
DIPC 2023
Donostia International Physics Center

ON THE COVER UNCONVENTIONAL SUPERCONDUCTORS

Transition metal dichalcogenides (TMD) are strongly correlated materials hosting a wealth of collective electronic phases. The combination of strong spin-orbit interactions and electron interactions presents them as promising candidates to host unprecedented forms of superconductivity. In this arena, local probe techniques such as scanning tunneling microscopy and spectroscopy (STM/STS) play a fundamental role. The cover features a STM image of the charge density wave of $4H_b$-TaSSe, a TMD superconductor exhibiting unconventional Cooper pair symmetries.

Image: Sandra Sajan, Haojie Guo and Miguel M. Ugeda | 2DSPM group

2023

DIPC ACTIVITY REPORT

Building New Science

Donostia International Physics Center (DIPC) is a singular research center devoted to physics and related disciplines. DIPC also assumes the responsibility to convey scientific culture to society. Since its inception in 2000, it has become an internationally recognized research center for both its scientific activity and for its major communication events.

Historically focused on condensed matter physics and materials science, DIPC's research lines have evolved and diversified. Nowadays, our research lines can be grouped in the QUANTUM, NANO, LIFE, and COSMOS big areas. These areas feature outstanding teams of researchers that investigate and develop ambitious projects at the forefront of scientific knowledge. One example of this is the development of quantum technologies, which has been boosted by the recent agreement signed between Basque public institutions, led by the Basque Government, and IBM. This agreement will lead to the installation of an IBM Quantum Computation Center in Donostia/San Sebastián in 2025, as part of the Basque Quantum initiative. The principal scope of Basque Quantum is to promote research, training, technology transfer, and industrial development. Basic research will be crucial in this particular field where the gap between fundamental knowledge and real applications in industry is shortened. The long tradition and expertise of DIPC in quantum physics, nanoscience, and advanced materials, together with the excellence of our scientific community, will be essential to contribute to the ambitious goals incorporated into this initiative.

Due to the great increase in personnel and scientific activity in recent years, as well as to the promising growing prospects for the future, funding for the construction of a **new DIPC building** of approximately 6,200m² has been approved in 2023. The new building will be located within the current premises of DIPC. The development of this project and the construction of the building is made possible thanks to the support of the Basque Government's Department of Education. The new DIPC building will be added to the existing facilities and the center's research space will be close to doubled. This newly gained space will help the expansion of the QUANTUM, NANO, LIFE, and COSMOS thematic areas. It will also be a tool to uplift quantitatively and qualitatively DIPC's current research activity. The building will include mostly space for scientific research, in particular, offices for researchers and experimental laboratories related to the aforementioned big science areas. In addition, it will include space for public use, such as an auditorium, a large lobby area for communal activities, meeting rooms and interaction spaces.

2023 was also the year of the construction of **DIPC's new Supercomputer HYPERION**. This expansion and improvement of the existing infrastructures at the DIPC Supercomputing Center will offer greater computational resources to the entire research community of the Basque Country. Thanks to an investment made by the Basque Government's Department of Education, DIPC has acquired state-of-the-art technology; HYPERION houses more than 14,000 cores and 150 TB of RAM, and triples the power of its predecessor Atlas. The HYPERION network exceeds 500 users and includes the nine Basque Research Centers of Excellence (BERC), the four universities of the Basque Country, as well as Cooperative Research Centers such as CIC nanoGUNE and CIC biomaGUNE, health research centers such as Biogipuzkoa, and technology centers such as Tecnalia.

Ricardo Díez Muiño, Director and **Pedro Miguel Echenique**, President

Due to the significant growth in personnel and scientific activity over recent years, as well as the promising future outlook, funding has been approved for the construction of a new DIPC building.

Another major milestone in 2023 was the **Passion for Knowledge (P4K)** science festival. In its fifth edition, P4K brought together an impressive total of 22,691 people in a single week in October. Spread across various locations including Donostia/San Sebastián, its main venue, as well as Bilbao and Beasain (CAF, Construcciones y Auxiliar de Ferrocarriles), the festival featured more than 80 activities tailored for diverse audiences. Thanks to the presence of leading international scientific figures, including **seven Nobel Laureates,** attendees had the unique opportunity to learn firsthand about groundbreaking advances and discoveries that have revolutionized our understanding of the world. The diverse program of activities reached students, teachers, families, the scientific community, and culture enthusiasts alike. A notable highlight of this edition was the 'STRØM-Inclusive Astronomy' exhibition, a new venture produced for the Passion for Knowledge festival by DIPC in collaboration with Tabakalera. The exhibition exceeded all expectations, attracting more than 12,000 visitors in a single month.

Any institution is made of people. The success of DIPC in 2023 has been based on the dedication, hard work, and enthusiasm of our entire scientific, technical, and administrative community. The center's achievements and progress are indeed only possible because of their commitment. ■

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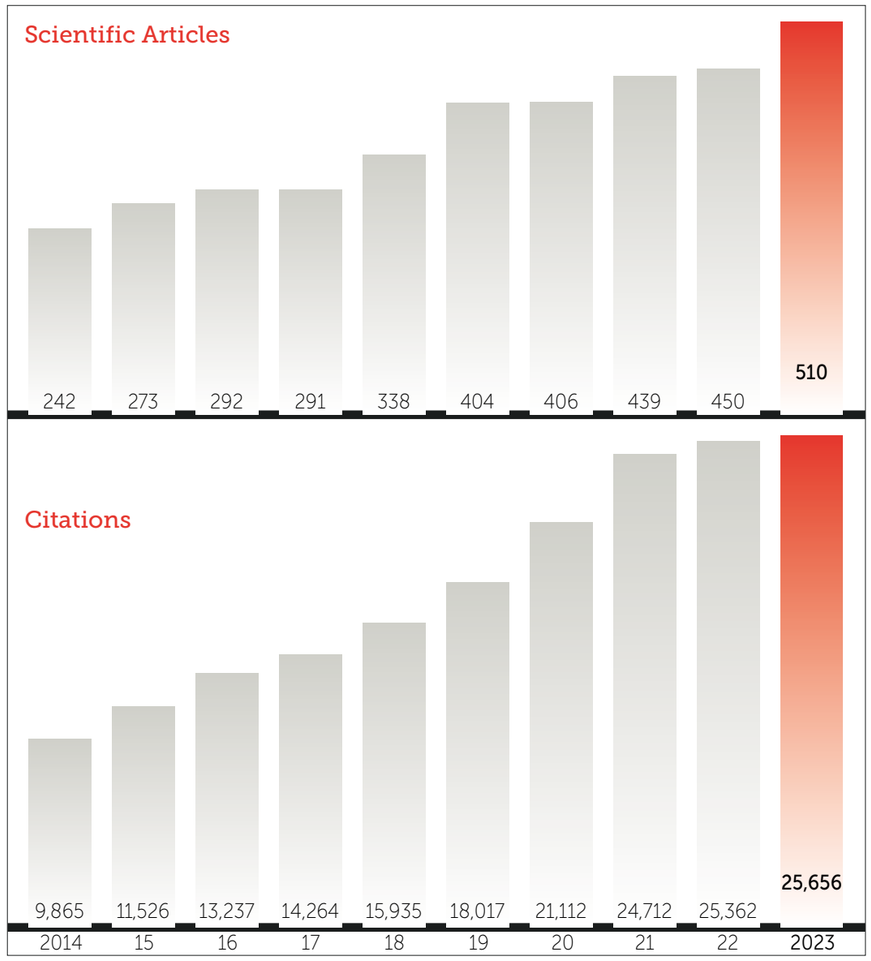
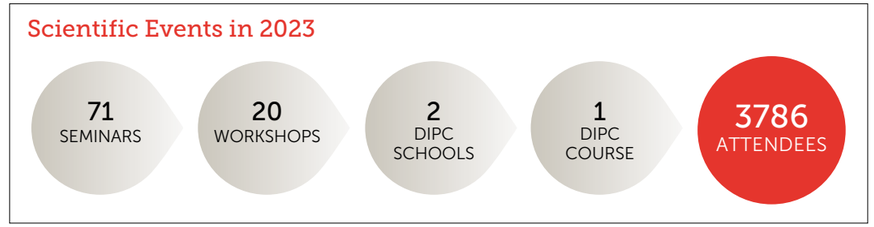
Research Activity at a Glance

The scientific production and international impact of DIPC is growing. Since 2000, the center has published a total of **5,800 ISI publications** and has received more than **230,000 citations**. In 2023, **510 scientific articles** were published.



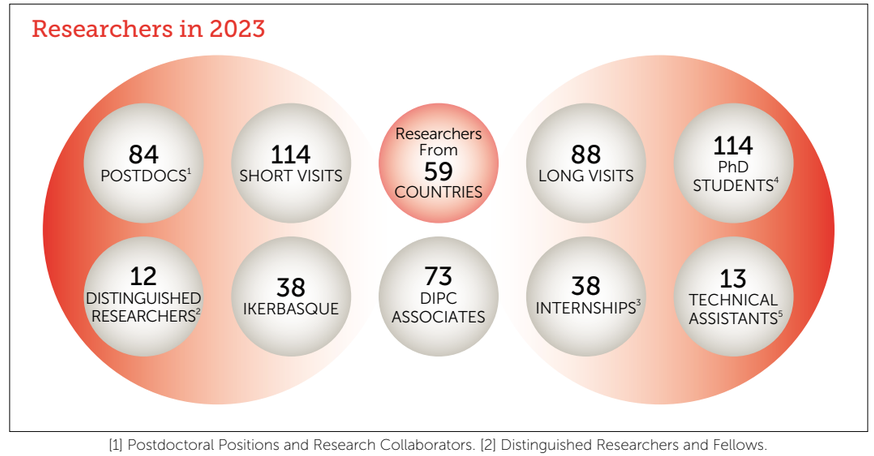
Source Web of Science Core Collection (all years and all indexes, 20/03/2024)



In addition to doing research, DIPC's annual strategic agenda of actions foster exchange with scientists from around the world. Our Scientific Events include several formats. Seminars, given by international experts, cover research topics of particular interest to our community. Our Workshops highlight specific subjects of interest. And both the DIPC Schools and the Courses, especially aimed at young researchers, focus on learning particular skills. In 2023 most of the programmed activities were held in person, but in order to reach a larger audience many of them were also streamed live.

Driving Force of DIPC's Research Activity: Our Highly Dynamic Community

The core of the DIPC Community is made up of senior scientists and technicians, as well as PhD students and postdoctoral researchers. These young scientists complete their training and hone their expertise at the Center. In addition, DIPC counts on DIPC Associates, who are hired by other institutions but develop part of their research activity at DIPC. Last but not least, our scientists act as hosts for a large number of international visiting researchers that greatly contribute to DIPC's scientific activity. All in all, the vibrant energy of our research community creates a stimulating environment that fosters creativity.



[1] Postdoctoral Positions and Research Collaborators. [2] Distinguished Researchers and Fellows.
[3] Internships and Undergraduate Students. [4] PhD Students and Research Assistants. [5] Technical Assistants and Engineers.

DIPC Supercomputing Center

The Supercomputing Center at DIPC is its great strategic infrastructure and serves as a fundamental tool for the excellent research carried out by our researchers and those of other research centers in the Basque Country

Computational physics and chemistry are among the strongest research fields in the Basque Country and the Supercomputing Center is one of its key resources. In recent years the Supercomputing Center has also started offering its services to other type of research lines related to Cosmology, Genetics, Artificial Intelligence, Mathematics... With its current level of physical, human and technical resources, this high performance computing (HPC) center has become a focus of technological knowledge, training, and innovation. Its status and influence transcend its primary mission, not only as a tool but also as a discipline in itself. There is no more powerful computing center of its type in the Basque Country.

DIPC Supercomputing Center's team.

Current computing resources

The Center has two rooms to host the HPC systems. These rooms have an isolated electrical connection, communications infrastructure, humidity, electricity consumption and temperature control sensors, various uninterrupted power supply systems, refrigeration systems, automatic fire-extinguishing systems and intrusion detection.

As of 2023, the Center has several supercomputers covering a wide range of computational needs. Its main facility is the Atlas supercomputer, a cluster with Xeon nodes (from 24 cores and 128 GB of RAM small nodes to large shared memory nodes with 52 cores and 1.5 TB of RAM in a single operating system image). The Atlas resources include NVIDIA Tesla P40 and GeForce RTX 3090 technology for GPGPU programming. With more than 13,000 cores and 80 TB of RAM, is one of the more powerful supercomputers in Spain.

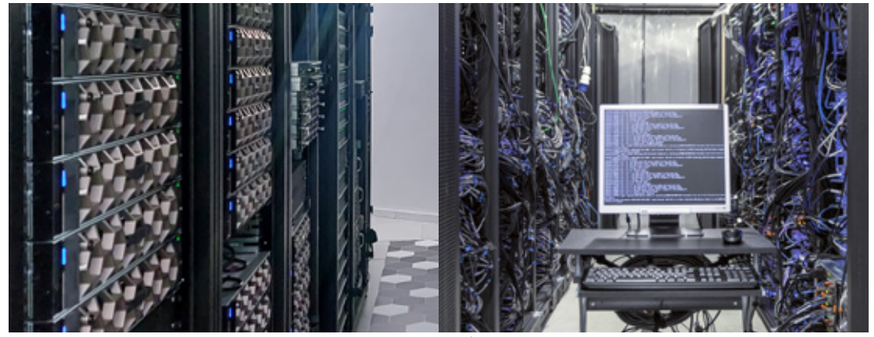
This year, the Center finished the building of a new supercomputer named Hyperion, whose computational power will be updated every year and at the end will reach three times the power of Atlas. In 2023, Hyperion started its operation with almost 13.500 cores, 140 TB of RAM memory and 48 NVIDIA Tesla A100, that are especially indicated for the training of big AI models.

TOTAL CAPACITY

cores	RAM	scratch disks	home directories
26.500	220 TB	1 PB	850 TB

NON-STOP SERVICE 24 HOURS 365 DAYS

More than 500 researchers from DIPC and other research centers of the Basque Country such as the UPV/EHU, Ikerbasque, BERC DIPC, BERC Achucarro, BERC BC3, BERC BCBL, BERC BCAM, BERC CFM/MPC, BERC Biofisika, BERC BCMaterials, BioGipuzkoa, CIC BiomaGUNE, CIC nanoGUNE, Tecnalia, ESS Bilbao, Tecnun, Biocruces, Neiker, Orai, CIC BioGUNE, Deusto University, CIC EnergiGUNE, HiTZ Center or Polymat used this computational infrastructure in 2023.



The installations of the Hyperion and Atlas supercomputers at DIPC.

Science Communication

In 2023, Donostia International Physics Center celebrated another edition of the Passion for Knowledge science festival, once again bringing together prominent scientists and thousands of enthusiastic citizens. This year the sensation was the opening exhibition 'STRØM - Inclusive Astronomy'. The event was created especially for the festival in collaboration with the Tabakalera International Centre for Contemporary Culture.

Overall, the DIPC Science Communication Program reached a new record in 2023 with **230 activities**, both in person and online. **62,000 people** participated directly and **100,000 views** were generated through various media.

From left to right: Jokin Bildarratz (Minister of Education, Basque Government), Eider Mendoza (General Deputy, Gipuzkoa Provincial Council), Iñigo Urkullu (President of the Basque Government), Pedro Miguel Echenique (President of DIPC), Eneko Goia (Mayor of Donostia/San Sebastián), and Ricardo Diez Muiño (Director of DIPC).

P4K 2023 PASSION FOR KNOWLEDGE

Donostia International Physics Center (DIPC) celebrated its passion for knowledge with prominent figures in science and thousands of citizens joining together for diverse events in Donostia/San Sebastián, as well as Bilbao and Beasain. This fifth edition of the **Passion for Knowledge (P4K)** science festival attracted a total of **22,691 people** from October 2nd to 7th. The festival offered activities for audiences of all kinds. The number of participants shows a growing interest in exploring the science around us.

The festival's diverse program of activities engaged not only our scientific community but students, teachers, families, and culture enthusiasts in general. The plenary lectures, encounters with scientists and hundreds of students, and other special events such as **Naukas** and **Bertso Passion**, **Streamers**, the **Passion Txiki** mini-festival, and **Origins of Life** scientific congress were all part of the extensive program. A **training day for PhD students** and the **Ikerbasque 2023 Awards** were also among the events. A new venture of this edition was the **'STRØM - Inclusive Astronomy'** exhibition, produced especially for the Passion for Knowledge festival by DIPC in collaboration with Tabakalera International Centre for Contemporary Culture.


JOCELYN BELL BURNELL


JUAN IGNACIO CIRAC


ADELA CORTINA


SANDRA MYRNA DÍAZ


FRANCESCA FERLAINO


DARIO GIL


JOAQUIN GORROCHATEGUI


JEAN MARIE LEHN

The plenary lectures, taking place in the afternoons at the Victoria Eugenia Theater and Euskalduna Palace remain the hallmark of the festival. Thanks to the presence of leading scientists from around the world, including **seven Nobel Laureates**, the public was able to learn first-hand about the advances and discoveries that have revolutionized our understanding of the world.


DIDIER QUELOZ


JEAN-PIERRE SAUVAGE


GEORGE SMOOT


DONNA STRICKLAND


JACK SZOSTAK


ÖZLEM TÜRECI


CRISTINA URIARTE


MARÍA VALLET-REGÍ

Plenary Lectures

October 02-07, 2023
Victoria Eugenia Theater, Donostia/San Sebastián

P4K 2023

Jocelyn Bell Burnell Breakthrough Prize 2018 | Astrophysics, University of Oxford, UK
Interview by Pedro Miguel Echenique with Jocelyn Bell, discoverer of the pulsar*/**

Juan Ignacio Cirac The Prince of Asturias Award 2006 | Quantum Physics, Max-Planck-Institut, Germany
Quantum technologies: from Schrödinger's cat to a new era in computing**

Adela Cortina National Essay Prize 2014 | Ethics and Philosophy, Universidad de Valencia, Spain
Ethics and technology**

Sandra Myrna Díaz Princess of Asturias Award 2019 | Nobel Peace Prize 2007 | Biodiversity and Climate Change, Universidad Nacional de Córdoba, Spain
About plants and people: vegetable biodiversity and its connections with human beings**

Francesca Ferlaino Feltrinelli Award 2017 | Quantum Technologies, Universität Innsbruck, Austria
Atoms approaching absolute zero temperature: the hardware of future quantum technologies*

Dario Gil Vice President of IBM and Director of IBM Research | Quantum Computing, IBM Research, Cambridge, MA, USA
What's Next in quantum computing**

Joaquin Gorrochategui Professor of Indo-European Linguistics | Indo-European Linguistics, UPV/EHU, Basque Country, Spain
On comparative linguistics and the origin of Basque language***

Jean Marie Lehn Nobel Prize in Chemistry 1987 | Supramolecular Chemistry, Université de Strasbourg, France
Steps towards complex matter: chemistry!*

Didier Queloz Nobel Prize in Physics 2019 | Astrophysicist, University of Cambridge, UK
The exoplanet revolution*

Jean-Pierre Sauvage Nobel Prize in Chemistry 2016 | Molecular Machines and Motors, Université de Strasbourg, France
Molecular machines and motors: from biology to chemistry*

George Smoot Nobel Prize in Physics 2006 | Cosmology, DIPC, Lawrence Berkeley National Laboratory, CA, USA
Current cosmology*

Donna Strickland Nobel Prize in Physics 2018 | Photonics, University of Waterloo, Canada
Generating high-intensity, ultra-short optical pulses*

Jack Szostak Nobel Prize in Physiology or Medicine 2009 | Ageing and Artificial Life, University of Chicago, IL, USA
From DNA breaks and telomeres to the origins of life: endless fascinating puzzles in science*

Özlem Türeci Princess of Asturias Award 2021 | Biotechnology, BioNTech, Germany
Molecular communication with the immune system*

Cristina Uriarte Commissioner for Science, Technology and Innovation | Scientific Policy, Basque Government, Spain
Facing Basque Country's future: the transformative path of research and innovation**

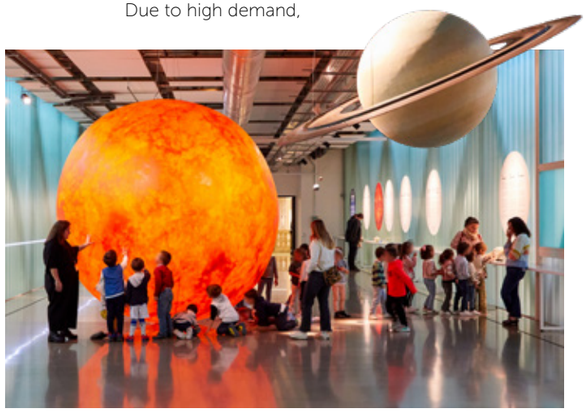
María Vallet-Regí Rey Jaime I Prize 2018 | Biomaterials, Universidad Complutense de Madrid, CIBER-BBN, Spain
Biomaterials: what they are and why we need them**

*Lectures were given in their original languages (*English, **Spanish, and ***Basque). Simultaneous translation was available.*

STRØM – Inclusive Astronomy

04-31/10/2023
Tabakalera International Centre of Contemporary Culture, Donostia/San Sebastián

This year, Passion for Knowledge opened its doors to inclusion with an innovative astronomy exhibition that presented accessible tactile, audio and audiovisual experiences, kindling the curiosity of thousands of people. The **STRØM – Inclusive Astronomy** exhibition was conceived and produced by **DIPC** in collaboration with **Tabakalera**, (International Centre of Contemporary Culture) and Morgancrea. Between the 4th and 31st of October, Tabakalera recorded **12,548 visitors**. Due to high demand, the guided tours organized in collaboration with Tabakalera's **Medialab** were extended throughout the month of November, allowing more schools and groups of people with disabilities to visit the exhibition. There were 50 organized visits in total, attended by 909 people.



The STRØM program of complementary activities included a series of talks and a roundtable discussion organized by DIPC and **Kutxa Fundazioa**; the aim was to promote the participation of people who normally have limited access to the dissemination of science. Medialab also organized six workshops mainly targeted towards children's interests.

In addition, every Tuesday and Thursday in October, researchers from **DIPC's Cosmology and Astrophysics Group** answered visitor's questions explaining their field of research.

'STRØM - Inclusive Astronomy' was conceived as an itinerant exhibition that aims to travel throughout Spain, and eventually abroad, to bring science and knowledge closer to all audiences, in line with the objectives of Passion for Knowledge.

ON ZIENTZIA

02-07/10/2023
Leidor Theater, Tolosa
Victoria Eugenia Theater, Donostia/San Sebastián

Screenings of the best videos of the On Zientzia contest were programmed in different venues, such as the Vitoria Eugenia Theatre and the Leidor Cinema in Tolosa. On Zientzia is a documentary-type audiovisual project organized by Elhuyar Fundazioa and DIPC. The audience also enjoyed the screening of some of the award-winning videos from previous editions of the competition.

Presenter: **Javier Peláez**

NAUKAS PASSION

05-06/10/2023
Victoria Eugenia Theater
Donostia/San Sebastián

As during previous years, the Passion for Knowledge public program included the well-known **Naukas Passion** sessions, organized in collaboration with the popular online science communication platform Naukas, and the support of the **Chair of Scientific Culture of the Universidad del País Vasco / Euskal Herriko Unibertsitatea (UPV/EHU)**.

Naukas' characteristic dynamic format of short talks once again filled the Victoria Eugenia Theater, offering the audience its particular vision of science in a fun and original way.

05/10/2023
Lectures:
Enrique Borja, Physics/Philosophy
The pleasure of not understanding

Clara Grima, Mathematics, Universidad de Sevilla
I believe you and I don't see you

Iñigo Olalde, Archaeogenetics, UPV/EHU
How a Neolithic family was organized 6000 years ago?

Almudena M. Castro, Physics and Aesthetics
The threads of the rainbow

Joaquín Sevilla, Science of Everyday Life, Universidad Pública de Navarra (UPNA)
Guidelines for sleeping well on any planet

Isabel Moreno, Climate Change
To the future with no return?

06/10/2023
Lectures:
Susana Escudero, Forensic anthropology and genetics, Canal Sur and **Guillermo Peris**, Forensic anthropology and genetics, Universitat Jaume I de Castellón
JB55: 19th century vampires

All lectures were given in Spanish.

Marga Sánchez Romero, Archaeology, Universidad de Granada
Women - what people thought about us: archaeology and discourses of inequity

Ignacio López-Goñi, Yeasts and Bacteria, Universidad de Navarra
The first miracle of Jesus

Iñaki Úcar, Scientific Method/Biases, Universidad Carlos III de Madrid
The day Maxwell missed the gorilla

Gemma del Caño, Food
When alcohol was able to save a life

ENCOUNTERS

One of the star activities of Passion for Knowledge is the popular **Encounters top@DIPC - Zientziarekin solasean!**, an event in which Nobel laureates and other leading scientists meet up with hundreds of secondary students of the Basque Country. The objective of the Encounters is to awaken young people's curiosity in relation to science and to inspire them to pursue a career in this field.

In a relaxed, friendly atmosphere, the students had the chance to talk to renowned figures in science and to address their doubts and questions directly to them. The most interesting question received a prize thanks to the special collaboration of **Telefónica** and **EDP Foundation**, members of DIPC Board of Partners.

CIC nanoGUNE and CFM (CSIC-UPV/EHU) collaborated in the organization of this year's Encounters with students, along with the Universidad del País Vasco/ Euskal Herriko Unibertsitatea (UPV/EHU).

03/10/2023
Encounters in Bilbao
Bizkaia Aretoa UPV/EHU

Guest scientists:
Donna Strickland Photonics
Nobel Prize in Physics 2018

George Smoot Cosmology
Nobel Prize in Physics 2006

Hosts:
Javier Benito
Director Telefónica Euskadi
Eva Ferreira
Rector of the UPV/EHU

Moderator:
Pedro Miguel Echenique
Emeritus Professor of the UPV/EHU and President of DIPC

The Encounters took place in Donostia/San Sebastián and Bilbao and brought together **467 students** and teachers from **91 schools**.

Presenter:
Idoia Mugica
Outreach Manager of the CFM (CSIC-UPV/EHU)

06/10/2023
Encounters in Donostia/San Sebastián
Victoria Eugenia Theater

Guest scientists:
Jean-Marie Lehn Supramolecular Chemistry
Nobel Prize in Chemistry 1987

Jack Szostak Ageing and Artificial Life
Nobel Prize in Physiology or Medicine 2009

Maria Vallet-Regí Biomaterials
Rey Jaime I Prize 2018

Host:
Izaskun Simon
Head of the EDP Foundation

Moderator:
Pedro Miguel Echenique
Emeritus Professor of the UPV/EHU and President of DIPC

Presenter:
Itziar Otegui
Outreach Manager of CIC nanoGUNE

PASSION TXIKI

07-08/10/2023
Club Room, Victoria Eugenia Theater
Kutxa Kluba, Tabakalera

Over the weekend, **Passion Txiki** filled the festival with energy and emotion. This section of the festival, designed especially for children and their families, immersed all visitors in a world of discovery and fun, with activities programmed in different locations of Donostia/San Sebastián. Passion Txiki had special collaboration from the **Center for Materials Physics** (CFM, CSIC UPV/EHU) and **Kutxa Fundazioa**.

The program included workshops filled with amazing science experiments and games that inspired the imagination and scientific thinking of the participants. Overall, Passion Txiki welcomed 272 children along with their families.

*Workshops were given in *Basque and **Spanish.*

07/10/2023
Club Room, Victoria Eugenia Theater
I Research*
Science Circuit
Mad Science presented a series of fun educational, hands-on activities aimed at children to bring them closer to the world of science.

07/10/2023
Club Room, Victoria Eugenia Theater
The life of a star*
Science Show
A group of scientists, working in a laboratory, receive a telegram telling them to expect a visit from a star.

07, 08, 28/10/2023
Kutxa Kluba, Tabakalera
JakinLab*/**
Family Workshop
These sessions combined science with philosophy for the enjoyment of families and participants of different generations.

STREAMERS SESSIONS

03, 07/10/2023
Victoria Eugenia Theater
Donostia/San Sebastián

This year, Passion for Knowledge welcomed a new section. National science **Streamers** took the stage of the Victoria Eugenia Theater to share their particular perspective on various scientific topics.

03/10/2023
Eduardo Sáenz de Cabezón, Professor at the Universidad de la Rioja, interviewed **Sara García-Alonso**, CNIO Researcher and member of the ESA Astronaut Reserve
Molecular Biology and Space Exploration
From cancer research to space exploration

07/10/2023
José Luis Crespo, Physicist and founder of the QuantumFracture channel
Mathematics and Physics
One triangle. Plenty of science

Lectures were given in Spanish.

CAF LECTURE

05/10/2023
CAF Headquarters, Beasain

As part of the Passion for Knowledge program, a special session was organized at the headquarters of **CAF** (Construcciones y Auxiliar de Ferrocarriles). **CAF** has been a member of the Board of Partners of DIPC from its inception.

The creator of molecular motors and the 2016 Nobel Prize in Chemistry, Jean-Pierre Sauvage, delivered a lecture on the varied and promising applications of molecular motors and machines in various scientific and technological fields.

Jean-Pierre Sauvage, Molecular Machines and Motors, Université de Strasbourg, France
Molecular machines and motors: from biology to chemistry

The lecture was given in English.

From left to right: Andrés Arizkorreta, Javier Martínez Ojinaga, Jean-Pierre Sauvage, Marta Vega de Seoane, Pedro Miguel Echenique, Igor Ramos, and Iosu Ibarbia at the headquarters of CAF.

BERTSO PASSION

04/10/2023
Victoria Eugenia Theater
Donostia/San Sebastián

The tradition of bertsolarismo has flourished over the centuries, captivating hearts with its passion, ingenuity and ability to create poetry in an instant; picking up the pulse of different social issues and concerns. As a result, it has become one of the Basque Country's most unique and acclaimed cultural activities.

In this new edition of Passion for Knowledge, Bertso Passion brought together some of the best exponents of bertsolarismo at the Victoria Eugenia Theater. For an hour, the audience had the chance to admire the beauty of improvised poetry and enjoy the verbal dexterity of the masters of verse.

Bertsolaris:
Amets Arzallus, Andoni Egaña, Nerea Ibarzabal, Maialen Lujanbio

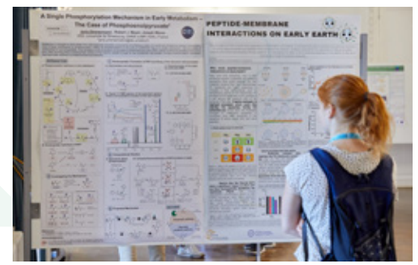
Gai-jartzailea:
Maite Berriozabal

ORIGINS OF LIFE

02-04/10/2023
Miramar Palace
Donostia/San Sebastián

The scientific congress **Origins of Life Donostia Meeting 2023** brought together a hundred or so renowned international researchers specializing in the chemical processes that gave rise to our existence. The congress was organized in the framework of the **Summer Courses of the UPV/EHU**.

This gathering was the final event of the European **Marie Curie ITN** project focusing on the physical and chemical roots of **ProtoMet** metabolism, but it was also open to the entire community dedicated to the origin of life. The congress program ranged from contributions relating to "proto-metabolic systems" to more conceptual or philosophical aspects on open questions that remain of interest to the scientific community.



For more information visit
www.oldm2023.org

RECOGNITION OF WOMEN RESEARCHERS

02/10/2024
Victoria Eugenia Theatre
Donostia/San Sebastián

The Ikerbasque 2023 Award is a recognition given annually by the Department of Education of the Basque Government and Ikerbasque and gives visibility to the work of women researchers in the Basque Country as inspiration for new generations of researchers. This year, the celebration took place as part of the opening ceremony of the science festival, Passion for Knowledge. The women scientists acknowledged at different stages of their scientific careers were:

Sara Barja, Ikerbasque Research Associate at the UPV/EHU and at the Materials Physics Center, received the award from **Donna Strickland**

Alicia Alonso, Professor of Biochemistry and Molecular Biology at the UPV/EHU, received the award from **Özlem Türeci**

Ainhoa Magrach, Ikerbasque Research Professor at the BC3, Basque Centre for Climate Change, received the award from **Sandra Díaz**

TRAINING FOR PhD STUDENTS

05/10/2024
Miramar Palace
Donostia/San Sebastián

The Passion for Knowledge festival program included a **training day for PhD students**. This activity was organized within the framework of the **Summer Courses of the UPV/EHU** in collaboration with **Euskampus**. The day combined a training slot followed by a special encounter with the French chemist and father of supramolecular chemistry **Jean-Marie Lehn**, winner of the 1987 Nobel Prize in Chemistry, and the British astrophysicist and pulsar discoverer **Jocelyn Bell Burnell**, winner of Breakthrough Prize 2018.

PASSION FOR KNOWLEDGE COMMITTEE

Pedro Miguel Echenique President of DIPC
Emeritus Professor of the UPV/EHU
President of P4K 2023

Ricardo Díez-Muiño Director of DIPC
Ikerbasque Research Professor
President of P4K 2023

Overall Coordination:

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Head of Outreach & Communication at DIPC

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Outreach & Communication at DIPC

Executive Committee:

Itxaso Azcune
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Silvia Bonoli
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Igor Campillo
Director of the Euskampus Fundazioa

Aitzol Garcia-Etxarri
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Cristina Juesas
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Outreach Manager at CFM (CSIC–UPV/EHU)

Itziar Otegui
Outreach Manager at CIC nanoGUNE

Juan Ignacio Pérez
Coordinator of the UPV/EHU's Chair of Scientific Culture

Valentina Rodríguez
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Kepa Ruiz-Mirazo
UPV/EHU Professor and Researcher

Eduardo Sáenz de Cabezón
Professor at the Department of Mathematics and Computing, Universidad de La Rioja

Marta Vega de Seoane
Events Organization and Administration at DIPC

Manex Urruzola
Head of the Communication Unit at Elhuyar

For more information visit:
p4k.dipc.org

CINEMA AND SCIENCE

The sixth edition of the 'Cinema and Science' cycle was organized jointly by DIPC, the Basque Film Archive, and the San Sebastián International Film Festival from January to March 2023. The aim was to transmit cinematographic and scientific culture. Ten films were screened in various venues, each preceded by inspiring presentations and followed by discussions led by renowned scientists.

The series included nearly fifty screenings across the three branches of the Basque Film Archive throughout the territory: Tabakalera (Donostia/San Sebastián), the Paraninfo of the UPV/EHU (Bilbao), which is being used as a substitute for the Bilbao Fine Arts Museum during its expansion works, and Artium (Vitoria-Gasteiz). Commercial theaters like Cinéma Le Sélect in San Juan de Luz (France) and Cines Golem in Pamplona also offered cinema and science screenings for local participants.

This year, volcanoes were the main focus. The poster featured a spectacular image from the Oscar-winning documentary **"Fire of Love"** (Sara Dosa, 2022), which tells the story of the French couple Katia and Maurice Krafft, both volcanologists, who were united by their love for each other and for volcanoes. The documentary was presented by the geologist Asier Hilario and the volcanologists Juana Vegas and Janire Prudencio. It captivated audiences in general screenings and in School Sessions.

Two scientific talks related to the films in the cycle were also scheduled. The first talk "Life-Changing Volcanoes", was given by geologist Juana Vegas from IGME-CSIC, Geoheritage at Tabakalera.The second talk, "Interview with the Vampire about Nanoscience" was given by neurobiologist Juan Ramón Alonso from the University of Salamanca and the Institute of Neuroscience of Castilla y León.

Special sessions were organized in collaboration with Emakumeak Zientzian and Biogipuzkoa, following tradition. In total, more than **5,100 people** participated in the **45 screenings** that were programmed throughout the region.

General Sessions

Films projected in
(1) Vitoria-Gasteiz (2) Donostia/San Sebastián
(3) Bilbao (4) Pamplona (5) Saint Jean de Luz

Der Name Der Rose (Jean-Jacques Annaud, 1986)
(1) 12/01/2023 (2) 13/01/2023
(3) 14/01/2023 (4) 17/01/2023
Physicist **Ricardo Díez Muiño**, DIPC, CFM (CSIC-UPV/EHU)
Physicist **Pedro Miguel Echenique**, UPV/EHU, DIPC

Soylent Green (Richard Fleischer, 1973)
(1) 26/01/2023 (2) 27/01/2023
(3) 28/01/2023 (4) 31/01/2023
Environmental Engineer **Marta Olazabal**, BC3, Ikerbasque
Physicist **Mercedes Villa**, Biotech Foods

Inherit the Wind (Stanley Kramer, 1960)
(1) 02/02/2023 (2) 03/02/2023
(3) 04/02/2023 (4) 07/02/2023
Biologist **Montse Hervella**, UPV/EHU
Biologist **Conchi de la Rúa**, UPV/EHU

Madame Curie (Mervyn LeRoy, 1943)
(1) 09/02/2023 (2) 10/02/2023
(3) 11/02/2023 (4) 14/02/2023
Physicist **Nerea Zabala**, UPV/EHU, DIPC
Chemist **Elisa Jiménez-Izal**, UPV/EHU, DIPC
Organized in collaboration with **Emakumeak Zientzian**

Dr. Strangelove: How I Learned to Stop Worrying and Love the Bomb (Stanley Kubrick, 1964)
(1) 16/02/2023 (2) 17/02/2023 (3) 18/02/2023
(4) 21/02/2023 (5) 27/02/2023
Physicist **María Blanco**, UPV/EHU, DIPC
Chemist **Fernando Cossío**, UPV/EHU, Ikerbasque
Physicist **Daniel Zerzion**, DIPC, CERN

Fire of Love (Sara Dosa, 2022)
(1) 23/02/2023 (2) 24/02/2023
(3) 25/02/2023 (4) 28/02/2023
Geologist **Juana Vegas**, Instituto Geológico y Minero de España (CSIC), IUGS Internal Commission on Geoheritage
Geologist **Janire Prudencio**, Universidad de Granada, Instituto Andaluz de Geofísica
Geologist **Asier Hilario**, Euskal Kostaldeko UNESCO Geoparkea, IUGS Internal Commission on Geoheritage

Philadelphia (Jonathan Demme, 1993)
(1) 02/03/2023 (2) 03/03/2023
(3) 04/03/2023 (4) 07/03/2023
Physician **Julio Arrizabalaga** Aguirreazaldegui, IIS Biodonostia, Hospital Universitario de Donostia
Organized in collaboration with Biodonostia

Bram Stoker's Dracula (Francis Ford Coppola, 1992)
(1) 09/03/2023 (2) 10/03/2023
(3) 11/03/2023 (4) 14/03/2023
Neurobiologist **José Ramón Alonso**, Universidad de Salamanca, Instituto de Neurociencias de Castilla y León
Physicist **Igor Campillo**, Euskampus Fundazioa

A beautiful mind (Ron Howard, 2001)
(1) 16/03/2023 (2) 17/03/2023 (3) 18/03/2023
(4) 21/03/2023 (5) 13/03/2023
Mathematician **José Antonio Lozano**, BCAM, UPV/EHU
Mathematician **Paula Gordaliza**, BCAM, UPNA
Mathematical Physicist **Jean-Bernard Bru**, UPV/EHU, BCAM

Jaws (Steven Spielberg, 1975)
(1) 23/03/2023 (2) 24/03/2023 (3) 25/03/2023
(4) 28/03/2023 (5) 06/03/2023
Biologist **Juan Ignacio Pérez Iglesias**, UPV/EHU, DIPC
Physicist **Amaia Arregi Buldain**, DIPC
Historian **Joxean Fernández**, Basque Film Archive

School Sessions

Special morning sessions were organized for students in San Sebastián, Bilbao and Vitoria-Gasteiz. The selected film was **"Fire of Love"** (Sara Dosa, 2022), a documentary film about the lives and careers of volcanologists Katia and Maurice Krafft. Scientists and science disseminators presented the screening.

Tabakalera	Bizkaia Aretoa UPV/EHU
Donostia/San Sebastián	Bilbao
28/02/2023 (in Basque)	07/03/2022 (in Basque)

Presentations
Geologist **Janire Prudencio** Universidad de Granada, Instituto Andaluz de Geofísica

Geologist **Asier Hilario**, Euskal Kostaldeko UNESCO Geoparkea, IUGS Internal Commission on Geoheritage

Representatives from different institutions at the presentation of the sixth edition of Cinema and Science.

WOMEN IN SCIENCE

08-17/02/2023

In 2023, **24 Basque entities** gathered around the Emakumeak Zientzian alliance to jointly organize the International Day of Women and Girls in Science, which is celebrated on February 11th. There were participants from all over the Basque Country; in Gipuzkoa and especially in San Sebastián where the project originated, as well as in Bizkaia where the initiative grew significantly this year. More than **8,500 people** participated directly in the program.

This project has been expanding annually and DIPC has been one of the major contributors involved from the very beginning.The initiative aims to increase visibility of women in science, challenge gender stereotypes associated with scientific and technical fields, and encourage girls and adolescents to pursue careers in science. The project was awarded the **STEAM Euskadi Prize 2022** and received **special recognition from Fomento San Sebastián**.

Emakumeak Zientzian 2023 had the outstanding support of the **Provincial Council of Gipuzkoa**, **Fomento San Sebastián** and the **Basque Research & Technology Alliance** (BRTA), as well as the collaboration of several entities and organizations.

A highly cooperative alliance put together **54 activities** aimed at all audiences, including workshops, public talks, family experiments, and virtual visits. Notably, an **opening ceremony** was organized to gather and thank more than **256 volunteers** from 24 institutions.

The following activities were organized by DIPC:

08/02/2023 | Intxaurrondo Cultural Center
Opening Ceremony with all the volunteers

10/02/2023 | CFM and DIPC
Virtual tour of DIPC and CFM centers with our female scientists

16/02/2023 | Vitoria Eugenia Club Aretoa, Donostia/San Sebastián
Women scientists of yesterday and today Public lectures
General public

Invited scientists and honored scientists:
Elixabete Rezabal, UPV/EHU, **Dorothy Crowfoot Hodgkin**
Olatz Perez de Viñaspre, UPV/EHU, **Karen Spärck Jones**
Amaia Iturrospe, CFM, **Marie-Anne Pierrette Paulze**
Raquel Ruiz Hernández, CIC biomaGUNE, **Rachel Carson**
Camila Vesga, Tecnun, **Ynes Mexia**

17/02/2023 | Bidebarrieta Library, Bilbao
Women scientists of yesterday and today Public lectures
General public

Invited scientists and honored scientists:
Marité Cárdenas, UPV/EHU, CSIC, **Kazue Kurihara**
Leire Bereziartua, University of Deusto, **Zaha Hadid**
Amanda Sierra, Achucarro, **Agnès Gruart i Masso**
Lore Zumeta, BCAM, **Florence Nightingale**
Aitziber Egusquiza, Tecnalia, **Jane Jacobs**
Neus Escobar, BC3, **Elfriede Tungl**

09/02/2023 | Artium Vitoria-Gasteiz
10/02/2023 | Donostia/San Sebastián
11/02/2023 | Bilbao
14/02/2023 | Baiona-Golem Pamplona
Cinema and Science
"Madame Curie" screening
Physicist **Nerea Zabala** UPV/EHU, DIPC
and **Elisa Jimenez-Izal** UPV/EHU, DIPC
General public

For more information visit
https://emakumeakzientzian.eus

ZIENTZIAKUTXA Lecture Series / Red hot

The Zientziakutxa lecture series this year was named "**Red hot**" due to the notable presence of the color red in its most intense and evocative forms. The lectures covered topics such as volcanology and geoparks with Juana Vegas, vampires and neuroscience with José Ramón Alonso, and climate change with Elisa Sainz de Murieta. The color red was used to evoke the hypnotic color of lava and the association with global warming.

24/02/2023 | Ruiz Balerdi Hall, Kutxa Kultur
Life-changing volcanoes*
Juana Vegas Instituto Geológico y Minero de España (IGME-CSIC), Internal Commission on Geoheritage, IUGS

10/03/2023 | Ruiz Balerdi Hall, Kutxa Kultur
Interview with the vampire on neuroscience*
José Ramón Alonso Universidad de Salamanca, Instituto de Neurociencias de Castilla y León

12/05/2023 | Ruiz Balerdi Hall, Kutxa Kultur
Climate change:
an emergency that concerns us all?**
Elisa Sainz de Murieta UPV/EHU

*Lectures were given in *Spanish and **Basque.*

WOMEN AND SCIENCE

The goal of the 'Women and Science' program, launched by the Gipuzkoa Provincial Council and DIPC in 2021, is to promote the presence of women in advanced science. Their aim is to combine the scientific excellence of DIPC with the Council's objective of promoting gender equality in all areas, especially those where inequality is most evident.

In the framework of this initiative, DIPC frequently organizes inspiring career sessions for young female researchers at DIPC.

28/03/2023
DIPC Auditorium
Inspiring Careers: a dialogue with Amena Karimyan *on astronomy and science development in Afghanistan*

Amena Karimyan is a civil engineer and first woman in the field of the development and education of astronomy in Afghanistan. In 2018, she founded the KAYHANA Astronomical Group, which encourages young women to learn about astronomy.

The lecture was given in English.

Portrait of Amena Karimyan (Photo by Ines Rudel)

EL PALO DE ERATÓSTENES – ZIENTZIA ELKARRIZKETAK

Sessions were hold the second Tuesday of every month at 18:30 in Eureka! Science Museum
13/06, 11/07, 12/09, 10/10, 14/11, 12/12/2023

On June 13th, Aranzadi Science Society began the lecture series *El Palo de Eratóstenes – Zientzia Elkarrizketak* in collaboration with Eureka! Science Museum and DIPC.

The series was named after the scientist Eratosthenes who measured the circumference of the Earth 2000 years ago using the shadow cast by a stick. In keeping with this spirit, each month, Aranzadi organizes meetings at the Eureka! Science Museum open to the public to discuss astronomy, astrophysics, cosmology and other related scientific fields. The sessions have an engaging format that includes a review of that month's visible sky, the introduction of objects and astronomical news, and dynamic interviews with scientists in the field.

To date, several of our researchers, including **Markos Polkas, Francisco Maion, Francesc Monrabal, Lurdes Ondaro and Yetli Rosas** have participated as experts in these meetings.

The program also includes some guided visits to sites dedicated to scientific research such as the Javalambre Astronomical Observatory (Teruel) or the Canfranc Underground Laboratory (Canfranc), where DIPC carries out several research projects in the field of astronomy and particle physics.

PRIDE IN SCIENCE

November 18th is the international day of Pride in STEM (Science, Technology, Engineering, and Mathematics). Since 2019, DIPC, CIC nanoGUNE and the Materials Physics Center (CFM) celebrate this day by promoting the initiative "**Harrotasuna Zientzian/Orgullo en Ciencia**", aimed at giving visibility to the LGBTQIA+community in science and actively contributing to eliminate old stereotypes, giving space to a plural reality which is crucial for ensuring that it plays a leading role in the future of science.

MESTIZAJES

Mestizajes is a project aimed at all audiences designed with an innovative and original perspective to foster dialogue between science, literature, and the humanities. The project is promoted and organized by DIPC within the framework of Euskampus and coordinated by Gustavo Ariel Schwartz.

Within the Mestizajes program, different activities such as conferences, seminars, presentations or collaborative projects have been carried out during the last 13 years. These activities have been done in collaboration with the San Telmo Museum, Donostia Kultura, Tabakalera and the Vice Rectorate of the Guipúzcoa Campus of the University of the Basque Country.

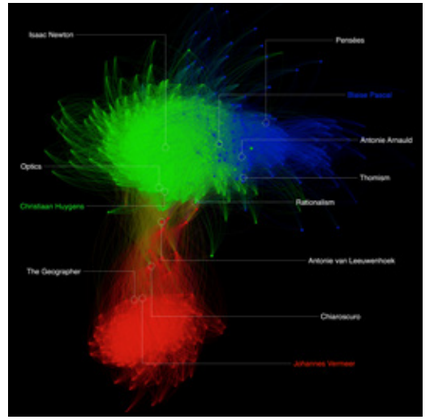
During 2023, the following activity was carried out:

COMPLEX NETWORK METHODS APPLIED TO CULTURAL ANALYTICS

Since 2021, we have forged a solid and fruitful collaboration with the digital humanities laboratory, The CulturePlex Lab, in London, Canada. As part of this collaboration, in 2023, we have hired a PhD student and a postdoc to conduct an intense research program. The work aims to explore numerical routes based on data mining, complex networks analysis and machine learning to understand the emergence of genius and revolutionary ideas.

Is genius a result of nature or nurture? How much chance and context are involved in the emergence of revolutionary ideas? Can we predict the appearance of the next Mozart?

This research project aims to analyze and understand the complex cultural networks around iconic people and revolutionary ideas to characterize the structure and dynamics of the networks that allow their emergence. For example, the image shows the cultural network of the relationships among art, science and philosophy in the 17th century. This approach allows us to conciliate the 'big picture' with the 'close reading' of traditional historical research, and it shows the potentiality of the numerical methods to boost humanistic studies.



For more information visit
www.mestizajes.es

MÁQUINAS DE INGENIO. JAKINTZEN BIDEGURUTZEAN

24/11/2023 – 04/02/2024
Exhibition Hall, Tabakalera

The exhibition "Máquinas de ingenio. Jakintzen bidegurutzean" presented a series of prototypes resulting from intensive work processes that Tabakalera has been promoting around the themes of Art, Science, Technology, and Society (ACTS) throughout 2023. By the 31st of December more than 7000 people had visited the exhibition.

The projects have been led by artists Marina Otero Verzier, Laura MM, Amaia Vicente, and Elsa Yranzo, and developed in collaboration with science and technology partners like DIPC, Tekniker, BCC Innovation, and the Basque Center on Cognition, Brain, and Language, along with Tabakalera-affiliated civic communities.

COMPUTATIONAL COMPOST

Computational compost is the result of a third collaboration between DIPC and Tabakalera, and is the work of the architect and researcher Marina Otero Verzier along with scientific collaboration from Txomin Romero, director of the DIPC Supercomputing Center, and researchers Silvia Bonoli, Raúl Angulo, Jens Stücker, and Fernando Álvarez González (UPV-EHU).

The work examines the environmental impact of data storage, highlighting the apparent transience of digital information, which in the real world, requires massive amounts of physical infrastructure that consumes energy, water, and raw materials. The piece asks a crucial question about the sustainability of these infrastructures in light of the future adoption of technologies such as artificial intelligence. The installation includes a vermicomposting system powered by the heat of DIPC's astronomical simulations, and presents an Incan quipu in the form of a film. Compost computacional highlights the political, ecological, and cultural dimensions of design decisions, and urges a critical reevaluation of the narratives of our digital future.

The exhibition also featured the Suprasprectives installation, by the Berlin-based artist duo Quadrature (Juliane Götz and Sebastián Neitsch), the first artistic creation produced by Medialab Tabakalera, in collaboration with Ars Electronica and DIPC.

HIGH SCHOOL VISITS

Every year since 2014, DIPC and the Materials Physics Center (CSIC–UPV/EHU) organize the DIPC/CFM Visit Program with an open call for high schools to visit our research centers. The aim of the program is to inspire scientific careers by showing our daily activities, research lines and facilities. In 2023, five on-site visits and two virtual visits were scheduled in order to meet the high demand from the educational institutions. A total of 17 high schools participated. In addition, two special visits were organized as part of the Egokitu orientation program (UPV/EHU). Moreover, students from the Computer Science Faculty paid a special visit to the DIPC Supercomputing Center. A total of 766 students were hosted.

JOT DOWN SCIENCE 2023

06-07/10/2023
Centro de Iniciativas Culturales de la Universidad de Sevilla

Since 2015, DIPC annually organizes the Jot Down Science outreach contest along with the popular cultural magazine Jot Down. Gradually, new collaborators and contest categories have joined in. Currently the official collaborators of the contest are the University of Seville, the Museum Laboratorium of Bergara, the Canfranc Underground Laboratory and the Margarita Salas Foundation.

The Jot Down Science event includes outreach talks, round tables and special sessions in a relaxed atmosphere. The award ceremony is also held during this event. Thanks to the collaborating institutions, the event is hosted in different cities each year. In recent years, it has been held in Seville, San Sebastián and Jaca. In 2023, the event returned to its traditional headquarters in Seville.

06/10/2023
Presenter: Raquel Sastre
Distinguishing knots, what for? Marithania Silvero
Dissemination for mental health prevention Benedicto Crespo from menteScopia
Suicide in the media Juan José Martínez Jambrina
What you need when science makes the news Clara Grima and Pampa G. Molina
First sleep, then dream Bernardo Ortín and Néstor Sánchez

07/10/2023
Presenter: Raquel Sastre
The madmen of Gericault Javier S. Burgos
Primary care and mental disorders Verónica Olmo
Conversation between Jesús Carrasco and Juan Luis Arsuaga about *Nuestro cuerpo*
Scientific illustration Vega Asencio, Maddi Astigarraga and Diego Ortega
The crystalization of dance Juan Manuel García Ruiz
Award ceremony Raquel Sastre

Scientific illustration workshop for young people between 8 and 12 years old.

All lectures were given in Spanish.

Jot Down 2023 Science Outreach Contest

Best Scientific Dissemination Essay
Complex equilibria | Ignacio Amigo

Best Science Fiction Narrative Award
Fermi in Los Alamos | Juan José Gómez Cadenas

Award for the Best Scientific Illustration
Armonía invisible | Manex San Sebastián
When chaos is ordered and magic happens | Marta Lanuza

Best Photography Award
The thinker | Manuel González Luján

The winning entries were presented in Spanish

ON ZIENTZIA

The 13th edition of the On Zientzia video contest was organized by DIPC and Elhuyar as part of the Teknopolis TV show. The aim of the competition is to produce and disseminate short, original videos on science and technology aimed at the general public.

This year, 80 pieces were submitted in Basque, Spanish, and English with gender balanced participation. Although the majority of the works were sent from the Basque Country, several videos were also received from countries such as Poland, Mexico, and India.

The 2023 award ceremony was held on June 9th at Tabakalera. The awards were presented by: Adolfo Morais Ezquerro, Deputy Minister for Universities and Research of the Basque Government, Jon Abril Olaetxea, General Coordinator of Elhuyar and Ricardo Díez Muiño, Director of the DIPC.

In each category, the following videos were awarded:

During Passion for Knowledge 2023, a selection of some of the best videos were screened in different cultural and recreational centers.

BEST DISSEMINATION VIDEO
*Crazy about your bones**
Daniel González Escudero

BEST VIDEO IN BASQUE
*Hot or Spicy? Spicy or hot?***
Ane Ibargoyen Alvarez

YOUNG PRIZE
*Storytime with my cousin and with Mendel**
Fermín Martínez Zabalza and Aitor Ros Bengochea

AUDIENCE AWARD
*The Science of Happiness***
Aimar Luis and Elene Lopez

*AI and Art**
Carlos David Macias Santillan and César Hilario Gómez Fonseca

*The videos were created in *Spanish and **Basque.*

To watch the videos visit
www.onzientzia.tv

SCIENCE WEEK

09-11/11/2023
Tabakalera

The research centers DIPC, CIC nanoGUNE, Materials Physics Center (CFM CSIC-UPV/EHU) and POLYMAT participated together in the Science Week of the University of the Basque Country (UPV/EHU). Researchers from the four centers led the usual stand with hands-on experiments on materials science and nanoscience, which was open to the general public in the "Txokos" section. The program also included a workshop for children focused on experimenting and visualizing the tiny world.

09-11/11/2023
Stand "Exploring the word of materials"

10/11/2023
Zientzia Club
180 milliliters of water, is it too much or too little?*
Jon Mattin Matxain UPV/EHU, DIPC associate

11/11/2023
Scale your World**
Workshop for children (4-8 years old)

**The lecture was given in Spanish.*
***The workshop was in both Basque and Spanish.*

SESSIONS FOR KIDS: San Sebastián International Film Festival

22, 25-29/09/2023
Ikastetxeak Belodromoan, Anoeta Velodrome

Thousands of children between the ages of 6 and 11 returned to the Anoeta Velodrome to enjoy the San Sebastián Film Festival screenings for kids, co-organized by the San Sebastián International Festival, DIPC, and the Basque Film Archive since 2019. The collaboration aims to promote a positive image of science to local schoolchildren while highlighting the city's strong connection to scientific research. The slogan *City of Cinema, City of Science* reflects this goal.

The selected film for this edition was *Boonie Bears: Blast into the Past*, an animated film directed by Leon Ding, and dubbed into Basque. It takes us back to prehistoric times to learn more about volcanoes. To liven up the meeting we had a special guest, the volcanologist **Janire Prudencio**, from Granada University. She has been passionate about volcanoes since childhood and has become an international expert. She studied the moment of volcanic eruption and shared her experiences with young audiences.

The event had another surprise in store: Sumi, an ancient volcano in the Basque Country, who woke up in the middle of the event to tell its story. Around **13,230 girls and boys from 91 schools** in Gipuzkoa participated in the six sessions held at the Velodrome and they were not frightened by the tremors and rumblings caused by this playful character.

DONOSTIA WeekINN 2023

DIPC collaborates regularly in the Innovation Week "Donostia WeekINN" organized by **Fomento of San Sebastián** every October. In 2023, DIPC participated in the activity "Barra libre de Ciencia e Innovación" which consisted of popular talks at various bars in Donostia/San Sebastián aimed at connecting with citizens on topics of science and innovation within the city's R&D&I ecosystem.

30/11/2024 | Bar Mala Gissona (Gros), Donostia/San Sebastián
Folding proteins for 50 years
David de Sancho DIPC

This lecture was given in Spanish.

NEUROTECHNOLOGIES, TOWARDS UNDERSTANDING THE HUMAN BRAIN

Everything that defines us as humans is born in the midst of the complex neural network: consciousness, abstract thought, imagination, creativity, dreams, memory. Likewise, any failure in the matrix can trigger pathologies such as Alzheimer's, Parkinson's or schizophrenia, among others. But what do we really know about these almost infinite connections in our brain?

The cycle "Neurotechnologies, towards understanding the human brain", organized by Donostia Kultura, DIPC and San Telmo Museoa, was the second edition of the program Donostia, Zientzia Hiria, which took place between March and April at San Telmo Museoa, as part of its initiative Challenges (Desafíos). In this cycle of talks, top speakers who carry out cutting-edge research in different areas related to the brain answered the aforementioned question.

21/03/2023 Public lecture
How our brain understands languages?
Esti Blanco Elorrieta Psycholinguist, Harvard University

28/03/2023 Public lecture
Neural interfaces and bioelectronic medicine: what do we know about the medicine of the future?
Ander Ramos Neuroprosthetics and Neurotechnology, Tecnalia, University of Tübingen

18/04/2023 Public lecture
Gold and neurotechnology
Ane Escobar Chemist, CFM CSIC-UPV/EHU

25/04/2023 Round table with members of Jakiunde
Neurotechnologies, towards the understanding of the human brain
Naroa Ibarretxe Psychologist
José Félix Martí Massó Neurologist
Víctor Gómez Pin Philosopher
Nekane Balluerka Sociologist
Moderated by **Aitzol García-Etxarri** Physicist

The lectures were given in Spanish and the round table discussion was also in Spanish.

OTHER COLLABORATIONS

In addition to our outreach program, each year we sponsor and support different initiatives with the participation of our researchers. In 2023, these initiatives include **Scientific Lifes**, organized by Eureka! Zientzia Museoa to inspire new generations of students to pursue scientific careers, and **Pint of Science**, an international initiative which offers informal talks by local scientists in bars around Donostia/San Sebastián.

IKUR QUANTUM TALKS

Physicist Maciej Lewenstein from the Institute of Photonic Sciences (ICFO) was the first invited scientist in 2023.

Ikerbasque researchers Geza Giedke from DIPC, Enrique Rico from the University of the Basque Country (UPV/EHU), and Jean Bernard Bru from the Basque Center for Applied Mathematics (BCAM), who are leaders and specialists in quantum technologies in the Basque Country, have initiated the IKUR Quantum Talks series to disseminate the scientific foundation and potential of quantum technologies.

The goal is to invite prominent figures in quantum technologies to the Basque Country and organize colloquia for the scientific community, as well as public lectures to promote quantum technologies both in Bilbao and Donostia/San Sebastián.

10/11/2023 | Azkuna Center, Bilbao
The Next Decade of Quantum Simulators
Maciej Lewenstein (Institute of Photonic Sciences, ICFO)

The lecture was given in English.

NEW WAYS OF SCIENCE

This cycle is co-organized by the Ernest Lluch Cultural Center of *Donostia Kultura* and DIPC. Its aim is to bridge the gap between our scientific endeavors and society at large. Members of DIPC research community present hot topics, milestones, and significant historical accomplishments in the field of physics and related disciplines, in a lucid and captivating manner.

In 2023, the following lectures were organized:

23/05/2023
Supercomputers: what they are, what they are used for, and what their limitations are
Txomin Romero DIPC

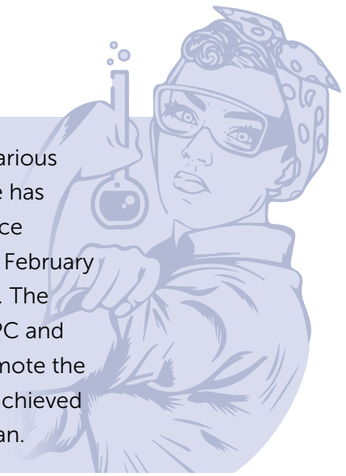
28/11/2023
Life, work, and miracles of supermassive black holes
Silvia Bonoli DIPC, Ikerbasque

The lectures were given in Spanish.

DIPC 2023 THE YEAR IN MEDIA

216	59	18	+700
newspaper articles	radio impacts	television appearances	online Impacts

Equality at DIPC



In 2023, we continued to work toward equality through various projects and initiatives. The Emakumeak Zientzian alliance has continued to build networks, raise awareness, and influence society through an extensive program of activities around February 11th, the International Day of Women and Girls in Science. The program Emakumea eta Zientzia, developed jointly by DIPC and the Provincial Council of Gipuzkoa, has continued to promote the careers of high-profile female scientists. Our Center has achieved a milestone by implementing actions from the Equality Plan.

The opening ceremony of Emakumeak Zientzian at Intxaurrondo Cultural Center in Donostia/San Sebastián.

Emakumeak Zientzian

Emakumeak Zientzian is a strategic equality project in the Basque Country that has received several awards. It has been promoted by DIPC since its inception and has successfully expanded its network of partners. In 2023, 24 Basque entities joined together to organize the International Day of Women and Girls in Science, which is celebrated on February 11th. These institutions have committed to the initiative's objectives by signing a collaboration agreement. The aim is to showcase women's activity in science, break gender stereotypes in scientific and technical fields, and encourage girls and adolescents to pursue scientific careers. The program has successfully achieved its goal through the implementation of **54 actions,** which involved over **8,500 individuals** of all ages, including children, teenagers, and adults.

Emakumeak Zientzian has fostered a strong partnership with Emakunde, the Basque Institute for Women. The international congress **'Equality, Science, and Technology: For a Paradigm Shift'** was organized by Emakunde and the Basque Government, with the valuable support of Emakumeak Zientzian members on its scientific committee.

DIPC Equality Plan

The first DIPC Equality Plan was launched by DIPC in 2020. It was designed as a framework consisting of four main areas identified as key challenges during the diagnostic process: organizational culture, workforce diversity, sexual harassment in the workplace, and work-life balance.

Creating an inclusive organizational culture with gender-diverse leadership and transparency at its core is one of the main goals we have been working on at DIPC. Significant actions are shared with the community each year. In addition, we recognize the importance of promoting diversity and inclusion internally through the use of language that is implemented in our various communication channels.

To promote a diverse workforce, we have been raising awareness and increasing the visibility of underrepresented researcher collectives (gender, ethnic background, etc.) as role models in local community events. The **Pride in Science** event, which we celebrate every year on November 18th together with CFM and CIC nanoGUNE, aims to give visibility to the LGBTQIA+ community in science and actively contributes to breaking down stereotypes. Furthermore, in partnership with the Gipuzkoa Provincial Council, a special program entitled **"Women and Science"** has been created.

Its main objective is to promote the careers of outstanding female scientists. Finally, in collaboration with the Gipuzkoa Coopera program of the Gipuzkoa Provincial Council, DIPC hosts an African researcher for several months through the Science by Women initiative, led by the Women for Africa Foundation. At the end of each year, the **Learn Africa scholarship** is offered jointly by CFM and DIPC to the chosen student for enrollment in the Master in Nanoscience program at UPV/EHU. Participants in these programs are regularly involved in community and educational activities.

In 2021, a protocol was established to ensure and maintain a dignified work environment for all DIPC employees, **free from violence** in general and **free from violence** against women and minorities, both within and outside the physical space of DIPC, as well as those that may occur through virtual or symbolic means of communication. The implementation of the Protocol, which has been in place for three years, is one of the most important milestones of our Gender Equality Plan. Every year, awareness and prevention campaigns are carried out with the participation of our community.

Ikerbasque 2023 Awards are a recognition given annually by the Department of Education of the Basque Government and Ikerbasque and gives visibility to the work of women researchers in the Basque Country as inspiration for new generations of researchers. This year, the celebration took place as part of the opening ceremony of the science festival Passion for Knowledge. The women scientists acknowledged at different stages of their scientific careers were Alicia Alonso (UPV/EHU), Ainhoa Magrach (Ikerbasque, BC3) and Sara Barja, (Ikerbasque, UPV/EHU, CFM), who received the recognition from Özlem Türeci (Princess of Asturias Award 2021), Sandra Díaz (Princess of Asturias Award 2019) and Donna Strickland (Nobel Prize in Physics 2018).

Protocol Against Harassment

First DIPC Equality Plan

One of our next challenges is to move forward in the area of **work-life balance**, with specific actions to develop a work environment that facilitates the integration of work, family and private life for both women and men. This will be one of the main lines of work in the DIPC Equality Plan for the coming years.

Personnel Segregated by Gender

	Total Staff	Women	Men
Direction & Management			
Directors	1	0%	100%
Management	4	75%	25%
Total	5	60%	40%
Scientific			
Pre-Docs	77	29%	71%
Post-Docs	64	20%	80%
Distinguished Researchers	9	33%	67%
Ikerbasque Research Fellows	5	20%	80%
Ikerbasque Research Associates	9	11%	89%
Ikerbasque Research Professors	9	10%	90%
Engineers	5	20%	80%
Technical Assistants	4	0%	100%
Total	182	23%	77%
Technical & Administrative			
Administrative Staff	15	73%	27%
IT Personnel	10	30%	70%
Outreach Personnel	4	100%	0%
Total	29	62%	38%
TOTAL	**216**	29%	71%

Associates and Visiting Researchers

	Total Staff	Women	Men
Strategic Level			
DIPC Associates	72	24%	76%
Visiting Researchers	202	19%	81%

Data as of 31/12/2023. DIPC includes the non-binary gender definition, but none has been recorded to date.

Scientific Highlights

Controlling the spin states of FeTBrPP on Au(111)

Meng X, Moller J, Mansouri M, Sanchez-Portal D, Garcia-Lekue A, Weismann A, Li C, Herges R, and Berndt R
ACS Nano 17, 1268 (2023)

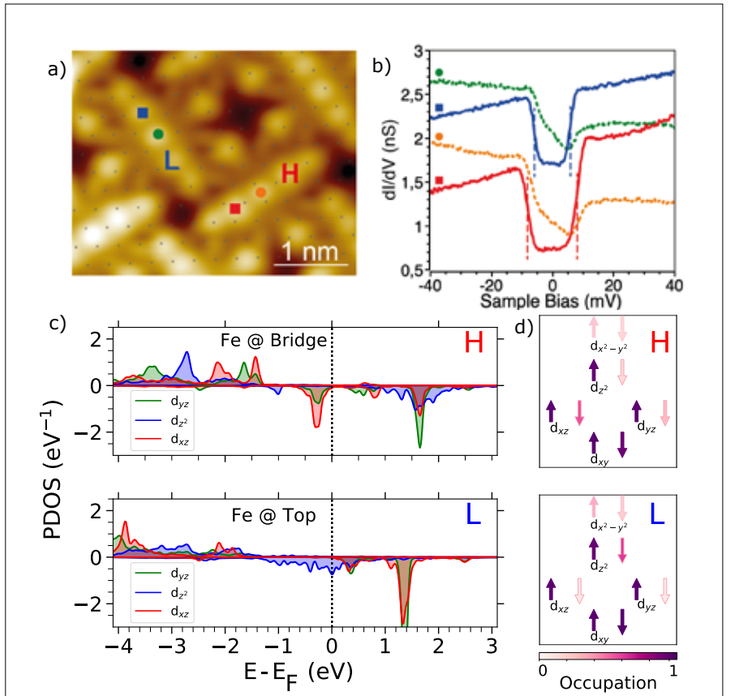
As candidates for high-density data storage and quantum computation, magnetic transition metal complexes have attracted extensive attention. It has been established that the atomic surroundings of the magnetic ions play a significant role and govern the magnetism of these magnetic complexes. One feature in particular, magnetic anisotropy, which describes the preferential orientation of the magnetic moment in certain directions, arises from the crystal field and the ligand field, which make the degenerate d-orbitals of the transition-metal ion (they have equal energy, but different spatial arrangements, when the ion is isolated) to have different energies via spin–orbit coupling. Understanding and controlling the magnetic anisotropy of the magnetic complexes are most important for practical applications.

Till now, a few approaches to tune the magnetic anisotropy of adsorbed coordination complexes have been reported, such as altering the ligand field via chemical modification or mechanical deformation. Chemical modification often introduces irreversible changes to the metal complexes and prevents a reversible manipulation of the magnetic anisotropy. A mechanical deformation, on the other hand, remains in place only as long as the external force used to produce it is maintained and controlling numerous molecules is difficult.

As these complexes are usually adsorbates, could a manipulation of the adsorption process alter magnetic anisotropy? The variation of the molecular adsorption site does not suffer from the limitations from chemical modification or mechanical deformation, but so far little is known about the site dependence of the magnetic anisotropy energy of molecules.

Now, a team of researchers has explored the behaviour of the magnetic complex Fe(II) 5,10,15,20-tetrakis (4'-bromophenyl)porphyrin (FeTBrPP) when adsorbed on Au(111) with a low-temperature scanning tunnelling microscope (STM) and density functional theory (DFT). The molecule has two stable adsorption structures on the surface that differ in magnetic anisotropy energy. The structural difference also leads to a distinct peak shift of the molecular orbitals.

FeTBrPP molecules exhibit two orientations, either parallel (L) or perpendicular (H) to a close-packed direction of a Au(111) substrate and occupy top and bridge sites, respectively. Different electronic structures and magnetic anisotropy energies are observed for the two adsorption geometries. DFT calculations reveal that the structural differences affect the distance between the Fe ion and substrate atoms and lead to variations of the Fe 3d level occupations, which in turn change the axial magnetic anisotropy.



Main STM observations and DFT-based results. (a) Constant-current STM image with molecules L and H. Squares and circles denote the tip positions used for dI/dV spectroscopy. Small gray dots show the positions of substrate atoms. (b) Spectra of the differential conductance obtained on the molecules. (c) Spin-polarized density of states projected (PDOS) on Fe d_{z^2}, d_{xz}, and d_{yz} orbitals, with x axis corresponding to the close-packed direction of Au(111). (d) Simplified scheme of the occupation of the Fe 3d levels.

Variation of the molecular adsorption emerges as a useful characteristic for spintronic applications

Importantly, the researchers also show that the magnetic anisotropy energy of the molecules can be easily tuned by manipulating the adsorption structure or the distance between the STM tip and the molecule. Actually, the contact of the STM tip to the molecular centre leads to an abrupt drop of the anisotropy. This way, the magnetic anisotropy of the molecules can be varied by switching between H and L adsorption geometries that are equally stable on the surface.

The fact that the magnetic anisotropy energy can be controlled by changing the adsorption site, the orientation, or the tip–molecule distance is the kind of things that are found useful for spintronic applications.

DIPC HIGHLIGHT 2023

A single-crystal monomer to single-crystal polymer reaction activated by a triplet excimer in a zipper mechanism

Long L, Medina Rivero S, Sun F, Wang D, Chekulaev D, Tonnele C, Casanova D, Casado J, and Zheng Y
Angewandte Chemie-International Edition 62, e202308780 (2023)

Single-crystal-to-single-crystal (SCSC) chemical reactions, including cyclization, dimerization, and polymerization, occur within the crystal lattice without causing lattice damage. This unique process enables the efficient synthesis of functional polymeric materials with highly ordered crystalline structures via SCSC polymerization. Notably, SCSC polymerization offers additional advantages, such as precise control over stereochemistry and regiochemistry within the resulting polymer product.

The present investigation integrates experimental and theoretical approaches to unravel the polymerization mechanism occurring in the solid state when a bisindenedione compound (BIT) undergoes crystal monomer to crystal polymer conversion (Figure 1). While the experimental analysis and characterization of the resulting polymer have been detailed elsewhere, this article delves into the intricate steps of the polymerization process itself. To explore this mechanism, the study utilizes a combination of variable-temperature electron spin resonance, femtosecond transient absorption spectroscopy, and vibrational Raman spectroscopic techniques, complemented by quantum chemical calculations.

The observed reaction pathway commences with the formation of a triplet excimer state, which subsequently transitions to an intermolecularly bonded triplet state (Figure 2). This bonded state serves as the initiation point for the polymerization propagation. Conceptually, one can envision this process akin to an unfolding zipper: initial light absorption forms a cursor or slider, followed by the closure of the zipper in which the open π–π column stacks get progressively closed (bonded) by motion of the cursor thermodynamically fueled by CC bond formation.

This detailed mechanistic insight is invaluable for understanding the complexities inherent in this significant reaction. Furthermore, it provides a platform for envisioning and diversifying the range of resulting products. The study has been performed by a team of researchers that includes DIPC and Ikerbasque researchers Claire Tonnelé and David Casanova.

Rationalization of topochemical polymerization in a single crystal

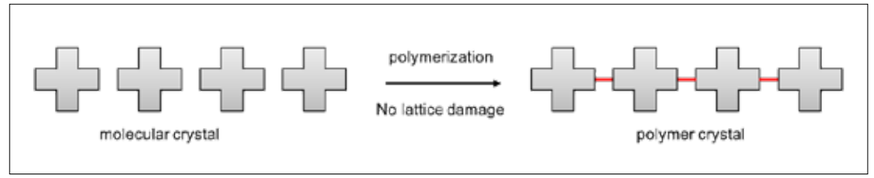


Figure 1. Schematic representation of the crystal monomer to crystal polymer conversion.

Computational characterization of the photo-induced polymerization mechanism

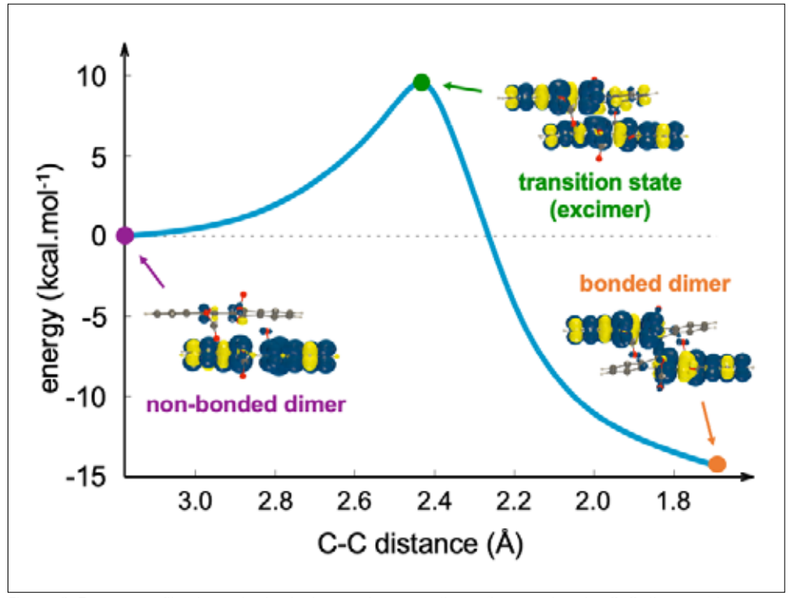


Figure 2. Energy profile along the intrinsic reaction coordinate (intermolecular C-C distance) between non-bonded (left) and bonded (right) triplet state of the BIT dimer computed at the ωB97X-D/6-311G(d,p) level. Triplet state spin densities represent the non-bonded, transition state (excimer) and bonded dimers.

DIPC HIGHLIGHT 2023

Current progress and challenges in large-scale 3D mitochondria instance segmentation

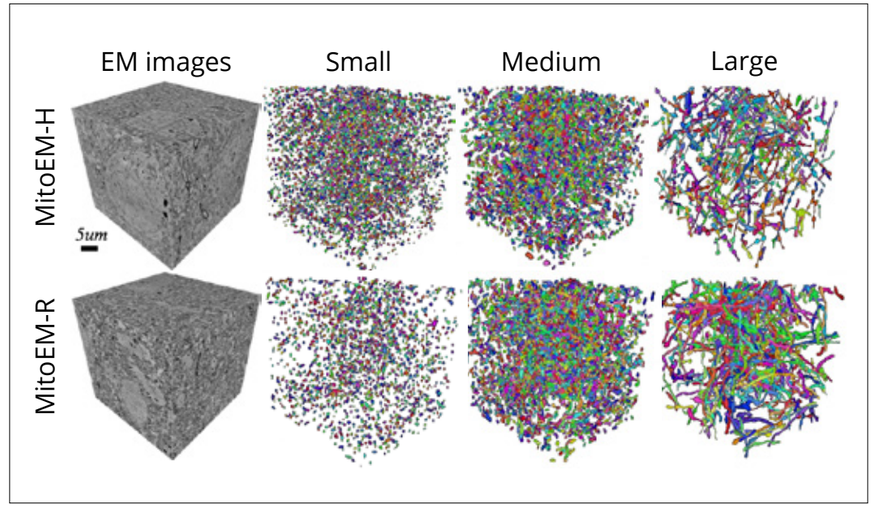
Franco-Barranco D, Lin Z, Jang WD, Wang X, Shen Q, Yin W,Fan Y, Li M, Chen C, Xiong Z, Xin R, Liu H, Chen H, Li Z, Zhao J, Chen X, Pape C, Conrad R, Nightingale L, de Folter J, Jones ML, Liu Y, Ziaei D, Huschauer S, Arganda-Carreras I, Pfister H, and Wei D
IEEE Transactions on Medical Imaging 42, 3956 (2023)

Mitochondria are the primary energy providers for cell activities. The quantification of the size and geometry of mitochondria is crucial to basic neuroscience research, as it contributes to the identification of neuron types. This quantification is also informative to clinical studies where energy-usage unbalances are implied, like bipolar disorder or diabetes. High-resolution imaging technologies like electron microscopy (EM) have been used to reveal the detailed 3D geometry of mitochondria at the nanometer level with terabyte data scale. Consequently, to enable an in-depth biological analysis, we need high-throughput and robust 3D mitochondria instance segmentation methods.

The Large-scale 3D Mitochondria Instance Segmentation challenge (MitoEM), presented at the IEEE International Symposium on Biomedical Imaging (ISBI) 2021, is the first open comparison of mitochondria instance segmentation algorithms on EM volumes. Now, a team of researchers analyzes the current progress in the mitochondria segmentation task based on the results of MitoEM, and presents an in-depth analysis of the state-of-the-art evaluation metrics for identifying mitochondria instance segmentation errors. This analysis reveals the difficulties of the current approaches and can be used as a guide for the creation of the next generation mitochondria segmentation models.

The basis for the MitoEM challenge is a previously released large-scale 3D mitochondria instance segmentation benchmark, known as the MitoEM dataset. The MitoEM dataset comprises two 3D EM image stacks. These image stacks originate from distinct sources, one from adult rat brain tissue (MitoEM-R) and the other from adult human brain tissue (MitoEM-H). Notably, the MitoEM dataset represents a substantial increase in scale, being approximately 1,986 times larger than the previous de facto benchmark dataset, the EPFL Hippocampus dataset, the so-called Lucchi benchmark. From the 1,000 consecutive slices of each stack, ground-truth mitochondria instance labels were provided for the first 500 slices and split into training (400 slices) and validation (100 slices) subsets. The annotations of the remaining 500 slices of each volume were kept private and used as the test set.

The challenge was accepted to ISBI 2021 in October 2020 and officially announced in November 2020. This announcement was accompanied by the creation of a dedicated website and the preparation of an evaluation system. The two image volumes, MitoEM-R and MitoEM-H, were made immediately available to participants to enable them to begin developing their methods. Participants performed the segmentation on their own computers. The challenge was widely advertised and was open to any interested participants. A total of 257 individuals registered for the challenge and 14 teams submitted their results. Eight teams successfully completed the challenge.



Visualization of MitoEM-H and MitoEM-R datasets splitting categories based on mitochondria length. From left to right: original 3D electron microscopy images, and their corresponding meshes of small (length ≤ 1μm), medium (1μm < length < 4μm), and large (length ≥ 4μm) mitochondria of human (top) and rat tissue (bottom).

This analysis reveals the difficulties of the current approaches and can be used as a guide for the creation of the next generation mitochondria segmentation models

Posterior to the challenge, annotation errors in the ground truth were corrected without altering the final ranking. The authors present in this new paper the eight top-performing approaches from the challenge participants, along with their own baseline strategies. But they also take a critical look at the challenge itself. A retrospective evaluation of the scoring system revealed that: 1) the challenge metric was permissive with the false positive predictions; and 2) the size-based grouping of instances did not correctly categorize mitochondria of interest.

Consequently, the researchers propose a new scoring system that better reflects the correctness of the segmentation results. Although several of the top methods are compared favorably to their own baselines, substantial errors remain unsolved for mitochondria with challenging morphologies. Thus, the challenge remains open for submission and automatic evaluation, with all volumes available for download.

DIPC HIGHLIGHT 2023

The BACCO simulation project: biased tracers in real space

Zennaro M, Angulo RE, Pellejero-Ibanez M, Stucker J, Contreras S, and Arico G
Monthly Notices of the Royal Astronomical Society 524, 2407 (2023)

The observed spatial distribution of galaxies offers an extremely valuable window to the physics of the universe. For instance, their clustering as a function of scale depends on early universe physics, where properties of the primordial quantum fluctuations leave distinctive signatures. Similarly, the relation between cosmic velocities and densities offers a pathway to constrain the nature of gravity and the growth of structure. Finally, the signature imprinted by sound waves in the primaeval universe can be employed to measure the expansion history of the universe, offering an opportunity to better constrain the properties of dark energy. However, accurately interpreting all this data is an extremely difficult task.

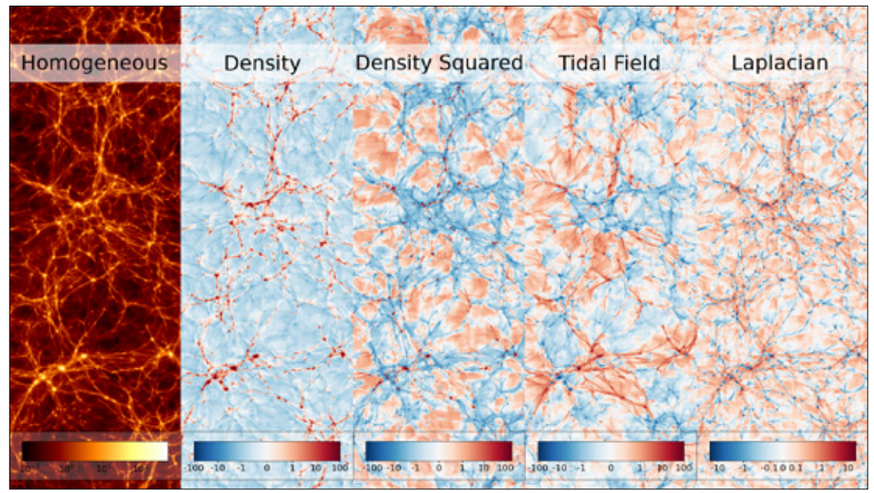
The challenge of modelling galaxy clustering arises from the nonlinearity of the physics involved. Although the seeds of structure formation can be predicted using linearized Boltzmann-Einstein equations, the subsequent gravitational evolution will create nonlinearities which cannot be computed accurately. Additionally, galaxies are expected to form in particular regions of the universe with an efficiency that depends on the details of galaxy formation physics.

The most accurate way to follow all these processes is provided by N-body simulations. In these, fluctuations in the universe are represented by a set of particles which are numerically evolved by solving their equations of motion. But simulations are computationally expensive, thus it is typically not possible to carry them out for more than a handful of different cosmological models.

Another problem that arises in simulation-based models is related to galaxy formation. Although there has been great recent progress in understanding galaxies and their connection with dark matter, predictions are still uncertain and model dependent. This implies that, when compared to observations, small model uncertainties could bias cosmological inferences or hide the signature of new fundamental physics.

Cosmological perturbation theory offers a very attractive alternative. By solving analytically the relevant fluid equations, it is possible to predict galaxy clustering in a general manner only relying on symmetries (e.g. homogeneity and isotropy in the universe) without making an explicit connection with particular galaxy formation physics. Unfortunately, this approach is only valid on the largest cosmic scales and does not provide enough accuracy given the quantity and quality of ongoing galaxy surveys.

Now, a team of researchers combines both approaches to create a framework that inherits the accuracy of numerical simulations with the flexibility of perturbative treatments. This novel approach is valid down to small nonlinear scales while being agnostic to the details of galaxy formation physics and the observational setup.



Visualization of different features of the cosmic density field that determine the spatial distribution of galaxies. Each panel corresponds to a projection of the same volume in a cosmological simulation but weighed differently which emphasise different aspects of the large-scale structure in the cosmos – for example, the density weighting emphasises filaments and clusters in the cosmic web whereas density squared weighting emphasises the regions associated with the most massive clusters (small red regions).

Analyzing observational maps of galaxies in conjunction with theoretical models allows researchers to test competing cosmological hypotheses and refine our understanding of the universe's structure, evolution, and fundamental properties

The researchers were able to do this by combining the benefits of several recent developments in cosmology. On the simulation side, they employ large N-body simulations, with accurate force and mass resolution, which have significant noise suppression by using special initial conditions. They combine these with neural networks which allow them to quickly make predictions while varying any cosmological parameter – including neutrinos and dark energy. On the perturbative side, they used an effective field theory that captures dependencies with the density and tidal fields and the non-locality of the galaxy formation process.

This approach is now being incorporated into the official analysis of the EUCLID satellite, and the scientists anticipate that it will be valuable for studying multiple problems in cosmology. For instance, its applications could be extended to describe the shapes of galaxies and the connection with the deflection of the light of high-redshift galaxies. Therefore, this approach has the potential to be able to distinguish competing explanations for the phenomena such as the accelerated expansion of the universe and the first few moments of the universe.

X-Ray scattering reveals phonon anomalies in kagome metals

[1] **Order-disorder charge density wave instability in the kagome metal $(Cs,Rb)V_3Sb_5$**
Subires D, Korshunov A, Said AH, Sanchez L, Ortiz BR, Wilson SD, Bosak A, and Blanco-Canosa S
Nature Communications 14, 1015 (2023)

[2] **Softening of a flat phonon mode in the kagome ScV_6Sn_6**
Korshunov A, Hu H, Subires D, Jiang Y, Calugaru D, Feng X, Rajapitamahuni A, Yi C, Roychowdhury S, Vergniory MG, Strempfer J, Shekhar C, Vescovo E, Chernyshov D, Said AH, Bosak A, Felser C, Bernevig BA and Blanco-Canosa S
Nature Communications 14, 6646 (2023)

Diffuse and inelastic x-ray scattering techniques combined with theoretical simulations, have enabled scientists to demonstrate the first example of phonon anomalies in a "kagome" metal exhibiting charge-density waves. The observations suggest that kagome metals are fertile ground for the investigation of novel phases of matter.

A topological material is one whose electronic structure has features akin to knots or twists that cannot be untangled without breaking or changing the fundamental nature of the material. One such feature is flat bands – that is, flat in momentum space, yet arising from the strong localisation of electrons in real space. This type of topology is particularly interesting as it is considered a route to enhance electron-correlation effects and engineer emergent phases of matter with rich, many-body physics, such as unconventional superconductivity, metal–insulator transitions, density-wave instabilities, and quantum spin liquids.

Recently, charge-density waves (CDWs) have been observed in the geometrically frustrated kagome lattice. This geometry, which resembles the overlapping triangles and hexagons of Japanese kagome basket-weaving, features topological electron flat bands at, below and above the Fermi level. CDWs, magnetism and superconducting phases are thought to be – depending on the electron number – the result of flat bands, multiple Dirac crossings or so-called van Hove singularities close to the Fermi level. In the kagome AV_3Sb_5 (where A=Cs, Rb, K) and FeGe metals, which have phase diagrams populated with van Hove singularities and Dirac crossings, "multi-Q" CDWs highlight a complex interplay between CDWs, magnetism and superconductivity. Nevertheless, the hallmark of the CDW phase transition, a phonon's "softening" or collapsing to zero frequency, has never been observed, and so the microscopic origin of the CDWs is still unknown. This phonon softening is obscured by a dynamical disorder of the kagome plane, which usually precludes the emergence of superconductivity and other coexisting or competing instabilities in the Fermi surface.

Now, a series of diffuse and inelastic x-ray scattering experiments reveal the phonon anomalies in the ScV_6Sn_6 (166) and AV_3Sb_5 kagome lattices. The spectroscopic measurements show that the low energy longitudinal phonon in AV_3Sb_5 with propagation vector (½ ½ ½) and characterized by an in-plane V displacement, does not soften and follows an order-disorder dynamics; while the and (1/3 1/3 1/2) phonon in ScV_6Sn_6 collapses at 98 K, without the direct emergence of a CDW; instead setting in with a propagation vector (1/3 1/3 1/3). Despite propagating with a different vector, the CDW in ScV_6Sn_6 is driven by the phonon softening in an overdamped flat plane at $k_z=\pi$, which is characterised by an out-of-plane vibration of the trigonal Sn atoms. Such phonon anomalies point to (a) the existence of approximately flat phonon bands, which disperse a little due to electron renormalisation; and (b) the effects of the momentum-dependent electron-phonon interaction in the CDW formation.

Our results report experimental and theoretical evidences of the collapse and the absence of thereof of a kagome flat phonon plane, and promotes the 135 and 166 compounds of the kagome family as primary candidates to explore the physics of correlated flat phonons and topologically flat electrons.

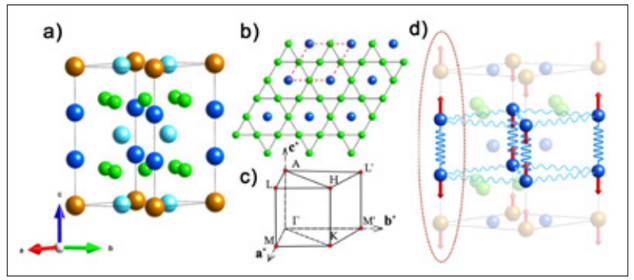


Figure 1. a) Side view of the ScV_6Sn_6 kagome structure. Green and gold balls denote V atoms that define the kagome net and Sc, respectively. Blue and cyan denote the trigonal Sn (Sn_T) and hexagonal Sn (Sn_H) atoms. b) Top view of the kagome net, highlighting the V and Sn_T atoms. Red dashed lines denote the unit cell. c) Brillouin zone of the space group *P6/mmm* (191) and the main symmetry directions. d) Vibration mode of the imaginary phonon mode at (1/3 1/3 1/2).

Phonon anomalies and charge density waves in correlated topological materials

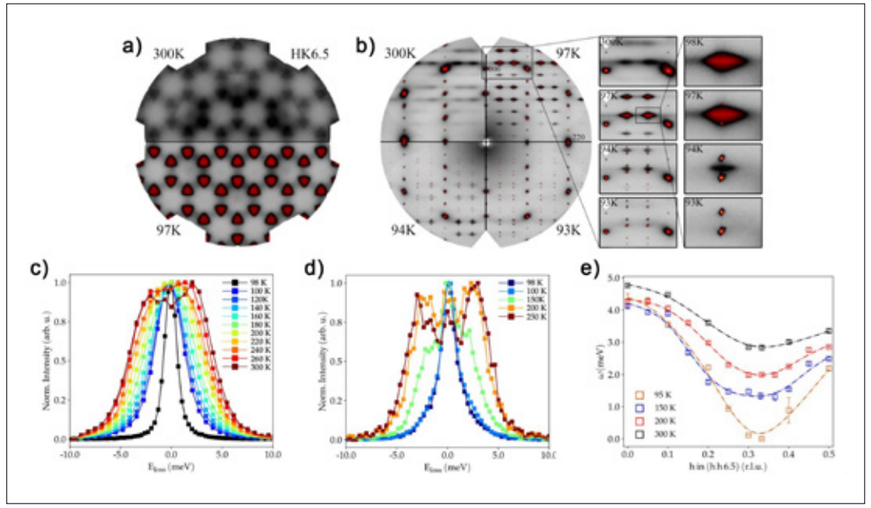


Figure 2. a) h k 6.5 plane at 300 K (top) and 100 K (bottom), showing the diffuse precursor of the 3D CDW at l=1/2 that grows in intensity upon cooling. b) h h l map, where no precursor is visible at l=1/3 at high temperature, but at l=1/2. The diffuse signal is replaced by the CDW Bragg satellites at low temperature, (right panels). c) Normalised temperature dependence of the IXS spectra at the (1/3 1/3 13/2) r.l.u. position. d) IXS scans as a function of temperature at the (1/3 1/3 19/3) r.l.u. position. e) Momentum dependence of the (1/3 1/3 13/2) phonon frequency at selected temperatures, highlighting the large momentum softening.

DIPC HIGHLIGHT 2023

Size-dependent vitrification in metallic glasses

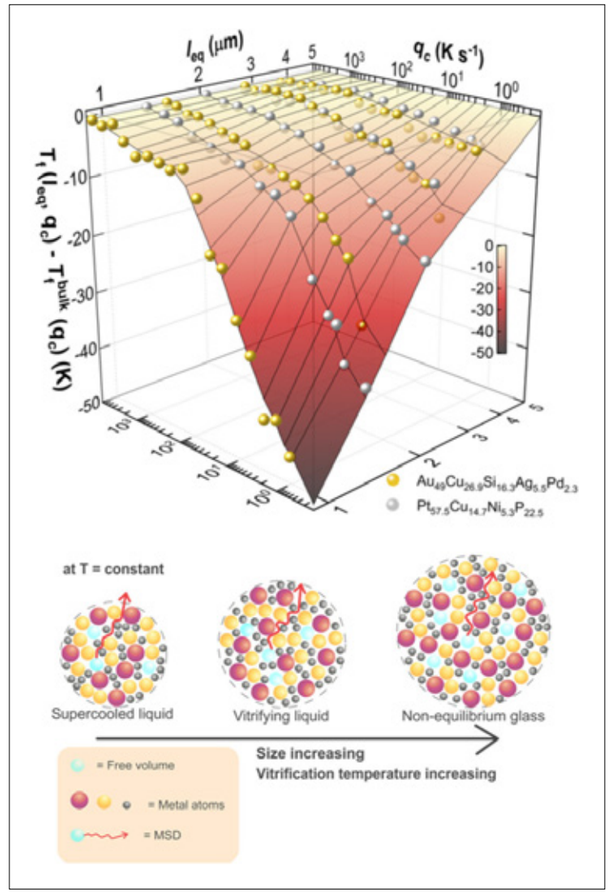
Di Lisio V, Gallino I, Riegler SS, Frey M, Neuber N, Kumar G, Schroers J, Busch R, and Cangialosi D
Nature Communications 14, 4698 (2023)

DIPC scientists show a hitherto unknown sample size effect on metallic glasses vitrification. Metallic glasses are materials of extraordinary importance due to their superior mechanical properties and corrosion resistance. A well-known and widely investigated aspect, which deeply impacts the metallic glass final properties, is that their thermodynamic state depends on the processing conditions employed to produce them. Hitherto much less investigated is the way reducing the sample size affects the glass thermodynamic state of the metallic glass and the implications on their final properties.

In this work, Valerio Di Lisio and Daniele Cangialosi, post-doctoral fellow and research associate at DIPC, respectively, present a study on the way vitrification (the transformation to a glass on cooling the liquid) takes place in two metal alloys based on gold and platinum, depending on certain conditions. The glass transition or vitrification, underlying the transformation of a liquid, supercooled below its melting temperature, into a glass, is one of the most fascinating and still unsolved problems in condensed matter physics. Besides the underlying fundamental process, the way vitrification actually takes place and how old the glass is can deeply impact the glass properties and their evolution.

More specifically, they vary the sample size and applied cooling rate using state-of-the-art fast scanning calorimetry that permits achieving heating/cooling rates as large as 40000 K/s. The key result of the study is that reducing the sample size to the micrometer scale allows conveying the glass to low energy/high density states, as parametrized by the fictive temperature, T_f, of the glass. While this effect is minimized in glasses cooled at high rates, cooling at rates of several K/s allow attaining reduction in T_f as large as 40 K for the smallest samples, a reduction that would require geological time scales in a bulk glass. Applying the free volume holes diffusion model allows capturing this phenomenology – where enthalpy reduction /density increase is assisted by release of free volume to the free interface.

These findings have profound implications from both technological and fundamental perspectives. They show how low energy/high density metallic glasses can be produced on time scales of seconds simply reducing the sample size. In this way, they open the door to reaching thermodynamic states otherwise unattainable on conventional bulk glasses in time scales accessible to the human being, thereby allowing exploring the fate of the thermodynamic state of a glass deep in the energy landscape.



T_f reduction with respect to the bulk as a function of cooling rate, q_c, and sample size, l_{eq}, for gold and platinum based metallic glasses (top) and schematic plot of the free volume holes diffusion model (bottom).

Reduction of the sample size to the micrometer length scale in metallic alloys results in remarkable reductions of the temperature of transformation of the liquid into a glass, thereby allowing obtaining ultradense glasses

DIPC HIGHLIGHT 2023

Long-lived spin waves in a metallic antiferromagnet

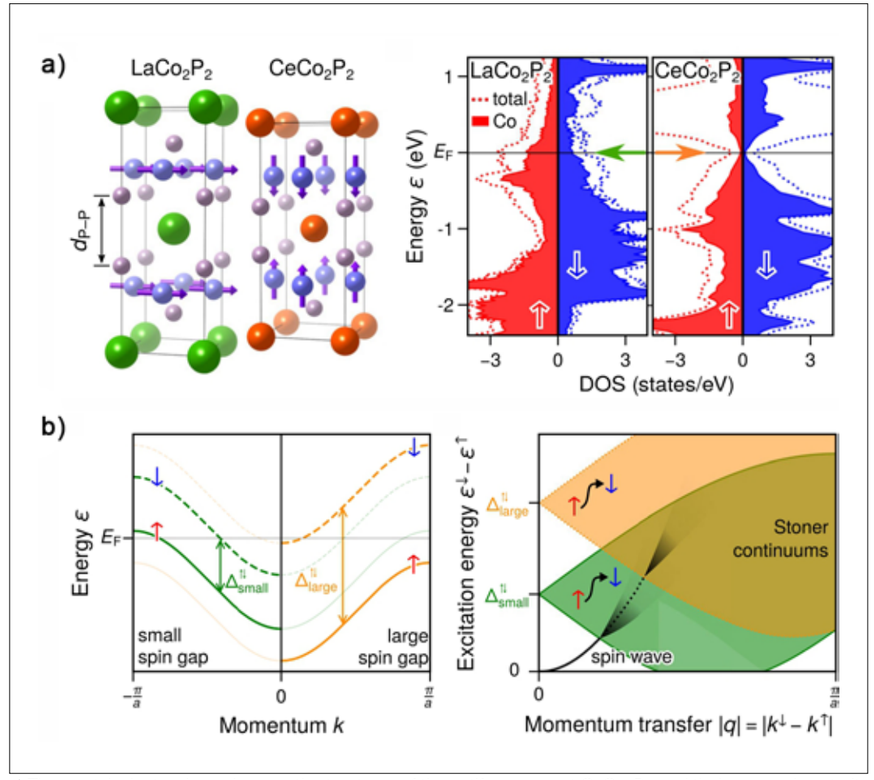
Poelchen G, Hellwig J, Peters M, Usachov DY, Kliemt K, Laubschat C, Echenique PM, Chulkov EV, Krellner C, Parkin SSP, Vyalikh DV, Ernst A, and Kummer K
Nature Communications 14, 5422 (2023)

Spin waves or magnons hold great promise for classical and quantum computing, due to the excellent energy-efficiency and scalability of magnonic devices. Both fundamental and applied research in the field of magnonics undergo rapid growth, fueled by the recent demonstrations of metamaterials and devices capable of information processing based upon propagating spin waves. The prospect of making such devices also ultrafast, i.e. operating at many GHz or even THz, is a major driver for these research efforts. In addition to reaching the THz regime, integration with existing CMOS technology is a major challenge in unlocking the full technological potential of magnonics. The typically considered insulating oxide materials, like ferrites, integrate, for example, poorly into monolithic microwave integrated circuits, and it becomes more and more clear that we need to explore the potential of metallic magnets as substitutes for those oxides.

One of the big challenges in finding suitable metallic magnets, both ferro- and antiferromagnetic, is that Stoner spin-flip excitations very strongly damp magnons in these materials, leading to very short magnon lifetimes towards the THz regime.

We have now identified a room temperature, metallic antiferromagnet $CeCo_2P_2$ with an unusually high ordering temperature of $T_N = 440$ K in which nearly undamped spin waves can be generated in the tens of THz regime. Using state-of-the art ab initio calculations we have found that $CeCo_2P_2$ should also exhibit a large Stoner gap as well as steep magnon dispersions with magnon energies reaching several hundred meV. Both are prerequisites for long lived magnons in the THz regime. Together with its good metal properties and its very high ordering temperature $CeCo_2P_2$ seems to be an extremely promising material for room temperature THz magnonics. Animated by our theoretical results, we performed high-resolution RIXS measurements, which can directly probe spin waves and their damping. In agreement with our predictions, we observe high-energy magnons up to THz energies with very long lifetimes. A detailed analysis of our experimental data shows lifetimes of 0.2 to 0.4 ps even at very high magnon energies (frequencies) above 150 meV (35 THz). The reason for these unusual properties in $CeCo_2P_2$ lies in intricacies of the electronic structure around the Fermi level. This is clearly demonstrated by comparison with $LaCo_2P_2$ where we show both experimentally and theoretically how the Ce to La substitution immediately restores the typical strong damping of high-frequency magnons in metals.

We believe that our identification of very long-lived THz magnons in a high-temperature metallic magnet could be an important milestone in the quest for THz magnonic devices working at room temperature conditions. For the future, it will be interesting to see how structural units of $CeCo_2P_2$ perform when integrated into different functional magnonic heterostructures, where further parameters, like interfacial stress and strain, charge transfer, etc become available for tuning material properties.



a) The crystal, electronic, and magnetic structures of the antiferromagnet $CeCo_2P_2$, and their comparison to its sister system $LaCo_2P_2$. b) Insight into the relationship between the Stoner continuum and the onset of the spin wave scattering. Larger spin gaps promote undamped spin waves up to higher energies.

Our findings reveal a room temperature, metallic antiferromagnet $CeCo_2P_2$ in which nearly undamped spin waves can be generated in the tens of THz regime

DIPC HIGHLIGHT 2023

Detecting the spin-polarization of edge states in graphene nanoribbons

Brede J, Merino-Diez N, Berdonces-Layunta A, Sanz S, Dominguez-Celorrio A, Lobo-Checa J, Vilas-Varela M, Pena D, Frederiksen T, Pascual JI, de Oteyza DG, and Serrate D
Nature Communications 14, 6677 (2023).

Low-dimensional carbon-based materials can show intrinsic magnetism associated to p-electrons in open-shell π-conjugated systems. Chemical design provides atomically precise control of the π-electron cloud, which makes them promising for nanoscale magnetic devices. In this pioneering study a collaborative team led by CSIC scientist David Serrate from the Instituto de Nanociencia y Materiales de Aragón (INMA), alongside researchers from DIPC, CIC nanoGUNE, CFM, CINN, and CIQUS, has achieved a scientific breakthrough by directly imaging the magnetic behavior of graphene nanostructures for the first time. In particular, the research team studied chiral graphene nanoribbons (one-dimensional strips of graphene with alternating zigzag and armchair boundaries) and mapped the spin-polarization of their edge states by means of spin-polarized scanning tunnelling microscopy (STM).

This cross-institutional endeavor synthesized chiral graphene nanoribbons on a ferromagnetic $GdAu_2$ monolayer (Figure 1). This substrate turned out to be fully compatible with on-surface synthesis of the rapidly growing class of nanographenes, while its magnetic character represents a novel method to stabilize organic magnetic moments, showcasing the ribbons' intrinsic magnetism along their atomically precise zigzag edge sequences (Figure 2). The team resolved the energy-dependent spin-moment distribution of spatially extended edge states with π-orbital character showing that this edge spin polarization lies beyond localized magnetic moments at radical or defective carbon sites. Guided by mean-field Hubbard calculations, they demonstrated that electron correlations are responsible for the spin-splitting of the electronic structure.

This innovative approach not only provides a versatile platform for the development of nanoscale magnetic and spintronic devices but also marks a significant advance in exploring π-orbital magnetism for technological applications. By employing spin-polarized STM technology available at the Laboratorio de Microscopias Avanzadas in Zaragoza, the researchers have challenged conventional magnetism paradigms and opened new avenues for the characterization of magnetic carbon-based materials. The project underscores the collective ambition of leading research institutions to unlock the quantum technological applications of graphene nanostructures, demonstrating the material's potential in future nanoscale magnetic and spintronic devices.

Graphene nanoribbons is a versatile and key material for the next generation of magnetic and spintronic devices

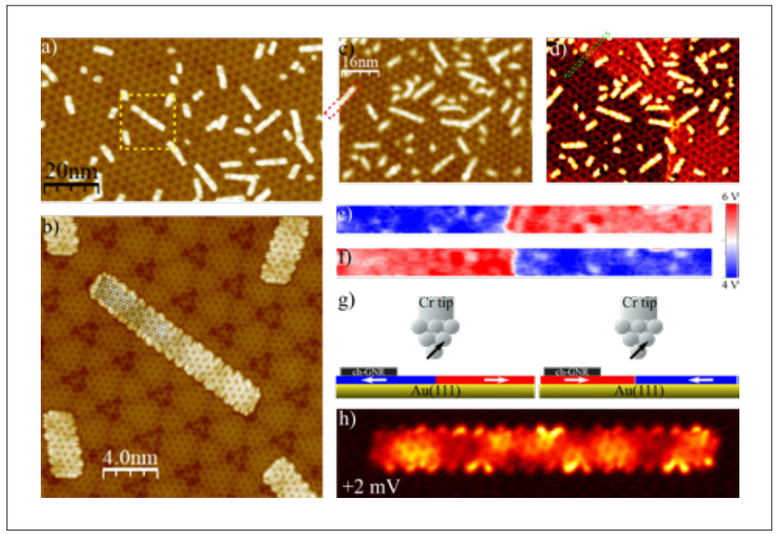


Figure 1. Experimental setup for magnetic characterization of chiral graphene nanoribbons on a magnetic monolayer of gold and gadolinium ($GdAu_2$). (a) Large-scale STM topography of the surface and (b) a zoom of a single ribbon inside the yellow box with the molecular structure superimposed. (c,d) Simultaneous topography and *dI/dV* spin-polarized map with an in-plane sensitive Cr tip. (e,f) Zoom of the region enclosed by the green rectancle in (d) of two different remanent magnetic states of the substrate obtained after cycling the field at maximum positive and negative out-of-plane field strength of ±3 tesla. (g) Sketch of the entire tip-sample system where arrows represent the local magnetic moments. (h) Constant-height dI/dV map at 2 mV with the Cr tip for the ribbon in (c).

This study presents the first direct evidence of spin-polarized edge states in graphene nanoribbons, marking a breakthrough in carbon-based magnetism

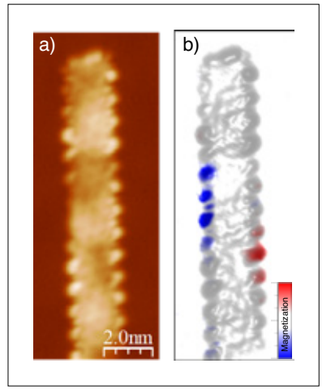


Figure 2. Spin-polarized STM characterization of a chiral graphene nanoribbon on magnetic $GdAu_2$. (a) Topographic image and (b) magnetization map with the edge spin density spatially resolved. /David Serrate

DIPC HIGHLIGHT 2023

Evidence for ground state coherence in a two-dimensional Kondo lattice

Wan W, Harsh R, Meninno A, Sajan S, Guo H, Errea I, de Juan F, and Ugeda MM
Nature Communications 14, 7005 (2023)

The scattering of conduction electrons in metals owing to impurities with magnetic moments is known as the Kondo effect, after Jun Kondo, who analysed the phenomenon in 1964. This scattering increases the electrical resistance and has the consequence that, in contrast to ordinary metals, the resistance reaches a minimum as the temperature is lowered and then increases as the temperature is lowered further.

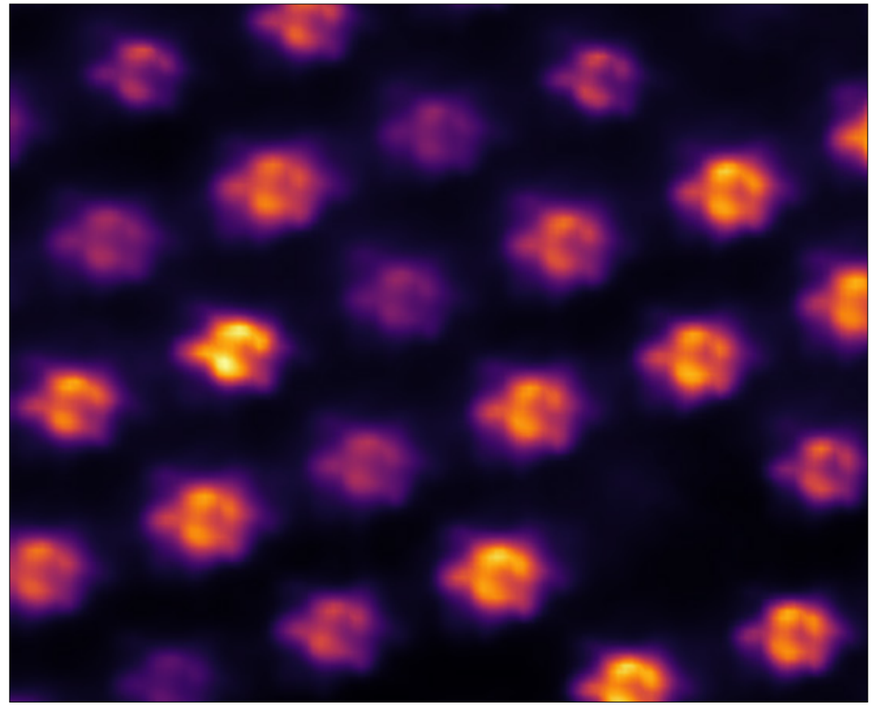
The Kondo effect is a collective one involving an indirect exchange interaction of the conduction electrons with a paramagnetic impurity. Thus, a Kondo lattice is a set of localized magnetic impurities arranged in a regular pattern, which interacts with a bath of delocalized conduction electrons. The Kondo lattice introduces a new energy scale, related to a temperature T^*, which plays the role of Kondo temperature, T_K – the one limiting the validity of the Kondo results – in the sense that below T^* the magnetic susceptibility starts being anomalously reduced due to partial screening.

The complexity of the Kondo lattice problem is best appreciated in comparison with the relative simplicity of that involving a single Kondo impurity. At temperatures below T_K, a magnetic impurity coupled to a metal with Kondo exchange coupling starts developing singlet correlations with the conduction electrons and eventually becomes completely screened at T = 0 K. In a periodic array of such impurities, the magnetic moments also develop independent singlet correlations around T_K. However, as the temperature is further lowered below a coherence scale T^*, the competition between the Kondo exchange and other interactions between moments can drive the system to different ground states like a Kondo paramagnet or magnetically ordered state.

A microscopic understanding of the ground state of this coherent Kondo lattice remains a central problem in condensed matter physics, especially as more complex scenarios are also possible, where Kondo screening coexists with magnetic order. Understanding the nature and possible types of zero-temperature quantum critical points between such phases and their influence in a variety of phenomena has been experimentally hindered by the complexity and lack of tunability of the f-electron compounds like those based in ytterbium or cerium.

The observation of the Kondo effect in transition metal dichalcogenide (TMD) heterobilayers formed by vertical stacks of T- and H-type monolayers has recently opened a new, simple, and accessible platform to design artificial Kondo lattices. However, lower-temperature evidence for any coherence behavior of the Kondo lattice remains sorely lacking, and fundamental questions such as the ground state of these compounds remain unanswered.

Now, a team of researchers has addressed this problem by performing high-resolution scanning tunneling microscopy/spectroscopy (STM/STS) experiments at 340 mK in a prototype 1T/1H-$TaSe_2$ heterostructure. The measurements reveal the existence of two symmetric electronic resonances around the Fermi energy, a hallmark of coherence in the spin lattice.



STM imaging of the spatial localization of the magnetic moments in the 2D Kondo lattice at a temperature of 340 mK.

This work provides the first experimental evidence for the coherence of the magnetic moments of an artificial two-dimensional Kondo lattice realized in a transition metal dichalcogenide (TMD) heterostructure.

Spectroscopic imaging locates both resonances at the central Ta atom of the charge density wave of the 1T phase, where the localized magnetic moment is held. On the other hand, the evolution of the electronic structure with the magnetic field reveals a non-linear increase of the energy separation between the electronic resonances.

Ab initio and auxiliary-fermion mean-field calculations show that this behaviour is inconsistent with a fully screened Kondo lattice, and suggests a ground state with magnetic order mediated by conduction electrons.

These results, i.e., the manifestation of magnetic coherence in TMD-based 2D Kondo lattices enables the exploration of magnetic quantum criticality, Kondo breakdown transitions and unconventional superconductivity in the strict two-dimensional limit, phenomena that remain a great challenge in the field.

DIPC HIGHLIGHT 2023

Real-space observation of ultra-confined in-plane anisotropic acoustic THz plasmon polaritons

Chen S, Leng PL, Konecna A, Modin E, Gutierrez-Amigo M, Vicentini E, Martin-Garcia B, Barra-Burillo M, Niehues I, Maciel-Escudero C, Xie XY, Hueso LE, Artacho E, Aizpurua J, Errea I, Vergniory MG, Chuvilin A, Xiu FX, and Hillenbrand R
Nature Materials 22, 860 (2023)

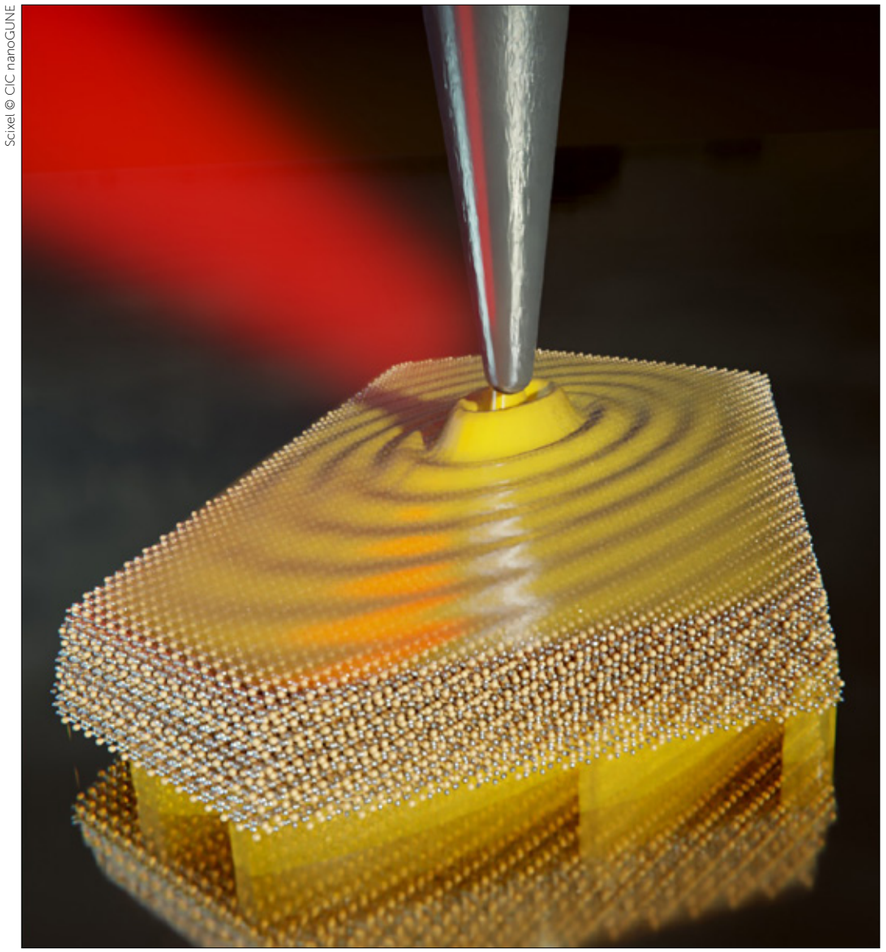
Polaritons are hybrid states of light and matter that arise from the coupling of light with matter excitations. Plasmon and phonon polaritons are among the most prominent examples, formed by the coupling of light to collective electron oscillations and crystal lattice vibrations, respectively. They play a crucial role in various applications, from sub-diffraction optical spectroscopy and ultrasensitive chemical sensors to ultracompact modulators for communication applications. In thin layers, polaritons can propagate with wavelengths up to 100 times shorter than the corresponding photon wavelength, allowing for manipulation of light on a much smaller scale than previously possible with conventional photonic devices. While most of these ultra-confined polaritons have been observed in form of phonon polaritons in the mid-infrared spectral range, plasmon polaritons can exist in much broader spectral ranges, including THz frequencies.

An international team at CIC nanoGUNE in collaboration with researchers from DIPC and other institutions in the Basque Country, as well as in China, Germany and Czech Republic, have studied thin platelets of the low-symmetry crystal silver telluride (Ag_2Te; Hessite) and obtained the first real-space images of THz plasmon polaritons, whose wavelengths are up to 65 times reduced compared to the photon wavelength and vary with the propagation direction. Silver telluride is a narrow bandgap semiconductor with a relatively high mobile electron concentration, which makes this material plasmonic at THz frequencies. Because of the low-symmetry monoclinic crystal structure, the effective electron mass is strongly anisotropic along the platelet surface, which explains the anisotropic plasmon polariton propagation. The researchers also demonstrated that the relative propagation lengths of the THz polaritons can be significantly increased by coupling them with their mirror image in an adjacent metal substrate. Furthermore, the long relative propagation lengths of the elliptical acoustic plasmon polaritons finally allowed the researchers to determine the in-plane anisotropic effective electron mass, establishing a unique method for the nanoscale measurement of directional effective carrier masses at room temperature.

Beyond exploring fundamental materials properties in conventional and novel quantum materials, ultra-confined in-plane anisotropic acoustic plasmon polaritons may lead to ultra-compact on-chip THz applications. The strong field concentration in the gap between the polaritonic layer and metal surface may be exploited for field-enhanced molecular sensing or for boosting (ultra)strong THz light–matter coupling with molecules, classical 2D electron gases or quantum materials.

Propagation of elliptical acoustic plasmons offer a unique method for nanoscale measurement of directional effective carrier masses at room temperature

Scixel © CIC nanoGUNE



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.

DIPC HIGHLIGHT 2023

Multiple and spectrally robust photonic magic angles in reconfigurable α-MoO_3 trilayers

Duan J, Alvarez-Perez G, Lanza C, Voronin K, Tresguerres-Mata AIF, Capote-Robayna C, Alvarez-Cuervo J, Martin-Luengo AT, Martin-Sanchez J, Volkov VS, Nikitin AY, and Alonso-Gonzalez P
Nature Materials 22, 867 (2023)

Tailoring the propagation of nanoscale electromagnetic waves is intriguing as it allows the manipulation of optical properties and energy at confined length scales. In this regard, an international team, led by the DIPC and University of Oviedo, demonstrates the possibility of channeling light at the nanoscale along any direction and on demand. Namely, by twisting three layers of α-phase molybdenum trioxide (α-MoO_3), the team could achieve broadband and reconfigurable canalization — diffractionless propagation — of infrared light at the nanoscale. The potential applications of this reconfigurable nanolight canalization in twisted α-MoO_3 trilayers are extensive, offering new possibilities for developing advanced nanophotonic devices with broadband and reconfigurable functionalities.

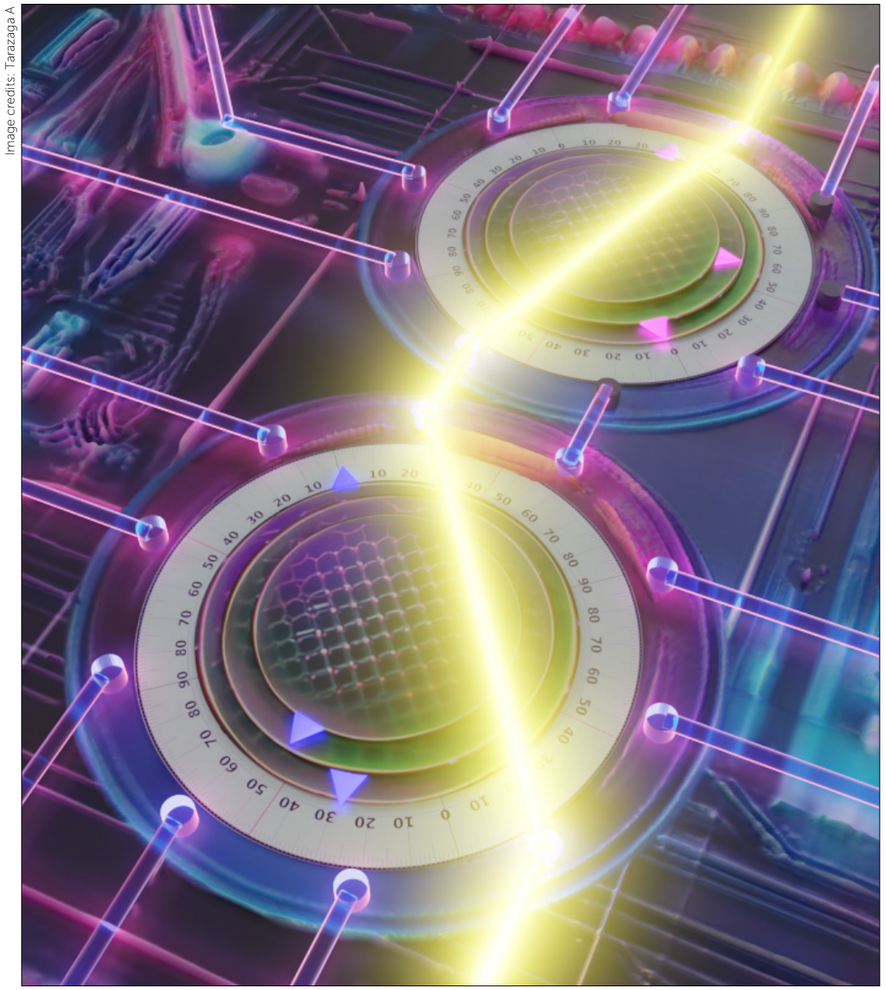
In their experiments, the scientists stacked three layers of MoO_3 and repeatedly adjusted the twist angles by disassembling and reassembling the resulting trilayers. By exciting light using a nanoscale gold rod as an optical emitter, they successfully controlled highly focused light according to their desired specifications, precisely varying the twist angles. The team made a fascinating discovery: while twisted bilayers possess only one specific angle that gives rise to canalization effects, twisted trilayers exhibit multiple magic angles for each layer. Using these three thin layers, nanolight can be guided and steered at will along any direction on the surface of the layers. What's even more intriguing is that these magic angles exist across a wide energy range, meaning that nanolight can be canalized at many different frequencies, which is key for the technological application of this optical phenomenon.

The visualization of on-demand propagation of nanolight in a broadband spectral range using twisted trilayers was truly unexpected. Adding a third layer to these systems seems to have deeper implications than one might initially think. Multiple and robust photonic magic angles in twisted trilayers allow us to manipulate the flow of light at the nanoscale like never before. The ability to arbitrarily change the canalization direction without assembling a new structure, but only slightly rotating the top layer brings twistoptics to the next level.

This breakthrough has opened up new possibilities for manipulating and harnessing light in nanoscale devices and applications. The robust broadband light canalization can be potentially used in the development of the next generation ultra-compact optical circuits, as well as in other applications such as biosensing, heat management and communication technologies.

Researchers enable a twist for nanolight

Image credits: Tarazaga A.



An artistic representation of an on-chip optical twisting device. Rotatable elements consist of twisted multilayers and can collimate light into extremely narrow (nanoscale) beams and redirect them along different waveguides.

Exotic nanolight wavefronts are shaped into a “virtual” waveguide

DIPC HIGHLIGHT 2023

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

Trivini S, Ortuzar J, Vaxevani K, Li J, Bergeret FS, Cazalilla MA, and Pascual JI
Physical Review Letters 130, 136004 (2023)

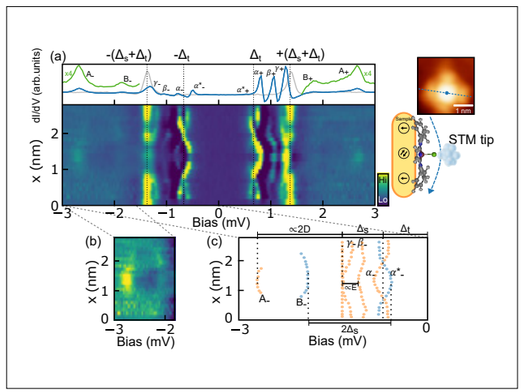
The development of superconducting devices was greatly stimulated after the acceptance of BCS theory proposed in 1957 by John Bardeen, Leon Cooper and Robert Schrieffer.

The basic idea of BCS is that electrons do not propagate as independent waves in a crystal. Instead, they pair up in bosonic-like Cooper pairs, which undergo Bose-Einstein condensation. A Bose-Einstein condensate is characterized by a macroscopic wavefunction, that is, a single complex function describing ~ 1022 Cooper pairs per cubic centimeter. Because of its collective nature, the electron condensate acquires emergent properties akin to the rigidity found in other ordered states of matter such as crystals. The coherent behavior of the condensate turns superconductors into an ideal platform for testing quantum coherent dynamics of many-body states and exploring their potential for quantum technologies such as qubits.

Cooper pairs require a minimum energy to be broken equal to twice the pairing gap. Breaking a Cooper pair results in a pair of "Bogoliubov" quasi-particles. Each quasi-particle is a quantum superposition of an electron and its absence (a hole). A pair of quasi-particles can be created by the absorption of a single (microwave) photon with energy larger than twice the pairing gap. In bulk superconductors, pairs of Bogoliubov excitations form a continuum and suffer from the effects of electron-electron interaction and disorder, which makes their lifetime rather short. In our work, we have found a way to produce a pair of two such quasi-particles with a long lifetime so that its existence can be detected using the scanning tunneling microscope (STM). To this end, we have used a normal/superconductor heterostructure: When a thin normal metal layer (made of gold in our case) is deposited on top of conventional superconductor (e.g. vanadium), the suppression of superconductivity in normal metal leads to confinement of Bogoliubov quasi-particle at the normal metal/superconductor interface, as first described by de Gennes and Saint-James in the mid 1960s.

Interestingly, by letting such confined quasi-particles scatter off a magnetic Fe-porphyrin molecule deposited on the surface of the gold layer, we have shown that it is possible to excite a pair of long-lived Bogoliubov quasi-particles and reveal an important property of the ground state the magnetic molecule in a superconducting substrate. Indeed, the magnetic molecule localizes one quasi-particle in its neighborhood when the magnetic moment of the impurity is sufficiently strongly coupled. The strength of the magnetic interaction can be tuned and probed by the tip of the STM. When the tip is away from the center of the molecule, its magnetic moment interacts strongly with the superconducting substrate and captures one quasi-particle with opposite spin, leading to the formation of a complex many-body state known as 'Kondo singlet". If this 'marriage' of the magneti impurity and a Bogoliubov quasi-particle is perturbed by an electron that tunnels from STM, the Kondo singlet can be broken to yield an excited quantum state where the magnetic impurity spin is free and a pair of Bogoliubov quasi-particles localized at the normal/superconductor interface is created. The signal of this double excitation appears as a distinctive peak in the spectrum of excitations measured by the STM (see Figure). Moreover, this signal also reveals important information about the fermion parity of the ground state: Since the superconductor ground state is a condensate of Cooper pairs, the addition or removal of a pair does not alter the properties of the condensate. However, the addition or removal of a single electron does as it changes the parity of the ground state from even to odd. The ground state of a strongly interacting magnetic impurity in a superconductor has odd parity as one quasi-particle needs to be added to the condensate of Cooper pairs in order to form the Kondo singlet. Thus, the excitation of the pair of quasi-particles is only possible when the parity of the ground state is odd. In our experiment we have shown that the signal of the pair of quasi-particles as a `detector' of the parity of the ground state. The detection of the ground state parity and the two quasi-particle states opens up a venue for the creation of new types of quantum detectors and for the manipulation of such quantum states for quantum information storage and processing. This is also a novel route for addressing pair excitations on a proximitized superconductor that unravels the true quantum nature of magnetic impurities on superconductors.

The detection of the ground state parity and the two quasi-particle states opens up a venue for the creation of new types of quantum detectors



a) Map of differential conductance spectra measured across a Fe-porphyrin molecule (sketched on the right) acquired using an STM. The spectrum on top is measured over the center. b) Zoom of the extragap spectral region to highlight signals A and B. B is the peak corresponding to the excitation of state with two Bogoliubov quasi-particles localized at the normal/superconductor interface. It is only present when the parity of the ground state is odd. The peak A corresponds (roughly) to an "internal" excitation of the impurity spin and it appears when the parity of the ground state is even. c) Energy position of peaks at negative bias voltage extracted from the line profile.

DIPC HIGHLIGHT 2023

Fermi arc reconstruction in synthetic photonic lattice

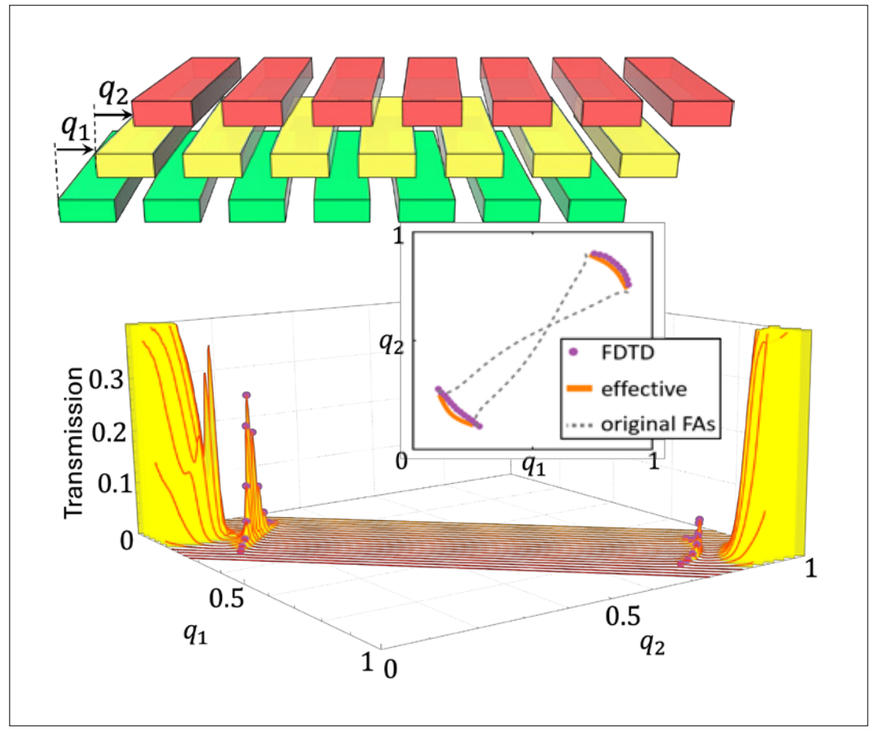
Nguyen DHM, Devescovi C, Nguyen DX, Nguyen NS, and Bercioux D
Physical Review Letters 131, 053602 (2023)

In 1929, Hermann Weyl discovered a massless fermion within the Dirac equation, later termed the Weyl fermion. Almost a century afterward, Weyl fermions have been recently demonstrated in condensed matter systems known as Weyl semimetals (WSMs).

Moreover, Weyl semimetals have also been realized in photonic and phononic systems with potential applications, such as generating optical vortex beams and robust transport in the bulk medium. One of the well-known signatures of Weyl semimetal is the appearance of the Fermi-arc surface states, which are chiral modes propagating unidirectionally on WSM surfaces and are topologically protected against disorder and defects. Intriguingly, at the interface of two Weyl semimetals, these Fermi arcs have been theorized to hybridize and alter their connectivity, featuring an avoided-crossing characteristic. Such a reconstruction of the Fermi arcs is predicted to give rise to new quantum transport phenomena. Nonetheless, directly observing the interface states between two three-dimensional crystals is immensely challenging, and fabricating such an interface is equally difficult. As a result, there is yet a practical configuration for observing Fermi Arc reconstruction.

Now, an international collaboration composed of researchers from DIPC - Duy Hoang Minh Nguyen, Chiara Devescovi, Dario Bercioux - and from other institutions in France and Korea has suggested utilizing a synthetic photonic crystal to observe the Fermi Arc reconstruction with light. The physical design is simple, consisting of three layers of photonic grating. The relative shifts between neighboring layers act as two synthetic momenta. This configuration mimics 3D crystals without time-reversal symmetry, encompassing Weyl semimetal, nodal line semimetal, and Chern insulator. The phase transition from Weyl semimetal to Chern insulator at telecom wavelengths is nicely demonstrated, with a perfect agreement between finite-difference time-domain simulations and analytical effective theory. Most importantly, by analyzing the transmission spectrum of the system, the researchers confirmed the Fermi Arc reconstruction for the first time in a realistic and practical system.

Their discoveries assertively lay the foundation for delving into the realms of physics in higher dimensions, such as the 4D quantum Hall effect and the 5D Weyl semimetal, in addition to novel phases of non-Hermitian topologies.



A sketch of the trilayer photonic lattice with two synthetic momenta, and its transmission spectrum demonstrating the reconstruction of the interfacial Fermi arcs.

The discoveries assertively lay the foundation for delving into the realms of physics in higher dimensions, such as the four-dimensional quantum Hall effect and the five-dimensional Weyl semimetal

DIPC HIGHLIGHT 2023

Strain-induced quasi-1D channels in twisted moiré lattices

Sinner A, Pantaleon PA, and Guinea F
Physical Review Letters 131, 166402 (2023)

A number of recent experiments conducted on bilayers of graphene and transition metal dichalcogenides have revealed the emergence of unusual one-dimensional moiré channels, typically attributed to stacking defects and impurities within the sample. In the highlighted work, Andreas Sinner, Pierre Pantaleón, and Francisco Guinea investigated the combined effects of twist and strain in moiré systems composed of honeycomb lattices.

They elucidated the formation of almost perfect one-dimensional moiré patterns in bilayer systems, attributing their emergence to the interplay between twist and strain, which leads to collapse of the reciprocal space unit cell. They discovered a simple relation between the two quantities and the material-specific Poisson ratio, which formulates a criterion for such collapse. Their findings are universally applicable to any hexagonal twisted moiré pattern and can be readily extended to other geometries.

A right relation between twist and strain in bilayers of honeycomb lattices gives rise to moiré patterns with different geometries. In a twisted honeycomb bilayer, the Brillouin zone has the form of a perfect honeycomb cell. With increasing strain, it gets deformed and elongated in a selected direction, until it collapses to a line at some critical value. Crucially, the selected direction turns out to be determined only by the Poisson ratio of the underlying honeycomb lattices.

In real space, the situation becomes even more intriguing, though. With increasing strain, the initially perfect honeycomb unit cell also becomes deformed and elongated. Near the critical strain, a set of one-dimensional channels begins to appear. At precisely the critical strain, almost perfect quasi-periodic one-dimensional channels emerge. Here, the material's properties are determined by a unit cell that diverges in one direction and by combinations of non-commensurate periodicities in the other direction.

Experimentally, such channels have been seen in virtually every bilayer of honeycomb lattices. The electronic structure in the one-dimensional regime is characterized by an interplay between two different, typically incommensurate, periodicities, suggesting parallels to the physics of the Harper equation of integer quantum Hall effect and one-dimensional quasicrystals.

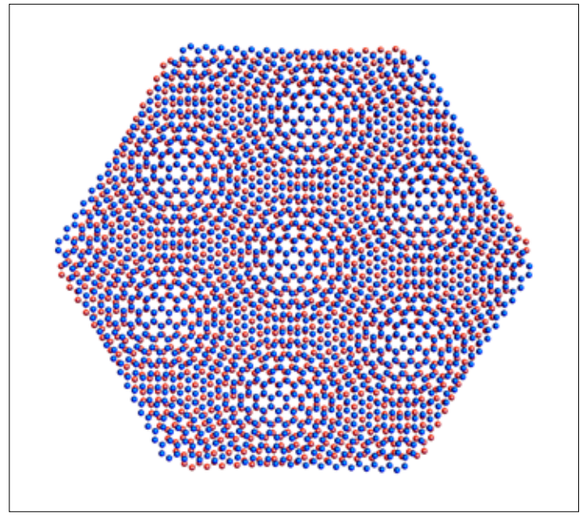


Figure 1 The twisted bilayer honeycomb lattice has a perfect hexagonal moiré unit cell, where the moiré patterns have a simple triangular periodicity. In the figure the underlying honeycomb lattices are stacked atop one another in what is referred to as the AA stack configuration, which is particularly well expressed in the center of each unit cell.

Exploration of twist and strain effects in bilayer honeycomb lattices elucidates the formation of perfect one-dimensional moiré patterns

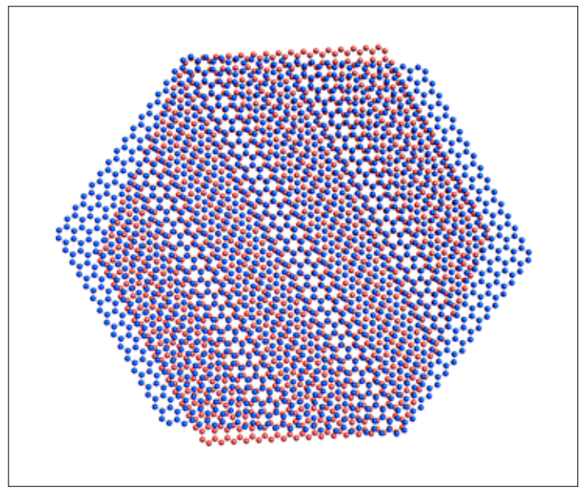


Figure 2 The twisted bilayer honeycomb lattice at critical strain. The AA sites in both honeycomb lattices form quasi-periodic one-dimensional channels. In graphene bilayers, this pattern can be created combining small twist angles and moderate strains.

DIPC HIGHLIGHT 2023

Symmetric Kondo lattice states in doped strained twisted bilayer graphene

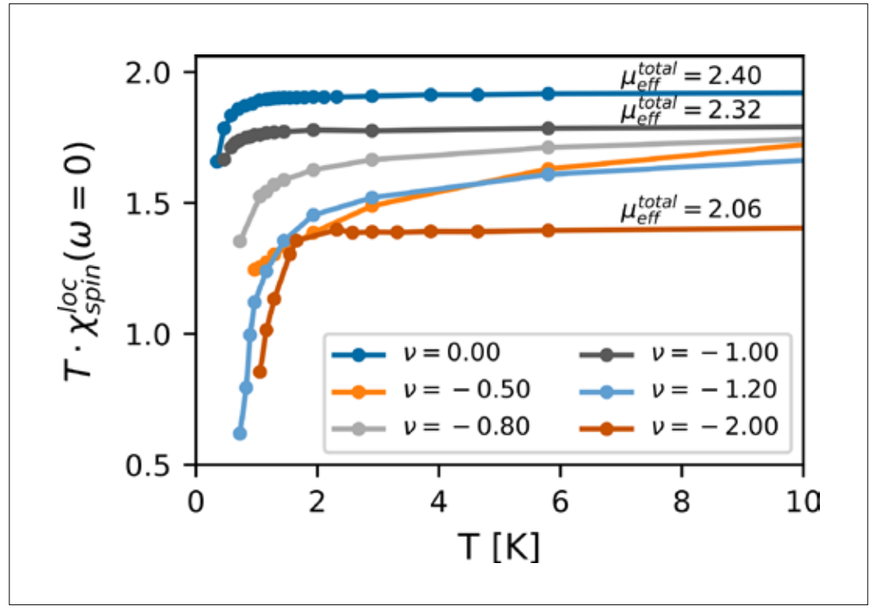
Hu H, Rai G, Crippa L, Herzog-Arbeitman J, Calugaru D, Wehling T, Sangiovanni G, Valenti R, Tsvelik AM, and Bernevig BA
Physics Review Letters 131, 166501 (2023)

We study the emergence of the Kondo effect in twisted bilayer graphene. Our DMFT and large-N calculations show that the Kondo effect is irrelevant at integer fillings, leading to long-range ordered states. However, at non-integer fillings, the Kondo effect gives rise to a correlated Fermi-liquid phase. We also analyze the spin susceptibility, observing Curie-Weiss behavior at integer fillings down to very low temperatures, while at non-integer fillings, we observe deviations from Curie-Weiss behavior at relatively high temperatures, indicating the onset of the Kondo effect.

The experiments on magic-angle twisted bilayer graphene (MATBG) have established the existence of a variety of quantum phases, including correlated insulating phases and superconductivity. Despite these significant experimental advances, a comprehensive and systematic theoretical understanding of MATBG's behavior remains elusive. This work aims to bridge this gap by investigating the correlation effects in MATBG through the topological heavy-fermion models.

Our study focuses on the development and manifestation of the Kondo effect, a phenomenon that denotes the screening of local moment fluctuations by the conduction electrons. Utilizing advanced theoretical techniques such as dynamical mean-field theory (DMFT) and large-N calculations, we investigate the intricate behavior of MATBG at both integer and non-integer fillings. Our calculations indicate that the Kondo effect is irrelevant at integer fillings, leading to long-range ordered states. At non-integer fillings, the Kondo effect becomes relevant and gives rise to a correlated Fermi-liquid phase. Furthermore, our analysis extends to the spin susceptibility of the system at various fillings. At integer fillings, we observe a distinct Curie-Weiss behavior that persists down to very low temperatures due to the fluctuating local moments. In contrast, at non-integer fillings, we observe deviations from the Curie-Weiss behavior at relatively high temperatures, signaling the onset of the Kondo effect and the formation of a correlated Fermi-liquid phase. In addition, we explore the impact of a C_{3z}-rotational-symmetry-breaking strain on the system's behavior using mean-field approaches. We find that a sufficiently large strain can destroy the long-range orders, and stabilize a symmetric Kondo state that only breaks the C_3 symmetry.

We provide a comprehensive understanding of the Kondo effect in MATBG, and offer valuable insights into the potential development of superconductivity from the Kondo phase



Temperature behaviors of spin susceptibility at various fillings.

Our results provide a natural explanation of the recent entropy experiments which reveal a high-temperature phase with fluctuating moments and a low-temperature Fermi liquid phase with unpolarized isospins. This could be understood as a sign of screening of the local moments and the development of the Kondo phase at low temperatures. Regarding the Kondo state, we have performed a systematic study of its band structure and topology, showing that the flat band in the Kondo phase belongs to a fragile topology.

In conclusion, our study provides a comprehensive understanding of the Kondo effect in MATBG, and offering valuable insights into the potential development of superconductivity from the Kondo phase. By unraveling the complex behavior of MATBG, we contribute to the broader understanding of quantum materials and pave the way for future experimental validations.

Search for a nonrelativistic boson in two-body antimuon decay

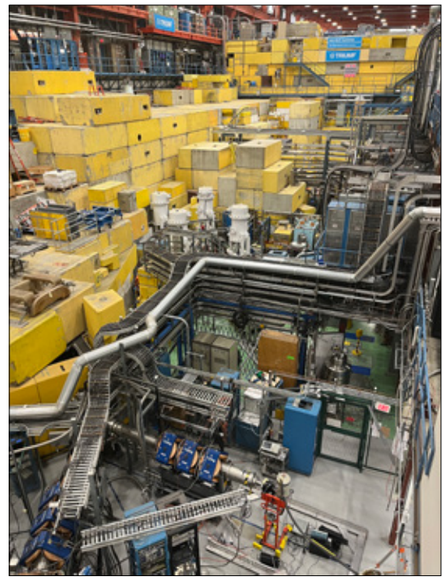
Collar JI, Cooper PS, and Lewis CM
Physical Review Letters 131, 241802 (2023)

A compact new detector exposed to a particle beam at Canada's TRIUMF cyclotron facility has explored, for the first time, the possibility that new exotic particles originating in the decay of the antimuon might be emitted with non-relativistic speeds. Slow-moving particles like those sought by this experiment can be gravitationally bound to stars and galaxies, possibly playing a role in explaining long-standing cosmological puzzles like the 511 keV gamma emission from the center of the Milky Way observed by the INTEGRAL satellite. The work described in this Letter departs from the standard approach in high-energy accelerator experiments, by concentrating its attention on the extraction of the weakest possible signals left in the detector.

Scientists from DIPC, University of Chicago and Fermi National Accelerator Laboratory received support from the US National Science Foundation program 20-127, which encourages interdisciplinary research aimed at developing new small-scale experiments and techniques that can complement large experimental particle physics facilities.

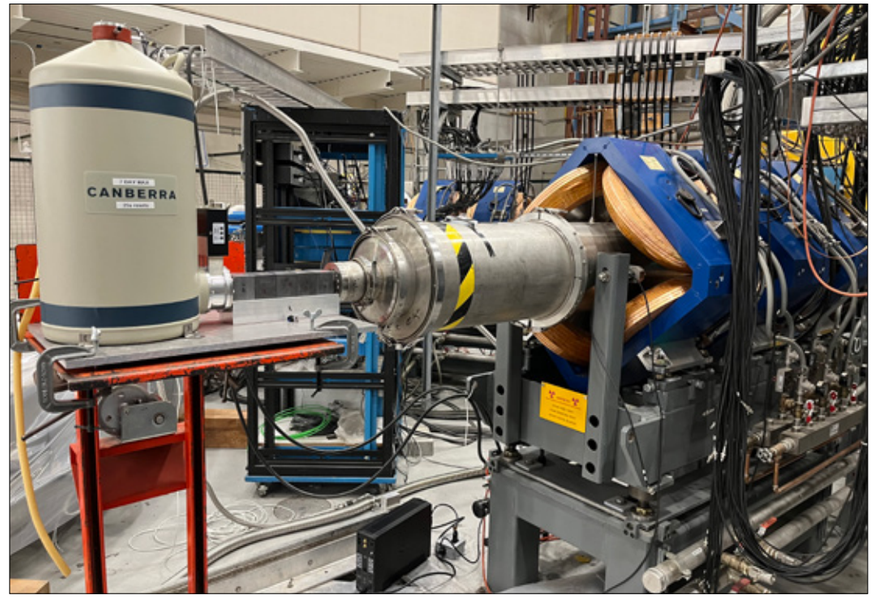
The strongest present evidence for the incompleteness of the standard model (SM) arises from the observation of lepton-flavor violation in the neutrino sector, manifested through the phenomenon of neutrino oscillations. This neutral-particle precedent guarantees the eventual appearance of charged lepton-flavor violation (CLFV). CLFV detection is within reach according to some favorable phenomenological perspectives.

In this paper the authors report the feasibility of probing the charged lepton-flavor-violating decay $\mu^+ \rightarrow e^+X^0$ for the presence of a slow-moving neutral boson X^0 capable of undergoing gravitational binding to large structures and, as such, able to participate in some cosmological scenarios. A short exposure to surface antimuons from beam line M20 at TRIUMF generates a branching ratio limit of $\lesssim 10^{-5}$. This is comparable to or better than previous searches for this channel, although in a thus-far-unexplored region of X0 phase space very close to the kinematic limit of the decay, where m_{X^0} approaches m_{μ^+}. The future improved sensitivity of the method using a customized p-type point-contact germanium detector is also described. The emergence of detector technologies with sensitivity to lower energies and improved resolution invites a shift of emphasis in particle-decay searches for massive neutral bosons. The kinematic limit of these reactions remains an unexplored realm where cosmologically relevant particles may lie in wait.



Tabletop accelerator experiment looks for slow-moving new particles at Canada's TRIUMF cyclotron facility

A small orange platform supports tabletop experiment S2129 amid the TRIUMF accelerator complex. The cyclotron monolith is visible in the background, beamline M20 is in front of the mentioned platform, supporting this comparatively tiny experiment.



Tabletop experiment apparatus. Surface μ^+ are stopped in a 0.25 cm3 n-type germanium detector. A trigger is provided by an ultrathin muon telescope. The device fits on a 60 cm x 30 cm tray, and it weighs less than 50 kg.

DIPC HIGHLIGHT 2023

Particle physics at the European Spallation Source

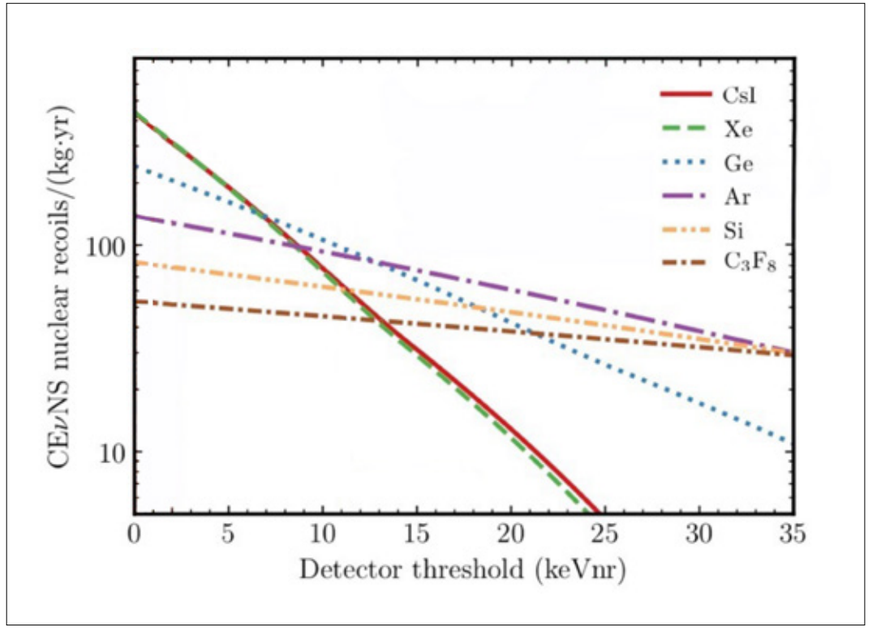
Abele H, Collar J, Monrabal F, Gomez-Cadenas JJ, Larizgoitia L, Lewis CM, Simon A, et al
Physics Reports 1, 1023 (2023)

This paper describes a series of different physics oportunities at the European Spallation Source (ESS). In this text we'll focus on the Coherent Elastic Neutrino-Nucleus Scattering (CEνNS) section, which is the one lead by DIPC.

Coherent Elastic Neutrino-Nucleus Scattering is the neutrino interaction process with largest cross section being the most probable mechanism for low-energy neutrino interaction. This process involves the coherent participation of nucleons, leading to a coupling proportional to the square of the number of neutrons in the target nucleus. Despite its relatively large cross section and being theoretically predicted four decades ago, CEνNS remained undetected until recently mostly because the very low energy deposition of this kind of interaction in any detector and also the limited intensity of available neutrino sources in the favourable energy range (below the coherence condition is lost).

The CEνNS is relevant for a large number of physics cases such as Dark Matter, Supernova explosions and, obviously, neutrino interactions and neutrino properties. In this direction, CEνNS measurements promise to improve our knowledge in these areas, providing new opportunities for revealing physics beyond the Standard Model.

In this work, researchers propose the use of three different technologies for the detection of these process. The first is based on monolithic, ultra-low noise Germanium diodes, a mature technology which can result in ultra-sensitive measurements. The second, uses undoped CsI scintillation crystals at cryogenic temperature (80K), and aims to reduce the energy threshold by at least a factor of five with the corresponding increase in statistics and sensitivity to new neutrino physics. The third technology proposed is based on the use of noble gases TPCs. These detectors also offer a very low energy threshold and add the benefit of allowing for an easy exchange of the active gas, thus permitting different measurements with the same set-up. The combination of the three highly-complementary and yet distinct technologies may be able to provide robust independent confirmation for any subtle signatures of new physics that might be found in one of them.



Expected integrated CEνNS rate above nuclear recoil threshold, 20 m away from the ESS target, for all detector materials considered in this work. All technologies considered for use at the ESS have thresholds at or below 1 keVnr.

Researchers propose three highly-complementary and yet distinct technologies that may be able to provide robust independent confirmation for any subtle signatures of new physics that might be found in one of them

DIPC HIGHLIGHT 2023

A magnified compact galaxy at redshift 9.51 with strong nebular emission lines

Williams H, Kelly PL, Chen W, Brammer G, Zitrin A, Treu T, Scarlata C, Koekemoer AM, Oguri M, Lin YH, Diego JM, Nonino M, Hjorth J, Langeroodi D, Broadhurst T, Rogers N, Perez-Fournon I, Foley RJ, Jha S, Filippenko AV, Strolger L, Pierel J, Poidevin F, and Yang L
Science 380, 416 (2023)

The expansion of the universe causes the light from distant galaxies to be redshifted to longer wavelengths. Candidate distant galaxies can be identified using imaging, but confirming their redshift requires spectroscopy. Broadhurst et al. used near-infrared imaging and spectroscopy to identify a galaxy at redshift 9.5, corresponding to about 500 million years after the Big Bang. Little is known about galaxies at that early time. Emission lines in the spectrum allowed the authors to determine some of the galaxy's physical properties, such as its abundance of elements heavier than helium, and they found that it is very compact and has a high density of star formation.

A serendipitous discovery by our James Webb Space Telescope (JWST) team of the most distant galaxy found to date where the estimation of the distance is 100% reliable, because we have been able to recognise distinct elements in the spectrum of this galaxy measured by JWST coming from hot gas that includes, hydrogen, carbon, oxygen and neon.

The James Webb telescope can observe a wide enough field to image an entire galaxy cluster at once. The researchers were able to find and study this new, tiny galaxy because of a phenomenon called gravitational lensing—where mass, such as that in a galaxy or galaxy cluster, bends and magnifies light. A galaxy cluster lens caused this small background galaxy to appear 20 times brighter than it would if the cluster were not magnifying its light.

By analyzing the spectra of several galaxies in the distant universe, the team was also able to confirm the detection of the most distant dwarf galaxy found to date. This very distant, young galaxy is one of the first galaxies to have formed only 500 million years after the Big Bang, when the volume of the universe was about one thousand times smaller in volume that it is today, which means the spectral lines of the elements we have identified are redshifted a tenfold expansion of the universe between now when detect it with JWST and 13 billion years ago when the light was emitted. We can also measure the size of this galaxy finding it to be a very small "dwarf" galaxy thanks to the high resolution of the James Webb telescope (JWST) combined with the high magnification by a massive foreground galaxy cluster that magnifies like a giant lens, forming three nearly identical images of this galaxy. This work has involved interpreting the spectrum and estimating the amplification of this galaxy by using a model of the gravitational field of the large cluster of galaxies acting as a lens in this case.

This galaxy was not our primary target, but fortunately it appeared in the images obtained with the James Webb. This serendipitous discovery says galaxies forming in the early universe were typically vey small indicating a hierarchical process of evolution merges such galaxies together by their mutual gravity, leading over time to the formation of massive galaxies like our own Milky Way.

By analyzing the spectra of several galaxies in the distant universe, the team was also able to confirm the detection of the most distant dwarf galaxy found to date

ESA/Webb, NASA and CSA, Kelly P

The team looked more than 13 billion years into the past to discover a very low-brightness dwarf galaxy that could help astronomers learn more about galaxies that were present shortly after the Big Bang. The 3 circles in the colour image are the 3 images of the distant galaxy lensed by the cluster of bright galaxies in the foreground.

DIPC HIGHLIGHT 2023

An atomic-scale multi-qubit platform

Wang Y, Chen Y, Bui HT, Wolf C, Haze M, Mier C, Kim J, Choi DJ, Lutz CP, Bae Y, Phark SH, and Heinrich AJ
Science 382, 87 (2023)

An international research team has presented a new quantum platform based on the electron spin of single atoms on a solid surface, achieving a 'multiple qubit (quantum bit)' system using three electron spins. Unlike previous atomic quantum devices on surfaces where only a single qubit could be controlled, the researchers have successfully demonstrated the ability to control multiple qubits simultaneously, enabling the application of single-, two-, and three-qubit gates.

The fundamental unit for information storage and computation in computers is the bit, which can have a value of either 0 or 1. In contrast, quantum computers operate with qubits as their fundamental unit, which can perform computations in a superposition of 0 and 1 states, meaning that they can exist simultaneously in both states, like the paradox of the Schrödinger's cat. This capacity results in significantly enhancing the performance in terms of information storage and processing speed compared to classical computers.

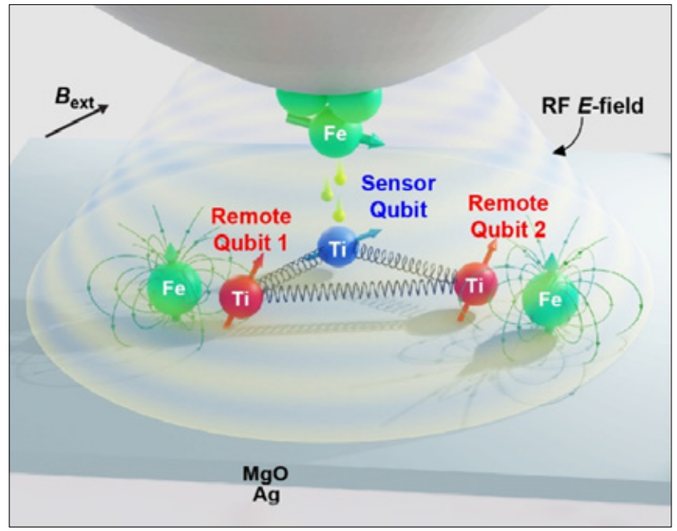
To commercialize quantum computers, various types of qubits have been proposed using superconducting junctions, ion traps, quantum dots, and quantum phase states. However, due to the relatively short history of quantum information science, the challenge to design an optimal qubit system is still on. For decades, scientists have aspired to construct a quantum-coherent architecture at the atomic scale, a realm where the fundamental properties of atoms, like electron spin, holds its way. Such an achievement could revolutionize quantum science and nanotechnology. Yet, building an atomic-scale quantum architecture, capable of precise assembly, controlled coupling, and coherent operation of multiple electron-spin qubits, has remained an extraordinary challenge.

In fact, there is a need for fundamental scientific research to implement a new quantum platform that addresses the shortcomings of existing qubits while increasing their integration and reliability.

Using a scanning tunneling microscopy (STM) has proven very useful to measure and control the electronic states of individual atoms, exploiting quantum mechanical phenomena. In this work, combining STM and ESR (electron spin resonance) technology, projecting microwave pulses onto individual titanium atoms on the surface leads to successfully controlling and measuring the spin states. As a result, precise control of the spin of a single atom and setting it to the desired quantum state became possible. The remaining challenge was to implement a multi-qubit system capable of controlling several qubits simultaneously. The qubit platform presented in this work consists of multiple titanium atoms placed on the surface of a thin insulator (magnesium oxide) and has succeeded in the challenge.

The researchers used the probing of a STM precisely manipulating the positions of each atom, creating a structure of multiple titanium atoms where their spins can interact [see Figure]. Subsequently, they applied a remote control method to the titanium atom that serves as a sensor (sensor qubit) and successfully controlled and measured multiple qubits (remote qubits) placed at a distance with a single probe.

Since each remote qubit interacts with the sensor qubit, changes in the spin state of the remote qubits affect the sensor qubit, and this change is read through the probe. The researchers also implemented the fundamental operations of quantum information processing, 'CNOT' (Controlled NOT gate) and 'Toffoli' gates, using this qubit platform. The research was conducted at a temperature of 0.4K (-272.6°C).



Three-Dimensional Model of a Single-Atom Electron Spin Qubit. The three qubits are all composed of titanium atoms located on the surface of a magnesium oxide substrate. They consist of one sensor qubit positioned beneath the STM (Scanning Tunneling Microscope) probe and two remote qubits positioned away from the probe. The precise interaction between these three qubits is designed through the manipulation of atomic positions using the STM probe. The quantum state of the sensor qubit is controlled by a high-frequency voltage applied between the probe and the substrate, combined with the inhomogeneous magnetic field generated by the magnetized probe. Each iron atom provides the necessary inhomogeneous magnetic field to control the quantum state of the surrounding remote qubits in place of the probe.

Precise control of the spin of a single atom and setting it to the desired quantum state became possible

"Manipulating multiple qubits remotely at the atomic level is truly remarkable," said one of the researchers. "Until now, we could only control a single qubit on the surface, but through this research, we have made a significant leap in implementing multiple qubit systems at the atomic level."

The platform introduced in this study has the advantage of precise control of information exchange between qubits at the atomic level. It is also distinctive from existing qubit platforms because it can implement quantum integrated circuits with individual qubits smaller than 1nm. Additionally, unlike other platforms that require specific materials (superconducting junction qubits), it allows for the selection of various atoms as qubit materials beyond titanium.

As for the future implementation and application of these results, applying the implemented qubit system for practical quantum information processing, will require to secure a sufficiently long operation time to perform various quantum operations continuously while increasing the number of qubits. Using the method introduced in this research, it is expected that up to 5-6 qubits could be connected and operated, but further research is needed to develop a platform that could control more than 10 qubits simultaneously by improving the connections and measurement methods between qubits.

DIPC HIGHLIGHT 2023

Overmassive black holes in dwarf galaxies out to z ~ 0.9 in the VIPERS survey

Mezcua M, Siudek M, Suh H, Valiante R, Spinoso D, and Bonoli S
The Astrophysical Journal Letters 943, L5 (2023)

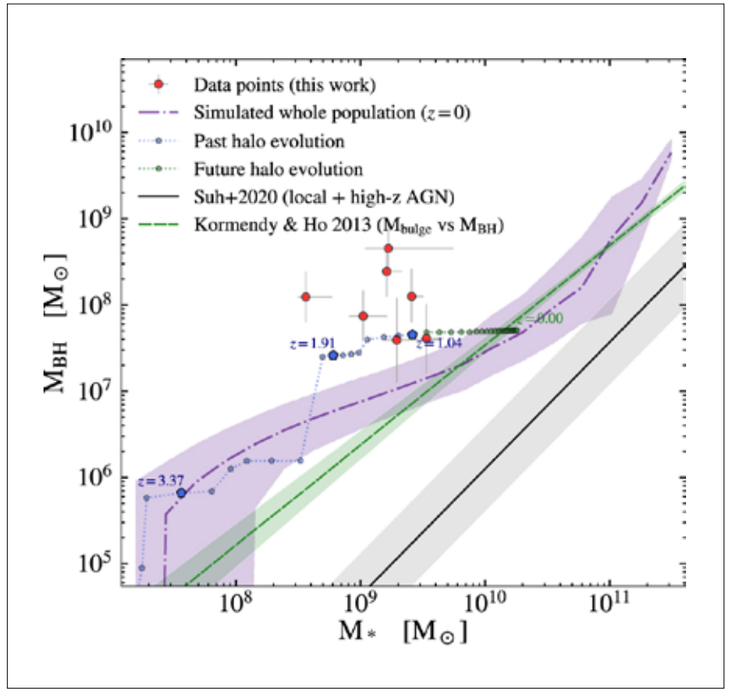
Strong observational evidences indicate that almost every massive galaxy in the universe hosts at its center a supermassive black hole, that is, a black hole with mass above one million times the one of the Sun. Moreover, the mass of these black holes correlates with the mass of the host galaxies, with larger black holes being hosted by larger galaxies, indicating a synchronized growth. The physical processes that lead to this synchronized growth and the origin (or "seeds") of these massive black holes is highly elusive and current speculations are based purely on theoretical arguments.

Black hole seeds are expected to have formed in the very early universe (at high redshifts, z > 10), when the universe was only few hundreds million years old, possibly via the direct collapse of primordial gas ("heavy seeds"), mergers in dense stellar clusters, or the death of the first generation of Population III stars ("light seeds"), among other possibilities.

The seed black holes that did not grow much through gas accretion in the past, could be today powering the active galactic nuclei found in local dwarf galaxies. But one thing is suspecting this is the case, and another, far from trivial, proving it. As it is, proving any connection between the early universe seed black holes and local supermassive black holes has been prevented by the scarce number of active galactic nuclei in dwarf galaxies. Massive black holes hosted in dwarf galaxies at intermediate redshifts (z~1, when the universe was half of its current age), on the other hand, may represent the evolved counterparts of the seeds formed at very early times and a bridge to link the present with the past.

The VIMOS Public Extragalactic Redshift Survey (VIPERS) is an ongoing Large Program to map in detail the large-scale distribution of galaxies at 0.5 < z < 1.2. Now, a team of researchers makes use of VIPERS data to identify active galactic nuclei in dwarf galaxies at $z \geq 0.4$ based on the detection of broad emission lines. This yields the detection of seven dwarf galaxies, for which the team derives black holes masses from 10 million to 400 million solar masses, indicative of overmassive black holes, that is, black holes that are more significantly massive than what expected.

The researchers performed semianalytical simulations to investigate the origin of these sources. They found that these objects are likely overmassive with respect to their hosts since early times (z > 4), independently of whether they formed as heavy or light seed black holes. In the simulations, these objects tend to grow faster than their host galaxies, contradicting models of synchronized growth. The results indicate that dwarf galaxies hosting overmassive black holes at high-z could be the progenitors of (at least one-third of) today's massive galaxies.



This figure shows the location of the "overmassive" black holes in the black hole mass- stellar mass plane (red dots) observed in the VIPERS survey. The green line indicates the relation between black hole and stellar mass observed in the local universe, and the purple one the one predicted by the simulations. Overmassive black holes are also found in the simulations, with the evolutionary track of one of them shown with the blue points.

The origin of the most massive black holes observed in the local universe is still unknown. Did they grow at the same rate as the galaxies in which they live? VIPERS observations indicate that there exist black holes that grew much faster than their host galaxies, challenging theories of synchronized growth

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1 **Theory of triangulene two-dimensional crystals.**
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2 **High-acoustic sensitivity radiopure piezoelectric materials for dark matter detection.**
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490 Femtosecond laser-induced desorption of hydrogen molecules from Ru(0001): a systematic study based on machine-learned potentials.
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Naskar S, Mujica V, and Herrmann C.
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495 Room-temperature C-C sigma-bond activation of biphenylene derivatives on Cu(111).
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Rodriguez-Fernandez A, Bonnet L, Larregaray P, and Muino RD.
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497 Chiral and catalytic effects of site-specific molecular adsorption.
Borca B, Michnowicz T, Aguilar-Galindo F, Petuya R, Pristl M, Schendel V, Pentegov I, Kraft U, Klauk H, Wahl P, et al.
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498 Steering on-surface reactions by kinetic and thermodynamic strategies.
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500 Unusual low-energy collective charge excitations in high-T_c cuprate superconductors.
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510 Effect of ferrocene on physicochemical properties of biochar extracted from windmill palm tree (*Trachycarpus Fortunei*).
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Waste and Biomass Valorization, 15, 1031 (2023)

DIPC Community

Pictured here is the DIPC Community
outside the headquarters in Donostia/San Sebastián.

Researchers

DIPC Associates

Javier Aizpurua Iriazabal CSIC
Maite Alducin Ochoa CSIC
Ignacio Arganda-Carreras UPV/EHU
Andrés Arnau Pino UPV/EHU
Emilio Artacho Cortés CIC nanoGUNE
Andrés Ayuela Fernández CSIC
Rolindes Balda de la Cruz UPV/EHU
Sara Barja Martínez UPV/EHU
Aitor Bergara Jauregi UPV/EHU
Sebastian Bergeret CSIC
María Blanco Rey UPV/EHU
Pedro Braña Coto CSIC
Tom J. Broadhurst UPV/EHU
Igor Campillo Santos Euskampus
Daniele Cangialosi CSIC
Silvina Cerveny CSIC
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Martina Corso CSIC
Fernando Cossio Mora UPV/EHU
David De Sancho Sánchez UPV/EHU
Nuno De Sousa Teixeira DIPC
Adolfo Del Campo Echevarría UNI.LU
Asier Eiguren Goyenetxea UPV/EHU
Ion Errea López UPV/EHU
Rubén Esteban Llorente CSIC
Francesca Ferlaino LFUI
Joaquín Fernández Rossier UPV/EHU
Felix Fernández Alonso CFM
Elena Formoso Estensoro UPV/EHU
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Dimas García de Oteyza Felderman CINN-CSIC-UNIOVI-PA
Vitaly Golovach CFM
Elton Gomes Dos Santos UoE
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Marek Grzelczak CSIC
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Iñaki Juaristi Oliden UPV/EHU
Stefan Kurth UPV/EHU
Aritz Leonardo Lizeranzu UPV/EHU
Xabier López Pestaña UPV/EHU
Nicolás Lorente Palacios CSIC
Jon Mattin Matxain Beraza UPV/EHU
José María Mercero Larraza UPV/EHU
Salvador Miret Artés IFF-CSIC
Gabriel Molina Terriza MPC
Álvaro Moreno UPV/EHU
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Enrique Ortega Conejero UPV/EHU
Mikhail Otrokov CFM
José Ignacio Pascual Chico CIC nanoGUNE
Juan Ignacio Pérez Iglesias UPV/EHU
José María Pitarke De la Torre UPV/EHU
Yuri Rakovich UPV/EHU
Daniel Reta Mañeru UPV/EHU
Elixabete Rezabal Astigarraga UPV/EHU
Enrique Rico Ortega UPV/EHU
Alberto Rivacoba Otxoa UPV/EHU
Celia Rogero Blanco CSIC
Jorge Sánchez Dolado CSIC
Daniel Sánchez Portal CSIC
Ane Sarasola Iñiguez UPV/EHU
Frederik Schiller CSIC
Gustavo Schwartz CSIC
Ivo Souza UPV/EHU
Eugene Tchulkov Savkin UPV/EHU
Ilya Tokatly UPV/EHU
Miquel Torrent Sucarrat UPV/EHU
Geza Toth UPV/EHU
Jesús Ugalde Uribe-Etxebarria UPV/EHU
Lucía Vitali UPV/EHU
Nerea Zabala Unzalu UPV/EHU

Ikerbasque Research Professors

Slawomir Grabowski
01/01/2012–Present
Hydrogen bonds in gas phase and crystals; quantum theory of atoms in molecules and natural bond orbitals approaches; intermolecular interactions as preliminary stages of chemical reactions.

Andreas Heidenreich
01/01/2012–Present
Computer simulations of nanoplasma formation, Coulom explosions and nuclear fusion induced by ultraintense and ultrashort laser pulses. Computer simulations of pump-probe signals.

Eugene Krasovskii
01/01/2012–Present
Electronic structure of surfaces and interfaces and computational spectroscopy: electron diffraction, angle and time-resolved photoemission, and dielectric response from first principles.

Mario Piris Silvera
01/01/2012–Present
Energy functional method development. Computational modelling of semiconductor nanocluster and molecular solid phases and polymorfism.

Vyacheslav Silkin
01/01/2012–Present
Ultrafast dynamics of the one-particle and collective electronic excitations in metals and their surfaces. The study of electronic excitations at adsorbates on metal surfaces.

Thomas Frederiksen
15/08/2012–Present
Nanoelectronics - theory and simulation.

Geza Giedke
01/09/2014–Present
Quantum systems and technologies.

Fabienne Barroso Bujans
01/02/2016–Present
Novel complex-shaped cyclic polymers, from synthesis to plysical properties. Devices and nanodevices based on cyclic polymers/graphene hybrid materials.

Luca Salassa
01/01/2017–Present
Development of photoactivatable anticancer metal complexes and nanomaterials. Experimental and computational inorganic photochemistry.

Denis Vyalykh
01/01/2017-Present
Photoemission measurements of magnetic surface states.

Juan José Gómez Cadenas
14/03/2018–Present
Experimental particle physics.

Román Orús Lacort
01/09/2018–Present
Quantum systems and technologies.

Miguel Ángel Cazalilla Gutiérrez
01/09/2020-Present
Investigation of the load and spin transport properties in low dimensional systems, highly correlated systems and superconductors. Quantum dissipation and non-balance effects.

Nathan John Bastian
01/03/2021–Present
Stellar population studies.

Juan Ignacio Collar Colmenero
23/11/2022–Present
Neutrino physics at the European Spallation Source.

Ronen Zangi
01/02/2023–Present
Computer Simulations of Biological and Chemical Systems. Statistical Mechanics of Finite Systems.

Miguel Moreno Ugeda
15/06/2023–Present
Low-temperature scanning tunneling microscopy and spectroscopy of two-dimensional materials and nanostructures.

Javier Aizpurua Iriazabal
01/12/2023–Present
Theory of nanophotonics.

Distinguished Researchers

Irina Sklyadneva
01/05/2003–Present
Electron-phonon coupling in the 3D topological isolators and Weil semiconductors as well as and in ultrathin lead and indium films on the Si substrate (superconductivity).

Albert Fert
01/01/2020–Present
Conversion between spin and charge currents at room temperature by Rashba or topological insulator interfaces, 2D magnets and perspective for low power spintronic devices.

George Fitzgerald Smoot
01/11/2020–Present
Measuring the sum of neutrino masses and properties, interpreting LIGO/Virgo events and testing the nature of Dark Matter.

Cheol Hwan Park
01/03/2022–28/02/2023
Topological, anomalous, and spin-Hall conductivities from effective field theory and first-principles calculations.

Roman Kuzian
01/07/2022–Present
Time-resolved photoemission from solids.

Anatolii V. Goncharenko
01/09/2022–Present
Plasmonics and nanooptics.

Francisco Guinea López
01/09/2022–Present
Two dimensional materials.

Tonica Valla
01/10/2022–Present
Condensed Matter Physics – Emergent Phenomena at Quantum Interfaces.

Maia García Vergniory
01/01/2023–Present
Prediction of new topological phases and materials.

Daniel Rubén Zerzión
01/03/2023–Present
Development and construction of the XeESS detector. Neutrino physics at the ESS.

Ikerbasque Research Associates

Arantzazu García Lekue
01/11/2017–31/12/2023
Modeling electron transport at the nanoscale. Theoretical investigation of electron processes at nanostructured surface.

Paola Ferrario
01/12/2017–31/12/2023
Naeutrino physics.

Alexey Nikitin
01/01/2018–Present
Nanophotonics of 2D materials.

Miguel Moreno Ugeda
01/04/2018–14/06/2023
Low-temperature scanning tunneling microscopy and spectroscopy of two-dimensional materials and nanostructures.

Raúl Esteban Angulo de la Fuente
01/06/2018–Present
Numerical simulations in cosmology.

David Casanova Casas
01/07/2018–Present
Electronic structure of molecular excited states and photophysical process: theory and applications.

Dario Bercioux
01/10/2019–Present
Quantum transport in nanostructures.

Santiago Blanco Canosa
01/10/2019–Present
Synchrotron research in high Tc superconductors and low dimensional ferromagnets.

Eduard Matito Gras
15/03/2020–31/12/2023
Development of electronic structure methods and real-space descriptors of chemical bonding and aromaticity.

Iván Rivilla De la Cruz
01/02/2021–Present
Field of molecular indicators for single atom detection in dry media, with major applications to neutrino physics and a clear potential for biomedical.

Francesc Monrabal Capilla
01/02/2022–Present
Development of xenon detectors for basic and applied physics.

Silvia Bonoli
01/09/2023–Present
Formation and evolution of supermassive black holes in a cosmological context, combining theoretical models and observational data.

Fernando de Juan Sanz
01/09/2023–Present
Topology and electronic correlations in quantum materials.

Ikerbasque Research Fellows

Silvia Bonoli
01/09/2018–31/08/2023
Formation and evolution of supermassive black holes in a cosmological context, combining theoretical models and observational data.

Fernando De Juan Sanz
01/09/2018–31/08/2023
Topology and electronic correlations in quantum materials.

Aitzol García-Etxarri
01/11/2019–Present
Nanophotonics theory.

Bo Chen
18/02/2020–Present
Nanothread chemistry and physics; high-pressure chemistry; carbene and diradical chemistry.

Carlos Sánchez Cano
01/09/2021–Present
Controlling the metabolism of cells using metal-based intracellular catalysts.

Tobias Daniel Grass
01/10/2022–Present
Quantum simulation and synthetic quantum matter.

Claire Tonnelé
01/09/2023–Present
Electronic structure in molecular photophysics and optoelectronics.

Fellows

Claire Tonnelé
01/11/2020–31/08/2023
Electronic structure in molecular photophysics and optoelectronics.

Maia García Vergniory
01/05/2021–31/12/2022
Prediction of new topological phases and materials.

María Navarro Gastiasoro
01/01/2023–Present
Exotic superconductivity and correlation in quantum materials.

Postdoctoral Positions

Abel Carreras Conill
01/04/2018–31/03/2023
Development of electronic structure methods for excited states.

Marcos Pellejero Ibáñez
01/10/2018–30/06/2023
Cosmological N-body simulations and the analysis of the large-scale structure of the universe.

Wen Wan
11/04/2019–10/04/2023
Growth and characterization of 2D materials and related heterostructures.

Jens Oliver Stücker
02/09/2019–Present
Cosmology.

Tao Wang
07/10/2019–Present
On-surface synthesis of functional molecular materials.

Nuno De Sousa Teixeira
03/02/2020–02/02/2023
Light scattering in disordered and nonreciprocal media.

Rubén Rodríguez Ferradás
01/05/2020–Present
Development of new density functional approximations.

Rishav Harsh
01/06/2020–31/05/2023
Solid-state doping of two-dimensional transition metal dichalcogenides.

Jonathan D'Emidio
05/10/2020–Present
Quantum Monte Carlo calculations and networks of tensors.

Sanghita Sengupta
17/12/2020–16/12/2023
Spin physics in graphene-based nanostructures.

Rafael Ramis Cortés
08/02/2021–Present
Molecular dynamics of potassium channels.

Rodrigo Humberto Aguilera del Toro
17/05/2021–31/08/2023
On the quest of new magnetic 2D materials.

Francisco Javier Alfaro Mozaz
17/05/2021–31/01/2023
Optically manipulating neuronal activity with nanoparticles.

María Jesús Morán Plata
20/09/2021–Present
Catalysis toward platinum substrates for drug delivery.

Pablo Fernández Menéndez
01/10/2021–Present
Development of water Cherenkov test be experiment.

Ricardo Ortiz Cano
16/10/2021–Present
Quantum correlations in graphene-based nanostructures.

Valerio Di Lisio
15/11/2021–Present
Non-equilibrium dynamics of amorphous polymers and other materials.

Rodrigo Voivodic
06/12/2021–Present
Cosmology – Large scale structure.

José Luis Montaño Priede
19/01/2022–31/05/2023
Computational electrodynamics for light control in plasmonic systems.

Iñigo Robredo Magro
01/02/2022–Present
Topological quantum materials as platforms for quantum computers.

Jorge Humberto Melillo
07/02/2022–Present
Supercooled water – polymeric and biological aqueous solutions.

Roberto Álvarez Boto
01/03/2022–Present
Quantum Technologies – Optical properties of doped nanographenes.

María Blanco De Paz
01/03/2022–Present
Quantum Technologies – Quantum metasurfaces.

Beatriz Robles Hernández
01/03/2022–Present
Polymers and soft matter.

Ander Simón Estévez
01/03/2022–Present
Coherent neutrino-nucleus scattering at ESS.

Alexey Brodoline
08/03/2022–Present
Optics, fluorescence.

Camillo Tassi
28/03/2022–27/03/2023
Quantum technologies: quantum simulation in condensed-matter and ultracold atom platforms.

Luis Alejandro Miccio Stefancik
01/04/2022–Present
Chain dynamics in crosslinked filled polymer systems with high plasticizer content.

María Isabel Ardaya Franco
04/04/2022–Present
Neurobioscience – nanoneuro: optically manipulating neuronal activity with nanoparticles.

Miguel Ángel Sánchez Martínez
09/05/2022–08/05/2023
Chiral superconductors in transition metal dichalcogenides.

Eloy Ramos Córdoba
01/06/2022–16/02/2023
Benchmarking of density functional approximations.

Juan Carlos Roldao
23/06/2022–17/09/2023
Theoretical treatment of optoelectronic properties and processes of organic compounds for energy and material conversion.

Ridwan Olamide Agbaoye
27/06/2022–31/05/2023
Ab-initio description of thermodielectric properties of zeolites and cement-based materials.

Anastasiia Skurativska
11/07/2022–Present
Quantum Technologies – Quantum annealing hardwarebased on non-conventional superconducting circuitsand new quantum materials.

Haoyu Hu
22/09/2022–Present
Development of flat band theory methods for search of new materials.

Stefano Roberto Soleti
26/09/2022–Present
Neutrinoles double-beta decay with the NEXT experiment.

Raphael Enoque De Paiva
30/09/2022–Present
Development of photoactivatable anticancer metal complexes and nanomaterials.

Sofía Sanz Wuhl
22/10/2022–30/04/2023
Theory of quantum transport in graphene-based nanostructure networks.

Siddhartha Patra
18/11/2022–Present
Tensor Networks and Artificial Intelligence for Quantum Matter.

Douglas Nakahata
21/11/2022–Present
Metal catalysis for the chemical modification of proteins.

Mario Fernández Pendás
01/12/2022–30/06/2023
Molecular simulations of protein aggregation.

Carmelo Naim
19/12/2022–28/02/2023
Computational chemistry.

Ana Cristina Carrasco Gento
01/01/2023–Present
Bioorthogonal photocatalysis towards metal substrates.

Ricardo Rama Eiroa
16/01/2023–Present
Designing the next generation of hard-drives using two-dimensional materials.

Jose Eduardo Barcelon
23/01/2023–Present
On-surface trapping of Ba ions by functionalized surfaces.

Fei Gao
23/01/2023–Present
Hybrid graphene nanoarchitectures for electrochemical sensing.

Jon Lafuente Bartolome
15/03–31/08/2023
Computational materials science; Many-body methods.

Raúl Guerrero Avilés
01/04/2023–Present
Adsorbing atoms and molecules on van der Waals heterostructures.

Charles Mark Lewis
01/04/2023–Present
Neutrino Physics as part of ESSCEvNS.

Mesías Agustín Orozco Ic
05/04/2023–Present
Theoretical Physical Chemistry.

Óscar Rodríguez Ballesteros
10/04/2023–Present
Computational design of proteins.

Mikel Iraola Iñurrieta
11/04/2023–Present
Topological phases in interacting-electron systems.

Fernando Peñaranda del Río
01/05/2023–Present
Multiscale modelling of moiré materials.

Mihovil Bosnar
10/05/2023–Present
Condensed matter physics.

Itay Azizi
24/05–14/10/2023
Alzheimer disease and protein folding using computational methods.

Ane Izaskun Aranburu Leiva
01/06/2023–Present
Development of luminiscent chemical sensors for the selective detection of Ba++.

Galder Llorente
01/06/2023–Present
Organic Chemistry, Neuroscience.

Álvaro Pozo Larrocha
01/06/2023–Present
Wave Dark Matte.

Shayan Edalatmanesh
05/06/2023–Present
Spin physics in graphene-based nanostructures.

Ilya Klimovskikh
19/06/2023–Present
Electronic Properties of Quantum Interfaces Studied in ARPES.

Sourav Biswas
01/07/2023–Present
Quantum technologies.

Haojie Guo
01/07/2023–Present
Condensed Matter Physics and Strong electron correlations in moiré quantum matter.

Yi Jiang
01/07/2023–Present
HPC&IA – Magnetic properties of flat band kagome lattices studied by Inelastic Neutron Scattering.

Arunava Kar
01/07/2023–Present
Electronic properties of flat band kagome lattices studied by ARPES.

Nico Leumer
01/07/2023–Present
Spin physics in driven graphene nanostructures.

Luan Felipe Santos Martins Veríssimo
01/07/2023–Present
Computational Condensed Matter.

Rubén Pellicer Guridi
01/07/2023–Present
Vacancy centres in diamond for advanced quantum sensing.

Germán Eduardo Pieslinger
01/07/2023–Present
Green H2 generation.

Mario Zapata Herrera
06/07/2023–Present
Nanophotonics.

Shivaprasad Achary Balahoju
01/09/2023–Present
Organic Donor-acceptor pi-conjugated molecular systems.

Tamara Richardson
01/09/2023–Present
Cosmology.

Benjamin Shirt-Ediss
14/09/2023–Present
Minimal agency and evolution.

Rodrigo Martínez Peña
01/10/2023–Present
Hybrid quantum algorithms for time series analysis.

Kate Storey-Fisher
11/10/2023–Present
Cosmological structure formation.

Constance Mahony
01/11/2023–Present
Weak gravitational lensing.

Hoang Nhan Luu
20/11/2023–Present
Exploring the nature of the standard cosmological model.

Moritz Frankerl
01/12/2023–Present
Theory of light emission from current-driven plasmonic nanocavities.

Antoine Patt
01/12/2023–Present
Theory and modelling, clathrate hydrates, porous materials.

Safa Hamreras
11/12/2023–Present
Hybrid quantum algorithms for pattern recognition.

Research Collaborators

Yetli Rosas Guevara
01/12/2020–Present
Theory and observation of galaxy formation.

Luis Antonio Soriano Águeda
01/02/2021–Present
Design of interchange and correlation functionalities for the correct description of dynamic and non-dynamic correlation.

Jorge Pelegrín Mosquera
08/09/2021–Present
Development of gas handling system for NEXT experiment.

Sergio Contreras Hantke
01/12/2021–Present
Modelling of galaxy formation physics and its impact on clustering and cosmological parameters.

Amjad Al Taleb
01/03/2022–30/03/2023
Study of surface catalysis using molecular beams.

PhD Students

José Aarón Rodríguez Jiménez
10/12/2019–09/12/2023
Computational chemistry in excited states. Development of density functionalities within the framework of the theory of time-dependent density functional.

Sara Lois Cerdeira
07/01/2020–Present
Tuning the chemical properties of graphene nanostructures.

Paula Andrade Sanpedro
01/09/2020–27/03/2023
Computational and experimental studies on the modification of aminoacids and peptides.

Chiara Devescovi Massussi
01/09/2020–06/02/2023
Topological phases at the frontier of electronic, optical and acoustic materials.

Daniel López Cano
01/09/2020–Present
Computational cosmology.

Miryam Martínez Vara
01/09/2020–Present
Search for double beta decay without neutrinos with the NEXT-100 detector.

Nischal Acharya
28/09/2020–Present
The environment of quasars & evolution of galaxies.

Nathaniel Capote Robayna
01/10/2020–Present
Polaritons in anisotropic van der Waals crystals.

Daniel Muñoz Segovia
01/11/2020–31/10/2023
Strongly correlated electron systems and topological materials.

Antonio David Subires Santana
01/02/2021–Present
Electronic and magnetic ordering in low dimensional systems.

Irián Sánchez Ramírez
01/07/2021–Present
Modeling of strongly correlated electronic systems.

Aitor Díaz Andrés
01/08/2021–Present
Photophysical processes in molecules, molecular aggregates and molecular solids.

Juan Sánchez-Camacho Sánchez
01/08/2021–Present
Development of new biorthogonal photocatalytic catalysts for cancer therapy.

Antonio Cebreiro Gallardo
01/09/2021–Present
Quantum computational chemistry.

Kateryna Domina
01/09/2021–Present
Anomalous wave phenomena in 2D materials.

Divya Jyoti
02/09/2021–Present
Impurities on superconductor.

Mohammed Loukili
15/09/2021–Present
Exploring organic chemistry under pressure with computations.

Francisco Germano Maion
27/09/2021–Present
Cosmological large-scale structure.

Lurdes Ondaro Mallea
01/10/2021–Present
Research in computational cosmology.

Markos Polkas
15/10/2021–Present
Supermassive black holes and galaxy evolution.

Xabier Díaz de Cerio Palacio
01/11/2021–Present
Electronic properties of carbon-based nanostructures.

Adam Roselló Sánchez
01/11/2021–Present
Light-matter interactions in molecular systems on surfaces.

Carlo Andrea Pagnacco
15/11/2021–Present
Synthesis of cyclic polymers for biomedical applications.

Kirill Voronin
13/12/2021–Present
Nanophotonics with van der Waals crystals.

Julen Untzaga San Vicente
21/12/2021–07/09/2023
Study of wandering black holes.

Sara Ortega Martínez
01/01/2022–Present
Cosmos: computational cosmology.

David Silva Brea
01/01/2022–30/06/2023
Theoretical simulations on the interaction of metals with intrinsically disordered peptide.

Andrei Paulau
12/01/2022–Present
Theoretical chemistry.

Leire Larizgoitia Arcocha
17/01/2022–Present
Development of gaseous detectors for the ESS.

Javier Antonio Vélez Simanca
31/01/2022–16/04/2023
3D ferromagnetic and antiferromagnetic texture dynamics in curved geometries.

Tim Kokkeler
07/02/2022–Present
Transport properties of non-conventional superconducting structures.

Amitayush Jha Takur
11/04/2022–Present
Condensed matter physics.

Chen-How Huang
03/05/2022–Present
Low dimensional system, quantum systems in non-equilibrium.

Andrés Felipe Bejarano Sánchez
06/05/2022–Present
Quantum transport.

Nino Lauber
09/05/2022–08/05/2023
Origins/emergence of metabolism.

Julen Aduriz Arrizabalaga
13/05/2022–Present
Theoretical simulation of metal-Abeta complexes.

Teresa Itziar Celaya Garmendia
17/05/2022–Present
Nanoneuro: optically manipulating neuronal activity with nanoparticles.

Helene Müller
30/06/2022–18/06/2023
Electronic properties at the nanoscale.

Nerea Salor Iguiñiz
01/08/2022–Present
Medical Physics.

Jinxiu Zhou
08/08/2022–01/05/2023
Helix polymer based on unnatural densely substitute propeline.

Nils Hoyer
01/09/2022–Present
The cosmological evolution of Nuclear Star Clusters.

Duy Hoang Minh Nguyen
01/09/2022–Present
Twisted 2D materials.

Sandra Sajan
01/09/2022–Present
Unconventional superconductivity in 2D materials.

María de los Ángeles Del Barrio Torregrosa
01/10/2022–Present
Neutrinoless double beta decay with the NEXT experiment.

Eric Gómez Urreizti
01/10/2022–Present
Synthesis of cyclic polymers for biomedical applications.

Josianne Imbola Owona
01/10/2022–Present
Theoretical Chemistry and Computational Modelling.

Martin Irizar Landa
01/10/2022–Present
Towards spin-qubits in 2.

Antonio Morales Pérez
01/10/2022–Present
Artificial Intelligence algorithms for the topological control of quantum emitters.

Marc Montilla Busquets
21/11/2022–20/06/2023
Nonlinear optical properties, decomposition, origin-independence.

Pablo Manuel Bermejo Navas
01/12/2022–Present
Hybrid quantum machine learning for NISQ devices. Analysis of QML methods, tensor networks and neuromorphic computing.

Marta Costa Verdugo
15/12/2022–Present
Development of new photocatalytic materials for drug delivery.

Javier Domínguez Calvo
19/12/2022–Present
Development of new density functional approximations.

Guillem Vila Siles
01/01–30/04/2023
Theoretical and computational chemistry.

Esteban Zingales
09/01/2023–Present
Metal modulation of glucose metabolism.

Francesco Di Marcantonio
16/01/2023–Present
Simulation of quantum matter and gauge theories with tensor networks.

Mikel Elorza Romera
23/01/2023–Present
Development of slow control system for the GaP detector.

Aitor González Marfil
06/03/2023–Present
Deep Self-Supervised Learning methods for Bioimage Analysis.

Daniel García Pina
15/03/2023–Present
Magnetism in graphene nanostructures: spin chains with tunable interactions.

Aimar Marauri Iribarri
22/03–16/05/2023
Inmobilisation of Fluorescent Biocolor Indicators.

Paschalis Agapitos
01/04/2023–Present
Complex networks methods applied to cultural analytics.

Nonia Vaquero Sabater
01/04/2023–Present
Quantum Algorithms for Quantum Chemistry.

Mikel Olano Aranburu
01/06/2023–Present
Moving Quantum Dots.

Elena Ramos Cascón
12/06/2023–Present
Development, data collection and physical analysis in the WCTE and Hyper-Kamiokande experiments.

Carlos Javier Rojas Bejarano
20/06–30/06/2023
AI applied to the design of plasmonicnanoparticles to be used as neuromodulators.

Hanae Boulehjour
01/07/2023–Present
Quantum Technologies – Asymmetric dilanthanide clusters as platforms for addressable qubits.

Hussen Oumer Mohammed
01/07/2023–Present
Computational Design of Draw Solutes for Forward – Osmosis Seawater Desalination.

Shah Jee Rahman
01/07/2023–Present
Optical Trapping and levitation.

Alicia Omist Gálvez
15/07/2023–Present
Quantum Technologies.

Andoni Agirre Arabolaza
01/10/2023–Present
Tensor Network methods for interacting electrons in quasi-1D graphene nanostructures.

Guillermo Santamaría Fernández
01/10/2023–Present
Study of phonons and charge and heat transport in molecular crystals.

Francisco Manuel Ballester Macià
16/10/2023–Present
Study and application of topological phonons.

Ramón María Bergua López
16/10/2023–Present
Study of fluxionality and environment effects on Pt nanoclusters for applications in catalysis.

Pablo Ramón García Valle
16/10/2023–Present
Development of luminiscent chemical sensors for the selective selection of Ba++.

Carolina Adriana Iacovone
23/10/2023–Present
Polymers and Soft Matter.

Marc Justin Seemann
27/10/2023–Present
Experimental particle physics: towards next-generation high pressure xenon time projection chambers for neutrinoless double beta decay.

Irene Valderrama Flores
01/11/2023–Present
Galaxies.

Alfonso Yubero Navarro
01/11/2023–Present
Neutrino physics, surface physics.

Victor Sierka
03/11/2023–Present
Design of quantum materials for channeling light and electrons.

Unai Pereira Castelo
01/12/2023–Present
Uniaxial strain tuning of the ground state of quantum materials.

Yongsong Wang
13/12/2023–Present
Electronic characterization of real- and momentum-space topology of ultraflat bands.

Research Assistants

Mikel Olano Aranburu
01/09/2021–28/02/2023

Maialen Galdeano Fraile
01/01/2022–02/05/2023

Ane Izaskun Aranburu Leiva
09/05/2022–31/05/2023

Carlos Alberto Maciel Escudero
01/07/2022–Present

Xiang Xu
20/08/2022–24/11/2023

Cristina Mier González
01/09/2022–28/02/2023

Mikel Elorza Romera
14/09/2022–22/01/2023

Alaitz Lecuona Isasa
01/10/2022–31/12/2023

Paloma Morilla Martínez
01/10/2022–30/04/2023

Unai Muniain Caballero
01/10/2022–08/11/2023

Auguste Tetenoire
01/10/2022–23/03/2023

Ainhoa Villoria Bárcena
01/10/2022–Present

Carolina Martínez Strasser
13/10/2022–Present

Miguel Ángel Jiménez Herrera
17/10/2022–Present

Jon Lasa Alonso
17/10/2022–03/09/2023

Alejandro Berdonces Layunta
22/10/2022–22/02/2023

Sophie Espert
01/11/2022–30/04/2023

Álvaro Pozo Larrocha
09/11/2022–08/03/2023

Riccardo Moro
21/11/2022–21/05/2023

Mikel Iraola Iñurrieta
22/11/2022–23/03/2023

Daniel García Pina
28/11/2022–14/03/2023

Álvaro Nodar Villa
01/12/2022–13/03/2023

Pablo Herrero Gómez
01/01–31/08/2023

Chiara Devescovi Massussi
07/02–31/12/2023

Mikel Arruabarrena Larrarte
17/02–08/10/2023

Jehyeok Ryu
01/03/2023–Present

Joan Grèbol Tomás
01/09–31/12/2023

Alfredo Serrano Jiménez
18/09/2023–Present

Markel García Ibarluzea
01/10/2023–Present

Irati Lizaso Berrueta
23/10/2023–Present

Daniel Muñoz Segovia
01/11–31/12/2023

Martín Molezuelas Ferreras
13/11/2023–Present

Martín Gutiérrez Amigo
04/12/2023–Present

José Aarón Rodríguez Jiménez
10/12/2023–Present

Engineers

Jordi Torrent Collell
16/06/2018–Present

Eva Oblak
14/09/2020–Present

Ana Belén Núñez Chico
25/01/2021–01/03/2023

José María Benlloch Rodríguez
22/01/2022–Present

Sergio Sánchez Martín
01/02/2022–26/02/2023

Asier Castillo Litago
02/02/2022–Present

Alejandro Taboada Fernández
11/09/2022–Present

Technical Assistants

Beatriz Romeo Zaragozano
01/11/2018–20/02/2023

Francisco López Gejo
01/01/2021–Present

Carlos Echeverría Lizarraga
01/03/2022–Present

Bruno López-Gómez Saldaña
11/09/2022–Present

Jon Zapata Muñoz
01/12/2022–30/06/2023

José Luis López Gómez
10/02/2023–Present

Internships

Aitor Echeverría Ibarbia
UPV/EHU, Spain
03/10/2022–31/08/2023
Escuela Universitaria de Ingeniería Dual, Spain
01/09/2023–Present
Infrastructure Monitoring.

Konstantin Todorov Andreev
UPV/EHU, Spain
17/10/2022–06/01/2023
Analysis and improvement of the execution processes of scientific applications in DIPC supercomputing systems.

Ganna Mashtaler
Technical University of Munich, Germany
24/10/2022–28/01/2023
Implementation and calculation of ab initio electronic couplings in energy transfer processes.

Iván Hidalgo Cenalmor
UPV/EHU, Spain
01/12/2022–06/02/2023
Biomedical Computer Vision: deep learning based super-resolution.

Hanae Boulehjour
Université de Bordeaux, France
16/01–16/06/2023
Electronic structure characterization of strongly correlated systems.

Mikel Goizueta Taberna
Zubiri Manteo, Spain
01/03–26/05/2023
Improvement in microinformatics system administration.

Álvaro Larrarte Arriazu
UPV/EHU, Spain
06/03–06/04/2023
Purchase and commissioning of DIPC information screens.

Xabier Peñagarikano Uriarte
UPV/EHU, Spain
06/03–06/06/2023
Analysis and improvement of the execution processes of scientific applications on DIPC supercomputing systems.

Héctor Javier Hernández Rojas
Universidad Internacional de La Rioja (UNIR), Spain
01/05–22/06/2023
Learning optimal Bayesian Networks structures from a case database using quantum computing.

Imanol Ortega Garrues
UPV/EHU, Spain
29/05–28/07/2023
Rational Design of Fluorescent Organometallic Complexes.

Marta Aldecoa Ortueta
UPV/EHU, Spain
01/06–13/08/2023
Polymer networks based on cyclic polymers.

Irene Plazaola Iguaran
UPV/EHU, Spain
01/06–31/07/2023
Chemigenetic probes based on synthetic chelators.

Alejandro Sebastián Gómez Gómez
Universidad Complutense de Madrid (UCM), Spain
05/06–05/08/2023
Investigation of semi-Dirac point in three-dimensional materials.

Diego Herrero Carrión
Universidad Complutense de Madrid (UCM), Spain
12/06–12/08/2023
Properties of globular clusters in a galaxy formation model.

Unai Razkin Zufiaur
UPV/EHU, Spain
12/06–11/08/2023
Controlling light at the nanoscale.

Naia Soler Iturrioz
UPV/EHU, Spain
12/06–20/08/2023
The spatial distribution of galaxies as a probe for fundamental physics.

Ander Aleson Gurruchaga
UPV/EHU, Spain
15/06–15/08/2023
Is it still hold the Aromaticity concept for large macrocycles?

Gaizka Otegi López
UPV/EHU, Spain
15/06–14/08/2023
Laser-coupled multiwell microelectrode array for plasmon-driven neuronal stimulation.

Alejandro Pérez Casas
UPV/EHU, Spain
15/06–31/08/2023
Computer Center Staff

Max De Carlos Generowicz
York University, United Kingdom
26/06–26/08/2023
Single ion detection to find the nature of the neutrino.

Ángel Giménez Mascarell
Universidad Complutense de Madrid (UCM), Spain
26/06–26/08/2023
2D Nanophotonics.

Itsaso Hontoria Indart
UPV/EHU, Spain
26/06–31/08/2023
Detection of neutrino-nucleus coherent scattering.

Isabel María Moreno Cuadrado
Universidad de Granada, Spain
26/06–21/07/2023
21/08–15/09/2023
Development of an android app to explore the physical chemistry of nanographenes.

David de la Fuente Pico
Universidad Autónoma de Madrid (UAM), Spain
01/07–31/08/2023
Superconductivity mediated by soft polar modes.

Zarko Ivkovic
Universidad de Barcelona, Spain
01/07–31/08/2023
Implementation of an effective method to simulate optical spectra.

Bryan Alexis Melo Flores
Universidad de Barcelona, Spain
01/07–31/08/2023
Computational study of the effect of pressure on organocatalysis.

Aitor Morais Miñambres
Deusto, Spain
01/07–31/08/2023
Universidad de Nebrija, Spain
01/09–29/09/2023
Development of deep learning tools for biomedical image analysis.

Joyce Samantha Romero Jiménez
UPV/EHU, Spain
01/07–01/09/2023
Inelastic scattering and photoemission in crystalline solids.

Eider Loyola Azanza
Universidad de Barcelona, Spain
10/07–09/09/2023
Controlling light at the nanoscale.

Sergi Betkhoshvili
Universidad de Barcelona, Spain
17/07–14/09/2023
Design of qubits from chromophore-radical systems.

Lorenz Fidelis Möhrle
University of Konstanz, Germany
16/08–24/10/2023
Investigation of Hyperfine Interaction in Carbon-based 2-dimensional Materials.

Gorka Acuña Pérez
Zubiri Manteo, Spain
21/09/2023–Present
Administration of networked computer systems.

Alfonso Yubero Navarro
Universidad de Zaragoza, Spain
05/10–31/10/2023
Experimental neutrino physis.

Alejandro Pérez Casas
UPV/EHU, Spain
30/10/2023–Present
Computer Engineering.

Undergraduate Candidates

Joyce Samantha Romero Jiménez
UPV/EHU, Spain
01/10/2022–30/06/2023
Inelastic scattering and photoemission in crystalline solids.

Ander Aleson Gurruchaga
UPV/EHU, Spain
11/10/2022–31/12/2023
Computational study of aromaticity with descriptors of electronic delocalization.

Jon Moriñigo Mazo
UPV/EHU, Spain
27/02/2023–27/05/2023
Develop and evaluate new network models for simulation in INSEE.

Patxi Moreno Estebánez
UPV/EHU, Spain
02/10/2023–Present
Introduction to synchrotron radiation and its use in photoemission studies.

Special Assignments

Fabienne Barroso Bujans
DIPC Summer Internships

Aitzol García Etxarri
DIPC Transdisciplinary Skills Courses

Arantzazu García Lekue
DIPC Calls for Young Researchers

Geza Giedke and Thomas Frederiksen
DIPC Colloquia

Marek Grzelczak
DIPC Seminars

Deung-Jang Choi and Nicolás Lorente Palacios
DIPC Courses

Luca Salassa
DIPC Workshops and DIPC Schools

Carlos Sánchez Cano
PhD Seminars

Gustavo Schwartz
Mestizajes program and DIPC
Transdisciplinary Skills Courses

Gender Equality Committee

Amaia Arregi Buldain

Silvia Bonoli

Ricardo Díez Muiño

Luz Fernández Vicente

Aitzol García Etxarri

Maia García Vergniory

Elisa Jimenez Izal

Olatz Leis Esnaola

Irián Sánchez Ramírez

Beatriz Suescun Rodríguez

Visiting Researchers

Long visits

Chizoba May Obele
Nnamdi Azikiwe University Awka,
Aanmbra State, Nigeria
22/09/2022–19/03/2023
Development of non toxic antifouling coating susing nanotubes.

Úrsula Fernanda Salazar Roggero
Universidad Estatal de Campinas, Sao Paulo, Brazil
26/09/2023–31/03/2023
Nanophotonics theory.

Germán Eduardo Pieslinger
Universidad de Buenos Aires CONICET/IQUIFIB,
Buenos Aires, Argentina
01/08/2022–30/06/2023
Bioorthogonal photocatalytic activation of metal-based anticancer prodrugs.

Nicolas Regnault
LPENS, École normale supérieure de Paris
and CNRS, París, France
01/10/2022–28/02/2023
ERC_AdG superflat.

Daniel Rubén Zerzión
European Organization for Nuclear Research
(CERN), Meyrin, Switzerland
01/09/2022–28/02/2023
Coherent neutrino collaboration.

Raffaele Resta
Istituto Officina dei Materiali, CNR;
University of Trieste, Italy
01/11/2022–31/01/2023
Geometry and topology in condensed matter physics.

Yurii Sitenko
Bogolyubov Institute for Theoretical Physics,
NAS of Ukraine, Kiev, Ukraine
06/09/2022–04/01/2023
Quantum effects in the background of topological defect.

Rubén Miguel Ochoa de Zuazola
Hitachi-Cambridge Laboratory, UK
01/01–30/06/2023
Neuromorphic computing with antiferromagnetic textures.

Juan Faustino Aguilera Granja
Instituto de Física, Universidad Autónoma de San Luís Potosí, México
02/01–31/01, 02/06–31/07/2023, 10/12–09/01/2024
Nanostructures made of new components.

Dumitru Calugaru
Princeton University, NJ, USA
09/01–31/05/2023
Flat phonon bands, gapping flat bands with SOC, new exact eigenstates of the Hubbard model.

Jorge Iván Cárdenas Gamboa
Max Planck Institute for Chemical Physics of Solilds, Dresden, Germany
15/01–26/02/2023
Topological materials.

Tymoteusz Salamon
ICFO, Castelldefels, Spain
16/01–12/04/2023
Strange metal phases in 1D flat-band systems.

Xiaolong Feng
Max Planck Institute for Chemical Physics of Solids, Dresden, Germany
20/01–26/02, 20/05–22/07/2023
Topological materials.

Jun Kameda
Institute for Cosmic Ray Research, The University of Tokyo, Kashiwa-city, Japan
23/01–08/02, 26/04–26/05/2023
Hyper-Kamiokande (MRR) - Anti-implosion roof construction.

Jonah Herzog-Arbeitman
Princeton University, NJ, USA
24/01–31/05/2023
Flat bands. Banda lauak.

Mohammadreza Izadifar
Institute of Construction and Building Materials, Darmstadt, Germany
01/02–28/02/2023
Working on GO composites.

Joseph Richard Manson
Clemson University, SC, USA
06/02–22/03/2023
Electron-phonon interactions at surfaces.

Matteo Mazzanti
University of Amsterdam, Netherlands
06/02–31/03/2023
Quantum computing using trapped ions.

Zeinab Khosravizadeh
Institute of Physics, Polish Academy of Sciences, Warsovia, Poland
11/02–11/03/2023
Growth and electronic structure investigations of 2D layers of graphene/hBN layers on curved single crystal

Elisa Bortolas
Università di Milano-Bicocca, Italy
13/02–11/03/2023
Shaping the history of supermassive black holes through stellar accretion events.

Amal Ebrahim Mohamed Ali Nasser
Higher Technological Institute, Cairo, Egypt
25/02–13/08/2023
Science by women.

Eman Ebrahim Mohamed Ali Nasser
Higher Technological Institute, Cairo, Egypt
25/02–13/08/2023
Science by Women.

Stefan Ilic
Centro de Física de Materiales, Donostia/San Sebastián, Spain
01/03–31/03/2023
Investigation of magnetoelectric phenomena in superconductors.

Román Eugenio Pico
Instituto de Física de Rosario, Argentina
01/03–15/05/2023
Electronic, magnetic and transport properties at the nanoscale.

Álvaro Pozo Larrocha
DIPC, Donostia/San Sebastián, Spain
09/03–30/05/2023
Start post-doc project in collaboration with the CFA.

Joshua Renner
IGFAE/Universidade de Santiago de Compostela, Spain
16/03–16/05/2023
HyperK/WCTE radioactive source development.

Haojie Guo
Universidad Autónoma de Madrid, Spain
19/03–30/06/2023
Condensed Matter Physics and Strong electron correlations in moiré quantum matter.

Paula Natalia Abufager
Instituto de Fisica Rosario, Argentina
08/04–13/05/2023
Electronic, magnetic and transport properties at the nanoscale.

José Nelson Onuchic
Rice University, Houston, TX, USA
13/04–31/07/2023
Protein design and folding.

Javier Antonio Vélez Simanca
UPV/EHU, Leioa, Spain
16/04–16/05/2023
Reservoir computing based on relativistic magnetic textures.

María del Mar Reguero de la Poza
Facultat de Química, Universitat Rovira i Virgili, Tarragona, Spain
24/04–24/05/2023
CO2 and SO2 "Nanodroplets" with Transition Metals: Is it possible to release O2?

Gaetano Ricci
Universitée de Namur, Belgium
01/05–31/07/2023
Role of intermolecular interactions in multiple resonance thermally activated delayed fluorescence.

Carlo Marotta
Industrial Chemistry University of Pisa, Italy
15/05–16/06/2023
Photochemical activation of metallodrugs.

Prodip Kumar Sarkar
Indian Institute of Technology Kharagpur, India
18/05–18/07/2023
Miracle photonic concrete.

Samuele Neuberg
Universitá degli Studi di Padova, Italy
29/05–29/09/2023
Photocatalytic gold nanomaterials for cancer therapy.

Juan Pablo Echeverry Enciso
Universidad de Ibagué, Colombia
01/06–30/07/2023
Thermal effects in the low energy response of transitions metal dichalcogenites.

Francisco José García Vidal
Facultad de Ciencias, Universidad Autónoma de Madrid, Spain
01/06–31/07/2023
Quantum light-matter interaction.

Elton Gomes Dos Santos
Higgs Centre for Theoretical Physics, The University of Edinburgh, UK
01/06–01/09/2023
Two-dimensional magnetic genome.

Oleg Prezhdo
University of Southern California, Los Ángeles, CA, USA
01/06–31/08/2023
Excited state dynamics in novel nanoscale materials for optoelectronic applications.

Andrey Vasenko
HSE University, Moscow, Russia
01/06–31/10/2023
Superconductivity in topologically nontrivial materials.

Stephanie Louise Yardley
University of Reading, UK
01/06–01/09/2023
Solar Physics/ Space weather.

Luca Sala
University Observatory, Faculty of Physics,
Ludwig-Maximilians-Universität München, Germany
04/06–28/07/2023
Scheduled secondment according
to BiD4BESt ITN plan.

Seok Gyeong Yoon
University of Chicago, IL, USA
15/06–15/08/2023
ERC-ESSCEvNS

Sergio Carbajo García
University of California Los Angeles, SLAC National
Accelerator Laboratory, CA, USA
16/06–06/08/2023
Light-triggered nonequilibrium dynamics.

Reidar Lund
University of Oslo, Norway
19/06–10/08/2023
Polymeric carrier systems for antibiotics and
anticancer drugs.

Gabriel Alejandro Cwilich
Yeshiva University, NY, USA
20/06–04/08/2023
Modeling of networks applied to vehicular
traffic and similar problems. Random sequential
absorption in various substrates.

Vasily Astratov
University of North Carolina at Charlotte, NC, USA
26/06–25/07/2023
Microspherical superlens windows to the
quantum world.

Alejandro González Tudela
Instituto de Física Fundamental, Madrid, Spain
01/07–31/07/2023
Topological quantum optics: theory
and implementations.

María Ángeles Hernández Vozmediano
Instituto de Ciencia de Materiales
de Madrid (CSIC), Spain
01/07–31/07/2023
Topological matter.

Nikolay Kabachnik
European XFEL GmbH, Schenefeld, Germany
01/07–30/09/2023
Two-photon photoemission from metals.

Anabel Lam Barandela
Instituto de Ciencia y Tecnología de Materiales
(IMRE), Universidad de La Habana, Cuba
01/07–31/08/2023
Cyclic polymers.

Luis Martín Moreno
Instituto de Nanociencia y Materiales de Aragón,
Univesidad de Zaragoza, Spain
01/07–31/07/2023
Theory on nanophotonics.

Vinod Menon
City College of New York, USA
01/07–01/08/2023
Nanophotonics.

Rafael Yuste Rojas
Columbia University, NY, USA
01/07–07/08/2023
Nanoneuro.

Yuval Oreg
Weizmann Institute of Science, Rehovot, Israel
09/07–09/08/2023
Novel properties of twisted bi-layer systems.

Felix von Oppen
Freie Universität Berlin, Germany
09/07–06/08/2023
Van der Waals heterostructures.

María Fernanda Florez Angarita
Université Paul Sabatier, Toulouse, France
17/07–17/09/2023
Rationalization of linear and non linear
optical properties.

Dumitru Calugaru
Princeton University, NJ, USA
01/08–31/08/2023
SuperFlat.

Petru Milev
Wroclaw University of Science
and Technology, Poland
14/08–15/09/2023
Efficient methodologies for computing response
propreties of molecules and materials.

Oleg Dolgov
Lebedev Physical Institute, Russian Academy
of Science, Moscow, Russia
01/09–01/12/2023
Electronic and magnetic excitations in
superconducting materials.

Ceferino López Fernández
ICMM (CSIC), Madrid, Spain
01/09–30/09/2023
Disorder Photonics and AI.

Joseph Richard Manson
Clemson University, SC, USA
01/09–31/10/2023
Electron-phonon interactions at surfaces.

Alejandro Martín Lobos
Instituto Interdisciplinario de Ciencias Básicas
Universidad Nacional de Cuyo - CONICET,
Mendoza, Argentina
01/09–30/09/2023
Low-temperature properties of low-dimensional
dissipative quantum systems.

Leonid Sandratskii
Institute of Physics of the Czech Academy of
Sciences, Praga, Germany
01/09–30/11/2023
Interplay of the spin-wave and Stoner excitations
in the physics of the magnetic 5f systems.

Irene Valderrama Flores
Universidad Autónoma de Barcelona, Spain
01/09–30/10/2023
L-Galaxies.

Carmen Mijangos Ugarte
Instituto de Ciencia y Tecnología de Polímeros,
CSIC, Madrid, Spain
02/09–01/11/2023
Polymerization reaction in nanoporous materials.

Abel Rojo Francàs
Universitat de Barcelona, Spain
15/09–15/12/2023
Study of interacting ion-atom systems.

Giorgio Benedek
Università di Milano-Bicocca, Italy
17/09–31/10/2023
Surface dynamics and electron phonon interaction.

Marc Justin Seemann
The University of Manchester, UK
25/09–26/10/2023
Experimental particle physics: Towards next-
generation high pressure xenon time projection
chambers for neutrinoless double beta decay.

Pablo Herrero Gómez
Hebrew Universtity of Jerusalem, Israel
01/10–30/04/2024
NEXT-BOLD

Eugene Kogan
Bar-Ilan University, Ramat-Gan, Israel
01/10–31/10/2023
Low-energy collective charge excitations
in superconductors.

Luis Alberto Montero Cabrera
Universidad de La Habana, Facultad de
Química, Cuba
01/10–01/12/2023
Photophysics of molecular photovoltaic devices.
Gailu fotovoltaiko molekularren fotofisika.

Joshua Renner
IGFAE / Universidade de Santiago
de Compostela, Spain
01/10–15/12/2023
HyperK / WCTE radioactive source development.

Eric Switzer
University of Central Florida, Orlando, FL, USA
01/10–01/11/2023
Developing new tools for the BASQ-IBM quantum computer.

Constance Mahony
Ruhr University Bochum, Germany
02/10–01/11/2023
Weak gravitational lensing.

Ángel Rodríguez Alcaráz
Universidad Complutense de Madrid, Spain
02/10–31/01/2024
Developing new tools for the BASQ-IBM quantum computer.

Andrey Borissov
ISMO, Institut des Sciences Moléculaires d'Orsay, Université Paris-Saclay, France
09/10–30/11/2023
Strong field processes in plasmonic gaps.

Chioma Ibiam Aja
Federal University of Technology Owerri (FUTO), Nigeria
17/10–16/09/2024
Introducing sulphons to amino acids to create super conducting capacitors.

Alfredo Manuel Rotundo
University of Calabria (UniCal), Cosenza, Italy
01/11–31/12/2023
Photoactive anticancer drugs.

Julio Alonso Martín
Universidad de Valladolid, Spain
01/12–31/01/2024
Interaction of small molecules with layered materials.

Talat Shahnaz Rahman
University of Central Florida, Orlando, FL, USA
01/12–31/03/2024
Theoretical and computational investigations of transport, magnetic and optical properties of functional nanomaterials.

Laura Barros Silva
Instituto de Química - Unicamp, Campinas, Brazil
10/12–11/03/2024
Synthesis, characterization and antiviral studies of novel Pd(II) complexes with aminoadamantanes.

Maxim Kagan
Higher School of Economics, Moscow, Russia
15/12–15/01/2024
Acoustic plasmons in novel superconducting materials.

Antonio Zelaquett Khoury
Instituto de Física, Universidade Federal Fluminense, Río de Janeiro, Brazil
18/12–17/03/2024
Quantum nanophotonics.

Short visits

Pablo Alonso González
Universidad de Oviedo, Spain
02/01–04/01/2023
Nanophotonics of 2D materials.

Sebastian Kamann
Astrophysics Research Institute, Liverpool John Moores University, UK
08/01–13/01/2023
Any kind of motion in star clusters, from stellar spins, to binary stars, and the overall cluster kinematics.

Mikhail Silaev
Computational Physics Laboratory, Tampere University, Finland
08/01–12/01/2023
Superconducting quantum materials: from controllable thermo-spin effects to on-chip quantum magnonics.

Miquel Llunell i Marí
Universitat de Barcelona, Spain
10/01–19/01/2023
Implementation of a general Extended Hückel code for applications in computational chemistry.

Luis A. Elcoro Cengotitabengoa
Facultad de Ciencia y Tecnología, UPV/EHU, Leioa, Spain
13/01–14/01/2023
ERC Superflat.

Giovanni Aricò
Institute for Computational Science, University of Zurich, Switzerland
16/01–03/02, 08/05–26/05, 18/09–29/09/2023
BACCO

Giandomenico Palumbo
Dublin Institute for Advanced Studies, Ireland
30/01–03/02/2023
Fragile topology.

Andreas Leitherer
NOMAD Laboratory at the FHI of the Max-Planck-Gesellschaft and IRIS-Adlershof of the Humboldt-Universität zu Berlin, Germany
02/02–04/02/2023
Machine learning for condensed matter.

Diana Gabriela Oprea
Max Planck Institute for the Chemical Physics of Solids, Dresden, Germany
05/02–25/02/2023
The role of crystalline symmetry sin correlated topological materials.

Jesús Rubayo Soneira
Instituto Superior de Tecnologías y Ciencias Aplicadas, Universidad de La Habana, Cuba
06/02–10/02/2023
Computational chemistry and physical chemistry.

Yurii Sitenko
Bogolyubov Institute for Theoretical Physics, NAS of Ukraine, Kiev, Ukraine
06/02–07/02/2023
Quantum effects in the background of topological defect.

Dimas García de Oteyza Felderman
Centro de Investigación en Nanomateriales y Nanotecnología (CINN), CSIC-UNIOVI-PA, El Entrego, Spain
08/02–09/02/2023
On-surface synthesis of functional molecular materials on surfaces.

Gabriele Natale
Institute for Quantum Optics and Quantum Information, Innsbruck, Austria
08/02–12/02/2023
Competing interactions in dipolar erbium atoms.

Claudia Politi
Institute for Quantum Optics and Quantum Information, Innsbruck, Austria
08/02–12/02/2023
Many-body phases in dipolar atoms: novel quantum mixtures and supersolidity.

Richard Berndt
Institute of Experimental and Applied Physics, Kiel University, Germany
15/02–19/02/2023
Molecules at surfaces.

Andrew Boothroyd
Oxford University, UK
15/02–17/02/2023
Topological materials.

Johannes Knolle
TU Munich, Theory of Quantum Matter TQM, Garching, Germany
19/02–21/02/2023
Topological semi-metals.

Giorgio Benedek
Università di Milano-Bicocca, Italy
20/02–04/03/2023
Surface dynamics and electronphononinteraction.

David Izquierdo Villalba
Università di Milano-Bicocca, Italy
26/02–03/03/2023
Black hole growth and spin evolution.

Daniele Pascuale Spinoso
Tsinghua University, Beijing, China
27/02–03/03, 27/03–31/03, 30/08–07/09/2023
Modelling the origin and evolution of SMBHs with the L-Galaxies semi-analytic model.

Tiago Batalha de Castro
Osservatorio Astronomico di Trieste, Italy
01/03–03/03/2023
Cosmological numerical simulations.

Antonio Hernando Grande
Universidad Complutense de Madrid, Spain
04/03–09/03, 09/10–15/10/2023
Brain estimulation by magnetic excitation. Magnetism in neurons.

Xiaolong Feng
Max Planck Institute for Chemical Physics of Solids, Dresden, Germany
05/03–02/04, 28/08–23/09/2023
Topological materials.

Martin Tomterud
University of Bergen, Norway
06/03–10/03/2023
Temperature dependent properties of two dimensional materials.

Matteo Zennaro
University of Oxford, UK
06/03–10/03, 08/05–19/05, 18/09–22/09/2023
BACCO

Sara Saracino
Astrophysics Research Institute, Liverpool John Moores University, Liverpool, UK
07/03–10/03/2023
Stellar mass black holes in stellar clusters.

Estíbaliz Blanco Elorrieta
Harvard University, Cambridge, MA, USA
09/03–24/03/2023
Nanoneuro.

Roberto Cammi
Universita de Parma, Italy
20/03–24/03/2023
Effect of pressure on tunneling in organic reactions.

Carlos S. Fenk
Durham University, InstItute for Computational Cosmology, UK
20/03–27/03/2023
DIPC Colloquium series.

Norhan Omar
Institut des Sciences Moléculaires, Talence, France
27/03–01/04/2023
Non adiabatic effects in theoretical gas-surface kinetics.

Jordi Pera i Ferreruela
Universitat Politècnica de Catalunya, Barcelona, Spain
10/04–21/04/2023
Finite-temperature ferromagnetism in multi-component Fermi gases beyond the leading perturbative orders.

Francoise Remacle
Université de Liège, Belgium
26/04–29/04/2023
Colloquia.

Ali Hassanali
The Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy
10/05–13/05/2023
Computational models of aqueous systems.

Alejandro Reyes Coronado
Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexico
15/05–30/05/2023
Induced forces by swift electrons on metallic nanoparticles.

Andrés Vega Hierro
Facultad de Ciencias, Universidad de Valladolid, Spain
17/05–18/05/2023
Magnetism and excitonic effects.

Maciej Andrzej Lewenstein
ICFO-Institute of Photonic Sciences and ICREA, Castelldefels, Spain
18/05–21/05/2023
Colloquia.

Sohini Kar-Narayan
University of Cambridge, UK
21/05–01/06/2023
Polymer-based nanomaterials for applications in energy harvesting and sensing,involving piezoelectric, ferroelectric, magnetoelectric and thermoelectric nanostructures.

Nadine Buczek
Lübeck University of Applied Sciences, Germany
03/06–10/06/2023
Electron dynamics.

Pawel Buczek
Hamburg University of Applied Sciences, Germany
03/06–10/06/2023
Electron dynamics.

Yvan Le Borgne
CNRS and LaBRI, University of Bordeaux, Talence, France
04/06–08/06/2023
An introduction to quantum computing.

Pilar Hernández Gamazo
IFIC, Universidad de Valencia, Rocafort, Spain
05/06–12/06/2023
Neutrino physics.

Georg Herzog
Università di Milano-Bicocca, Italy
05/06–09/06/2023
Formation and evolution of dwarf galaxies.

Francisco J. Carrera Troyano
Instituto de Física de Cantabria, Santander, Spain
06/06–07/06/2023
Collaboration on ITN Bid4Best.

Georgios Mountrichas
Instituto de Física de Cantabria, Santander, Spain
06/06–09/06/2023
BiD4BEST

Abhishek Ghosh
Nicolaus Copernicus University in Torun, Institute of Physics, Poland
11/06–23/06/2023
Defects in graphene-based capacitors.

Nazim Mammadov
Baku State University (BSU), Azerbaijan
11/06–15/06/2023
Collaboration agreement between DIPC and BSU.

Karolina Slowik
Nicolaus Copernicus University in Torun, Institute of Physics, Poland
11/06–23/06/2023
Defects in graphene-based capacitors.

Josep Alberola Boloix
Instituto de Ciencia Molecular, University of Valencia, Paterna, Spain
13/06–16/06/2023
Molecular electronic structure.

Elia Strambini
Istituto Nanoscienze, Consiglio Nazionale delle Ricerche, CNR-NANO, Pisa, Italy
15/06–01/07/2023
Experimental studies of transport properties of superconductor/ferromagnetic insulators.

Igor Aharonovich
University of Technology Sydney, Australia
18/06–30/06/2023
Optical and Phonon polaritons with hBNl.

Andrey Borissov
ISMO, Institut des Sciences Moléculaires d'Orsay, Université Paris-Saclay, France
22/06–28/06/2023
Olasmonics with TDDFT.

Peter Apell
Chalmers University of Technology, Göteborg, Sweden
23/06–28/06/2023
Optical response in nanostructures.

Pavel Jelinek
Institute of Physics of the Czech Academy of Sciences, Prague, Czech Republic
25/06–15/07/2023
Low-dimensional molecular systems.

Héctor Ochoa de Eguileor Romillo
Columbia University, NY, USA
28/06–07/07/2023
Condensed matter theory.

Ana Asenjo García
Columbia University, NY, USA
01/07–08/07/2023
Condensed matter theory.

Javier García de Abajo
ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain
10/07–25/07/2023
Plasmonics in atomically thin crystalline silver films.

David Nicolás Laroze Navarrete
Universidad de Tarapacá, Arica, Chile
15/07–29/07/2023
Chaotic proliferation of topologically protected magnetic textures.

Frederico Alves Lima
European XFEL GmbH, Schenefeld, Germany
16/07–17/07/2023
XFEL- and synchrotron-based techniques applied to metallodrugs in biological systems.

Akashdeep Kamra
Universidad Autónoma de Madrid, (IFIMAC), Spain
16/07–22/07/2023
Spin polaritonics.

Klaus von Klitzing
Max-Planck-Institut für Festkörperforschung, Stuttgart, Germany
16/07–21/07/2023
Spintronics and spin-orbitronics in hybrid nanostructures: from classical to quantum technologies.

Adiel Stern
Weizmann Institute of Science, Rehovot, Israel
17/07–11/08/2023
Novel features of two dimensional materials.

Ulrich Höfer
Philipps-Universität MarburgFachbereich Physik, Germany
19/07–27/07/2023
Time-resolved photoemission: from bandstructure to orbital movies.

Cecilia Clementi
Freie Universitaet Berlin, Germany
26/07–31/07/2023
Multiscale modeling for classical and quantum systems.

Daniel Jaque García
Universidad Autónoma de Madrid, Facultad de Ciencias, Spain
26/07–27/07/2023
Nanoneuro.

Kuo Li
Center for High Pressure Science and Technology Advanced Research, Beijing, China
29/07–01/08/2023
Mechanisms of nanothread formation reactions.

David Zueco Láinez
Instituto de Nanociencia y Materiales de Aragón (INMA,)CSIC-Universidad de Zaragoza, Zaragoza, Spain
31/07–06/08/2023
Quantum optical technologies.

David Stephen Abergel
Springer Nature, Berlin, Germany
20/08–23/08/2023
Topological materials.

Natália Villa Nova Rodrigues
Institute of Physics, University of São Paulo, Brazil
22/08–25/08/2023
Studying the galaxy-halo connection with neural networks.

Arthur Ernst
Johannes Kepler University of Linz, Germany
26/08–09/09/2023
Discussion of current projects and of a joint ERC proposal.

Qiong Ma
Boston College, Boston, MA, USA
27/08–30/08/2023
Moire quantum materials.

Suyang Xu
Harvard University, Cambridge, MA, USA
27/08–30/08/2023
Magnetic topological insulator.

Juan Urrutia Pérez
KBFI, Tallinn, Estonia
31/08–01/09/2023
Cosmological large scale structure.

Dmitri Efremov
Leibniz Institute for Solid State Physics and Material Research IFW Dresden, Germany
01/09–30/09/2023
Collective electronic excitations in high-Tc cuprates.

Kostiantyn Bliokh
RIKEN, Saitama, Japan
03/09–17/09/2023
Polaritonic vortices in 2D materials.

Garnett Bryant
National Institute of Standards and Technology, Gaithersburg, MD, USA
03/09–09/09/2023
BasQ.

Antón Baleato Lizancos
UC Berkeley and LBNL, CA, USA
05/09–06/09/2023
Modeling impact of baryons on CMB lensing mesurements.

Mu-Kun Li
Waseda University, Tokyo, Japan
16/09–24/09/2023
Neuromorphic computing with magnetic textures.

Al Shahrour Ahmed Shaalan Alag
Eötvös Loránd University, Budapest, Hungary
16/09–24/09/2023
Characterization of exciton and charge-transfer excited states in conformationally restricted arylene cages by spin-component scaled ADC(2) method.

José Ángel Hernando Morata
Instituto Galego de Física de Altas Enerxías (IGFAE) Universidade de Santiago de Compostela (USC), Spain
01/10–07/10/2023
NEXT

Dumitru Calugaru
Princeton University, NJ, USA
02/10–13/10/2023
SuperFlat

Sara Capponi
IBM Almaden Research Center, San Jose, CA, USA
07/10–23/10/2023
Nanoneuro.

Alexander Yaresko
Max Planck Institute for Solid State Research, Stuttgart, Germany
09/10–20/10/2023
Magnetic dichroism in layered intermetallic compounds.

Alexei Mikhail Tsvelik
Brookhaven National Laboratory, Upton, NY, USA
12/10–22/10/2023
Topological insulators.

Angela Dellai
Institut des Sciences Moléculaires, Université de Bordeaux, Talence, France
16/10–31/10/2023
Modelling of the nonlinear optical response of photoswitchable self-assembled monolayers.

Nikolaos Iliopoulos
University of Patras, Greece
17/10–01/11/2023
Quantum modeling of molecular light emision.

Rian Ligthart
Utrecht University, Ornstein Laboratory, Germany
17/10–21/10/2023
Towards topological edge states with artificial electronic lattices: Cs on InAs(111)A.

Michael Edward Flatté
University of Iowa, IA, USA
21/10–24/10/2023
Quantum coherent single-spin dynamics measurable in DC electrical transport.

Miguel Alvarado Herrero
Facultad de Ciencias, módulo 5, Universidad Autónoma de Madrid, Spain
23/10–25/10/2023
Superconducting diode effect in graphene based structures.

Oliver Hahn
University of Vienna, Austria
24/10–28/10/2023
Cosmological simulations.

José Luis Bernal Mera
Instituto de Fisica de Cantabria, Universidad de Cantabria, Santander, Spain
25/10–27/10/2023
Cosmology and the large-scale structure of the universe.

Diego Gianolio
Diamond Light Source, Didcot, UK
26/10–29/10/2023
X-ray absorption spectroscopy at diamond light source, a powerful tool for In situ/Operando characterization studies of chemical reactions.

Karín Menéndez Delmestre
Valongo Observatory, Astronomy Institute of the Federal University of Rio de Janeiro, Brazil
02/11–12/11/2023
Bar properties in Illustris TNG-50.

Charlotte Bouquiaux
Univertié de Namur, Belgium
07/11–11/11/2023
Visit to the theoretical chemistry group.

Juan Manuel García Ruiz
Instituto Andaluz de Ciencias de la Tierra (CSIC-Universidad de Granada), Granada, Spain
09/11–11/11, 01/12–13/12/2023
Silica-induced mineral self-organization in a lifeless planet. Mineral self-organization and origin of life.

Vasily Stolyarov
École Supérieure de Physica et de Chimie Industrielles de la Ville de Paris, France
10/11–20/11/2023
Investigation of the coexistence of superconductivity and ferromagnetism on the atomic scale.

Alberto Fraile García
Nuclear Futures Institute, Bangor University, UK
13/11–17/11/2023
Atomistic simulations of hypervelocity impacts: the tungsten case.

László Oroszlány
Eötvös Loránd UniversityandWigner Research Center for Physics, Budapest, Hungary
15/11–19/11/2023
A simple electronic ladder model harboring Z4 parafermions.

Saranya Pullanchery Sankara Narayanan
EPFL, Lausanne, Spain
19/11–21/11/2023
Shining light on the interface: from metallomembranes to hydrophobic droplets in water.

Ángel Martín Pendás
Universidad de Oviedo, Facultad de Química, Spain
20/11–24/11/2023
Open quantum systems and local spin.

Nicolas Regnault
Laboratoire de Physique de l'Ecole Normale Superieure, París, France
23/11–26/11/2023
Topological materials.

Rafael Guzmán Llorente
Instituto de Fisica de Cantabria and University of Florida, Santander, Spain
28/11–01/12/2023
Transferable skills.

Thomas Christensen
Technical University of Denmark, DTU Electro, Lyngby, Denmark
11/12–14/12/2023
Topological materials.

Christian Jenewein
Instituto Andaluz de Ciencias de la Tierra (IACT), Armilla, Granada, Spain
12/12–14/12/2023
Mineral self-organization and origin of life.

Adolfo González Grushin
Institute Néel, Grenoble, France
17/12–23/12/2023
Disordered topological phases.

Blanca del Rosal Rabes
RMIT University, Melbourne, Australia
19/12–21/12/2023
Nanoneuro.

Administration and Services

General Management

Ricardo Díez Muiño
Director

Management

Nora González Lakunza
Head of Outreach & Communication

Olatz Leis Esnaola
Head of Accounting & Finance
and R+D+i Projects Management

Txomin Romero Asturiano
Head of Supercomputing Center

Beatriz Suescun Rodríguez
Head of Administration,
Human Resources and Legal Area

Administration

Karmela Alonso Arreche
Organization of Scientific Events
and Administration

María del Mar Álvarez San Martín
Human Resources and Administration

Amaia Etxaburu Munduate
President's Assistant

Nerea Fariñas Conde
Public Procurements and Administration

Udane Galardi Iñarra
Public Procurements and Administration
End of contract 21/11/2023

Leire Herranz Erquicia
Accounting & Finance and Administration

Irati Jauregi Unanue
Public Procurements and Administration

Natasha Nedashkivska
Accounting & Finance and Administration

Yannick Sáenz Augusto
Accounting & Finance and Administration

Laura Sancho Ortega
Human Resources and Administration

María Tarazona Lorente
Public Procurements and Administration

Supercomputing Center

José Caballero Tobajas
HPC Resources Administration

Luz Fernández Vicente
Help Desk & Microinformatics

Daniel Franco Barranco
HPC Resources Administration

Mikel Goizueta Taberna
Help Desk & Microinformatics

Belén Isla Rodríguez
HPC Services Design & Purchasing

Diego Lasa Goicuría
HPC Software & Applications

Carmen Martín Pulpón
Security, Web & Networks

Iker Ortiz de Luzuriaga
HPC Resources Administration

Youssef Raoudi Zakir
Help Desk & Microinformatics

Unai Sainz de la Maza Gamboa
Computing System Management

Julen Suárez Ventosa
HPC Resources Administration

Outreach and Communication

Amaia Arregui Buldain

Itxaso Azcune Tolosa

Valentina Rodríguez Castro

Marta Vega de Seoane López de Goicoechea

R+D+i Projects Management

Mikel Abadía Gutiérrez

Marina Santos Ovejero

Jone Zabaleta Llorens

Maintenance

Juan Burgos Jiménez

Ekain Ugalde Goldarazena

Seminars

1 Superconducting quantum materials: from controllable thermo-spin effects to on-chip quantum magnonics
11/01/2023
Mikhail Silaev
Tampere University, Finland

2 Nano in 3D: Carbon nanotubes used to reconnect the nervous and cardiac systems
12/01/2023
Nuria Alegret
CIC BiomaGUNE, Donostia/San Sebastián, Spain

3 DIPC Community Seminars: Bioimage analysis in the era of deep learning
19/01/2023
Ignacio Arganda Carreras
UPV/EHU, Ikerbasque, DIPC, Biofisika Institute, Donostia/San Sebastián, Spain

4 Fundamentals of dc conductivity: Longitudinal and transverse, linear and nonlinear
26/01/2023
Raffaele Resta
IOM-CNR, Trieste, Italy

5 Second Euler number in four dimensional synthetic matter
01/02/2023
Giandomenico Palumbo
Dublin Institute for Advanced Studies, Ireland

6 Combining supervised and unsupervised machine learning for materials classification
03/02/2023
Andreas Leitherer
NOMAD Max-Planck-Gesellschaft and IRIS-Adlershof of the Humboldt-Universität zu Berlin, Germany

7 Quantum effects in the background of a topological defect
07/02/2023
Yurii Sitenko
Bogolyubov Institute for Theoretical Physics, National Academy of Sciences of Ukraine, Kyiv, Ukraine

8 Many-body phases in dipolar atoms: novel quantum mixtures and supersolidity
10/02/2023
Claudia Politi
Institute for Quantum Optics and Quantum Information, Innsbruck, Austria

9 Competing interactions in dipolar erbium atoms
10/02/2023
Gabriele Natale
University of Innsbruck, Austria

10 DIPC Community Seminars: Understanding magnetic anisotropy in spin orientation and spin-spin interactions
16/02/2023
María Blanco Rey
UPV/EHU, Donostia/San Sebastián, Spain

11 Magnetic order control of topological metals and semimetals
16/02/2023
Andrew Boothroyd
University of Oxford, UK

12 Probing molecular spins at surfaces
17/02/2023
Richard Berndt
Christian-Albrechts-Universität zu Kiel, Germany

13 DIPC Community Seminar: Light-matter interaction at the (sub)nanometer scale
02/03/2023
Ruben Esteban Llorente
CFM, Donostia/San Sebastián, Spain

14 Super-resolution STED microscopy for investigating the brain extracellular space in live tissue
09/03/2023
Jan Tonnesen
UPV/EHU and Achucarro Basque Center for Neuroscience, Spain

15 CFM–DIPC PhD Student Seminar Series
15/03/2023
Sara Lois Cerdeira and Josu Diego López
DIPC and CFM, Donostia/San Sebastián, Spain

16 DIPC Community Seminar: Molecular magnetism: theory and experiment
16/03/2023
Daniel Reta Mañeru
Faculty of Chemistry UPV/EHU and DIPC, Donostia/San Sebastián, Spain

17 Language processing in the multilingual brain
17/03/2023
Esti Blanco Elorrieta
Harvard University, Cambridge, MA, USA

18 Anomalous quantum oscillations in metals and Insulators
21/03/2023
Johannes Knolle
Technical University of Munich, Germany

19 DIPC Colloquium: A conclusive test of the cold dark matter model
23/03/2023
Carlos Frenk
Institute for Computational Cosmology, Durham University, UK

20 Twist-free quantum simulation of twisted bi-layer materials
29/03/2023
Tymoteusz Salamon
ICFO, Castelldefels, Spain

21 DIPC Community Seminars: From entangled photons to levitated particles
20/04/2023
Gabriel Molina Terriza
CFM, DIPC, Donostia/San Sebastián, Spain

22 DIPC Colloquium: Quantum parallelism at room temperature by coherent excitonic dynamics of an ensemble CdSe quantum dot dimers
27/04/2023
Francoise Remacle
University of Liege, Belgium

23 DIPC Community Seminar: PETALO: Positron emission tomography with liquid xenon
04/05/2023
Paola Ferrario
DIPC, Ikerbasque, Donostia/San Sebastián, Spain

24 Catalytic properties toward the oxygen reduction reaction of 2D metal-organic frameworks
08/05/2023
Paula Abufager
IFIR CONICET-UNR, Rosario, Argentina

25 Chemical continuum: Overcoming discrete notions underlying fluctuations in water
12/05/2023
Ali Hassanali
ICTP, Trieste, Italy

26 CFM–DIPC PhD Student Seminar Series
17/05/2023
J. Aarón Rodríguez Jiménez, DIPC, Donostia/San Sebastián, Spain
Alba Jumbo Nogales, CFM, Donostia/San Sebastián, Spain

27 DIPC Colloquium: The coming decades of quantum simulators
19/05/2023
Maciej Lewenstein
ICFO, Castelldefels, Spain

28 Protein sequence coevolution, energy landscapes and applications to large protein complexes
22/05/2023
José Onuchic
CTBP - Rice University, Houston, TX, USA

29 Probabilistic error cancellation with sparse Pauli-Lindblad models on noisy quantum processors
23/05/2023
Kristan Temme
IBM Quantum, NY, USA

30 DIPC Community Seminar: Quantum anharmonic effects in solids:
A trip from high-Tc hydrogen-rich superconductors to charge-density-wave materials
25/05/2023
Ion Errea López
UPV/EHU, Donostia/San Sebastián, Spain

31 Scanning tunneling spectroscopy in quantum materials at very low temperatures
26/05/2023
Hermann Suderow
Universidad Autónoma de Madrid, Spain

32 DIPC Community Seminar: The emergence of magnetism in graphene nanostructures
08/06/2023
Natxo Pascual Chico
CIC nanoGUNE, Donostia/San Sebastián, Spain

33 CFM–DIPC PhD Student Seminar Series
14/06/2023
Daniel Muñoz-Segovia, DIPC, Donostia/San Sebastián, Spain
Martin Gutierrez Amigo, CFM, Donostia/San Sebastián, Spain

34 Nonlinear optical probing and control of magnetism and electronic band topology
15/06/2023
Gregory Fiete
Northeastern University, Boston, MA, USA

35 DIPC Community Seminars: Following the exciting life of massive black holes
22/06/2023
Silvia Bonoli
DIPC, Donostia/San Sebastián, Spain

36 Strangeness from electron-phason scattering in moiré superlattices
30/06/2023
Héctor Ochoa de Eguileor Romillo
Columbia University, NY, USA

37 Many-body quantum optics
03/07/2023
Ana Asenjo García
Columbia University, NY, USA

38 Can the angle resolved photoemission spectroscopy finally solve
the problem of high Tc superconductivity?
11/07/2023
Tonica Valla
DIPC, Donostia/San Sebastián, Spain

39 Nanophotonics with free electrons
14/07/2023
Javier García de Abajo
ICFO, Castelldefels, Spain

40 Opportunities for ultrafast science at the FXE instrument at the European XFEL
17/07/2023
Frederico Lima
European XFEL, Hamburg and Umgebung, Germany

41 Optical random forces in dipolar systems: control colloidal iterations
18/07/2023
Diego Romero Abujetas
Fribourg University, Switzerland

42 Exciton-polaritons: from condensation to quantum nonlinearity
19/07/2023
Vinod Menon
City College and Graduate Center of CUNY, NY, USA

43 Time-resolved photoemission: From bandstructure to orbital movies
20/07/2023
Ulrich Höfer
Philipps-Universität Marburg Fachbereich Physik, Germany

44 Novel BODIPY dyes and photosensitized nanoparticles for photodynamic therapy (PDT)
26/07/2023
Virginia Martínez Martínez
UPV/EHU, Donostia/San Sebastián, Spain

45 DIPC Colloquium: Multiscale modeling for classical and quantum systems
28/07/2023
Cecilia Clementi
Freie Universität Berlin, Germany

46 Synthesis of the multi-dimensional nano-carbon materials and the reaction mechanisms
01/08/2023
Kuo Li
Center for High Pressure Science and Technology Advanced Research, Beijing, China

47 3nd Seminar of Internship Students 2023
25/08/2023
DIPC's Internships students

48 Optical control of antiferromagnetic order
28/08/2023
Suyang Xu
Harvard University, Cambridge, MA, USA

49 Emergent ferroelectrics in 2D moire superlattices
29/08/2023
Qiong Ma
Boston College, MA, USA

50 Analog quantum simulation with dopant-based semiconductor devices: what we could learn with atom-scale simulators
06/09/2023
Garnett W. Bryant
National Institute of Standards and Technology, MD, USA

51 Combining neutron diffraction, X-ray diffraction and advanced materials modelling to gain insights into the thermoelectric compounds CePdSb and LaPdSb
15/09/2023
Matthias Gutmann
Rutherford Appleton Laboratory, ISIS Facility, UK

52 Anisotropy and spin-fluctuation effects on the spectral properties of Shiba impurities
29/09/2023
Alejandro Martín Lobos
ICB-CONICET UNCUYO, Mendoza, Argentina

53 Classical and quantum machine learning approaches for cellular engineering
11/10/2023
Sara Capponi
IBM Almaden Research Center, San José, CA, USA

54 Towards topological edge states with artificial electronic lattices: Cs on InAs(111)A
19/10/2023
Rian Ligthart
Utrecht University, The Netherlands

55 Quantum coherent single-spin dynamics measurable in DC electrical transport
23/10/2023
Michael E. Flatte
University of Iowa, USA

56 Intrinsic non-magnetic phi0 Josephson junctions in twisted bilayer graphene
24/10/2023
Miguel Alvarado Herrero
Universidad Autónoma de Madrid, Spain

57 X-ray absorption spectroscopy at Diamond Light Source, a powerful tool for in situ/operando characterization studies of chemical reactions
27/10/2023
Diego Gianolio
Diamond Light Source, Oxfordshire, UK

58 DIPC Community Seminars: Molecular electronic structure investigations at the DIPC
09/11/2023
David Casanova Casas
DIPC, Donostia/San Sebastián, Spain

59 Silica-induced mineral self-organization in a lifeless planet
10/11/2023
Juan Manuel García-Ruiz
Instituto Andaluz de Ciencias de la Tierra, CSIC–Universidad de Granada, Spain

60 How predictive are cosmological theories
13/11/2023
Viatcheslav Mukhanov
Ludwig Maximilian University of Munich, Germany

61 Atomistic simulations of hypervelocity impacts: the tungsten case
15/11/2023
Alberto García Fraile
Bangor University, Nuclear Futures Institute, UK

62 A simple electronic ladder model harboring Z4 parafermions
17/11/2023
László Oroszlány
Eötvös Loránd University and Wigner RCP, Budapest, Hungary

63 Shining light on the interface: From metallomembranes to hydrophobic droplets in water
20/11/2023
Saranya Pullanchery
EPFL, Lausanne, Switzerland

64 From molecular spin-orbit torque to van der Waals materials:
A density functional theory story
22/11/2023
María Camarasa Gómez
Weizmann Institute of Science, Rehovot, Israel

65 ARRAKIHS: The new ESA F-class mission to Investigate the nature of dark matter
29/11/2023
Rafael Guzmán Llorente
IFCA and UF, Santander, Spain

66 Devices, models and algorithms for nuclear imaging and beyond
01/12/2023
Magdalena Rafecas López
Universität zu Lubeck, Germany

67 Prevalence and inverse design of topological photonic crystals
12/12/2023
Thomas Christensen
DTU, Kongens Lyngby, Denmark

68 Arte y ciencia en el CERN
13/12/2023
Mónica Bello
Curator and Head of Arts at CERN, Geneva, Switzerland

69 DIPC Community Seminar: Nanoelectronics: Bridging theory and simulation in atomistic modelling
14/12/2023
Thomas Frederiksen
DIPC, Donostia/San Sebstián, Spain

70 Amorphous topological metals
18/12/2023
Adolfo G. Grushin
Néel Institute, Grenoble, France

71 Optical modulation and sensing of neuronal activity
20/12/2023
Blanca del Rosal Rabes
RMIT University, Melbourne, Australia

Workshops

Other Workshops

19th European Workshop on Phosphorus Chemistry and 3rd Spanish Workshop on Phosphorus Chemistry (EWPC-19 & SWPC-3)

March 28-30, 2023
Carlos Santamaría Centre, Donostia/San Sebastián
https://www.phoschem-spain.com/SWPC.html

Organizing Committee
Abel de Cózar (UPV/EHU, Ikerbasque)
Carlos Romero Nieto (UCLM, University of Heidelberg, Germany)

EWPC-19 & SWPC-3 aimed to gather the leading research groups working on different aspects of phosphorus chemistry (organic/inorganic/biochemistry/computational/material science...), in order to show and discuss the recent developments on the topic and establish new international collaborations. To this end, this European-Spanish joint workshop was attended by 98 participants from 14 different countries, who enjoyed three keynote talks, 34 oral communications and 47 panel communications.

Remarkably, all oral communications were given by PhD students, which also acted as chairs of all the sessions in order to promote the visibility of early stage researchers.

Invited Speakers
Ana M. Geer (Universidad de Zaragoza, Spain)
Thomas Baumgartner (York University, Toronto, Canada)
Andreas Orthaber (University of Uppsala, Sweden)

From Bioinorganic Chemistry to Catalysis, 4th Edition

May 12, 2023
UPV/EHU, Donostia/San Sebastián

Organizing Committee
Luca Salassa (Ikerbasque, DIPC)
Miguel Huertos (Ikerbasque, UPV/EHU)
Jon M. Matxain (UPV/EHU, DIPC)
Carlos Sanchez Cano (Ikerbasque, DIPC)
Ana Beloqui (Ikerbasque, UPV/EHU, Polymat)
Marcelo Calderon (Ikerbasque, UPV/EHU, Polymat)

This one-day workshop brought together researchers active in the interconnected fields of molecular catalysis and bioinorganic chemistry, targeting an audience of master and doctorate students. The aim of the meeting was to create new synergies among researchers working in various research institutes located in Donostia. The workshop also counted with the kind participation of Dr. Ignacio Sancho-Martinez (Faes Farma), Dr. Mohit Kumar (University of Barcelona) and Dr. Denis Scaini (UPV/EHU, Vitoria-Gasteiz). Eight early-stage researchers (PhD students and postdocs) presented their work to the local scientific community in two sessions.

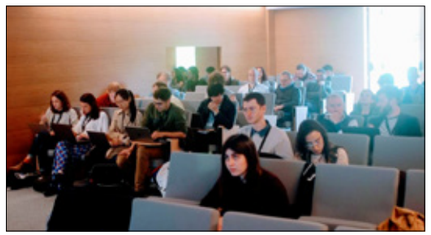
Invited Speakers
Ignacio Sancho-Martinez (Faes Farma, Spain)
Susana Carregal (CIC biomaGUNE, Spain)
Ana Beloqui (UPV/EHU, POLYMAT, Spain)
Elisa Jimenez (UPV/EHU, DIPC, Spain)
Mohit Kumar (University of Barcelona, Spain)
Denis Scaini (UPV/EHU, Vitoria-Gasteiz, Spain)
Ester Verde (CSIC-UPV/EHU-MPC, Ikerbasque, Spain)
Ibon Santiago (CIC NanoGUNE, Spain)

Cosmology with the Large Scale Structure of the Universe (CosmoLSS)

May 15-18, 2023
DIPC, Donostia/San Sebastián
https://bacco.dipc.org/workshop

Organizing Committee
Raul Angulo (Ikerbasque, DIPC)
Marcos Pellejero-Ibañez (DIPC)
Lurdes Ondaro (DIPC)
Sara Ortega (DIPC)
Daniel Lopez-Cano (DIPC)
Sergio Contreras (DIPC)
Jens Stucker (DIPC)
Francisco Maion (DIPC)

The four-day workshop proved to be successful, fostering new collaborations and ideas in the field of large-scale structure of the Universe. The meeting consisted of 47 scientists from 27 different institutions, each offering complementary expertise and unique perspectives. The discussion sessions covered the current main topics in the field: cosmological inferences, numerical simulations, machine learning and modelling, and data analyses. Additionally, we held four brainstorming sessions aimed at defining joint research projects and exploring new ideas. The atmosphere throughout both the discussion and brainstorming sessions was vibrant and fruitful, thanks to the sharing and open attitude of all the participants. Therefore, the workshop's outcome promises to enable the development of numerous novel ideas and approaches within the field.



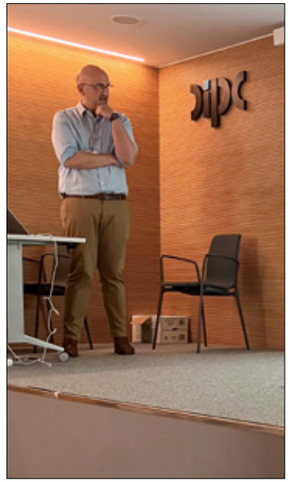
Invited Speakers
David Alonso (Oxford University, UK)
Dragan Huterer (University of Michigan, USA)
Francoise Lanusse (CNRS, Paris, France)
Alkistis Pourtsidou (University of Edinburgh, Scotland)
Volker Springel (Max Planck Institute for Astrophysics, München, Germany)
Romain Teyssier (Princeton University, USA)
Licia Verde (University of Barcelona, Spain)
Mark Vogelsberger (MIT Kavli Institute, USA)

Mathematical Finance and Stochastics: A Conference in Honor of David Nualart

May 29-31, 2023
DIPC, Donostia/San Sebastián
https://wis.kuleuven.be/events/2023_conferentie-san-sebastian/ConferenceNualart

Organizing Committee
Wim Schoutens (UC Leuven)
José Manuel Corcuera (UB, Barcelona)

This workshop was devoted to celebrate the remarkable academic career of Prof. Dr. David Nualart Rodon and his influence in the area of theoretical finance and in stochastic analysis. By putting together young and renowned senior researchers around the world, many of them with a strong link with David Nualart's work, we got to establish connections with different projects and at the same time to show the mathematical value of different results obtained by David.



Invited Speakers
Dilip Madan (Maryland University, USA)
Salvador Ortiz (Oslo University, Norway)
Arturo Kohatsu-Higa (Ritsumeikan University, Japan)
Ivan Nourdin (Luxembourg University, Luxembourg)
Giovanni Peccati (Luxembourg University, Luxembourg)
Mark Podolskij (Luxembourg University, Luxembourg)
Nakahiro Yoshida (Tokyo University, Japan)
Guangqu Zheng (Liverpool University, UK)
Giulia Di Nunno (Oslo University, Norway)
Peter Imkeller (Humbolt University, Germany)
Yahozong Hu (University of Alberta, Canada)
Tommi Sottinen (University of Vaasa, Finland)
Benjamin Robinson (University of Viena, Austria)
Asma Khedher (University of Amsterdam, The Netherlands)
Gero Junike (Carl von Ossietzky Universität, Institut für Mathematik, Oldenburg, Germany)

BiD4BESt–Network Training Event 2023

June 5-9, 2023
DIPC, Donostia/San Sebastián
https://www.bid4best.org/2023/06/27/bid4best-network-training-event-5th-9th-june-2023-donostia-international-physics-centre-san-sebastian-spain

Organizing Committee
Silvia Bonoli (Ikerbasque, DIPC)
Francesco Shankar (University of Southampton)

The meeting was the third weeklong in-person meeting and training event of the BiD4BESt ITN, a network funded by H2020. The network focuses on the study of the evolution of supermassive black holes and includes 13 early career researchers and their supervisors, located in 10 different institutes across Europe. During the first two days of the meeting we discussed the advance of the project and future projections. We also invited Prof. Francisco Carrera and Dr. George Mountrichas (IFCA, Santander) to discuss advances in the field of X-ray astronomy.

The last three days, the early career researchers experienced several training sessions centered mostly around the preparation for their next steps in either academia or industry.

Invited Speakers
Carolina Andonie (UDUR, UK)
Brivael Laloux (NOA, Greece)
Blessing Musiimenta (UNIBO, Italy)
Giovanna Speranza (IAC, Spain)
Mathilda Avirett-MacKenzie (University of Bath, UK)
Ivan Munoz Rodriguez (NOA, Greece)
Ivan Lopez (UNIBO, Italy)
Nischal Acharya (DIPC, Spain)
Alexander Sicilia (SISSA, Trieste, Italy)
Evgenii Chaikin (ULEI, The Netherlands)
Alba Vega Alonso Tetilla (SOTON, UK)
Hao Fu (SOTON, UK)
Luca Sala (LMU, Germany)

Nanophotonics of 2D Materials, N2D 2023

June 19-22, 2023
Miramar Palace, Donostia/San Sebastián
https://n2d-2023.dipc.org

Organizing Committee
Alexey Nikitin (DIPC, Ikerbasque)
Luis Martín-Moreno (INMA, CSIC-UNIZAR)
Tony Low (University of Minnesota)

Over the past decade, there is a growing research activity on light-matter interactions in atomically thin materials, such as graphene, topological insulators, thin polar and semiconducting layers and other van der Waals materials, including their heterostructures. Nanophotonics of 2D materials (N2D) aimed at the exploration of their optical phenomena and at providing a setting where researchers from diverse fields could convene; classical and quantum optics; excitons, phonons and plasmons; far-field and near field spectroscopies; many body optical physics; topological photonics; among many others. Through these interactions, N2D sought to provide a setting where unifying concepts could form, new ideas could be inspired, and new frontiers in theoretical and experimental research on 2D materials nanophotonics could emerge.

Invited Speakers
Igor Aharonovich (University of Technology Sydney, Australia)
Harry Atwater (California Institute of Technology, USA)
Pablo Alonso Gonzalez (University of Oviedo, Spain)
Claudia Backes (University of Kassel, Germany)
Dmitri Basov (Columbia University, USA)
Stéphane Berciaud (Université de Strasbourg, CNRS, IPCMS, France)
Dario Bercioux (DIPC, Ikerbasque, Spain)
Zhigang Chen (Nankai University, China and San Francisco State University, USA)
Cheng Wei Qiu (National University of Singapore)
Monica Crăciun (University of Exeter, UK)
Robert J. Hicken (University of Exeter, UK)
Felipe Jornada (Stanford University, USA)
Ido Kaminer (Technion, Israel)
Susanne Kehr (Technische Universität Dresden, Germany)
Frank Koppens (ICFO, ICREA, Spain)
Alexander S. McLeod (Columbia University, University of Minnesota Twin Cities, USA)
Vinod Menon (City College of New York, CUNY, USA)
Doron Naveh (Bar-Ilan University, Ramat Gan, Israel)
Justin Song (Nanyang Technological University, Singapore)
Miriam Vitiello (National Research Council, Italy)
Amaia Zurutuza (Graphenea, Spain)

NEXT Collaboration Summer Meeting 2023

June 19-23, 2023
DIPC, Donostia/San Sebastián
https://next.ific.uv.es/next

Organizing Committee
Paola Ferrario (DIPC, Ikerbasque)
Juan Jose Gomez Cadenas (DIPC, Ikerbasque)
Francesc Monrabal Capilla (DIPC, Ikerbasque)
Stefano Roberto Soleti (DIPC)

The collaboration meets regularly to discuss the status and the plans for the NEXT experiment. The goal is to detect a hypothetical nuclear process called neutrinoless double beta decay, which could explain the asymmetry between matter and antimatter in the universe.

During the workshop the collaborators discussed the progress towards the installation of the NEXT-100 detector and the plans for the NEXT-HD and NEXT-BOLD projects.

Invited Speakers
Pau Novella (IFIC, Valencia, Spain)
Helena Almazan Molina (University of Manchester, UK)
Brais Palmeiro (University of Manchester, UK)
Krishan Mistry (UTA, USA)
Leslie Rogers (Argonne National Laboratory, USA)
Roxanne Guenette (University of Manchester, UK)
Vicente Herrero-Bosch (UPV, Spain)
Curro Toledo (UPV, Spain)
Fabian Kellerer (IFIC, Valencia, Spain)
Lior Arazi (Ben Gurion University, Israel)
Fernando Cossio (UPV/EHU, Spain)
Zoraida Freixa (UPV/EHU, Spain)
Karen Navarro (UTA, USA)
Reagan Miller (UTA, USA)
Martín Pérez Maneiro (IGFAE-USC, Spain)

Quantum Phenomena in 2D Matter (QP2DM-2023)

July 17-21, 2023
Miramar Palace, Donostia/San Sebastián
https://qp2dm.dipc.org

Organizing Committee
Vitaly Golovach (CFM-UPV/EHU, DIPC, Ikerbasque)
Evgeny Sherman (EHU Quantum Center, UPV/EHU, Ikerbasque)
Michael Zudov (University of Minnesota, USA)

Modern theoretical, experimental, and applied physics of two-dimensional systems explore and employ the great richness of their quantum properties. These properties are probed by various experimental techniques, such as charge, spin, exciton, and heat transport, optical, microwave, and scanning-probe spectroscopies, photo resistance, etc. Some of the most celebrated phenomena realized in these 2D systems are quantum Hall effects, Wigner crystals, stripes and bubble phases, and excitonic Bose condensates.

We aimed to bring together leading experts and the researchers at the beginning of their careers in the field of quantum physics of 2D matter for presentation and discussion of their recent results and ongoing developments. On the humanitarian side, we accomplished the goal of gathering a well-tuned audience, ranging from renown physicists (including a Nobel laureate) to young and brilliant minds at world's most famous universities. Additionally, the workshop was attended by representatives of the editorial staff at Nature Reviews Physics, the R&D company Tecnalia Research & Innovation, and the Gordon and Betty Moore Foundation. On the scientific side, we accomplished the goal of reviewing the most important advances in the field since the pre-covid times, exchanged expectations for the future progress in the field, and created a stimulating atmosphere for the exchange of knowledge in the community, encompassing also the Basque science community.

Invited Speakers
Shaffique Adam (Yale-NUS College, Singapore)
Eva Andrei (Rutgers University, USA)
Ankita Anirban (Nature Reviews Physics, UK)
Alexey Berdyugin (University of Manchester, UK)
Deung-Jang (DJ) Choi (CFM/MPC, Spain)
Swarup Deb (University of Rostock, Germany)
Lingjie Du (Nanjing University, China)
Rui-Rui Du (Peking University, China)
Lloyd Engel (Florida State University, USA)
Jaroslav Fabian (Regensburg University, Germany)
Yuval Gefen (Weizmann Institute of Science, Israel)
Leonid Golub (Regensburg University, Germany)
Alejandro Gonzalez-Tudela (IFF-CSIC, Spain)
Igor Gornyi (Karlsruhe Institute of Technology, Germany)
Francisco Guinea (IMDEA Madrid and DIPC, Spain)
Adbhut Gupta (Princeton University, USA)
Bertrand Halperin (Harvard University, USA)
Alexander Hamilton (University of NSW, Australia)
Zeyu Hao (Harvard University, USA)
Masayuki Hashisaka (NTT Basic Research Laboratories, Japan)
Harold Hwang (Stanford University, USA)
Maxim Ilyn (MPC-CFM, Spain)
Takuya Iwasaki (National Institute for Materials Science, Japan)
Jainendra Jain (Pennsylvania State University, USA)
Jelena Klinovaja (University of Basel, Switzerland)
Klaus von Klitzing (Max Planck Institute for Solid State Research, Germany)
Piotr Kossacki (University of Warsaw, Poland)
Ze Don Kvon (Novosibirsk State University, Russia)
Maria Labendik (Weizmann Institute of Science, Israel)
Alex Levchenko (University of Wisconsin-Madison, USA)
Yang Liu (Peking University, China)
Daniel Loss (University of Basel, Switzerland)
Allan MacDonald (University of Texas Austin, USA)
Michael Manfra (Purdue University, USA)
Xavier Marie (INSA Toulouse, France)
Denis Maryenko (RIKEN, Japan)
Yigal Meir (Ben Gurion University, Israel)
Dmitry Miserev (University of Basel, Switzerland)
Markus Morgenstern (RWTH Aachen University, Germany)

Alberto Morpurgo (University of Geneva, Switzerland)
Elisabetta Paladino (University of Catania, Italy)
Stuart Parkin (Max Planck Institute of Microstructure Physics, Germany)
Loren Pfeiffer (Princeton University, USA)
Leonid Ponomarenko (Lancaster University, UK)
Marek Potemski (LNCMI-CNRS, France)
Leonid Rokhinson (Purdue University, USA)
Maksim Savchenko (Vienna University of Technology, Austria)
Qianhui Shi (University of California, USA)
Inti Sodemann (University of Leipzig, Germany)
Takashi Taniguchi (National Institute for Materials Science, Japan)
Lars Tiemann (University of Hamburg, Germany)
Ilya Tokatly (UPV/EHU, Spain)
Miguel Moreno Ugeda (DIPC, Ikerbasque, Spain)
Chengyu Wang (Princeton University, USA)
Robert Willett (Nokia Bell Labs, USA)
Chi Zhang (Institute of Semiconductors, Chinese Academy of Science, China)
Jun Zhu (Pennsylvania State University, USA)
Michael Zudov (University of Minnesota, USA)

NanoNeuro 2023

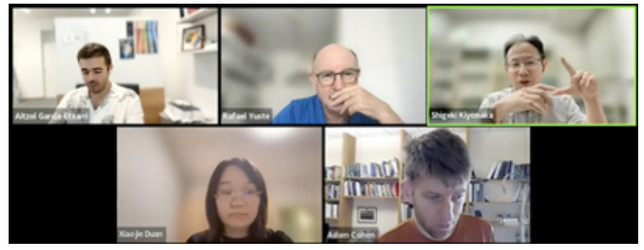
July 20, 2023
Live streamed
https://ntc.columbia.edu/nanoneuro-2023

Organizing Committee
Aitzol Garcia-Etxarri (DIPC, Ikerbasque)
Rafael Yuste (Columbia University, NY, USA)

The conference aimed to help nucleate the emerging field of research at the intersection of Nanoscience and Neuroscience and provide a forum for experts from both areas to interact.

NanoNeuro2023 was an online conference, organized by the NeuroTechnology center at Columbia University and Donostia International Physics Center (DIPC). The Conference was organized in thematic sessions with keynote and invited talks. This workshop was sponsored by the Tianqiao and Chrissy Chen Institute.

The conference achieved its scientific objectives and was followed by a total 1000 people, making it a great success with the public as well.



Invited Speakers
Jinwoo Cheon (Yonsei University, South Korea)
Adam Cohen (Harvard University, USA)
Xiaojie Duan (Peking University, China)
Julliet Gopinath (University of Colorado, USA)
Shigeki Kiyonaka (Nagoya University, Japan)
Michael Krieg (ICFO, Spain)
Alvaro Pascual-Leone (Harvard University, USA)
Lisa Poulikakos (UCSD, USA)

Workshop on Long-Range Interactions in Quantum Systems

September 05-08, 2023
Miramar Palace, Donostia/San Sebastián
https://www.erbium.at/FF/?page_id=50671

Organizing Committee
Francesca Ferlaino (University of Innsbruck, IQOQI)
Antoine Browaeys (Institut d'Optique, CNRS, France)
Robert Loew (Stuttgart University, Germany)

The conference "Long-Range interactions in Quantum Systems" was a highly successful scientific event, bringing together several world experts to discuss and present the latest experimental and theoretical results in the field of long-range interactions.

To motivate and recognize the work of the PhD students, nine posters were chosen to become "hot-topic" and the authors were given 30 minutes to present their work.

On Wednesday, September 6, a lunch for gender inclusion was held to which all the female participants and the organizers were invited. This luncheon served to strengthen the bonds between female scientists and to raise awareness of the gender imbalance in academia and inspire women to pursue their studies in physics.

The workshop was a great scientific success. Various realizations of many-body systems with long-range interaction, from Rydberg atoms to molecules and dipole condensates, were discussed. The speakers not only presented published results, but also unpublished data were discussed. There was an active exchange of ideas between speakers and participants.

Invited Speakers
Waseem Bakr (Princeton University, USA)
Luca Barbiero (Politecnico di Torino, Italy)
Nigel Cooper (Cambridge University, UK)
Tobias Donner (ETHZ, Switzerland)
Ofer Firstenberg (Weizmann Institute, Israel)
Markus Greiner (Harvard University, USA)
Atac Imamoglu (ETHZ, Switzerland)
Matthew Jones (Durham University, UK)
Kang-Kuen Ni (Harvard University, USA)
Tilman Pfau (Stuttgart University, Germany)
Sylvain Ravets (CNRS, France)
Ana-Maria Rey (JILA, USA)
Richard Schmidt (Heidelberg University, Germany)
Leticia Tarruell (ICFO, Spain)
Sebastian Will (Columbia University, USA)
O. Rubies Bigorda (MIT, USA)
Thomas Pohl (Aarhus University, Denmark)
Wolfgang Ketterle (Nobel Prize in Physics 2001, MIT, USA)

Artificial Intelligence Photonics 2023

September 11-14, 2023
Carlos Santamaría Centre, Donostia/San Sebastián
https://aiphotonics.dipc.org

Organizing Committee
Cefe López (DIPC, ICMM-CSIC)
David García (CSIC)
Aitzol Garcia-Etxarri (DIPC, Ikerbasque)
Javier Aizpurua (CFM-CSIC)

With this workshop, we intended to bring forward a meeting with international experts in the areas of artificial intelligence and photonics and the respective national communities to create the seed of a new speciality almost absent in the country and foster new joint industrial or research initiatives.

Invited Speakers
Thomas Bocklitz (University of Jena, Germany)
Daniel Brunner (CNRS, FEMTO-ST, France)
Sylvain Gigan (Sorbonne Université, CNRS, France)
Antonio Hurtado (University of Strathclyde, UK)
Laurent Larger (FEMTO-ST, France)
Serge Massar (Université Libre de Bruxelles, Belgium)
Wolfram H Pernice (Physics Institute, CeNTech, Germany)
Davide Pierangeli (La Sapienza, Rome)
Paul R Prucnal (Princeton University, USA)
Demetri Psaltis (EPFL, Switzerland)
Junsuk Rho (POSTECH, South Korea)
Damien Rontani (CentraleSupélec, France)
Miguel Soriano (IFISC-UIB-CSIC, Spain)
Giovani Volpe (University of Gothenburg, Sweden)
Roberta Zambrini (IFISC-UIB-CSIC, Spain)

The Third Spins on Surfaces (SoS III)

September 11-15, 2023
Miramar Palace, Donostia/San Sebastián
http://sos3.dipc.org

Organizing Committee
Deung-Jang, Choi (CFM-CSIC-UPV/EHU, Donostia/San Sebastián)
Andreas Heinrich (Center for Quantum Nanoscience, Seoul, Korea)

The workshop provided a comprehensive platform for researchers to present and share their work, resulting in the dissemination of valuable knowledge in the realm of quantum nanoscience. Attendees gained insights into the latest breakthroughs and research directions. SoS III facilitated networking and collaboration opportunities among scientists, enabling the formation of collaborations that are essential for advancing research in quantum nanoscience. The workshop effectively highlighted the significance of milestones in the field, particularly the detection of the spin resonance signal. This emphasized the importance of staying at the forefront of developments in this rapidly evolving area. By exploring the potential of the Scanning Tunneling Microscope in measuring and controlling quantum spins, SoS III contributed to the advancement of quantum information research, opening up new avenues for research and innovation. Attendees gained a deeper understanding of correlations and the manipulation of quantum objects, paving the way for further progress in quantum technologies and applications. The workshop successfully explored the introduction of superconducting substrates and the creation of topological states, shedding light on the exciting possibilities in the field of quantum computing and information processing.

In conclusion, the SoS III International workshop met its aims by fostering knowledge dissemination, collaboration, and exploration of key milestones in quantum nanoscience. It successfully advanced the understanding of quantum information and correlations for the future of quantum technologies.

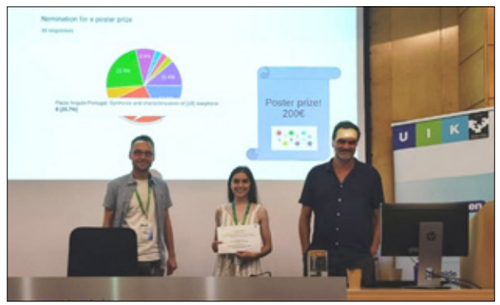
Invited Speakers
Jens Wiebe (Hamburg University, Germany)
Andreas Heinrich (Center for Quantum Nano Science, Seoul, Korea)
Nicolas Lorente (CFM-CSIC-UPV/EHU, Donostia/San Sebastián, Spain)
Christopher Lutz (IBM Research, USA)
Harald Brune (École Polytechnique Fédérale de Lausanne, Switzerland)
Philip Willke (Karlsruher Institut für Technologie, Germany)
Christian Ast (Max Planck Institute for Solid State Research, Stuttgart, Germany)
Deung-Jang Choi (Materials Physics Center, Donostia/San Sebastián, Spain)
Sander Otte (Delft University of Technology, The Netherlands)
Fernando Delgado (University of La Laguna, Spain)
Sebastian Stepanow (ETH Zürich, Switzerland)
Alex Khajetoorians (Radboud University, The Netherlands)
Soo-hyon Phark (Center for Quantum Nano Science, Seoul, Korea)
Laurent Limot (IPCMS, CNRS, University of Strasbourg, France)

International Workshop on Spin Research in Graphene Nanostructures (SPRING'23)

September 18-20, 2023
UPV/EHU, Donostia/San Sebastián
https://spring23.dipc.org

Organizing Committee
Jose Ignacio Pascual (CIC nanoGUNE, Donostia/San Sebastián)
Thomas Frederiksen (DIPC, Ikerbasque, Donostia/San Sebastián)

The International Workshop on Spin Research in Graphene Nanostructures (SPRING'23) stood as a beacon of innovation, commemorating the recent advancements surrounding graphene's magnetism. Under the banner of the EU-funded SPRING project through the H2020 FET-Open initiative, there has been a resolute commitment to pioneer an all-carbon platform tailored for spintronics applications. Over the years, this ambition has brought together researchers from diverse disciplines, culminating in the creation of atomically precise graphene nanostructures and the skillful characterization and manipulation of their electron and nuclear spins. SPRING'23 not only showcased the significant milestones of the SPRING project but also created a fertile ground for academic exchange. With an attendance of 63 participants and a distinguished lineup of 13 invited speakers, the workshop echoed with insightful discussions on a range of topics, from the intricacies of magnetism in graphene nanostructures to fabrication methodologies, proficient electron spin detection, and cutting-edge computational modeling and theoretical insights. Furthermore, the workshop was marked by engaging scientific discussions, some of which unveiled unpublished findings, a stimulating poster session bursting with novel ideas, and an overarching atmosphere of open dialogue and collaboration.



Invited Speakers
Guido Burkard (University of Konstanz, Germany)
Araceli G. Campaña (Granada University, Spain)
Juan Casado (Málaga University, Spain)
David Écija (IMDEA Nanociencia, Madrid, Spain)
Läetitia Farinacci (TUDelft, The Netherlands)
Roman Fasel (EMPA, Zürich, Switwerland)
Joaquin Fernandez-Rossier (University of Alicante, Spain and INL Braga, Portugal)
Pavel Jelinek (Institute of Physics, Czech Academy of Sciences, Czechia)
Aurelio Mateo-Alonso (Polymat UPV/EHU, Spain)
Dimas G. de Oteyza (CINN, Oviedo, Spain)
Igor Rončević (University of Oxford, UK)
Lisanne Sellies (Regensburg University, Germany)
Oleg V. Yazyev (EPFL, Lausanne, Switzerland)

Origins of Life Donostia Meeting 2023 (OLDM'23)

October 02-04, 2023

Miramar Palace, Donostia/San Sebastián

https://www.oldm2023.org

Organizing Committee

Kepa Ruiz-Mirazo (UPV/EHU)

Daniele De Martino (Ikerbasque Fellow, Biofisika Institute)

Nino Lauber (DIPC, UPV/EHU)

Arián Ferrero (PhD student, Biofisika Institute)

Scientific Committee

Juli Peretó (University of Valencia, Spain)

Sheref Mansy (CIBIO, University of Trento, Italy and University of Alberta, Canada)

Joseph Moran (University of Strasbourg, France)

Dora Tang (Max Planck Institute, Dresden, Germany)

Matthew Powner (University College London, UK)

Peter Walde (ETH-Zürich, Switzerland)

The motivation for organizing this event was to provide an opportunity for all researchers interested in the problem of life's origin (i.e., the problem of how biological phenomena could emerge from complex physics and chemistry) to get together in a beautiful location, in a friendly environment where they/we could share and discuss recent ideas/results on this fascinating topic. In addition, the meeting was the final event of a European Marie Curie ITN Project centred on the physical and chemical roots of metabolism (https://protomet-etn.eu/), but we decided to open it to the whole origin-of-life community. Therefore, although the programme covered a significant number of contributions related to 'proto-metabolic systems', a wider range of questions within the field were welcome for presentation and debate. This included scientific inputs, of course, both experimental and theoretical, but also more conceptual/philosophical reflections on open questions that remain a challenge, of more general concern, for the whole community.

The meeting was an absolute success, not only in terms of participation but also, and more importantly, in terms of the quality of the contributions (invited lectures, oral communications and posters) as well as the questions/exchanges made and the general atmosphere during the sessions. Given the recent pandemic and post-pandemic years, it is quite safe to say that this was the best 'in-person' international meeting of the origins-of-life community for a long time.

Invited Speakers

Jack Szostak (Nobel Prize in Physiology or Medicine 2009, University of Chicago, USA)

Matthew Powner (University College London, UK)

Irene Chen (University of California, LA, USA)

Joana Xavier (Dayhoff Labs London, UK)

Karin Oberg (Harvard University, USA)

Dora Tang (Max Planck Institute, Dresden, Germany)

Daniel Segré (Boston University, USA)

Joseph Moran (University of Strasbourg, France)

Ram Krishnamurthy (The Scripps Research Institute, USA)

Sheref Mansy (University of Trento, Italy and University of Alberta, Canada)

Claudia Bonfio (University of Strasbourg, France)

Peter Walde (ETH-Zürich, Switzerland)

XV International Ontology Congress–The Issue of the Uniqueness of HUMANKIND. State of the art in the light of contemporary scientific and philosophical thinking

October 3-7, 2023
UPV/EHU, Chillida-Leku Museum, Donostia/San Sebastián
October 9-10, 2023
Ca' Foscari University, Venice, Italy
October 26, 2023
Fundación Paideia Galiza, A Coruña
www.ontologia.info

Organizing Committee
Víctor Gómez Pin (UAB)
Bárbara Jiménez Pazos (UPV/EHU)
Gotzon Arrizabalaga Pikabea (UPV/EHU)
Juan Ramón Macuso
Stefano Maso (Ca' Foscari)
Davide Spanio (Ca' Foscari)

As planned, the 30th anniversary edition of the XV International Ontology Congress was inaugurated at Chillida-Leku Museum on October 3rd. The regular sessions were held at the Faculty of Education, Philosophy and Anthropology were very successful. The capacity of the halls was filled in most cases. These sessions received much attention not only from participants, but also from visitors who came along as listeners. These regular sessions were closed at Chillida-Leku Museum on October 7th.

On October 9th and 10th, the Venice sessions of the congress were held at Ca' Foscari University, Aula Mario Baratto in Canal Grande. All keynote speakers were highly acclaimed for the quality of their interventions and debates raised during the Q&A time slots were transferred outside the boundaries of Ca' Foscari University and continued through lunch and dinner.

On October 14th, a debate on the "Uniqueness of humankind" was held at the Paideia-Galiza Foundation in A Coruña, with the participation of Javier Gomá (Fundación Juan March, Madrid), Bárbara Jiménez (UPV/EHU, Donostia/San Sebastián) and Daniel Innerarity (European University Institute, Firenze). The capacity of the main hall at Paideia foundation was filled. After all participants gave their speeches, a very thought-provoking debate was raised between the speakers and audience.

Having all this in mind, we believe that the congress fulfilled its main objectives.

Invited Speakers
Luca Maria Scarantino (Fudan scholar, Italy)
Steen Rasmussen (University of Southern Denmark)
Humberto Bustince (UPNA, European Academy of Sciences and Arts, Spain)
David Wallace (Pittsburgh University, USA)
Tim Maudlin (New York University, USA)
Alberto Cordero (City University of New York, USA)
Javier Tejada (UB, Barcelona, Spain)
Pedro Miguel Echenique (DIPC, Spain)
Daniel Innerarity (Ikerbasque, Spain and EUI, Firenze, Italy)
Francis Wolff (ENS, Paris, France)
Roberto R. Aramayo (CSIC, Madrid, Spain)
Bárbara Jiménez (UPV/EHU, Spain)
Paavo Pylkkänen (University of Helsinki, Finland and University of Skövde, Sweden)
Jeffrey Barrett (University of California, USA)
Juan José Gómez Cadenas (Ikerbasque, DIPC, Spain)
Adela Cortina (Universidad de Valencia, ACMYP, Spain)
Javier Echeverría (Jakiunde, Spain)
Jesús Zamora Bonilla (UNED, Madrid, Spain)
Silvia de Bianchi (Università degli Studi di Milano, Italy)
Elena Partene (ENS, Paris, France)
Stella Villarmea (UCM, Spain and Oxford University, UK)
Ambrosio Velasco (UNAM, Mexico)
Paolo Ponzio (Bari University, Italy)
Maite Arraiza (UPV/EHU, Spain)
Javier Gomá (Fundación Juan March, Madrid, Spain)
M. Pierre-Marie Morel (University of Paris 1, France)
Elisabetta Cattanei (Università Cattolica del Santo Cuore, Milano, Italy)
L. Paltrinieri (Ca' Foscari, Venezia, Italy)
Iker Martínez (UNED, Madrid, Spain)
F. G. Herrmann (Swansea University, UK)
Franco Ferrari (University of Pavia, Italy)
Messinese Leonardo (Pontificia Università Lateranense, Italy)
Rafael Yuste (Columbia University, USA)
Riccardo Chiaradonna (Università Roma Tre, Italy)
Emiliano Trizio (Ca' Foscari Venezia, Italy)
Cecilia Martini (Padova Università, Italy)

International Quantum Matter Conference & Expo–QUANTUMatter 2023

May 23-25, 2023
Espacio Pablo VI, Madrid
https://www.quantumconf.eu/2023/about.php#about

Organizing Committee
Antonio Correia (Phantoms Foundation)
Ricardo Díez Muiño (DIPC, CFM-CSIC, Ikerbasque)
Juan Jose Garcia-Ripoll (IFF-CSIC)
Pablo Ordejón (ICN2)
Gloria Platero Coello (ICMM-CSIC)
Ramon Aguado (ICMM/CSIC)
Alejandro Gonzalez-Tudela (IFF-CSIC)
Alfredo Levy Yeyati (IFIMAC / UAM)
Diego Porras (IFF-CSIC)
Alejandro Pozas (UCM)

The 3rd edition of the Quantum Matter International Conference – QUANTUMatter 2023 (Madrid, Spain)– aimed at gathering the various communities engaged in the science and technologies of quantum information and quantum matter, to foster the incubation of new ideas & collaborations at the forefront of quantum technologies, emerging quantum materials and novel generations of quantum communication protocols, quantum sensing and quantum simulation.

Quantum Information and Quantum Matter are two components of revolutionary treatments of information, which are becoming cornerstones for discovering and implementing disruptive paradigms in quantum computation and quantum technologies. They have huge potential to impact established industrial sectors or building novel industries, as evidenced by the race towards practical quantum computers, together with the use of quantum technologies for secure communication, sensing and simulations of the quantum world.

Quantum Matter encompasses existing materials used in current quantum technologies and Qubits-based architectures design as well as the vast family of topological quantum materials in which symmetries, topology and entanglement are strongly intertwined. They give rise to spectacular phenomena such as exotic superconductivity, quantum spin liquids, quantum anomalous Hall effect, nontrivial fermionic excitations such as Majorana fermions or more exotic many-body states, etc. The convergences and synergies between Q-information and Q-Matter are foundational and will keep flourishing in the next decade.

Invited Speakers
Jerry Chow (IBM, USA)
Daniel Loss (University of Basel, Switzerland)
Mikhail Lukin (Harvard University, USA)
Maciej Lewenstein (ICFO/ICREA, Spain)
Chetan Nayak (Microsoft Research, USA)
William Oliver (MIT, USA)
Ana Maria Rey (University of Colorado, USA)
Pascale Senellart-Mardon (C2N-CNRS-Université Paris Saclay, France)
Monika Aidelsburger (Ludwig-Maximilians-University Munich, Germany)
Hugues de Riedmatten (ICFO, Spain)
Yvonne Gao (NUS, Singapore)
Géza Giedke (DIPC, Ikerbasque, Spain)
Georgios Katsaros (IST Austria)
Eun-Ah Kim (Cornell University, USA)
Jelena Klinovaja (University of Basel, Switzerland)
Eduardo Lee (IFIMAC / UAM, Spain)
Fernando Luis (UNIZAR, Spain)
Mikko Möttönen (Aalto University, Finland)
Ioan Pop (KIT, Germany)
Giordano Scappucci (TU Delft, The Netherlands)
Costanza Toninelli (Istituto Nazionale di Ottica, Italy)
Binghai Yan (Weizmann Institute of Science, Israel)
Yonatan Cohen (Quantum Machines, Israel)
Yemliha Bilal Kalyoncu (Qblox BV, The Netherlands)
Moritz Kirste (Zurich Instruments AG, Switzerland)
Lucas Leclerc (PASQAL, France)
Zlatko Minev (IBM Quantum Research, USA)
Roman Orus (DIPC, Ikerbasque, Multiverse Computing, Spain)
Pedram Roushan (Google Inc, USA)

Topological Photonics 2023 (TopoPhoto23)

May 31 - June 2, 2023
CSIC Central Campus (Serrano), Madrid
https://eventos.uam.es/88595/detail/topological-photonics-2023.html

Organizing Committee
Aitzol Garcia-Etxarri (DIPC, Ikerbasque)
Paloma A. Huidobro (IFIMAC-UAM)
Alejandro González Tudela (Instituto de Física Fundamental-CSIC)
Diego Porras (Instituto de Física Fundamental-CSIC)
Alberto Amo (Laboratoire PhLAM CNRS – Université de Lille)

The TopoPhoto23 workshop was aimed at gathering a critical mass of people working in the vibrant area of Topological Photonics as well as topology in other wave and quantum phenomena. It continued the series of workshops "Topology meets quantum optics 2021 (online)" and "Topological Photonics 2022 (San Sebastian, Spain). The 2023 meeting brought together scientists exploring topics such as topological photonic crystals, topological metamaterials, non-Hermitian topology, topological light-matter interfaces, directional amplifiers, topological protection of non-classical states of light, as well as topological effects in other classical non-classical systems.

Invited Speakers
B. Andrei Bernevig (Visiting DIPC, Ikerbasque, Spain and Princeton University, USA)
Jacqueline Bloch (C2N-CNRS, France)
Mohammad Hafezi (University of Maryland, USA)
Mikael C. Rechtsman (Penn State, USA)
Marin Soljačić (MIT, USA)
Andrea Blanco Redondo (Nokia Bell Labs, USA)
Lacopo Carusotto (INO-CNR Trento, Italy)
Boubacar Kanté (Berkeley University, USA)
Alireza Marandi (Caltech, USA)
F. Nur Ünal (University of Cambridge, UK)
Vittorio Peano (MPL, Germany)
Maia G. Vergniory (DIPC, Spain and MPI CPfS, Dresden, Germany)
Baile Zhang (NTU, Singapore)
Alberto Cortijo (UAM, Spain)
Konstantin Bliokh (Riken, Japan)

Discussions on Nano and Mesoscopic Optics (DINAMO 2023)

June 11-16, 2023
Svolvær, Lofoten Islands, Norway
https://www.ntnu.edu/nano/dinamo-2023

Organizing Committee
John de Mello (NTNU, Norway)
Stefan Maier (Monash University, Australia)
Andrea Bragas (UBA, Argentina)
In honor of Juan José Saenz (DIPC, Ikerbasque, Spain)

DINAMO 2023 is the fourth edition of "Discussions on Nano and Mesoscopic Optics". At this inspiring international meeting, scientists were invited to discuss in a relaxed atmosphere recent advances in understanding the interaction of light with nano and microscale systems. The meeting had a strong emphasis on encouraging interactions between senior and early stage scientists, with technical and social activities all day long, from breakfast until after dinner.

Nano and mesoscale optics is a multidisciplinary field that spans many different disciplines. DINAMO aimed to promote interactions between researchers from diverse backgrounds to give new solutions to complex problems. DINAMO explored the different circumstances in which nano and mesoscale optics occur, e.g., biological systems (proteins and DNA), soft materials (colloids and polymers), fabricated mechanical nanostructures (nano-antennas, motors, ratchets, and scaffolding), and, more generally, it explored light emission and propagation through complex and diffusive media.

DINAMO embraced all branches of nano and mesoscopic optics, including plasmonics, optical manipulation, cavity optics, nanophononics, optical fields in random media, single molecule spectroscopy, non-linear nano-optics, nano-holography, optical nano-antennas, optomechanics, and biophotonics, from both experimental and theoretical viewpoints.

Invited Speakers

Guillermo Acuna (University of Fribourg, Germany)
Andrea Bragas (Universidad de Buenos Aires, Argentina)
Dag Breiby (NTNU, Norway)
Oto Brzobohat (Institute of Scientific Instruments of the CAS, V. V. I., Czech Republic)
Joshua Caldwell (Vanderbilt University, USA)
Rémi Carimanti (Institut Langevin, France)
Cristian Ciracì (Istituto Italiano di Tecnologia, Italy)
Emiliano Cortés (University of Munich, Germany)
Gabriel Cwilich (Yeshiva Universith, USA)
Konstantinos Daskalakis (Turku University, Finland)
Simone De Liberato (University of Southampton, UK)
John de Mello (NTNU, Norway)
Yannick De Wilde (Institut Langevin, ESPCI Paris, PSL, CNRS, France)
Alexandre Dmitriev (University of Gothenburg, Sweden)
Aristide Dogariu (University of Central Florida, USA)
Jochen Feldmann (Nano-Institute, LMU Munich, Germany)
Luis Foa-Torres (University of Chile)
Jon Otto Fossum (NTNU, Norway)
Bettina Frank (University of Stuttgart, 4th Physics Institute, Germany)
Javier García De Abajo (ICFO, Spain)
Aitzol Garcia-Etxarri (DIPC, Ikerbasque, Spain)
Antonio Garcia-Martin (CSIC - Instituto de Micro y Nanotecnologia, Spain)
Maria Garcia-Parajo (ICFO - Institute of Photonic Sciences, Spain)
Vincenzo Giannini (TII, Italy)
Harald Giessen (University of Stuttgart, Germany)
Martin Greve (University of Bergen, Norway)
Nathan Hale (Department of Physics, NTNU, Norway)
Bodil Holst (University of Bergen, Department of Physics and Technology, Norway)
Boris Kalinic (University of Padova, Italy)
Morten Kildemo (NTNU, Norway)
Henrik Koch (Department of Chemistry, NTNU, Norway)
Arseniy Kuznetsov (Institute of Materials Research and Engineering, A*STAR, Singapore)
Mikael Käll (Chalmers University of Technology, Sweden)
Philippe Lalanne (CNRS, France)
Mia Kvåle Løvmo (Medical University Innsbruck, Switzerland)
Stefan Maier (Monash University, Australia)
Alejandro Manjavacas (Insituto de Optica-CSIC, Spain)
Onofrio Marago (CNR-IPCF, Italy)
Manuel Marques (UAM, Spain)
Eugenio Mendez (CICESE, Mexico)
Roberto Merlin (University of Michigan, USA)
Daniel Midtvedt (University of Gothenburg, Sweden)
Marcin Nyk (Wroclaw University of Science and Technology, Poland)
Sang-Hyun Oh (University of Minnesota, USA)
Michel Orrit (Leiden University, The Netherlands)
Aliaksandra Rakovich (King's College London, UK)
Daniel Ramos (ICMM, CSIC, Spain)
Helmut Ritsch (Universität Innsbruck, Switzerland)
Monika Ritsch-Marte (Medical University of Innsbruck, Switzerland)
Halina Rubinsztein-Dunlop (The University of Queensland, Australia)
Jose A. Sanchez-Gil (CSIC - Instituto de Estructura de la Materia, Spain)
Riccardo Sapienza (Imperial College London, UK)
Frank Scheffold (University of Fribourg, Germany)
Ingve Simonsen (Department of Physics, NTNU, Norway)
Natalie Stingelin (Georgia Institute of Technology, USA)
Giulia Tagliabue (EPFL, Switzerland)
Jason Valentine (Vanderbilt University, USA)
Niek Van Hulst (ICFO - the Institute of Photonic Sciences, Spain)
Alessandro Veltri (Universidad San Francisco De Quito, Ecuador)
Giorgio Volpe (University College London, UK)
Giovanni Volpe (University of Gothenburg, Sweden)
Rafal Wiglusz, (Polish Academy of Science, Poland)

6th Basque/2nd IKUR Quantum Science and Technology Workshop

October 20, 2023

UPV/EHU, Leioa

https://giedke.dipc.org/eusqutech23.html

Organizing Committee

Enrique Rico (UPV/EHU, Ikerbasque)
Geza Giedke (DIPC, Ikerbasque)

The meeting continues the tradition started in 2016. It aimed to bring together the growing community of researchers in the Basque Country working on or interested in quantum science and technology and related fields and to nurture and facilitate interaction, discussion, and collaboration. This year again as in 2022, we extended the invitation also to colleagues across the border in Bordeaux/Burdeos.

This year's workshop was the best attended so far, with close to 100 participants, including researchers from UPV/EHU, DIPC, CFM, BCAM, Tecnun, Tecnalia, University of Mondragon, as well as University of Bordeaux, and several Basque companies.

Invited Speakers

María Gastiasoro (DIPC, Ikerbasque, Spain)
Tobias Grass (DIPC, Ikerbasque, Spain)
Brahim Lounis (University of Bordeaux, France)
David Novoa (UPV/EHU, Ikerbasque, Spain)
Mikel Sanz (BCAM, UPV/EHU, Ikerbasque, Spain)
Jonathan Wise (University of Bordeaux, France)

Opportunities from Local Noise Spectroscopy

November 20-24, 2023

Lorentz Centre, University of Leiden, The Netherlands

https://www.lorentzcenter.nl/opportunities-from-local-noise-spectroscopy.html

Organizing Committee

Milan Allan (Leiden University)
Anastasiia Skurativska (DIPC)
Dario Bercioux (DIPC, Ikerbasque)
Ingmar Swart (Utrecht University)

This workshop brought together experts in mesoscopic noise and local noise, both from theory and experiment, to explore new opportunities offered by local noise spectroscopy.

Invited Speakers

Franke Katharina (FU Berlin, Germany)
Blanter Yaroslav (TU-Delft, The Netherlands)
Frederiksen Thomas (DIPC, Ikerbasque, Spain)
Ge Jacky (University of Leiden, The Netherlands)
Simon Pascal (University Paris-Saclay, France)
Eugene Demler (ETH, Switzerland)
Belzig Wolfgang (University of Konstanz, Germany)
Massee Freek (University Paris-Saclay, France)
Ortego Larraazabal Maialen (University of Leiden, The Netherlands)
Cuperus Jan (Utrecht University, The Netherlands)
Brede Jens (University of Cologne, Germany)
Verena Caspari (FU Berlin, Germany)
Bernhard Luescher (University of Zurich, Switzerland)
Ludovico Tesser (Chalmers University, Sweden)
Jan van Ruitenbeek (University of Leiden, The Netherlands)
Jiasen Niu (University of Leiden, The Netherlands)

Higher Education

Summer School on the Calculation of Ionic Quantum and Anharmonic Effects with the Stochastic Self-Consistent Harmonic Approximation (SSCHA School 2023)

June 26-30, 2023
Materials Physics Center (CSIC-UPV/EHU), Donostia/San Sebastián
http://sscha.eu/Schools/2023/home

Organizing Committee
Ion Errea (UPV/EHU, Spain)
Lorenzo Monacelli (EPFL, Switzerland)
Diego Martínez Gutiérrez (MPC, Spain)
Raffaello Bianco (UNIMORE, Italy)

The first "Summer School on the Calculation of Ionic Quantum and Anharmonic Effects with the Stochastic Self-Consistent Harmonic Approximation" provided a fantastic opportunity to learn the fundamental physics behind the SSCHA code and to get hands-on training sessions on its different utilities with lectures given by the developers of the code. The lectures covered a wide range of topics about the applications of the SSCHA on, for example, thermodynamic, vibrational, transport, spectroscopic, and superconducting properties in strongly anharmonic materials. The lectures and the hands-on sessions focused on the basics of the SSCHA, the calculation of the critical temperature of charge-density wave transitions, Raman and Infrared spectra of strongly anharmonic systems, the thermal conductivity at different levels of theory, and the superconducting properties of materials even if the harmonic approximation collapses.

The goals of the school were reached as the participants learned both the basics of the theory and how to use the code.

Invited Speakers
Ion Errea (UPV/EHU, Spain)
Lorenzo Monacelli (EPFL, Switzerland)
Diego Martínez Gutiérrez (MPC, Spain)
Raffaello Bianco (UNIMORE, Italy)
Giocanni Marini (Istituto Italiano di Tecnologia, Italy)
Francesco Mauri (La Sapienza University, Italy)
Antonio Siciliano (La Sapienza University, Italy)
Đorđe Dangić (UPV/EHU, Spain)
Guglielmo Marchese (La Sapienza University, Italy)

Topological Matter School 2023

August 21-25, 2023
Miramar Palace, Donostia/San Sebastián
http://tms.dipc.org

Organizing Committee
Maia G. Vergniory (DIPC, Max Planck for Chemical Physics of Solids)
Reyes Calvo (University of Alicante)
Santiago Blanco-Canosa (DIPC, Ikerbasque)
Adolfo Grushin (Institut NEEL – CNRS)
Alexander Altland (University of Cologne)

In this year's edition we focused on optical and electronic responses of topological matter such as novel and sizable non-linear optical effects, non-linear Hall responses without magnetic fields and universal responses of topological metals. Also, magnetotransport in topological metals is an exciting frontier to uncover exotic anomalous responses rooted in concepts from high-energy physics, such as the chiral anomaly. In this edition we have tackled all these phenomena, offering a pedagogical and broad picture of the main responses of topological matter.

Invited Speakers
Philip J. W. Moll (MPI, Hamburg, Germany)
Phuan Ong (Princeton University, USA)
Julen Ibañez-Azpiroz (UPV/EHU, CSIC, Spain)
Andrei Bernevig (Princeton University, USA)
Stepan Tsirkin (UPV/EHU, CSIC, Spain)
Dmytro Pesin (University of Virginia, USA)
Jennifer Cano (Flatiron and SBU, USA)
Nadya Mason (UIUC, USA)
Qiong Ma (Boston College, USA)
Prineha Narang (UCLA, USA)
David Vanderbilt (Rutgers, USA)
John Sipe (University of Toronto, Canada)
David Abergel (Chief editor Nature Physics, UK)

DIPC Course

An Introduction to Quantum Computing

June 6-8, 2023
CFM Auditorium, Donostia/San Sebastián

Yvan Le Borgne
Département Combinatoire et Algorithmique, LABRI, Université Bordeaux and CNRS

This lecture introduced the elementary notions of quantum computation at scales known by computer scientists; from the notions of quantum bits, gates and circuits up to algorithms solving problems. We briefly discussed the possible physical devices able to support the basic elements. Then we check how classical computation may be seen as a subset of quantum computation. We also studied quantum algorithms significantly more efficient (on an ideal quantum computer) than classical algorithms from Deutsh-Josza, Simon and Grover. We presented the BB84 protocol for quantum key distribution that relies on no-cloning theorem. We briefly illustrated the possibility of programming and simulating quantum circuits.

Quantum computation revisits interference and entanglement; the chain supporting computation on classical computers that goes from physical devices to algorithms solving problems. The aim of this lecture was to give a quick overview of this field. A tentative outline is:

- What is a quantum bit? A quantum gate? A quantum circuit?
- An interferometer's experiment dating from XIXth century as first physical quantum circuit not explainable by probabilities.
- What are the possible physical devices supporting quantum computation and their current qualities?
- Despite the restrictions on qubits, especially reversibility of computation before measurement, does quantum circuits extend classical circuits?
- What are the good old problems significantly better solved on an hypotetic perfect quantum computer than on an classical computer?
- How to program today targeting a quantum computer?
- The not detailed Shor's algorithm factoring integers is a threat for cryptography based on RSA, but is the no-cloning theorem a decisive advantage for quantum key distribution?
- How to improve qualities of quantum circuits via software?

Since the pace of the lecture will by adapted to the reaction of the audience, if time permits:

- How to get lower bounds on complexity for quantum circuits solving a problem?
- Quantum phase estimation
- What is a universal set of gates for quantum circuits?
- What is new in compilation of quantum circuits?

Skills acquired during lecture:

- What are quantum bits, gates, circuits and their measurement
- Superposition in qubit's states with possibility of interference
- Various physical devices for qubits with an intuition of their advantages and drawbacks
- How any boolean function is computable via quantum circuit
- Deutsch-Jozsa's algorithm, Simon's algorithms, Grover's algorithm
- Describing quantum circuit in python and simulating their execution
- (Idealized) BB84 protocol for quantum key distribution based on no-cloning theorem

Transferable Skills Courses

Equipping researchers with skills beyond the purely scientific is a challenge that institutions are beginning to take up in the framework of what is known as the "transferable skills" education programs. Organized by Aitzol García-Etxarri (DIPC, Ikerbasque) and Gustavo A. Schwartz Pomeraniec (DIPC, CFM-CSIC) launched a full program covering issues like stress management, time and career management or transformative leadership. 55 researchers joined these courses in 2023.

Course on: "Emotional Well-being in Science"

May 10, 19, and 24, 2023
DIPC Josebe Olarra Auditorium, Donostia/San Sebastián

Sofia Facal
Skills for Science and Industry

The Emotional Well-being in Science training was designed to provide PhD students with tools and strategies to manage the emotional challenges of academia. The three sessions covered topics such as understanding emotional distress and mental health issues, building resilience and self-care, and creating a supportive environment. Through interactive activities, case studies, and group discussions, participants learned to identify signs of emotional distress, develop a self-care routine, and build a supportive network.

Session 1 Understanding Emotional Well-being in Academia

- Introduction & Understanding the emotional challenges of being a PhD student
- Identifying signs of emotional distress and mental health issues
- Strategies for coping with stress and anxiety
- Imposter syndrome

Session 2 Building Resilience and Self-care

- Building resilience to handle academic and personal challenges
- Knowing and developing helpful routines for emotional and physical well-being
- Strategies for maintaining work-life balance

Session 3 Creating a Supportive Environment

- Strategies for building a supportive network
- Importance of good communication skills to handle difficult situations
- Building a culture of well-being in academia

Time and Career Management

October 23-25, 2023
CFM Auditorium, Donostia/San Sebastián

Sofia Facal
Skills for Science and Industry

This training aimed to provide a comprehensive and interactive learning experience for PhD students in scientific careers, helping them enhance their time management skills and navigate the diverse career paths available, whether within academia or beyond. Each session included a mix of presentations, practical exercises, and opportunities for discussion and engagement with experts in the field.

The content of the workshop included

- Develop effective time management strategies
- Gain the skills to prioritize tasks and set achievable goals
- Learn how to plan and organize your work for optimal results
- Dealing with Procrastination
- The Changing Landscape of Scientific Careers
- Creating a personalized career plan to align with your aspirations
- Navigating the Academic Job Market
- Exploring Career Opportunities in Technology Centers
- Transitioning to Industry: Application Process
- Preparing your materials: CV industry vs CV academia
- Interview Preparation

Navigating the Research Seas: Transferable Skills for PIs

November 16, 23 and 30, 2023
DIPC Josebe Olarra Auditorium, Donostia/San Sebastián

Sofia Facal
Skills for Science and Industry

The training program "Navigating the Research Seas: Transferable Skills for PIs" was designed to address the need for soft skills development among Principal Investigators (PIs). The role of a PI goes beyond technical expertise, as they are responsible for shaping the direction of their research teams and fostering a culture of excellence. As emphasized by the questionnaire, we are in favor of PIs in the CFM and DIPC communities. Good leadership skills are indispensable for avoiding problems within a group and enhancing overall productivity.

Effective communication, emotional intelligence, and interpersonal skills form the backbone of successful leadership, creating a positive and collaborative environment where team members feel valued and supported. PIs who excel in motivating and inspiring their teams play a pivotal role in driving innovation and achieving collective goals. This training recognized the importance of honing soft skills and provided tools, the necessary self reflection for each PI to lead, influence, and nurture within their own unique style, their research groups in the interconnected and dynamic landscape of modern science.

This training consisted of three sessions that aligned with the various phases of group dynamics, enabling PIs to have tools for the different phases of the process or research groups. The tips and tools tackled how to form, navigate challenges, and optimize their research teams. As we embarked on this journey, we explored the critical aspects of leadership, from forming a good-performing group to handling diversity and conflicts, and finally, fostering productivity and motivation within your research team.

Session 1 Forming the group
- Leadership styles, how to combine them
- Group dynamics: phases and what is needed in each stage
- Establishing a clear vision and values for your research group
- Strategies for attracting, onboarding, and retaining the right team members for your group

Session 2 Group Storming - Cultivating Communication and collaboration
- Effective communication skills in a diverse multicultural environment
- Feedback: transforming critics into constructive contributions
- Conflict resolution strategies for maintaining balance within the group
- Navigating diverse perspectives and fostering collaboration

Session 3 Group Norming - Keeping Motivation and working effectively
- Time management techniques
- Delegation and empowerment strategies
- Techniques for keeping the research team motivated and engaged, ensuring sustained productivity and collaboration in a good environment

Theses

Relativistic and topological domain wall signatures in spin space.
Ricardo Rama Eiroa
11/01/2023
Supervisors: Rubén M. Otxoa de Zuazola and Konstantin Guslienko

Stackings and their boundaries in few-layer graphene: stability and electronic properties in Bi- and trilayer graphene.
Raúl Guerrero Avilés
20/02/2023
Supervisors: Andrés Ayuela Fernández and Marta Pelc

Large-scale and linear-scaling quantum mechanics computational methods to characterize G-quadruplexes and their interaction with small molecules.
Iker Ortíz De Luzuriaga
03/03/2023
Supervisors: Xabier López Pestaña and Adrià Gil Mestres

Topological quantum chemistry description of interacting-electron systems.
Mikel Iraola Iñurreta
20/03/2023
Supervisor: Maia García Vergniory

Molecular dynamics simulations of femtosecond laser induced desorption of adsorbates from metal surfaces.
Auguste Tetenoire
23/03/2023
Supervisors: Maite Alducin Ochoa and J. Iñaki Juaristi Oliden

Experimental and theoretical investigation of strong acid hydrates.
Sophie Espert
30/03/2023
Supervisors: Arnaud Desmedt and Daniel Sánchez Portal

Iridium(III)-based photoluminescent sensors for Ba2+ tagging: toward background-free Ba2+ sensing.
Ane Aranburu Leiva
31/03/2023
Supervisors: Zoraida Freixa Fernández and Fernando Cossío Mora

Atomic and molecular structures on a superconducting surface.
Cristina Mier González
04/05/2023
Supervisors: Nicolás Lorente Palacios and Deung-Jang Choi

Atomic and molecular structures on a superconducting surface. Theoretical description of light emission in the presence of nanoscale resonators: from classical scattering to photon states entanglement and statistics.
Álvaro Nodar Villa
19/05/2023
Supervisors: Javier Aizpurua Iriazabal and Rubén Esteban Llorente

Engineering Hybrid nanostructure for the photocatalytic activation of Pt(IV) prodrugs.
Laura Filomena Mazzei
09/06/2023
Supervisors: Luca Salassa and Aitziber López Cortajarena

Development of sensors for individual barium ion identification in the context of the NEXT experiment.
Pablo Herrero Gómez
23/06/2023
Supervisors: Celia Rogero Blanco and Francesc Monrabal Capilla

Synthesis, magnetism and reactivity of graphene nanoribbons.
Alejandro Berdonces Layunta
23/06/2023
Supervisor: Dimas García de Oteyza Feldeman

Quantum-mechanical study of optical excitations in nanoscale systems: first-principles description of plasmons, tunneling-induced light emission and ultrastrong light-matter interaction.
Unai Muniain Caballero
08/11/2023
Supervisors: Rubén Esteban Llorente and Vyacheslav Silkin

Two aspects of electron correlation: multireference diagnostics and London dispersion interactions.
Xiang Xu
23/11/2023
Supervisors: Eduard Matito Gras and Eloy Ramos Córdoba

Space-time symmetries in classical and quantum electromagnetic scattering theory.
Jon Lasa Alonso
01/12/2023
Supervisors: Gabriel Molina Terriza and Aitzol García-Etxarri

3D topological photonic crystals: theoretical methods and applications.
Chiara Devescovi
13/12/2023
Supervisors: Aitzol García Etxarri and Maia García Vergniory

Symmetry-breaking and topology in correlated and amorphous matter.
Daniel Muñoz Segovia
22/12/2023
Supervisors: Fernando de Juan Sanz and Adolfo González Grushin

UPV/EHU Research Master in Nanoscience

DIPC, along with CIC nanoGUNE, collaborates in the Materials Physics Department of the University of the Basque Country (UPV/EHU) and the Materials Physics Center (CFM-CSIC-UPV/EHU) official master's degree program with a Research Master in Nanoscience. The Research Master in Nanoscience has been offered since 2007. Since then, 163 students have obtained their Master's degree. Almost 25% of our graduates are international students from four continents (Europe, America, Africa and Asia). Researchers at DIPC participate in this program in various ways and from different perspectives by developing curriculums, giving lectures, acting as counselors to some of the students, and providing seminars on issues of special interest to the students. In addition, DIPC plays a valuable role, providing essential infrastructure and funding, within its means, to help ensure the proper development of the program.

For more information visit: http://ehu.eus/en/web/master/master-nanoscience

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