxevani, José Ignacio Pascual, and Javier Aizpurua.*

International Conference on Optical MEMS and Nanophotonics

Date: 28 July - 1 August 2024

Place: Donostia / San Sebastian

Chair: *Andreas Seifert*

Charge and spin transport in low-symmetry, topological, and magnetic materials: Mini Colloquium at CMD31 (Biennial Conference of the Condensed Matter Division of the European Physical Society)

Date: 2-6 September 2024

Place: Braga (Portugal)

Organizers: *Sofia Ferreira-Teixeira, André Pereira, Luis Hueso, Ivan Vera-Marun, Tatiana Rappoport, Sroj Dash, and Carmine Ortix*

Orbitronics - exploring the power of orbital angular momentum manipulation: Mini Colloquium at CMD31 (Biennial Conference of the Condensed Matter Division of the European Physical Society)

Date: 2-6 September 2024

Place: Braga (Portugal)

Organizers: *Tatiana Rappoport, Fèlix Casanova, Aurelien Manchon, and José García*

nanoGUNE community

As our community is growing, we would like to stay together. With this objective in mind, we organize a number of social activities along the year.

30 January 2023

nanoGUNE PhD Workshop 2023
Science and Outreach

26 January 2024

nanoGUNE PhD Workshop 2024
nanoCooking

18 December 2023
19 December 2024

New-Year celebrations

PhD Viva celebrations

When our predoctoral researchers defend heir theses, we organize an informal gathering to celebrate together

alumni NETWORK

As part of our Alumni Network initiative, we have invited five professionals who previously worked at nanoGUNE to share their career journeys with our current team. This exchange aims to provide valuable insights into their experiences and professional growth since leaving the center.

- ***Amilcar Bedoya**, ICMol (Spain)*
- ***Nicolò Maccaferri**, Umeå University (Sweden)*
- ***Patricia Riego**, Industrial Furnaces and Mondragon University (Spain)*
- ***Lorenzo Fallarino**, CIC energiGUNE (Spain)*
- ***Nerea Ontoso**, Connect Group (Spain)*

30 January 2023

26 January 2024

December 2024

PhD Viva celebrations

A CAREER IN SCIENCE AND TECHNOLOGY

A career in academia and industry

Visits for educational centers

Following our open-doors policy, we offer high-school and university students the possibility to have a close look at nanoscience research. In the period 2023-2024, over 150 high-school students visited nanoGUNE in person.

Summer Internships

Every year, we offer undergraduate students the opportunity to participate at our Summer Internship Program. Scholarships are offered to 3rd and 4th year undergraduates for a two-months project. In the period 2023-2024, 23 undergraduates joined the program.

Winter School

NanoGUNE's Winter School is primarily aimed at undergraduate students. It includes a combination of academic lectures, soft-skills training sessions, and hands-on lab practicals. In the period 2023-2024, 46 students were selected to attend the school.

Bachelor and Master theses

In the framework of collaboration agreements with various universities and official master programs, we offer the possibility to develop bachelor and/or master theses in our center. In particular, we closely collaborate with Master programs of the University of the Basque Country (UPV/EHU). A call for master grants is launched every year. In the period 2023-2024, 10 bachelor and 6 master theses were conducted at nanoGUNE.

PhD

PhD-thesis projects are offered to physics, chemistry, biology, engineering, and materials-science graduates. We closely collaborate, in particular, with the PhD program "Physics of Nanostructures and Advanced Materials (PNAM)" of the University of the Basque Country (UPV/EHU). 11 PhD theses were finalized in the period of this report. At the end of 2024, we had 55 PhD theses ongoing at nanoGUNE and another 9 PhD theses were being co-supervised to students that were enrolled at other research centers or universities in the Basque Country.

Awarded in 2023-2024

Iker Ortiz de Luzuriaga
3 March 2023 - UPV/EHU
Large-scale and linear-scaling quantum mechanics computational methods to characterize the dna g-quadruplexes and their interaction with small molecules
Supervisors: *Adrià Gil and Xabier López*

Stefano Trivini
16 June 2023 - UPV/EHU
Manipulating superconductivity at the nanoscale through magnetism and proximity effects
Supervisor: *José Ignacio Pascual*

Mikel Quintana
17 July 2023 - UPV/EHU
Phase transitions in nanoscale designed magnetic thin films
Supervisor: *Andreas Berger*

Maria Barra
21 September 2023 - UPV/EHU
Micro and nanofabrication of structures for light-matter interaction
Supervisors: *Luis Hueso and Rainer Hillenbrand*

Stefan Merkens
3 November 2023 - UPV/EHU
Orchestrated mass transport for quantitative liquid-phase transmission electron microscopy
Supervisors: *Andrey Chuvilin and Marek Grzelczak*

Isabel Arango
27 November 2023 - UPV/EHU
Spin-to-charge current interconversion in highly resistive sputtered bismuth selenide
Supervisors: *Fèlix Casanova and Luis Hueso*

Gabriele Botta
29 January 2024 - UPV/EHU
Controlling area-selective growth mechanisms of Nickel-based nanostructures through ALD and surface pre-patterinng
Supervisor: *Mato Knez*

Carlos Maciel
9 February 2024 - UPV/EHU
Probing nanosclae light-matter interactions with fast electrons and near-field optical probes
Supervisors: *Rainer Hillenbrand and Javier Aizpurua*

Andrei Bylinkin
16 May 2024 - UPV/EHU
Near- and far-field studies of polariton-enhanced interactions between light and molecules
Supervisor: *Rainer Hillenbrand*

Matteo Menniti
12 July 2024 - UPV/EHU
Nanomagnetic logic by photothermal excitation and magnetic nanostructure networks
Supervisor: *Paolo Vavassori*

Divya Virmani
20 December 2024 - UPV/EHU
Infrared nanoimaging and nanospectroscopy in liquid environment
Supervisor: *Rainer Hillenbrand*

Building a career path

We are committed to providing high-level training and contributing to a successful professional development of our team, both in academia and in industry.

Seminar series

NanoGUNE organizes weekly seminars to be given by both nanoGUNE personnel and external invited speakers. All these seminars take place at nanoGUNE and are open to all the scientific community, fostering a continuous learning, interdisciplinary knowledge, and interaction. A list of all seminars held at nanoGUNE in the 2023-2024 period is presented in the appendix.

Basque and Spanish courses

Language courses are offered to all employees.

Outplacement service

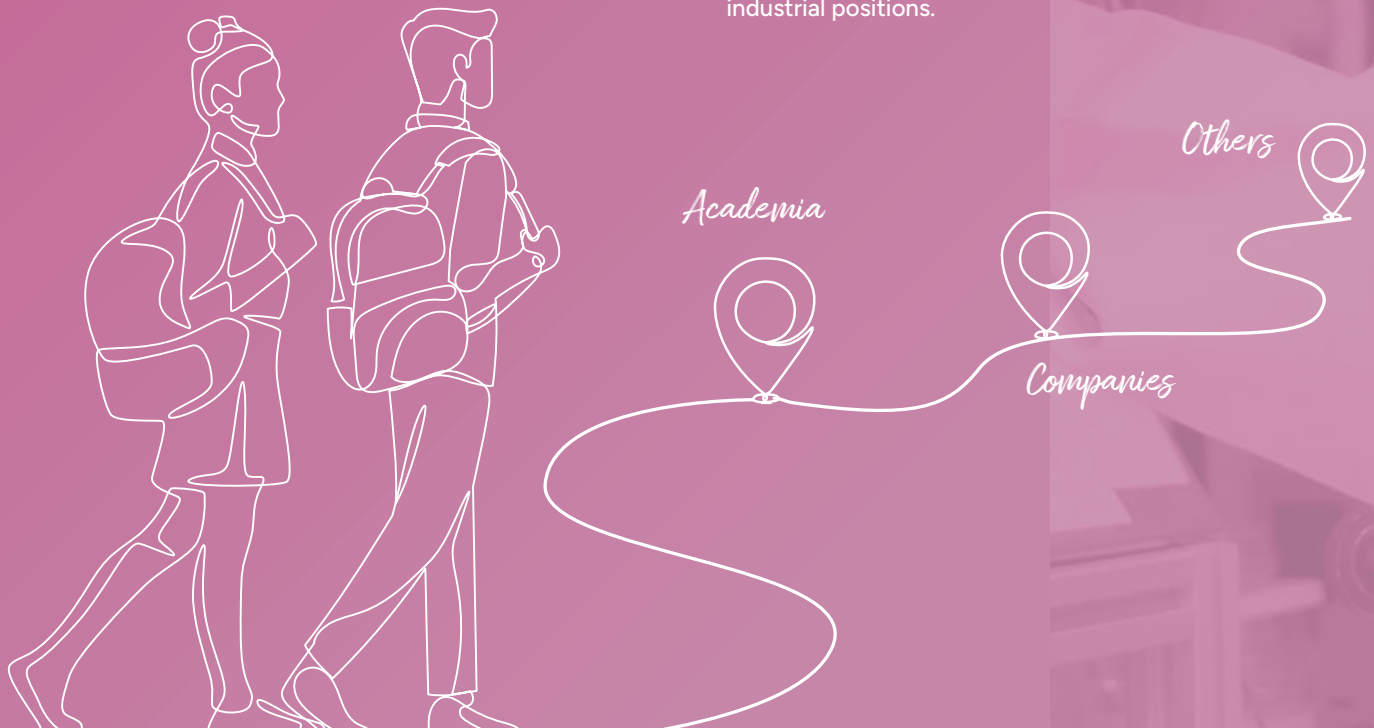
An outplacement service is offered to all employees who would like to pursue their professional career at local industry.

Women-in-Science mentoring program

The Women-in-Science mentoring program aims at supporting young female researchers with their career goals and the ways of achieving them. In this period, 10 female PhD students have participated in this program.

Business-culture training program

This training program aims at strengthening the business culture of our young researchers, thus making it easier for them to become part of the industrial world in case they would be interested to choose this career path. The program includes training and special workshops on different topics, such as communication skills, entrepreneurship, and career orientation towards industrial positions.

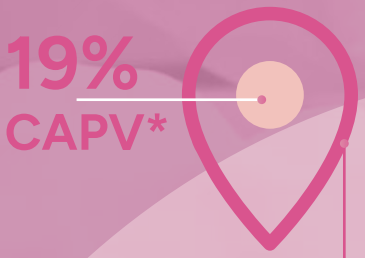


As nanoGUNE is a research center where most employees (mainly pre-docs and post-docs) are expected to leave after a period of 3-5 years, we monitor their professional development once they have left us.

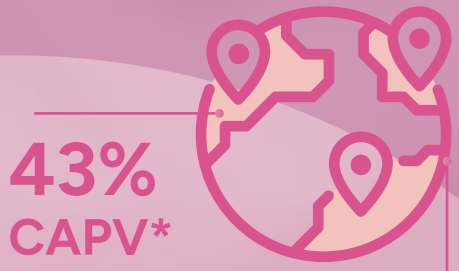
The territorial mobility is significant, as expected, and the net flux is positive, which means that the number of researchers coming to the Basque Country is higher than the number of researchers leaving to another place elsewhere in the world. On the other hand, it is interesting to point out that the transfer of highly-qualified personnel to companies, in general, and local companies, in particular, is increasing.

CAREER PATH

MOBILITY (origin)



MOBILITY (destination)



These percentages refer to the sum of pre-docs, post-docs, and fellows.

* *CAPV: Autonomous Community of the Basque Country.*


CIC
nanoGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

ORGANIZATION AND FUNDING

Organization

An efficient management of resources and people is essential in any organization, even more so in dynamic environments where teams, projects, and funding are constantly changing. This is the case of nanoGUNE.

We rely on a highly experienced technical and management team to support the activities of the research groups. Together, we make possible for our center to comply with its founding mission: to carry out world-class nanoscience research for the competitive growth of the Basque Country.

Governance

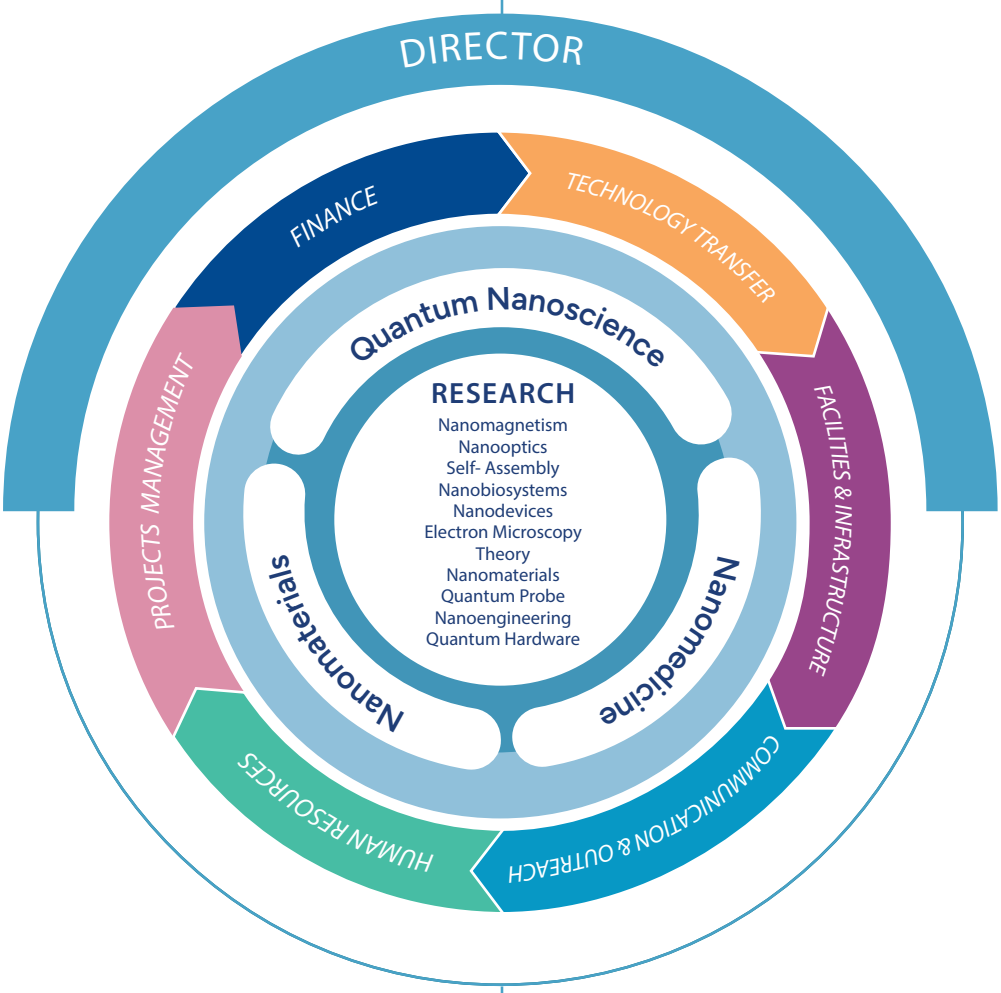
NanoGUNE is a non-profit association promoted by the Basque Government in 2006 and officially inaugurated in 2009.

A Governing Board, currently composed by all partners, is the final responsible for the overall management of the center. An International Advisory Committee, composed of renowned scientists and professionals, advises us on the orientation that should be given to the center.

"NanoGUNE has always played a key role in placing the Basque Country at the forefront of emerging technologies, such as quantum computing and nanomedicine at the present time."

Javier Martínez-Ojinaga
nanoGUNE President
CAF CEO

Board of partners



International Advisory Committee

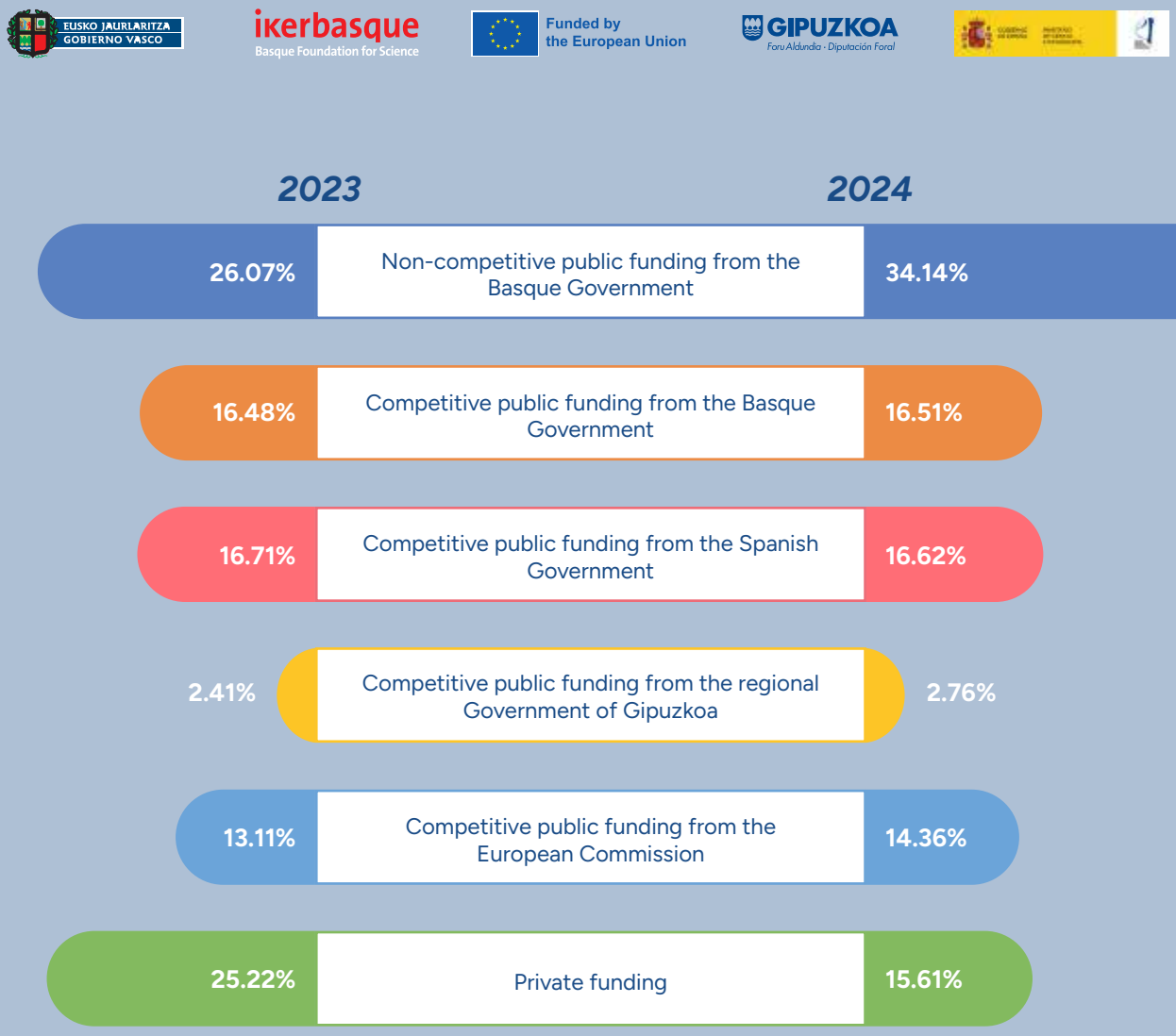
Prof. Sir John Pendry, Chair, Imperial College, London (UK)
Prof. Anne Dell, Imperial College, London (UK)
Prof. Jean-Marie Lehn, Chemistry Nobel Prize 1987, Strasbourg University, Strasbourg (France)
Dr. José Maiz, Intel Fellow, Oregon (USA)
Prof. Emilio Méndez, Brookhaven National Laboratory, New York (USA)
Prof. Sir John Pethica, CRANN, Dublin (Ireland)

Funding

In the period 2023-2024, we have attracted considerable funding from the Regional Government of Gipuzkoa, the Basque Government, the Spanish Government, the European Commission, and private sources. We have also benefited from the support of the Basque Science Foundation (Ikerbasque) through its program to attract top-class researchers from all over the world.

R&D Income
(in thousands of EUR)

9 856 *2023* → **9 166** *2024*



Alliances

Partnerships are extremely important to us, as they contribute to better channel our efforts towards a larger impact of our activity onto society.

NanoGUNE is a founding member of the Basque Research and Technology Alliance (BRTA), composed of 13 technology centers and 4 cooperative research centers. BRTA aims at responding to the socio-economic challenges of the Basque Country through research and technology, with international scope and visibility.

In the period 2023-2024, a special effort has been made to define BRTA's research activity, and specific Research Agendas have been published on Smart Industry, Energy Transition, Personalized Health Care, Healthy Food, Sustainable Mobility, Digital Technologies, and Eco-innovation.

BRTA
BASQUE RESEARCH
& TECHNOLOGY
ALLIANCE

SOMM
EXCELLENCE
ALLIANCE

NanoGUNE is also a member of SOMMa, the alliance of Severo Ochoa and María de Maeztu Centers built to promote Spanish excellence in research and to enhance its social impact at the highest international level.

Organizational aspects

Innovation Management System

NanoGUNE's management is organized around an Innovation Management System (IMS), which is certified under the standard UNE 166002:2021. This standard aims to guide organizations in the development, implementation, and maintenance of a framework for systematic innovation management practices, integrating them within a Research, Development, and Innovation Management System. The person responsible for the IMS is the Finance and HR Director.

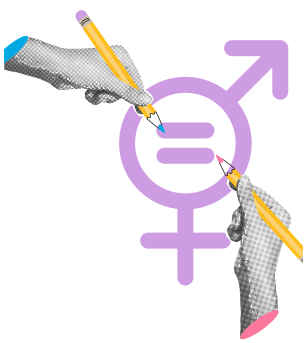
People

HR EXCELLENCE IN RESEARCH

NanoGUNE holds the "HR Excellence in Research" award, granted by the European Comission, which gives public recognition to research institutions that have made progress in aligning their human-resources policies with the principles of the so-called European Charter&Code for Researchers.

In 2024, nanoGUNE passed through the process of renewing the award. A new Charter&Code committee was launched to work on an action plan for the upcoming years, with a focus on the welcoming of the new members, an extended harassment protocol, and the presentation of a new code of conduct. A survey on psychosocial risks has also been conducted, remarking on the effort to foster a respectful and supportive work environment.

Gender Equality Plan



In 2023, the implementation of nanoGUNE's first Gender Equality Plan was successfully concluded, achieving a high level of compliance with our established goals. Additionally, a new gender equality diagnosis was conducted in 2023, leading to the design of the next Gender Equality Plan, which began implementation in September 2024.

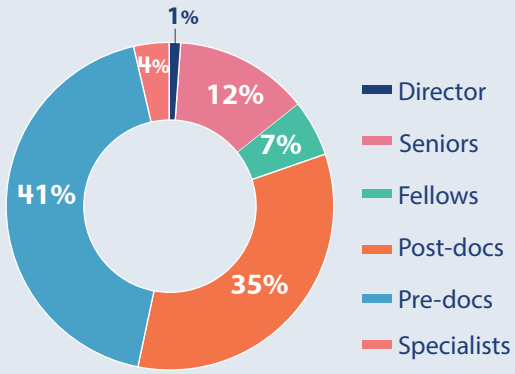
These processes have been led by the Outreach Manager, the Finance and HR Director, and the Director-General, in close collaboration with the Gender Equality Committee.

The new plan emphasizes a structural change and the integration of gender equality across all areas of the organization. By fostering a culture of inclusivity and equality, we aim to create a more supportive and diverse environment for all members of our community.

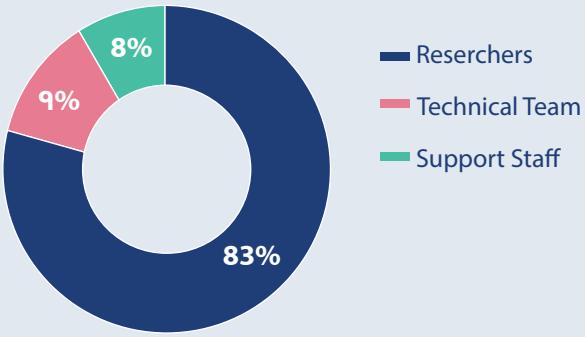
Our community in numbers

In December 2024, the nanoGUNE team was composed of 138 employees , with a Full-Time Equivalent (FTE) of 128. The FTE pie-charts below illustrate the composition of our community.

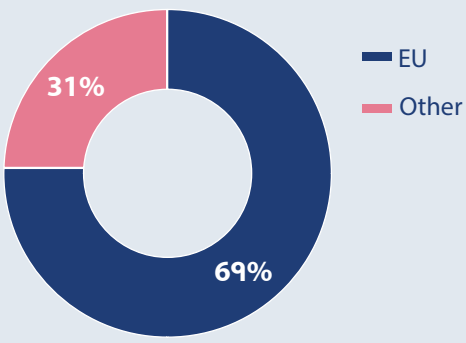
Researchers



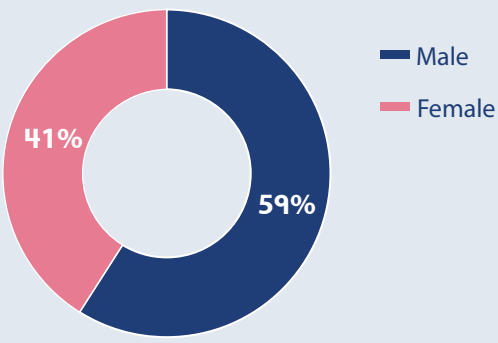
Staff categories



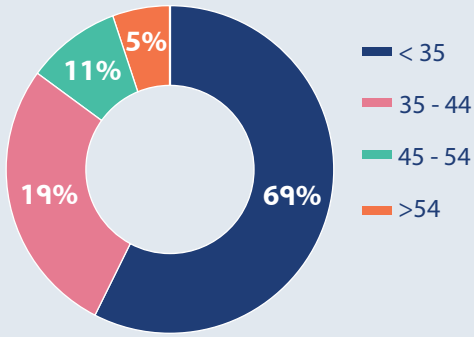
Origin



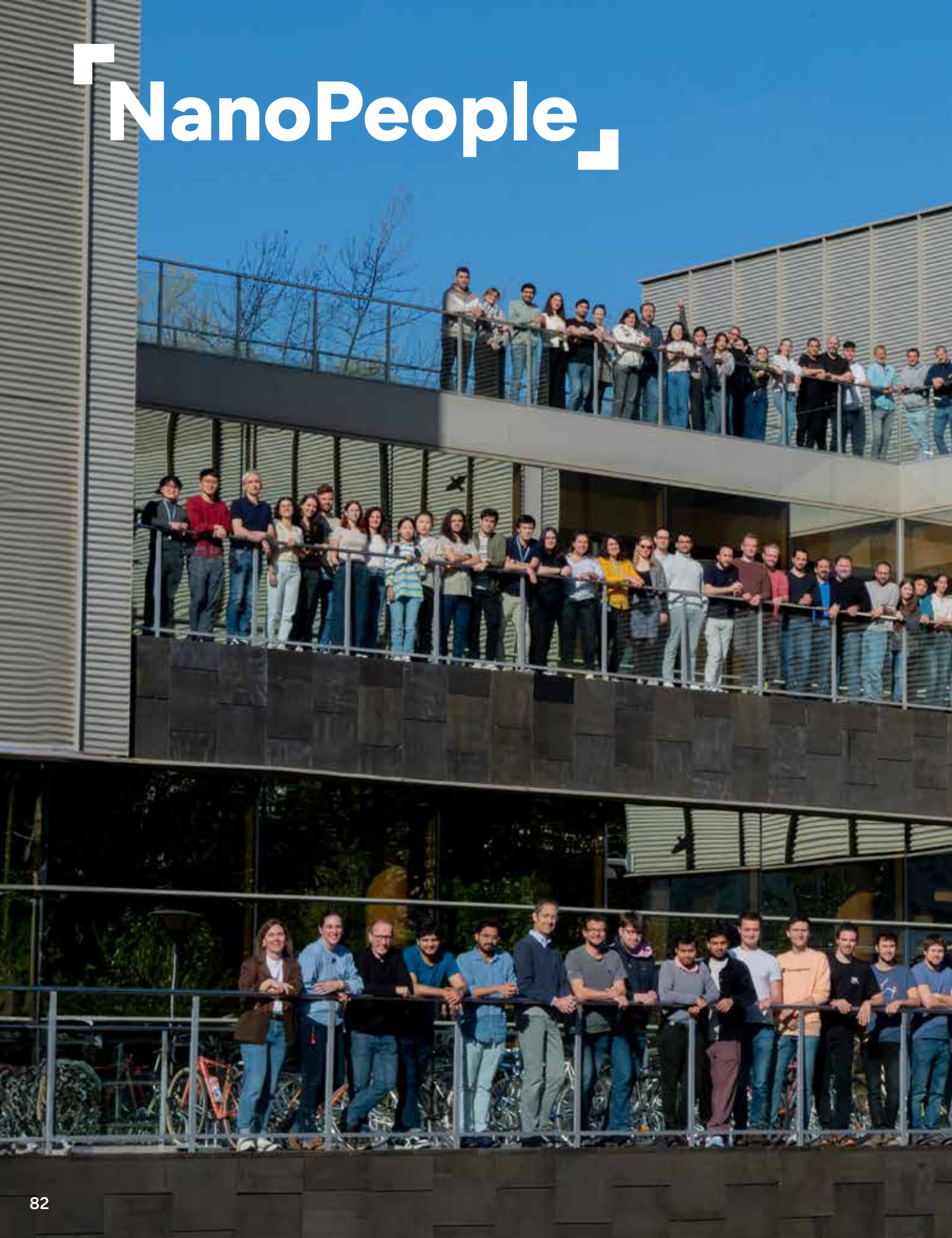
Gender

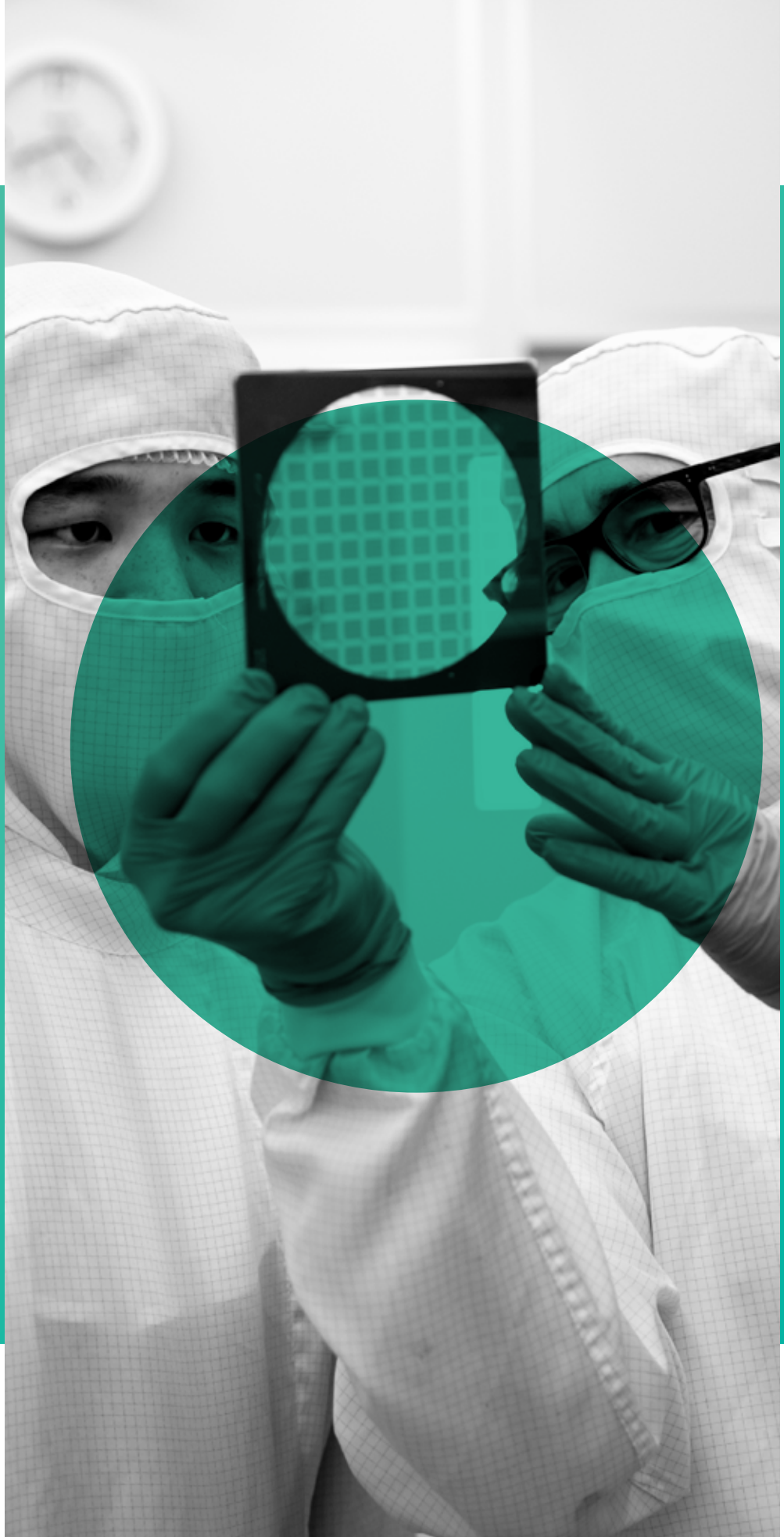


Age Structure



NanoPeople





APPENDIX

Publications

1. S. Merkens, G. De Salvo, J. Kruse, E. Modin, C. Tollan, M. Grzelczak, and A. Chuvilin
Ultramicroscopy **245**, 113654 (2023)
Quantification of reagent mixing in liquid flow cells for Liquid Phase-TEM

2. T. Biurrun, L. Abarzuza, and B. Fernandez-d'Arlas
Afinidad **80**, 99 (2023)
Affinity between wool keratoses and different aqueous phase ions analyzed by sedimentation

3. A. Vorfolomeeva, S. Stolyarova, I. Asanov, E. Shlyakhova, P. Plyusnin, E. Maksimovskiy, E. Gerasimov, A. Chuvilin, A. Okotrub, and L. Bulusheva
Nanomaterials **13**, 153 (2023)
Single-walled carbon nanotubes with red phosphorus in lithium-ion batteries: effect of surface and encapsulated phosphorus

4. X. Mu, W. Wang, C. Sun, D. Zhao, C. Ma, J. Zhu, and M. Knez
Nanotechnology **34**, 015709 (2023)
Greatly increased electrical conduc tivity of PBTTT-C14 thin film via controllable single precursor vapor phase infiltration

5. B. Alonso-Lerma, Y. Jabalera, S. Samperio, M. Morin, A. Fernandez, L. Hille, R. Silverstein, A. Quesada-Ganuza, A. Reifs, S. Fernandez-Penalver, Y. Benitez, L. Soletto, J. Gavira, A. Diaz, W. Vranken, A. Sanchez-Mejias, M. Guell, F. Mojica, B. Kleinstiver, M. Moreno-Pelayo, L. Montoliu, and R. Perez-Jimenez
Nature Microbiology **8**, 77 (2023)
Evolution of CRISPR-associated endonucleases as inferred from resurrected protein

6. S. Gurbatov, V. Puzikov, D. Storozhenko, E. Modin, E. Mitsai, A. Cherepakhin, A. Shevlyagin, A. Gerasimenko, S. Kulinich, and A. Kuchmizhak
ACS Applied Materials & Interfaces **15**, 3336 (2023)
Multigram-Scale production of hybrid Au-Si nanomaterial by laser ablation in liquid (LAL) for temperature-feedback optical nanosensing, light-to-heat conversion, and anticounterfeit labeling

7. A. Reifs, I. Ortiz, A. Saa, J. Schonfelder, D. De Sancho, V. Munoz, and R. Perez-Jimenez
Communications Physics **6**, 7 (2023)
Compliant mechanical response of the ultrafast folding protein EnHD under force

8. N. Ontoso, C. Safeer, F. Herling, J. Ingla-Aynes, H. Yang, Z. Chi, B. Martin-Garcia, I. Robredo, M. Vergniory, F. de Juan, M. Calvo, L. E. Hueso, and F. Casanova
Physical Review Applied **19**, 014053 (2023)
Unconventional charge-to-spin conversion in graphene/$MoTe_2$ van der Waals heterostructures

9. A. Blacha, K. Milowska, M. Payne, H. Greer, A. Terzyk, E. Korczeniewski, A. Cyganiuk, and S. Boncel
Advanced Materials Interfaces **10**, 2202407 (2023)
The origin of amphipathic nature of short and thin pristine carbon nanotubes—fully recyclable 1D water-in-oil emulsion stabilizers

10. B. Medina and R. Fernandez
Journal of Manufacturing and Materials Processing **7**, 13 (2023)
Material behavior around the FSW/FSP tool described by molecular dynamics

11. D. Silva-Brea, D. De Sancho, and X. Lopez
Biophysical Journal **122**, 202 (2023)
Entropy-enthalpy interplay in aluminum bound neurofilaments

12. I. Niehues, L. Mester, E. Vicentini, D. Wigger, M. Schnell, and R. Hillenbrand
Optics Express **31**, 7012 (2023)
Identification of weak molecular absorption in single-wavelength s-SNOM images

13. M. Charconnet, M. Korsa, S. Petersen, J. Plou, C. Hanske, J. Adam, and A. Seifert
Small Methods **7**, 2201546 (2023)
Generalization of self-assembly toward differently shaped colloidal nanoparticles for plasmonic superlattices

14. J. Teunissen, T. Jarrin, N. Richard, N. Koval, D. Santiburcio, J. Kohanoff, E. Artacho, F. Cleri, and F. Da Pieve
Physical Review Materials **7**, 025404 (2023)
Effect of electronic stopping in molecular dynamics simulations of collision cascades in gallium arsenide

15. P. Tiwari, B. Podlesny, M. Krzywiecki, K. Milowska, and D. Janas
Nanoscale Horizons **8**, 685 (2023)
Understanding the partitioning behavior of single-walled carbon nanotubes using an aqueous two-phase extraction system composed of non-ionic surfactants and polymers

16. M. Sekhar, G. Pippia, I. Tanghe, B. Martin-Garcia, A. Rousaki, P. Vandenabeele, P. Schiettecatte, I. Moreels, and P. Geiregat
Journal of Physical Chemistry Letters **14**, 2620 (2023)
Charge carrier dynamics in colloidally synthesized monolayer MoX_2 nanosheets

17. A. Benito-Kaesbach, J. Amigo, U. Izagirre, N. Garcia-Velasco, L. Arevalo, A. Seifert, and K. Castro
Science of the Total Environment **876**, 162810 (2023)
Misinterpretation in microplastic detection in biological tissues: when 2D imaging is not enough

18. N. Maccaferri, A. Gabbani, F. Pineider, T. Kaihara, T. Tapani, and P. Vavassori
Applied Physics Letters **122**, 120502 (2023)
Magnetoplasmonics in confined geometries: current challenges and future opportunities

19. P. Yuan, X. Guo, and D. Ma
ACS Materials Letters **5**, 1295 (2023)
Sign inversion of magnetoconductance in organic semiconductors by different spin-mixing channels at charge-transfer interfaces

20. S. Trivini, J. Ortuzar, K. Vaxevani, J. Li, F. S. Bergeret, M. A. Cazalilla, and J. I. Pascual
Physical Review Letters **130**, 136004 (2023)
Cooper pair excitation mediated by a molecular quantum spin on a superconducting proximitized gold film

21. D. Opra, S. Sinebryukhov, E. Modin, A. Sokolov, A. Podgorbunsky, A. Ziatdinov, A. Ustinov, V. Mayorov, and S. Gnedenkov
Batteries-Basel **9**, 229 (2023)
Manganese, fluorine, and nitrogen Co-doped bronze titanium dioxide nanotubes with improved lithium-ion storage properties

22. Y. Borodaenko, E. Khairullina, A. Levshakova, A. Shmalko, I. Tumkin, S. Gurbatov, A. Mironenko, E. Mitsai, E. Modin, E. Gurevich, and A. Kuchmizhak
Nanomaterials 13, 1300 (2023)
Noble-metal nanoparticle-embedded silicon nanogratings via single-step laser-induced periodic surface structuring

Publications

23. A. Ghita, T. Mocioi, A. Lomonosov, J. Kim, O. Kovalenko, P. Vavassori, and V. Temnov
Physical Review B **107**, 134419 (2023)
Anatomy of ultrafast quantitative magnetoacoustics in freestanding nickel thin films

24. I. Lebedeva, A. Garcia, E. Artacho, and P. Ordejon
Royal Society Open Science **10**, 230063 (2023)
Modular implementation of the linear- and cubic-scaling orbital minimization methods in electronic structure codes using atomic orbitals

25. A. Nikitin, R. Hillenbrand, A. Bylinkin, F. Calavalle, M. Barra-Burillo, R. Kirtaev, E. Nikulina, E. Modin, E. Janzen, J. Edgar, F. Casanova, L. E. Hueso, V. Volkov, P. Vavassori, I. Aharonovich, and P. Alonso-Gonzalez
Nano Letters **23**, 3985 (2023)
Dual-band coupling of phonon and surface plasmon polaritons with vibrational and electronic excitations in molecules

26. H. Thiel, M. Wagner, B. Nard, A. Schlager, R. Chapman, S. Frick, H. Suchomel, M. Kamp, S. Hofling, C. Schneider, and G. Weihs
Optical Materials Express **13**, 1278 (2023)
Fabrication of low-loss III-V Bragg-reflection waveguides for parametric down-conversion

27. H. Yang, M. Ormaza, Z. Chi, E. Dolan, J. Ingla-Aynes, C. Safeer, F. Herling, N. Ontoso, M. Gobbi, B. Martin-Garcia, F. Schiller, L. E. Hueso, and F. Casanova
Nano Letters **23**, 4406 (2023)
Gate-tunable spin Hall effect in an all-light-element heterostructure: graphene with copper oxide

28. S. Chen, P. Leng, A. Konecna, E. Modin, M. Gutierrez-Amigo, E. Vicentini, B. Martin-Garcia, M. Barra-Burillo, I. Niehues, M. C. Escudero, X. Y. Xie, L. E. Hueso, E. Artacho, J. Aizpurua, I. Errea, M. G. Vergniory, A. Chuvilin, F. X. Xiu, and R. Hillenbrand
Nature Materials **22**, 860 (2023)
Real-space observation of ultraconfined in-plane anisotropic acoustic terahertz plasmon polaritons

29. C. Horowitz, C. Proetto, and J. M. Pitarke
Physical Review B **107**, 195120 (2023)
Towards a universal exchange enhancement factor in density functional theory

30. V. Vento, P. Roelli, S. Verlekar, and C. Galland
Nano Letters **23**, 4885 (2023)
Mode-specific coupling of nanoparticle-on-mirror cavities with cylindrical vector beams

31. Y. Borodaenko, S. Gurbatov, E. Modin, A. Chepak, M. Tutov, A. Mironenko, and A. Kuchmizhak
Chemosensors **11**, 307 (2023)
A laser-printed surface-enhanced photoluminescence sensor for the sub-nanomolar optical detection of mercury in water

32. I. Groen, V. Pham, S. Ilic, A. Chuvilin, W. Choi, E. Sagasta, D. Vaz, I. Arango, N. Ontoso, F. Bergeret, L. E. Hueso, I. Tokatly, and F. Casanova
Physical Review B **107**, 184438 (2023)
Emergence of large spin-charge interconversion at an oxidized Cu/W interface

33. K. Nguyen, Y. Jiang, M. Cao, P. Purohit, A. Yadav, P. Garcia-Fernandez, M. Tate, C. Chang, P. Aguado-Puente, J. Iniguez, F. Gomez-Ortiz, S. Gruner, J. Junquera, L. Martin, R. Ramesh, and D. Muller
Physical Review B **107**, 205419 (2023)
Transferring orbital angular momentum to an electron beam reveals toroidal and chiral order

34. R. Lopez-Domene, S. Vazquez-Diaz, E. Modin, A. Beloqui, and A. Cortajarena
Advanced Functional Materials **33**, 2301131 (2023)
An emerging nanozyme class for a la carte enzymatic-like activities based on protein-metal nanocluster hybrids

35. A. Ray, B. Martin-Garcia, M. Prato, A. Moliterni, S. Bordignon, D. Spirito, S. Marras, L. Goldoni, K. Boopathi, F. Moro, N. Casati, C. Giacobbe, M. Saidaminov, C. Giannini, M. Chierotti, R. Krahne, L. Manna, and A. Abdelhady
ACS Applied Materials & Interfaces **15**, 28166 (2023)
Mixed organic cations promote ambient light-induced formation of metallic lead in lead halide perovskite crystals

36. A. Skurativska, J. Ortuzar, D. Bercioux, F. Bergeret, and M. Cazalilla
Physical Review B **107**, 224507 (2023)
Robust spin polarization of Yu-Shiba-Rusinov states in superconductor/ferromagnetic insulator heterostructures

37. A. Boschi, A. Kovtun, F. Liscio, Z. Xia, K. Kim, S. Avila, S. De Simone, V. Mussi, C. Barone, S. Pagano, M. Gobbi, P. Samori, M. Affronte, A. Candini, V. Palermo, and A. Liscio
Small **19**, 2303238 (2023)
Mesoscopic 3D charge transport in solution-processed graphene-based thin films: a multiscale analysis

38. E. Vicentini, A. Gambetta, F. Canella, N. Coluccelli, P. Laporta, and G. Galzerano
Optics Express **31**, 21482 (2023)
High-resolution mid-infrared spectroscopy based on ultrafast Cr:ZnSe laser

39. A. Konecna, M. Schmidt, R. Hillenbrand, and J. Aizpurua
Physical Review Research **5**, 023192 (2023)
Probing the electromagnetic response of dielectric antennas by vortex electron beams

40. J. Pawlak, W. Skowronski, P. Kuswik, M. Gajewska, F. Casanova, and M. Przybylski
Advanced Electronic Materials **9**, (2023)
***Spin Hall induced magnetization dynamics in multiferroic tunnel junction*41. S. Deng, S. Chen, B. Monserrat, E. Artacho, and**

41. S. Deng, S. Chen, B. Monserrat, E. Artacho, and S. Saxena
SciPost Physics **15**, 020 (2023)
Pressure-induced transitions in $FePS_3$: structural, magnetic, and electronic properties

42. P. Varlamov, A. Semisalova, A. Nguyen, M. Farle, Y. Laplace, M. Raynaud, O. Noel, P. Vavassori, and V. Temnov
Magnetochemistry **9**, 186 (2023)
Femtosecond laser ablation-induced magnetic phase transformations in FeRh thin films

43. B. Goncalves, V. Sousa, J. Virtuoso, E. Modin, O. Lebedev, G. Botelho, S. Sadewasser, L. Salonen, S. Lanceros-Mendez, and Y. Kolen'ko
Nanomaterials **13**, 1920 (2023)
Towards all-non-vacuum-processed photovoltaic systems: a water-based screen-printed $Cu(In,Ga)Se_2$ photoabsorber with a 6.6% efficiency

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44. J. Pereira, D. Tezze, M. Ormaza, L. E. Hueso, and M. Gobbi
Advanced Physics Research **2**, 2200084 (2023)
Engineering magnetism and superconductivity in van der Waals materials via organic-ion intercalation

45. M. Molina-Garcia, S. Bellani, A. Castillo, I. Conticello, L. Gabatel, M. Zappia, M. Eredia, S. Thorat, B. Martin-Garcia, L. Ceseracciu, M. Piccinni, and F. Bonaccorso
Journal of Physics-Materials **6**, 035006 (2023)
Wet-jet milling exfoliated hexagonal boron nitride as industrial anticorrosive pigment for polymeric coatings

46. E. Vicentini, W. Nuansing, I. Niehues, I. Amenabar, A. M. Bittner, R. Hillernbrand, and M. Schnell
Optics Express **31**, 22308 (2023)
Pseudoheterodyne interferometry for multicolor near-field imaging

47. I. Arango, A. Anadon, S. Novoa, V. Pham, W. Choi, J. Alegre, L. Badie, A. Chuvilin, L. E. Hueso, F. Casanova, and C. Rojas-Sanchez
Physical Review Materials **7**, 075402 (2023)
Spin-to-charge conversion by spin pumping in sputtered polycrystalline Bi_xSe_{1-x}

48. I. Razquin, A. Iregui, M. Cobos, J. Latasa, A. Eceiza, K. Gonzáles, L. Martin, A. Muller, A. Gonzalez, and L. Irusta
Polymer **282**, 126160 (2023)
Cationically photocured epoxy/polycaprolactone materials processed by solution electrospinning, melt electrowriting and 3D printing: morphology and shape memory properties

49. C. Martin-Valderrama, M. Quintana, and A. Berger
Physical Review B **108**, 14415 (2023)
Experimental verification of the reflection matrix description in linear magneto-optics

50. A. Koshikawa, J. Llandro, M. Ohzeki, S. Fukami, H. Ohno, and N. Leo
Physical Review B **108**, 024414 (2023)
Magnetic order in nanoscale gyroid networks

51. N. Ontoso, C. Safeer, J. Ingla-Aynes, F. Herling, L. E. Hueso, M. Calvo, and F. Casanova
Applied Physics Letters **123**, 032401 (2023)
Out-of-plane spin-to-charge conversion at low temperatures in graphene/$MoTe_2$ heterostructures

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Condensation or desublimation: nanolevel structural look on two frost formation pathways on surfaces with different wettabilities

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Photothermal Conversion and Laser-Induced Transformations in Silicon-Germanium Alloy Nanoparticles

48. V. Temnov and P. Vavassori
Nature Photonics **18**, 529 (2024)
All-optical polarization switching in ferroelectrics

49. H. Gergeroglu, M. Ebeoglugil, S. Bayrak, D. Aksu, and Y. Azar
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Systematic investigation and controlled synthesis of Ag/Ti co-doped hydroxyapatite for bone tissue engineering

50. O. David, M. Benavides, I. Altuna, F. Carretero, M. Zabarte, J. Flat, Q. Pineau, M. Larruskain, and R. Hillenbrand
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Correlating gas permeability and morphology of bio-based polyether-block-amide copolymer membranes by IR nanospectroscopy

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Human Reproduction **39**, I317 (2024)
In vitro fertilization (IVF) using magnetotactic sperm cells and their prospects for assisted* in vivo *reproduction

52. C. Martin-Valderrama, I. Prieto, M. Quintana, A. Martinez-de-Guerenu, and A. Berger
Applied Physics Letters **125**, 022401 (2024**)**
Layer-resolved vector magnetometry using generalized magneto-optical ellipsometry

Publications

53. V. Sousa, M. Goto, M. Claro, S. Pyrlin, L. Marques, E. Modin, O. Lebedev, S. Alizadeh, C. Freitas, E. Vieira, K. Kovnir, P. Alpuim, T. Mori, and Y. Kolen'ko
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PbSe quantum dot superlattice thin films for thermoelectric applications

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Chemphyschem **25**, e202400394 (2024)
Strain in hybrid organic-inorganic metal halide perovskites microstructures by numerical simulations

55. P. Valera, M. Henriques-Pereira, M. Wagner, V. Gaspar, J. Mano, and L. Liz-Marzán
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ACS Applied Materials & Interfaces **16**, 41626 (2024)
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Nanoscale **16**, 15280 (2024)
Laser polarization as a critical factor in the SERS-based molecular sensing performance of nano-gapped Au nanowires

58. S. Mahatha, J. Phillips, J. Corral-Sertal, D. Subires, A. Korshunov, A. Kar, J. Buck, F. Diekmann, G. Garbarino, Y. Ivanov, A. Chuvilin, D. Mondal, I. Vobornik, A. Bosak, K. Rossnagel, V. Pardo, A. Fumega, and S. Blanco-Canosa
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Nature Communications **15**, 6760 (2024)
Experimental verification of field-enhanced molecular vibrational scattering at single infrared antennas

61. C. Martin-Valderrama, I. Prieto, M. Quintana, and A. Berger
Journal of Physics D-Applied Physics **57**, 315003 (2024)
Magneto-optical detection of non-collinear magnetization states in ferromagnetic multilayers

62. A. Vaitsi, V. Sleziona, L. López, Y. Behovits, F. Schulz, N. Sabanés, T. Kampfrath, M. Wolf, T. Seifert, and M. Müller
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Rotating spintronic terahertz emitter optimized for microjoule pump-pulse energies and megahertz repetition rates

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Physical Review B **110**, 064415 (2024)
Direct observation of skyrmions with arbitrary helicity in patterned Co/Pt multilayers

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The role of rare-earth atoms in the anisotropy and antiferromagnetic exchange coupling at a hybrid metal-organic interface

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Advanced Functional Materials 34, 2405057 (2024)
Promoting surface conduction through scalable structure engineering of flexible topological insulator thin films

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Multiplex determination of glycan profiles on urinary prostate-specific antigen by quartz-crystal microbalance combined with surface-enhanced Raman scattering

70. G. Yavuz, F. Günes, K. Aydin, and H. Gergeroglu
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Seeding layer effect on the microstructure of hydrothermally grown a-manganese dioxide nanowires on three-dimensional graphene foam

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Magnetization reversal and direct observation of magnetic domains on FePt thin films

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Publications

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Tuning the spin interaction in nonplanar organic diradicals through mechanical manipulation

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Plasma-assisted fabrication of ultra-dispersed copper oxides in and on C-rich carbon nitride as functional composites for the oxygen evolution reaction

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Fusion of Raman and FTIR spectroscopy data uncovers physiological changes associated with lung cancer

80. D. Bennett, P. Aguado-Puente, E. Artacho, and N. Bristowe
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Pseudo-proper two-dimensional electron gas formation

81. M. Benedet, A. Fasan, D. Barreca, C. Maccato, C. Sada, S. M. Deambrosis, V. Zin, F. Montagner, O. I. Lebedev, E. Modin, G. A. Rizzi, and A. Gasparotto
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Plasma-assisted fabrication of ultra-dispersed copper oxides in and on C-rich carbon nitride as functional composites for the oxygen evolution reaction

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On-chip phonon-enhanced IR near-field detection of molecular vibrations

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Gate-Tunable Exchange Bias and Volage-Controlled Magnetization Switching in a van der Waals Ferromagnet

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Computational and Theoretical Chemistry **1241**, 114913 (2024)
Magnetic and electronic properties of 1D hybrid nanoobjects composed of alternating polycyclic hydrocarbon regions and double carbon chains

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Unveiling intrinsic bulk photovoltaic effect in atomically thin ReS_2

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Nature Communications **15**, 9733 (2024)
Fluorescence from a single-molecule probe directly attached to a plasmonic STM tip

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Nature Communications **15**, 10270 (2024)
Molecular-scale insights into the electrical double layer at oxide-electrolyte interfaces

90. A. Salehi, S. Hosseinpour, N. Tabatabaei, M. Firouz, N. Zadebana, R. Nauber, and M. Medina-Sanchez
Advanced Intelligent Systems, 2400458 (2024)
Advancements in machine learning for microrobotics in biomedicine

91. S. Trivini, J. Ortuzar, J. Zaldivar, E. Herrera, I. Guillamon, H. Suderow, F. Bergeret, and J. I. Pascual
Physical Review B **110**, 235405 (2024)
Diluted Yu-Shiba-Rusinov arrays on the anisotropic superconductor ß-Bi_2Pd

92. M. Charconnet and J. Plou
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Seeing beyond labels: optical technologies reshaping cell culture monitoring in biomedicine

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Emergence of exotic spin texture in supramolecular metal complexes on a 2D superconductor

94. J. Lasa-Alonso, C. Devescovi, C. Maciel-Escudero, A. Garcia-Etxarri, and G. Molina-Terriza
Physical Review Research **6**, 043311 (2024)
Origin of the Kerker phenomena

95. Z. Vatansever, E. Vatansever, A. Berger, A. Vasilopoulos, and N. Fytas
Physical Review E **110**, 064155 (2024)
Monte Carlo study of the two-dimensional kinetic Ising model under a nonantisymmetric magnetic field

Intived Conference Talks 2023

Magnetic impurities on proximitized superconductors
17/01/2023, **Jose I. Pascual**
Surface Science Discussions (SSD) 2023, online

SNOM for nanoscale characterization
27/01/2023, **Rainer Hillenbrand**
Quantitative Chemically-Specific Imaging (QCSI) Infrastructure for Material and Life Sciences Launch Symposium 2023, Helsinki, Finland

Surface and sub-surface alteration of materials for controlled tailoring of their physical, chemical, or biological properties
12/03/2023, **Mato Knez**
SPIE Smart Structures (SS) + Nondestructive Evaluation (NDE) 2023, Long Beach, California, USA

Non-equilibrium electronic processes triggered by swift nuclei in condensed matter
28/03/2023, **Emilio Artacho**
CECAM Workshop 2023 on "Triggering Out-of-Equilibrium Dynamics in Molecular Systems", Lausanne, Switzerland

Spin-orbit proximity in van der Waals heterostructures
31/03/2023, **Fèlix Casanova**
DPG Spring Meeting 2023 of the Condensed Matter Section (SKM), Dresden, Germany

Paramagnetism in triangular pieces of graphene
10/05/2023, **Jose I. Pascual**
16th European School on Molecular Nanoscience (ESMolNa 2023), Madrid, Spain

Applications of thermoplasmonics to nanomagnetic logic
15/05/2023, **Paolo Vavassori**
2023 IEEE International Magnetic Conference (INTERMAG), Sendai, Japan

Thermoplasmonics for nanomagnetic logic
23/05/2023, **Paolo Vavassori**
International Conference on Advanced Plasmonics, Magneto-Optical Technologies (ICAPMOT) 2023, Niagara Falls, Canada

Thermoplasmonics for nanomagnetic logic
14/06/2023, **Paolo Vavassori**
Workshop on Frontiers in Artificial Spin Ice 2023, Lenzburg, Switzerland

Strong coupling between molecular vibrations and phonon polaritons in van der Waals materials
21/06/2023, **Rainer Hillenbrand**
Strong Coupling of Organic Molecules (SCOM) Conference 2023, La Jolla, California, USA

Amplification of magneto-optical activity via plasmonic modes hybridization
19/07/2023, **Paolo Vavassori**
13th International Conference on Metamaterials, Photonic Crystals, and Plasmonics (META 2023), Paris, France

Quantum transport through suspended graphene nanoribbons
26/07/2023, **Jose I. Pascual**
Telluride Workshop on "Quantum Transport Through Molecules", Telluride, Colorado, USA

Voltage-based magnetization switching and reading in magnetoelectric spin-orbit devices
24/07/2023, **Fèlix Casanova**
11th International Symposium on Metallic Multilayers (MML 2023), Seoul, Korea

Colloidal versus substrate-based plasmonic materials
02/08/2023, **Andreas Seifert**
2023 International Conference on Optical MEMS and Nanophotonics (OMN), Campinas, Brazil

Tunning magnetic phase transitions in thin films and multilayers
02/09/2023, **Andreas Berger**
Spin Electronics and Nanomagnetism Colloquium 2023, Nancy, France

Emerging properties in 2D magnetic materials: single and multilayered heterostructures
05/09/2023, **Luis Hueso**
Conference of the Condensed Matter Division of the European Physical Society (CMD30), Milan, Italy

Evolution of vapor phase processing (VPI) as the fourth pillar of atomic layer processing
10/09/2023, **Mato Knez**
ALI Workshop 2023 on Atomic Layer Infiltration and Deposition for Functional Hybrid Materials, Haifa, Israel

Magnetoplasmonic metasurfaces for the amplification of magneto-optical activity via plasmonic modes hybridization
13/09/2023, **Paolo Vavassori**
IEEE Research and Applications of Photonics in Defense (RAPID) 2023, Miramar Beach, Florida, USA

IR and THz nanoimaging and nanospectroscopy for physical and (bio)chemical nanoanalytics
13/09/2023, **Rainer Hillenbrand**
First International Workshop on "Near-Field Optical Imaging and Spectroscopy" 2023, Sheffield, UK

Lessons from nature: how to get the best out of materials
15/09/2023, **Mato Knez**
The 4th International Workshop "Atomic Layer Deposition 2023" (ALD 2023), Makhachkala, Russia

Lessons from nature: how to get the best out of materials
22/10/2023, **Mato Knez**
2023 IEEE Nanotechnology Materials and Devices Conference (NMDC), Paestum, Italy

Designing magnetic phase transitions in thin films and multilayers
16/10/2023, **Andreas Berger**
XII Latin American Workshop on Magnetism, Magnetic Materials, & Their Applications (LAW3M 2023), Puerto Varas, Chile

Nonlinear transport effects in chiral elemental tellurium
21/11/2023, **Fèlix Casanova**
2023 Orbitronics Workshop, Kaist, Daejeon, Korea

Intived Conference Talks 2024

THz nanoscopy of ultraconfined in-plane anisotropic plasmon polaritons
04/01/2024, **Rainer Hillenbrand**
Nanometa 2024, Seefeld, Austria

Multivariate design and data analysis for plasmonic sensing
30/01/2024, **Andreas Seifert**
SPIE Photonics West 2024, San Francisco, California, USA

Spin-orbit coupling: from logic devices to twisted layers
08/02/2024, **Luis Hueso**
VIII Italian Conference on Magnetism (Magnet 2024), Milan, Italy

Introduction to ESL general idea and perspectives
19/02/2024, **Emilio Artacho**
CECAM Workshop 2024 "Electronic Structure Software Development: Advancing the Modular Paradigm", Lausanne, Switzerland

Amplification of magneto-optical activity through plasmonic modes hybridization
22/02/2024, **Paolo Vavassori**
12th International Conference on Photonics, Optics, and Laser Technology (PHOTOPTICS 2024), Rome, Italy

THz nanoscopy of ultraconfined in-plane anisotropic plasmon polaritons
13/03/2024, **Rainer Hillenbrand**
36th International Winterschool on Electronic Properties of Novel Materials (IVEPNM 2024), Kirchberg, Austria

Medical microrobots in reproductive medicine
13/03/2024, **Mariana Medina-Sánchez**
71st SRI Annual Scientific Meeting: Endometrial Satellite Symposium, Vancouver, Canada

Embodiment intelligence in medical microrobotics
20/03/2024, **Mariana Medina-Sánchez**
Embodied Intelligence Conference 2024, online

Building up magnetic graphene nanostructures
26/03/2024, **Jose I. Pascual**
The European Physical Society (EPS) Forum 2024, Berlin, Germany

Out of equilibrium, non-adiabatic dynamics when irradiating condensed matter with nuclei
24/04/2024, **Emilio Artacho**
Psi-k WG6, online

Surface science and surface modification of porous materials
28/04/2024, **Mato Knez**
Porous Semiconductors Science and Technology (PSST) 2024, Brno, Czech Republic

ALD processing : user and equipment manufacturer's points of view
23/05/2024, **Mato Knez**
Precursor Day, Lyon, France

Tiny robots, big impact: transforming gynecological care
16/05/2024, **Mariana Medina-Sánchez**
2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan

Inducing magnetism and superconductivity in graphene
23/05/2024, **Jose I. Pascual**
17th European School on Molecular Nanoscience (ESMoINA 2024), Madrid, Spain

Utilizing sperm as vectors for gynecological cancer treatment
05/06/2024, **Mariana Medina-Sánchez**
Nanomotors International Conference: 20th Anniversary, Barcelona, Spain

IR and THz nanoimaging and nanospectroscopy of phonon and plasmon polaritons
07/06/2024, **Rainer Hillenbrand**
2D Materials Conference, Munich, Germany

Sperm-carrying micromotors for gynecological cancer and infertility interventions
07/06/2024, **Mariana Medina-Sánchez**
European South Atlantic Biophysics Congress (ESAB) 2024, Donostia / San Sebastian, Spain

Mapping ultraconfined polaritons by s-SNOM
11/06/2024, **Rainer Hillenbrand**
International Workshop on Electrons, Photons, and Plasmons (EPP) 2024, Nyon, Switzerland

Surface science and surface modification of porous materials
17/06/2024, **Mato Knez**
3rd Annual NanoSeries Conference, Lisbon, Portugal

Light-controlled nanomagnetic logic
28/06/2024, **Paolo Vavassori**
Spin-based Computing and Signal Processing (SpinCom) 2024, Milan, Italy

Inducing superconductivity in graphene
27/06/2024, **Jose I. Pascual**
III International Conference on Novel 2D Materials explored via Scanning Probe Microscopy & Spectroscopy (2DSPM) 2024, Donostia / San Sebastian, Spain

Peptide and protein fibres, self-assembly vs electrospinning
28/06/2024, **Alexander Bittner**
8th International Conference on Electrospinning (Electrospin 2024), Krakow, Poland

Medical microrobots in gynecologic oncology
02/07/2024, **Mariana Medina-Sánchez**
The 7th International Conference on Manipulation, Automation, and Robotics at Small Scales (MARSS 2024), Delft, Netherlands

Spin-charge interconversion with low-symmetry materials
02/07/2024, **Fèlix Casanova**
International Conference on Magnetism (ICM) 2024, Bologna, Italy

Emergent paramagnetism in graphene nanostructures
03/07/2024, **Jose I. Pascual**
STiBNite Symposium, Leiden, Netherlands

Probing local light-matter interactions by near-field microscopy
10/07/2024, **Rainer Hillenbrand**
2024 Plasmonics and Nanophotonics Gordon Research Conference, Newry, Maine, USA

Microrobotic magnetic technologies for healthcare applications
17/07/2024, **Mariana Medina-Sánchez**
46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2024), Orlando, Florida, USA

Inducing superconductivity in graphene
19/07/2024, **Jose I. Pascual**
Quantum Designer Physics 2024, Donostia / San Sebastian, Spain

Spin texture control with low symmetry 2D heterostructures
04/09/2024, **Luis Hueso**
Conference of the Condensed Matter Division of the European Physical Society (CMD31), Braga, Portugal

Thin water layers on biosurfaces
02/10/2024, **Alexander Bittner**
Conference on Molecular Nanoscience 2024, Ascona, Switzerland

Spin-charge interconversion with low-symmetry materials
16/10/2024, **Fèlix Casanova**
The 6th International Workshop on Spintronic Memory and Logic (SML 2024), Beijing, China

Seminars

2023

Orbital Hall effect in two-dimensional materials
13/02/2023 | **Tatiana Rappoport**
Iberian Nanotechnology Laboratory (INL), Braga, Portugal

Magnonic nanocavities for quantum technologies
20/02/2023 | **María José Martínez-Pérez**
Instituto de Nanociencia y Materiales de Aragón (INMA), Zaragoza, Spain

Simulating lattice gauge theories within quantum technologies
27/02/2023 | **Enrique Rico**
University of the Basque Country, Leioa, Spain

Ph.D. Thesis Defense: Large-scale and linear-scaling quantum mechanics computational methods to characterize the DNA G-quadruplexes and their interaction with small molecules
03/03/2023 | **Iker Ortiz de Luzuriaga**
nanoGUNE

IESM Triple talk
06/03/2023 | **Yvonne Joseph, Nadja Lumme,** and **Katja Heise**
Institute of Electronic and Sensor Materials, Freiberg, Germany

Ferroelectric switching of spin-to-charge conversion for ultralow power spintronics
13/03/2023 | **Christian Rinaldi**
Polythecnique University of Milan, Milan, Italy

nanoGUNE Colloquium: MEMS smart glass, a chance for huge energy savings in buildings and a way into the mysterious world of Casimir forces
20/03/2023 | **Hartmut Hillmer**
University of Kassel, Kassel, Germany

Contribution to new IoT society from spintronics
23/03/2023 | **Hiromi Yuasa**
Kyushu University, Fukuoka, Japan

The origin of amphipathic nature of short and thin pristine carbon nanotubes, fully recyclable 1D water-in-oil emulsion stabilizers
27/03/2023 | **Karolina Milowska**
nanoGUNE

π-magnetism and transport in graphene nanostructures
03/04/2023 | **Thomas Frederiksen**
Donostia International Physics Center (DIPC), Donostia / San Sebastian, Spain

Enhanced optical spectroscopy for single molecule detection with plasmonic nanopores: challenges and prospects
05/04/2023 | **Denis Garoli**
Italian Institute of Technology, Genoa, Italy

Hybrid organic-inorganic thermoelectric materials through a concept of vapor phase infiltration
17/04/2023 | **Kristina Ashurbekova**
nanoGUNE

Peptide self-assembly and computational/experimental symbiosis for their understanding and design
20/04/2023 | **Ivan Sasselli**
Materials Physics Center, Donosta / San Sebastian, Spain

Engineering repeat proteins towards functional nanostructures
20/04/2023 | **Aitziber López-Cortajarena**
biomaGUNE, Donostia / San Sebastian, Spain

Magnetic Impurities on proximitized metals
24/04/2023 | **Jon Ortuzar**
nanoGUNE

Turning infrared into visible light with a scanning probe tip
15/05/2023 | **Philippe Roelli**
nanoGUNE

Research infrastructure opportunities at the new Solaris synchrotron in Krakow
17/05/2023 | **Tomasz Wróbel**
National Synchrotron Radiation Center Solaris, Krakow, Poland

nanoGUNE Colloquium: Functional nanomaterials and devices for energy, sensing, and biomedical applications
22/05/2023 | **Sohini Kar-Narayan**
University of Cambridge, Cambridge, UK

HR-STEM study of semiconductor colloidal nanocrystals
29/05/2023 | **Iurii Ivanov**
Italian Institute of Technology, Genoa, Italy

Spin and charge interconversion in van der Waals proximitized heterostructures
05/06/2023 | **Haozhe Yang**
nanoGUNE

Hybrid organic-inorganic Sb_2Te_3-doped PEDOT:PSS thermoelectric materials
12/06/2023 | **Kristina Ashurbekova**
nanoGUNE

Altermagnetism explored in MnTe and Mn_5Si_3 thin films
19/06/2023 | **Helena Reichlovaa**
Dresden University of Technology, Dresden, Germany

Electronic transport through free-standing graphene nanoribbons using a scanning tunneling microscope
26/06/2023 | **Niklas Friedrich**
nanoGUNE

Ph.D. Thesis Defense: Phase transitions in nanoscale designed magnetic thin films
17/07/2023 | **Mikel Quintana**
nanoGUNE

Magnetoplasmonic nanocavities for active control of light polarization
04/09/2023 | **Terunori Kaihara**
nanoGUNE

Topological and 2D materials grown by MBE: crafting exotic physics into functional heterostructures
11/09/2023 | **Amilcar Bedoya**
Institute for Molecular Science, Valencia, Spain

Tip-enhanced photoluminescence of single-photon emitters in hBN
18/09/2023 | **Iris Niehues**
nanoGUNE

PhD Mid-Term Seminar Series: Ultrasensitive magneto-optical ellipsometry for depth-resolved magnetometry
25/09/2023 | **Carmen Martín-Valderrama**
nanoGUNE

PhD Mid-Term Seminar Series: Nonlinear transport effects in chiral elemental tellurium
25/09/2023 | **Manuel Suárez-Rodríguez**
nanoGUNE

Low-energy radiation dosimetry from a density functional theory approach
02/10/2023 | **Guerda Massillon**
National Autonomous University of Mexico, Mexico City, Mexico

PhD Mid-Term Seminar Series: Designer spin states in nanographenes "seen" by scanning probe microscopy techniques
09/10/2023 | **Francisco Romero**
nanoGUNE

Seminars

2023

PhD Mid-Term Seminar Series: Discovering the versatility of superconducting proximitized platforms, from single molecules to extended nanostructures
09/10/2023 | **Katerina Vaxevani**
nanoGUNE

From complexity to homogeneity by sorting mixtures of single-walled carbon nanotubes
16/10/2023 | **Dawid Janas**
Silesian University of Technology, Gliwice, Poland

PhD Mid-Term Seminar Series: Characterization of 2D hybrid organic-inorganic metal-halide perovskites for spintronic and optoelectronic devices
23/10/2023 | **Yaiza Asensio**
nanoGUNE

PhD Mid-Term Seminar Series: Raman spectroscopy and chemometrics, the future of lung cancer detection?
23/10/2023 | **Harun Hano**
nanoGUNE

Structural characterization with electron diffraction – 1D, 2D, 3D
30/10/2023 | **Tatiana Gorelik**
Helmholtz Center for Infection Research (HZI), Braunschweig, Germany

Picosecond laser ultrasonics, an interesting technique for imaging and mechanical characterization
06/11/2023 | **Samuel Raetz**
Le Mans University, Le Mans, France

nanoGUNE Colloquium: Nanoengineering gone viral, plant virus-based therapeutics
15/11/2023 | **Nicole Steinmetz**
University of California San Diego (UCSD), San Diego, California, USA

Ultrafast nanophotonics and optoelectronics, from metamaterial-based all-optical switching to plasmon-driven polaritonic chemistry
20/11/2023 | **Nicoló Maccaferri**
Umeå Center for Microbial Research, Umeå, Sweden

Surface science approach for developing materials and heterostructures for mesoscopic devices
04/12/2023 | **Celia Rogero**
Materials Physics Center, Donostia / San Sebastian, Spain

An ultrafast view on spins and magnetism in van der Waals materials
11/12/2023 | **Marcos Guimarães**
Zernike Institute for Advanced Materials, Groningen, Netherlands

Technology transfer at nanoGUNE, an overview of the activities and results
08/01/2024 | **Ainara Garcia-Gallastegui**
nanoGUNE

Optimization of graphene-based nanohybrid synthesis using the Taguchi method for water treatment applications
15/01/2024 | **Hazal Gergeroglu**
nanoGUNE

Optical measurements of single molecules and their clusters
05/02/2024 | **Martin Svec**
Institute of Physics of the Czech Academy of Sciences, Cukrovarnická, Czech Republic

Fibres from electrified jets; writing, spinning, and spraying
19/02/2024 | **Alexander Bittner**
nanoGUNE

DNA data storage in composite nucleic acid-polymer fibers
26/02/2024 | **Diana Soukarie**
nanoGUNE

Control of charge-spin interconversion in van der Waals heterostructures with chiral charge-density wave
04/03/2024 | **Zhendong Chi**
nanoGUNE

Accessing liquid-solid interfaces and studying their radiation chemistry in cryogenic electron microscopy and spectroscopy
11/03/2024 | **Patricia Abellan**
Nantes University, Nantes, France

Understanding crystallization from first principles
18/03/2024 | **Pablo Piaggi**
nanoGUNE

Magnetic properties of 2D transition metal dihalides
25/03/2024 | **Maxin Ilin**
Materials Physics Center, Donostia / San Sebastian, Spain

From alkali-ion batteries toward anode-less batteries; current developments, issues, and challenges
08/04/2024 | **Lorenzo Fallarino**
CIC energiGUNE, Gasteiz, Spain

Towards full quantum control of individual molecules
15/04/2024 | **Leonard Edens**
nanoGUNE

Ab initio electronic and excitonic properties of pristine and defected van der Waals matter
22/04/2024 | **Daniel Hernangómez**
nanoGUNE

Critical behavior of dynamic phase transitions in ferromagnetic thin films
29/04/2024 | **Mikel Quintana**
nanoGUNE

Identification of metal soaps and other degradation products in modern oil paints
06/05/2024 | **Oskar González-Mendia**
University of the Basque Country, Leioa, Spain

What an ancient bacterial cytoskeletal protein can teach us about dissipative self-assembly
13/05/2024 | **Marisela Velez**
Institute of Catalysis and Petrochemistry, Madrid, Spain

Light scattering in resonant nanostructures with broken symmetries; chirality and magneto-optics
20/05/2024 | **Antonio García-Martín**
Institute of Micro and Nanotechnology, Madrid, Spain

Seminars

Optimization of Fe-Mn-C steels for biodegradable vascular implant applications
27/05/2024 | **Martin Otto**
Leibinz Institute for Solid State and Materials Research (IFW), Dresden, Germany

Study of machining process in a high-speed linear cutting test bench
10/06/2024 | **Cristhian Chingo**
Mondragon University, Arrasate, Spain

Data-driven many-body potentials for realistic molecular simulations
18/06/2024 | **Francesco Paesani**
University of California San Diego (UCSD), San Diego, California, USA

2D van der Waals magnet CrSBr, application beyond 3D magnets
24/06/2024 | **Junhyeon Jo**
nanoGUNE

Visualizing energy transport in nanostructured semiconductors
08/07/2024 | **Ferry Prins**
Autonomous University of Madrid, Madrid, Spain

Strongly correlated pi-magnets driven by e-ph and e-e interaction
10/07/2024 | **Pavel Jelinek**
Institute of Physics of the Czech Academy of Sciences, Prague, Czech Republic

Accelerating materials design with AI emulators and generators
19/07/2024 | **Claudio Zeni**
Microsoft Research Lab, Cambridge, UK

Customized polymeric nanocontainers, tailoring membrane properties for targeted biological functions
09/09/2024 | **Silvia Moreno**
University of Alcalá, Alcalá de Henares, Spain

Scaffolds as tissues mimicries, from biochemical to biophysical stimuli
16/09/2024 | **Sandra Camarero-Espinosa**
University of the Basque Country, Donostia / San Sebastian, Spain

Advanced imaging techniques in *in vivo* models (intravital microscopy, nuclear and molecular imaging)
23/09/2024 | **Andrea Zapater**
Paralab Bio S.L., Madrid, Spain

Graphene-based room-temperature IR detector for phonon-enhanced near-field molecular sensing
30/09/2024 | **Andrei Bylinkin**
nanoGUNE

Advancing cardiac tissue engineering; developing polymer-hydrogel scaffolds through melt electrowriting
07/10/2024 | **Mohammad Amini**
nanoGUNE

Diverse functions of organic semiconductors; from solution-processable transistor fabrication to clean fuel production
14/10/2024 | **Kei Noda**
Keio University, Tokyo, Japan

Unveiling intrinsic bulk photovoltaic effect in atomically thin ReS_2
21/10/2024 | **Maria Ramos**
nanoGUNE

nanoGUNE Colloquium: Curvilinear magnetism, current research, and technology perspectives
28/10/2024 | **Denys Makarov**
Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany

Optoelectronics on the atomic scale; what we can learn from STM on single molecules
11/11/2024 | **Katharina Kaiser**
University of Göttingen, Göttingen, Germany

Unveiling large magnetic exchange coupling and intermolecular interactions in diverse carbon-based nanomaterials
25/11/2024 | **Kalyan Biswas**
nanoGUNE

Reliable electronic and optical characterization of 2D materials using density functional theory
02/12/2024 | **María Camarasa**
Materials Physics Center, Donostia / San Sebastian, Spain

Metal additive manufacturing: challenges and opportunities
09/12/2024 | **Yulia Kuzminova**
nanoGUNE

nanoGUNE Colloquium: Hitting Atomic Limits, pushing the frontiers in semiconductor nanofabrication
16/12/2024 | **Erwin Kessels**
Eindhoven University of Technology, Eindhoven, Netherlands

RESEARCH GRANTS ONGOING 2023 - 2024

European Commission

Project	Period	Call
MicroGIFT *Microrobotic gamete/zygote intrafallopian transfer* Id. 853609	2020 - 2026	ERC Starting Grant 2019
CONSPIRA *Coherent control of spin chains in graphene nanostructures* Id. 101097693	2024 - 2028	ERC Advanced Grant 2022
SPRING *Spin research in graphene* Id. 863098	2019 - 2024	H2020-FETOPEN-2018-2020-RIA
INTERFAST *Gated interfaces for fast information processing* Id. 965046	2021 - 2024	H2020-FETOPEN-2018-2020-RIA
SINFONIA *Selectively activated information technology by hybrid organic interfaces* Id. 964396	2021 - 2025	H2020-FETOPEN-2018-2020-RIA
FANTASTICOF *Fabricating and implementing exotic Moiré materials from covalent organic frameworks* Id. 101046231	2022 - 2025	HORIZON-EIC-2021-PATHFINDEROPEN
TextaDNA *High-throughput oligonucleotide synthesis and NGS for Digital text storage and retrieval in DNA encapsulated nanofibers* Id. 101115292	2024 - 2028	HORIZON-EIC-2022-PATHFINDERCHALLENGES
Graphene Core3 *Graphene Flagship core project 3* Id. 881603	2020 - 2023	H2020-SGA-FET-GRAPHENE-2019

Project	Period	Call
ENSEMBLE3 *Center of excellence for nanophotonics, advanced materials, and novel crystal growth-based technologies* Id. 857543	2019 - 2026	H2020-WIDESPREAD-2018-2020
RAVEN *Revolutionary accuracy in waveguide- and photoacoustic-enabled atmospheric sensors* Id. 101135787	2024 - 2028	HORIZON-CL4-2023-DIGITAL-EMERGING-01
SPEAR *Spin-orbit materials, emergent phenomena, and related technology training* Id. 955671	2021 - 2025	H2020-MSCA-ITN-2020
DYNAMO *Dynamic control in hybrid plasmonic nanopores: road to next generation multiplexed single molecule detection* Id. 101072818	2022 - 2026	HORIZON-MSCA-2021-DN-01-01
NanoRemedi *Functional nano-scaffolds for regenerative medicine* Id. 101072645	2022 - 2026	HORIZON-MSCA-2021-DN-01-01
HYTEM - Kristina Ashurbekova *Organic-inorganic hybrid thermoelectric materials through a new concept of simultaneous vapor-phase coating and infiltration (VPI/SCIP)* Id. 101032113	2021 - 2023	H2020-MSCA-IF-2020
MANACOLIPO - Terunori Kaihara Magnetoplasmonic nanocavities for active control of light polarization Id. 101029928	2022 - 2024	H2020-MSCA-IF-2020

RESEARCH GRANTS ONGOING 2023 - 2024

European Commission

Project	Period	Call
QMOLESR - Danilo Longo *Addressing molecular spin qubits by ESR-STM* Id. 101064332	2022 - 2024	HORIZON-MSCA-PF 2021
TERRaMoOn - Philippe Roelli *Development of hybrid tip-enhanced IR-Raman microscopy for the study of molecular optomechanical upconversion* Id. 101065661	2024 - 2026	HORIZON-MSCA-PF 2021
CHEERS - Sofia Ferreira-Teixeira *Chirality controlled spin-to-charge interconversion in Tellurium* Id. 101106104	2024 - 2025	HORIZON-MSCA-PF 2022
ACCESS - Tanweer Ahmed *Engineering spin-splitting in atomically thin 2D non-centrosymmetric crystals* Id. 101107842	2024 - 2025	HORIZON-MSCA-PF 2022
MolQuMag - María Tenorio *Molecular quantum magnets on graphene as novel spin qubit platforms* Id. 101154676	2024 - 2027	HORIZON-MSCA-PF 2023

Project	Period	Call
ULTIMATE-I *Ultra-thin magneto thermal sensoring* Id. 101007825	2021 - 2025	H2020-MSCA-RISE-2020
MAMBA *Materials irradiation: from basics to applications* Id. 101131245	2023 - 2027	HORIZON-MSCA-SE-2022
MULTISPIN *Molecular engineering of layered magnetic materials: towards multifunctional spintronic devices*	2021 - 2024	FLAG ERA 3 Call 2021
THERMOS Tellurium-free thermoelectric modules by interface engineering	2022 - 2025	M-ERA.NET Call 2021

RESEARCH GRANTS ONGOING 2023 - 2024

Spanish Government

Project	Period	Call
nanoGUNE Unidad María de Maeztu Id. CEX2020-001038-M	2022 - 2025	Excellence Research Centers 2020
CryoFIB *Advanced ion-beam device with cryogenic functionality* Id. EQC2021-007107-P	2021 - 2023	Acquisition of scientific-technical equipment 2021
MULTISPIN *Molecular engineering of layered magnetic materials: towards multifunctional spintronic devices* Id. PCI2021-122038-2A	2021 - 2025	International collaborative projects 2021
Thermos *Tellurium-free thermoelectric modules by interface engineering* Id. PCI2022-132940	2022 - 2025	International collaborative projects 2022
BRIDGE *Bridging the gap between synthetic polymers and biopolymers physical and chemical properties* Id. PID2019-104650GB-C22	2020 - 2023	Research projects 2019
FunMolSyS *Magnetism and topological states of on-surface engineered molecular nanosystems* Id. PID2019-107338RB-C61	2020 - 2023	Research projects 2019
SYNERFUN *Synergistic surface functionalization for advanced diagnostic, catalytic,and packaging materials* Id. PID2019-111065RB-I00	2020 - 2023	Research projects 2019

Project	Period	Call
SNOMCELL *Near-field microscopy for a label-free ultrastructural pathology* Id. PID2020-115221GA-C44	2021 - 2024	Research projects 2020
NANOSPEC *Advanced near-field optical nanospectroscopy and novel applications in materials sciences and nanophotonics* Id. PID2021-123949OB-I00	2022 - 2025	Research projects 2021
HiMat *Hybrid layered materials for nanodevices* Id. PID2021-128004NB-C21	2022 - 2025	Research projects 2021
LSD *Low-dimensional spin devices* Id. PID2021-122511OB-I00	2022 - 2025	Research projects 2021
OPTOMETAMAG *Optical-control of thermally driven magnetic phase transitions in metamaterials* Id. PID2021-123943NB-I00	2022 - 2025	Research projects 2021
SIESTA *SIESTA ecosystem of atomistic simulations of materials* Id. PID2022-139776NB-C65	2023 - 2026	Research projects 2022
TILDEMON *Thin-film devices for more than Moore* Id. PID2022-140861OB-I00	2023 - 2026	Research projects 2022
MolSense *On-surface synthesis of molecular architectures with optical and magnetic functionality* Id. PID2022-140845OB-C61	2023 - 2026	Research projects 2022

RESEARCH GRANTS ONGOING 2023 - 2024

Spanish Government

Project	Period	Call
ASSIST *Adaptive surface coatings for integrated self-repair and enhanced thermal resistance in building materials* Id. PID2023-147532OA-I00	2024 - 2027	Research projects 2023
AI-NANOSPEC *AI-augmented nano-spectroscopy for biomedical diagnosis* Id. PID2023-148359NB-C22	2024 - 2027	Research projects 2023
GENSPERMBOT *Remotely controlled magnetotactic sperm for targeted gene editing* Id. PID2023-148899OA-I00	2024 - 2027	Research projects 2023
IVIS-AID *Additive manufacturing of scaffolds and nanoscale physicochemical analysis* Id. PID2023-147987OB-C32	2024 - 2027	Research projects 2023
CARDIOPRINT *Advanced multifunction 3D biofabrication for the generation of computationally modeled human-scale therapeutic cardiac tissues* Id. PLEC2021-008127	2021 - 2024	Strategic research projects in public-private collaboration 2021
Beatriz Martín-García *Development of tailor-made 2D materials for optoelectronic devices* Id. RYC2021-034836-I	2023 - 2028	Ramón y Cajal 2021
Fabian Schulz *Novel approaches combining high-resolution scanning probe microscopy with light-in/light-out methods* Id. RYC2021-034304-I	2023 - 2027	Ramón y Cajal 2021

Project	Period	Call
Dongfei Wang Id. FJC2020-043831-I	2021 - 2023	Juan de la Cierva 2020
Yuan Peisen Id. FJC2020-044666-I	2021 - 2023	Juan de la Cierva 2020
Junhyeon Jo Id. FJC2020-042842-I	2022 - 2024	Juan de la Cierva 2020
Zhendong Chi Id. FJC2021-047257-I	2022 - 2024	Juan de la Cierva 2021
Edoardo Vicentini Id. FJC2021-046779-I	2023 - 2025	Juan de la Cierva 2021
Xiaomin Guo Id. JDC2022-049712-I	2024 - 2025	Juan de la Cierva 2022
Gabriele Botta *Functionalization of 2D materials by ALD* *Id. PRE2018-084190*	2019 - 2023	FPI predoctoral grant 2018
María Barra *Extreme nanofabrication of spintronic and plasmonic devices* *Id. PRE2018-084207*	2019 - 2023	FPI predoctoral grant 2018
Stefano Trivini *Atomic scale superconductivity of novel materials* Id. PRE2018-083316	2019 - 2023	FPI predoctoral grant 2018
Andrei Bylinkin *Optical phenomena in novel Van der Waals materials* Id. PRE2019-088168	2020 - 2024	FPI predoctoral grant 2019

RESEARCH GRANTS ONGOING 2023 - 2024

Spanish Government

Project	Period	Call
Jose Manuel Pereira *Magnetism at 2D material/molecule interfaces* Id. PRE2019-090346	2020 - 2024	FPI predoctoral grant 2019
Matteo Menniti *Nanomagnetic logic by photothermal excitation of magnetic nanostructure networks* Id. PRE2019-088070	2020 - 2024	FPI predoctoral grant 2019
Mikel Quintana *Magnetic properties of non-planar magnetic films and multilayers* Id. PRE2019-088428	2020 - 2024	FPI predoctoral grant 2019
Montserrat Aguilar *Bringing functional molecular systems onto non-metallic surfaces* Id. PRE2019-089833	2020 - 2024	FPI predoctoral grant 2019
Daniel Tezze *Tuning the physical properties of layered compounds through molecular functionalization* Id. PRE2020-092992	2021 - 2025	FPI predoctoral grant 2020
Leonard Edens *Study of exotic spin phenomena in graphene nanostructures using STM-ESR* Id. PRE2020-094813	2021 - 2025	FPI predoctoral grant 2020
Sara Samperio *Understanding and fighting microbial infections: ancestral sequence reconstruction and mechanobiology against the patogen staphylococcus aureus* Id. PRE2020-094264	2021 - 2025	FPI predoctoral grant 2020

Project	Period	Call
Iker Herrero *Advanced near-field optical nanospectroscopy and novel applications in material sciences and nanophotonics (NANOSPEC)* Id. PRE2021-099011	2022 - 2026	FPI predoctoral grant 2021
Pablo Rodríguez *Magnetoplasmonic metamaterials for active control of light polarization* Id. PPRE2021-099586	2022 - 2026	FPI predoctoral grant 2021
Yaiza Asensio *Characterization of 2D materials for spintronic and optoelectronic devices* Id. PRE2021-099999	2022 - 2026	FPI predoctoral grant 2021
Yoav Urbina *Opto-thermal-acoustic control of magnetism behavior in nanostructures* Id. PRE2022-103017	2023 - 2027	FPI predoctoral grant 2022
Jan Krpensky *Development and application of infrared and terahertz near field microscopy for mapping anisotropic dielectric properties and polaritons in 2D and 3D materials* Id. PRE2022-102795	2023 - 2027	FPI predoctoral grant 2022
Lucía Olano *Low-dimensional spin devices* Id. PRE2022-104385	2023 - 2027	FPI predoctoral grant 2022
Covadonga Álvarez *Intercalation of layered materials for advanced electronic devices* Id. PRE2022-104487	2023 - 2027	FPI predoctoral grant 2022

RESEARCH GRANTS ONGOING 2023 - 2024

Spanish Government

Project	Period	Call
Quang Bao Tu *2D heterostructures for spintronics applications* Id. PRE2022-103674	2023 - 2027	FPI predoctoral grant 2022
Nuria Santervás *Calculation of nonlinear optical response in nanoscopic open systems using Floquet theory* Id. PRE2022-101273	2023 - 2027	FPI predoctoral grant 2022
Katerina Vaxevani *Probing magnetism in graphene nanosystems* Id. PRE2022-102887	2023 - 2027	FPI predoctoral grant 2022
Renata Matekalo *Machine-learning-assisted development of organic matrices for environmental remediation* Id. PPRE2022-105730	2023 - 2027	FPI predoctoral grant 2022

Project	Period	Call
Sanaz Gerivani *Excess electronic energy evolution in ion irradiation processes in matter from time-dependent first-principles simulations* Id. PREP2022-000453	2024 - 2027	FPI predoctoral grant PID 2022
Trisha Sai *Sensing and manipulating spins in open-shell graphene nanostructures* Id. PREP2022-000247	2024 - 2028	FPI predoctoral grant PID 2022
Francisco Romero *Developping a spintronic device made of atomically-precise open-shell graphene nanostructures* Id. FPU20/03305	2021 - 2025	FPU predoctoral grant 2020

RESEARCH GRANTS ONGOING 2023 - 2024

Basque Government

Project	Period	Call
CIC nanoGUNE 2023	2023 - 2023	EMAITEK 2023
CIC nanoGUNE 2024	2024 - 2024	EMAITEK 2024
Mask Aligner *Mask aligner for photolithography* Id. PZ-2022/00016	2022 - 2023	AZPITEK 2022 Acquisition of scientific and technological infrastructure
SiQIC *Adquisición de equipamiento científico-tecnológico de computación cuántica: Refrigerador de Dilución* Id PZ-2024/00021	2024 - 2025	AZPITEK 2024 Acquisition of scientific and technological infrastructure
ALD6I *ALD system with a 6-inch chamber* Id. EC_2022_1_0022	2022 - 2023	EKIZIEN 2022 Acquisition of scientific equipment
nG22 *Developments at the nanoscale for manufacturing and healthcare* Id. KK-2022/00001	2022 - 2023	ELKARTEK 2022 Collaborative strategic research: Fundamental
BRTA_Q *BRTA Quantum: towards a harmonized specialization in quantum technologies at BRTA* Id. KK-2022/00041	2022 - 2023	ELKARTEK 2022 Collaborative strategic research: Fundamental
nG23 *Intelligent approach to the design of micro-nano-fluidic sensing devices. Micro-nano-fluidic and new functionalities for fluidic analysis.* Id. KK-2023/00001	2023 - 2024	ELKARTEK 2023 Collaborative strategic research: Fundamental

Project	Period	Call
nG24 *Nanoscale developments for advanced metal fabrication processes* Id. KK-2024/00001	2024 - 2025	ELKARTEK 2024 Collaborative strategic research: Fundamental
Martin Snell *Development of advanced microscopy techniques and their application to fundamental and applied research in nanooptics, optical metrology, and biomedical imaging*	2020 - 2025	IKERBASQUE RESEARCH FELLOWS 2020
Karolina Z. Milowska *Atomistic simulations of low-dimensional systems for sustainable energy generation*	2022 - 2026	IKERBASQUE RESEARCH FELLOWS 2021
Beatriz Martin García Rational design of low-dimensional and hybrid organic-inorganic materials for optoelectronic and spintronic applications	2022 - 2027	IKERBASQUE RESEARCH FELLOWS 2022
Pablo M. Piaggi *Understanding crystallization from first principles*	2024 - 2028	IKERBASQUE RESEARCH FELLOWS 2023
Marina Borraz *Polymeric food packaging with conductive antimicrobial coatings* Id. 003-B2/2020	2020 - 2024	BIKAINTEK 2020 Industrial pre-docs
Susan Azpeitia *ALD perovskite thin films* Id. 035-B1/2021	2021 - 2023	BIKAINTEK 2021 Industrial post-docs

RESEARCH GRANTS ONGOING 2023 - 2024

Basque Government

Project	Period	Call
Ane Rivas *Ancestral reconstruction of beta-xylosidases for use in lignocellulosic enzyme cocktails* Id. 014-B2/2021	2021 - 2025	BIKAINTEK 2021 Industrial pre-docs
Ana Álvarez *Self-cleaning antimicrobial fabrics by ALD* Id. 013-B2/2021	2021 - 2025	BIKAINTEK 2021 Industrial pre-docs
Natalia Chamorro *Polymeric fibers and fabrics for multifunctional textiles* Id. 018-B1/2022	2022 - 2024	BIKAINTEK 2022 Industrial post-docs
Yavar Azar *Web platform for scientific software* Id. 021-B1/2022	2022 - 2024	BIKAINTEK 2022 Industrial post-docs
Maryam Jebari *Point-of-care device for sperm DNA integrity assessment: implementation in clinical practice* Id. 023-B2/2024	2024 - 2028	BIKAINTEK 2024 Industrial pre-docs
Gorka Aizpurua *Quantum computing in silicon* Id. 024-B2/2024	2024 - 2028	BIKAINTEK 2024 Industrial pre-docs
Stefan Merkens In-situ *studies of nanoparticles growth and self-assembly using liquid cell transmission electron microscopy*	2020 - 2023	PFPI predoctoral grant 2019
Carmen Martín-Valderrama *Ultrasensitive magneto-optical ellipsometry for depth-resolved magnetometry*	2022 - 2025	PFPI predoctoral grant 2021

Project	Period	Call
Jon Ortuzar *Magnetic interactions in non-conventional superconductor systems*	2022 - 2025	PFPI predoctoral grant 2021
Jone Mencos *Looking for the spin swapping effect*	2023 - 2026	PFPI predoctoral grant 2022
Erlaitz Gómez-Castrillo *Integration of Dirac Materials into MESO devices*	2023 - 2026	PFPI predoctoral grant 2022
BIOCART Integrated multiomics and spectroscopic approach for the identification of novel CAR-T biomarkers in blood using machine-learning analysis Id. 2024333011	2024	Proyectos de Investigación y Desarrollo en Salud 2024 (RIS3 - GV)
Quantum computing for high-accuracy first-principles calculations of condensed matter: DFT	2024 - 2025	IKUR - QUANTUM TECHNOLOGIES 2023
New materials in advanced quantum electronic applications	2024 - 2025	IKUR - QUANTUM TECHNOLOGIES 2023
Non-linear transport and spintronics phenomena in low-dimensional materials with broken symmetries	2024- 2025	IKUR - QUANTUM TECHNOLOGIES 2023
Quantum register based on molecular spins and graphene nanostructures	2024 - 2025	IKUR - QUANTUM TECHNOLOGIES 2023
Quantum behaviour of artificial spin ice lattices	2024 - 2025	IKUR - QUANTUM TECHNOLOGIES 2023
First-principles simulations	2024 - 2025	IKUR - HPC & IA 2023
OMN 2024 *International Conference on Optical MEMS and Nanophotonics* Id. RC_2024_2_0043	2024	Organización de congresos y reuniones de carácter científico a celebrar en el segundo semestre de 2024

RESEARCH GRANTS ONGOING 2023 - 2024

Regional Government of Gipuzkoa

Gipuzkoako Foru Aldundia
Diputación Foral de Gipuzkoa

Project	Period	Call
Pablo Aguado *IV-VI semiconductors for multifunctional electronic devices: coupling between topology, polarization, and spin at ferroelectric domain interfaces and walls*	2020 - 2023	Gipuzkoa Fellows 2020
Ibon Santiago *Soft molecular robotics with DNA nanotechnology*	2022 - 2023	Gipuzkoa Fellows 2021
Daniel Hernangómez *Dynamics and decoherence of transition-metal dichalcogenide defect qubits*	2023 - 2025	Gipuzkoa Fellows 2023
faraDNA *Atomically precise fabrication of self-assembled nanodevices using DNA* Id. 2022-CIEN-000015-01	2022 - 2023	Research projects 2022
PLASMODO *Nanoscopic study in the THZ range of ultraconfined plasmons in micro- and nano-structures of Ag_2Te* Id. 2023-CIEN-000016-01	2023 - 2024	Research projects 2023
SHIFTE High-strength smart fibers for tissue engineering Id. 2024-CIE4-000025-01	2024 - 2025	Research projects 2024
PROXMAT *Engineering proximitized superconducting interfaces for quantum nanoscience* Id. 2023-CIEN-000061-01	2023 - 2024	Gipuzkoa NEXT 2023
Kuantu-Aldiak *Quantum computing for materials* Id. 2022-QUAN-000032-01	2022 - 2023	Quantum Gipuzkoa 2022

Project	Period	Call
ASAP-SQ *Software to automate a systematic theoretical design of spin-qubits* Id. 2023-QUAN-000007-01	2023 - 2024	Quantum Gipuzkoa 2023
QUANMOS *Quantum register based on molecular spins and graphene nanostructures* Id. 2023-QUAN-000028-01	2023 - 2024	Quantum Gipuzkoa 2023
OCC-SO *Quantum coherence optimization through spin-orbit coupling simulations* Id. 2024-QUAN-000003-01	2024 - 2025	Quantum Gipuzkoa 2024
SUPERINT *Unconventional superconductivity and ultrathin Josephson junctions in intercalation composites* Id. 2024-QUAN-000005-01	2024 - 2025	Quantum Gipuzkoa 2024
Helipurifactor *Helium purification system for cryogenic measurements* Id. 2022-CIEN-000011-01	2022 - 2023	Adquisition of scientific and technological equipment 2022
MICRONANOLITO Acquisition of a 3D-4D micronanolithography system for nanoestructures and microstructures fabrication Id. 2023-CIEN-000015-01	2023 - 2024	Adquisition of scientific and technological equipment 2023
TRACKBOT *Acquisition of a dual ultrasound and photoacoustic imaging system for the manipulation of micro-nanorobots* in vivo Id. 2024-CIE3-000014-01	2024 - 2025	Adquisition of scientific and technological equipment 2024
OMN 2024 *International Conference on Optical MEMS and Nanophotonics* Id. 2024-RI06-000006-01	2024	Fomento de la actividad turística MICE de Gipuzkoa 2024

RESEARCH GRANTS ONGOING 2023 - 2024

La Caixa Foundation

Project	Period	Call
Manuel Suárez *Chiral spintronics and optoelectronics* Id. LCF/BQ/DR21/11880030	2021 - 2024	Doctoral INPhINIT fellowships program 2021
Aranzazu Sierra *Self-healing, multifunctional hybrid coatings for enhanced durability of ancient and modern construction materials* Id. fellowidJL.tbd.2023.017	2023 - 2026	Postdoctoral Junior Leader – Incoming fellowships 2023

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