IfiMAC
Condensed Matter Physics Center

NEWSLETTER #1

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(and more)

The IFIMAC Newsletter is released twice a year, aimed at both IFIMAC members and anyone with an interest in the field of Condensed Matter Physics.

Communication Committee:
Carlos Antón Solanas
Pablo Ares García
Paloma Arroyo Huidobro
Antonio I. Fernández Domínguez
Akashdeep Kamra
Diego Martín Cano
Ferry Prins

Technical support:
Stefan Bilan
Almudena Conde Angulo
Patricia Marqués Gallego

Rubén Pérez Pérez

WELCOME TO THE 1st NEWSLETTER

Welcome to the first issue of the Condensed Matter Physics Center (IFIMAC) Newsletter. Established in 2012, IFIMAC's mission is pursuing cutting-edge research and scientific excellence in this broad field, at the crossroads of Physics, Chemistry, Materials Science and Biology, fostering a truly multidisciplinary approach. With two consecutive awards (2015-2019, 2019-2023) as a "Maria de Maeztu research unit of excellence", these eleven years have consolidated IFIMAC as a Spanish center of reference, with an internationally recognized research program that spans from Quantum Materials and Technologies, Nano and Quantum optics, and Nanotechnology, to Soft and Active Matter and Biophysics.

This Newsletter is part of the communication strategy envisioned by the new Steering Committee in October 2021. It serves a double purpose, as an internal channel to share our day-by-day activity in order to foster IFIMAC's identity, and as a regular update on IFIMAC's achievements for the whole scientific community. I thank the Communication Committee for the effort to set up this initiative and invite you to explore its pages and discover IFIMAC's reality.

Mentoring programme 2022/2023

IFIMAC's mentoring programme for undergraduate students aims to enhance their academic careers and retain more women in science. We strongly believe that mentoring is essential to empower women studying physics by helping them to realise their potential and showing them the different routes for an academic career. Our programme creates a safe and supportive environment where budding researchers can interact closely with experienced researchers. This type of guidance and support should have a significant impact on students' learning and decision-making skills. In addition, the mentoring initiatives actively motivate students to continue their research journeys.

With the first edition of our mentoring programme (academic year 2022/2023), we are proud to announce that 34 women studying physics at the UAM have been matched with highly motivated mentors from IFIMAC leading to a high level of satisfaction with our initiative. According to our recent internal evaluation, a majority of mentees expressed their satisfaction with the programme. A 37% of respondents rated their experience as excellent, 53% as very good and a further 10% as good. Additionally, 100% of mentees would recommend the programme to their peers. These satisfactory results allows considering the programme as a success, with positive impact and transformative experience, and its promising continuation in forthcoming academic years.

To gain a deeper insight into the impact of the programme, we conducted a series of interviews with four talented mentees.

They shared their personal journeys and motivations for joining the initiative. Here are the highlights from their experiences. Full interviews can be found in our YouTube channel.

"We saw this experience as a way to approach researcher's path that seems interesting".
Laura Rojo

"It is a way to break that barrier between the researcher and you as student".
Lucía Romero

"I would definitely recommend it [...] you should have the information to make a decision in the future".
Lucía Mejía

"It made me realise that the academic life is plausible for me".
Paloma Cerezo

Mentoring programme 2022/2023

The 1st edition of the IFIMAC Mentoring Programme culminated in a closing ceremony at the Rectorate on 2 June. Prof. Pilar López Sancho (ICMM-CSIC), winner of the winter 2021 Emmy Noether Award for Women in Physics, gave an inspiring presentation on the pressing issue of gender inequality in science. With her wealth of knowledge and experience, she shed light on the systemic challenges faced by women in science and the importance of mentoring programmes in fostering inclusivity and empowering women scientists.
The closing ceremony also provided a platform to celebrate the remarkable achievements of both mentees and mentors throughout the programme.

Based on the positive feedback received from all the parts, we are pleased to announce that a new edition of this mentoring scheme will continue its important mission in the next academic year (2023/2024). Applications are open until 23 June.
As we embark on this new edition, we would like to thank all the mentees, mentors, faculty and supporters who have contributed to the success of the programme.

mentoria.ifimac@uam.es

AWARDS

Celia Polop and a team of physics experts from Europe have won the BLA Awards (Blended-Learning Awards) for their course on "Fundamentals, materials, and applications of lithium-ion batteries". The course, offered by the CIVIS Forum Area - Climate, Environment, and Energy, explores the important aspects of lithium-ion batteries. This recognition highlights their significant contributions to the field and their commitment to advancing knowledge in climate, environment, and energy-related areas.

Carlos Antón Solanas has been awarded with two prestigious grants to research on experimental quatum photonics: a Leonardo Grant in Physics and a Ramón Areces project.

Leonardo Grant: Carlos is one of seven 2023 recipients in the field of physics. The Leonardo Fellowships for Researchers in Physics recognise the excellence of mid-career researchers who have made significant contributions to the field. His project, entitled 'Quantum Key Distribution with Single-Photon Sources at Room Temperature', focuses on the development of solid-state single-photon sources using defects in hexagonal boron nitride. The aim of the project is to create efficient and highly pure single-photon sources that can be used in free-space quantum key distribution protocols.

Check out page 5 for more details on Carlos´Ramón Areces project

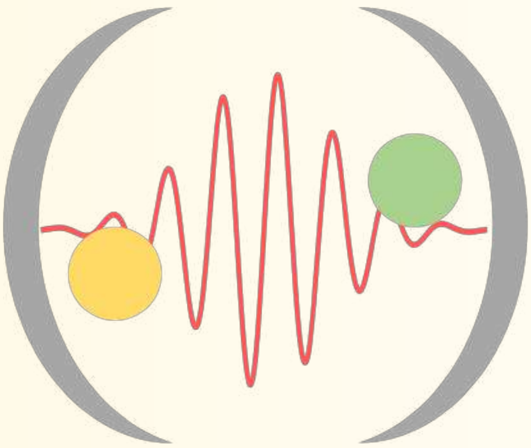
Interview with Carlos Antón Solanas

NEWS - Carlos Antón Solanas 2023 Ramón Areces awardee.

Since 2022, Carlos Antón is Junior Principal Investigator at the IFIMAC, working on high-dimensional entanglement with photons. His research is focused around two main areas: (1) the study of quantum optics in the field of solid-state systems, and (2) the study of nonlinear optics based on the strong interaction of light with excitons in disruptive quantum materials.

In an exciting development, the Ramón Areces Foundation has recently awarded grants totalling 2.35 million euros to 19 ground-breaking research projects. These projects, which involve the collaboration of 97 talented scientists, will run for three years and aim to promote and advance Spanish science.

Among all the projects to receive funding is a fascinating venture in the field of new materials. Carlos Antón Solanas has been selected as a beneficiary for his project entitled "Ultrabright Sources of Photons in Open Cavities".



This disruptive project aims to develop an ultra-bright source of single photons that operates effectively at both ambient and cryogenic temperatures.

The primary focus of the project is to optimise the generation of single photons, as the widespread use and advancement of quantum photonics technology depends heavily on this crucial aspect.

In an interview with Carlos, he outlined two key goals for his project: first, to achieve single photon emission for quantum communication applications, and second, to generate highly coherent single photons for use in quantum computing protocols. This endeavour has the potential to revolutionise the field of new materials and have significant applications in the ever-evolving field of quantum technology. Carlos will be tackling key challenges such us developing photonic resonators (open microcavities that trap light) coupled to certain quantum materials, rendering the single-photon emission extremely bright.

We are excited to witness the progress and outcomes of this project over the next three years.

IfiMAC Colloquium

The IFIMAC Colloquium brings leading experts from different areas of research in condensed matter physics.

Interviews with the speakers and their colloquium talk can be found in our YouTube channel.

Andreas J. Heinrich, Feb 3rd
"Towards Quantum Computing with Spins on Surfaces".

Allan MacDonald, Mar 24th
"Exciton Condensates through the years".

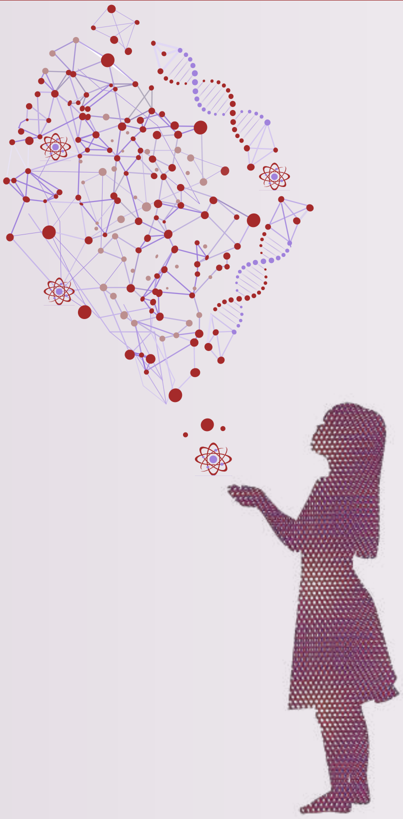
Roser Valentí, Apr 14th
"Strategies to design Quantum Materials with exotic properties".

Atac Imamoglu, June 9th
"Optical Investigation of Strong Electronic Correlations".

Interviewing the colloquium speakers is an excellent opportunity for our doctoral students to learn from world-leading experts in their research field. It is also a great approach to showcase the work of these experts from a different perspective and share their insights with a wider audience. By making the interviews available on the IFIMAC YouTube channel, we are building a valuable dissemination platform for science, targeting a broad spectrum of online viewers. The personal insights and career advice shared by the speakers is also inspiring and helpful to students and early career researchers. Overall, this is an excellent initiative that will benefit not only the students but also a wider community interested in novel physics.

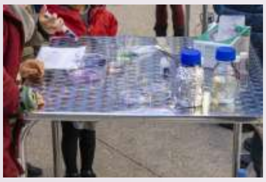
NEWS - outreach activities

11th February International Day of Women and Girls in Science



A series of workshops for the International Day of Women and Girls in Science was organised by IFIMAC in the heart of Madrid. This event brought together over 200 participants who had the opportunity to explore the fascinating fields of soft and hard matter and optics. Overall, the event was an excellent opportunity to inspire curiosity and interest in science, and we were thrilled to be a part of it. We hope to continue to inspire and engage people to learn about science and its positive impact on our society.

During the event, the public had the chance to investigate the behaviour of soft matter such as liquids and gels through hands-on experiments and learn about the impact of applications emerging from this research field. They also had the opportunity to explore the transformation of matter from one state to another with 'hard matter' scientists. In the optics workshop, participants played with light to unlock its secrets, spectrally separating light to discover all its colours and uncovering some of the secrets hidden in everyday objects such as olive oil.



In addition to the workshops, several IFIMAC members have promoted science among children, young women and men through presentations:

Dr. Linda Zotti and Paloma Cerezo. Colegio Altair (Madrid) 9.02.2023.
María Dolores Martín. CEIP Fuente Santa (Colmenar Viejo) 10.02.2023.
Nerea Alcázar. IES Francisco de Goya (Madrid) 13.02.2023.
Eva Osuna and Beatriz Viña. IES Severo Ochoa (Alcobendas) 17.02.2023.
Celia González. IES Leonardo Da Vinci (Majadahonda) 6.02.2023. IES Gran Capitán (Madrid) 7.02.2023. CEIP Gustavo Adolfo Bécquer (Madrid) 9.02.2023 and 14.02.2023.

Outreach activities

Workshops at Instituto de Libre Enseñanza

We are delighted to share with you the recent success of our **joint workshops with the Instituto de Libre Enseñanza of the Fundación Giner**. Held in Madrid on 15 April and 13 May, these engaging workshops were specifically designed to stimulate young children's curiosity and interest in science through a fun and interactive approach. Eva Osuna, a PhD student at IFIMAC, explored the state of matter through fun experiments in her workshop "Let's change matter by sublimating, vaporising, crystallising". Celia González, also a PhD student at IFIMAC, explored how density works in her workshop "Do you float or sink? The mystery of density".

Workshops at schools

Promoting science to young children is a wonderful initiative that can stimulate their curiosity, encourage critical thinking, and foster a love of learning. IFIMAC members have conducted workshops at CEIP Alfredo Di Stefano and CEIP Príncipe de Asturias with children aged 4/5 and 6/7 respectively. The "Invisible Forces" workshop introduced the students to magnetism, electricity, and surface tension, while the "What is colour?" workshop explored light and how we can see different colours from its spectrum.

New video YouTube

How to create a One atom thick material (and why they are revolutionary)

Thanks to the support from the Fundación Española para la Ciencia y la Tecnología (FECYT), IFIMAC has continued its collaboration with the Quantum Fracture YouTube channel. In this video, we explore materials that are just one atom thick. We showed how they can be assembled, describing the techniques involved, and how they have been developed in recent years. We also discuss the potential applications that these extraordinary materials will have in the near future. This new video is a didactic introduction to the scientific and technological revolution in two-dimensional materials.

PARTICIPATION IN SCIENTIFIC EVENTS

GEFES 2023 - from 1 to 3 February in Salamanca (ES). XII meeting for the División de Física de la Materia Condensada de la Real Sociedad Española de Física RSEF.

Topological Photonics 2023 – from 31 May to 2 June at Central Campus CSIC Madrid (ES) (co-organized by Paloma Arroyo Huidobro). The TopoPhoto23 workshop brings together experts in topological photonics and other wave and quantum phenomena to foster collaboration and innovation.

Quantum Matter - from 23 to 25 May in Madrid (ES). IFIMAC was a Silver Sponsor. This event brought together the different communities involved in the science and technology of quantum information and quantum matter to foster the incubation of new ideas and collaborations at the forefront of quantum technologies, emerging quantum materials and new generations of quantum communication protocols, quantum sensing and quantum simulation. IFIMAC researchers presented 20 contributions in the form of posters, oral communications and invited talks.

NanoSeries 2023, 2nd Annual Conference on Global Nanotechnology - from 19 to 21 June at the ICMM-CSIC Materials Science Institute of Madrid (ES) (Pablo Ares in the Advisory Board and Local Organising Committee). The NanoSeries conference aims to provide an open forum to discuss all aspects of matter at the nanoscale, to exchange ideas, to stimulate collaborations and to establish new networks.

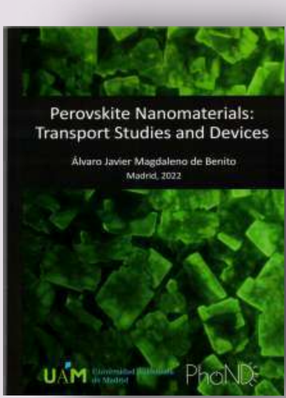
Special Issue in Polaritonics Optical Materials Express: Polaritonics is a highly multidisciplinary field with versatile applications and a promising future in nanophotonics. This Optical Materials Express feature issue (opened from 1st April to the 1st of June, Carlos Anton-Solanas as a Guest Editor) will highlight recent advances and future perspectives in the field of polaritons and the strong-coupling regime between light and matter, covering photonics, materials science, quantum technology and computing.

27-28 March 2023: 6 month review meeting MIRAQLS consortium.

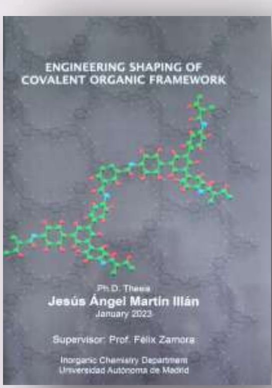
Mid-infRAred Quantum TechnoLogies for SensinG

The MIRAQLS consortium met in a hybrid format (online-onsite) at the Universidad Autónoma de Madrid. During the meeting we witnessed significant progress in the different research groups within the consortium. Researchers presented their findings, shared valuable insights, and engaged in fruitful discussions. One of the main objectives of the meeting was to foster collaboration and strengthen existing links between the consortium members. We are pleased to say that this goal was successfully achieved! Through interactive sessions and networking opportunities, new collaborations were forged, encouraging interdisciplinary approaches and increasing the overall impact of our research.

Recent PhD theses

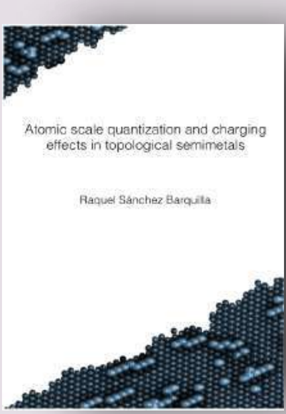


Álvaro J. Magdaleno
20 January 2023



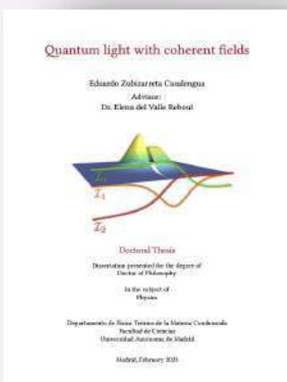
Jesús A. Martín
26 January 2023

Eva Cortes del Río
10 March 2023

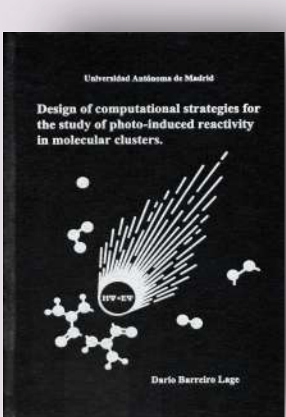


Raquel Sánchez
21 March 2023

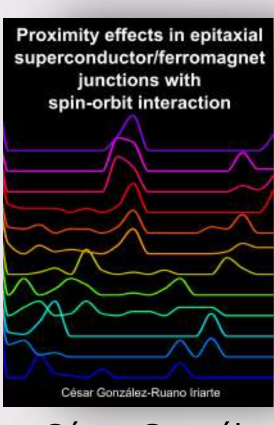
Ignacio Romero Muñiz
31 March 2023



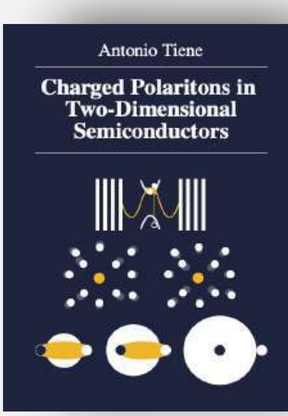
Eduardo Zubizarreta
28 April 2023



Darío Barreiro Lage
28 April 2023



César González
18 May 2023



Antonio Tiene
8 June 2023

NEW ARRIVALS

PhD Students

Óscar Mateos López Advisors: José Guilherme Vilhena Albuquerque Dórey, Juan Carlos Cuevas Rodríguez.
Jara Trujillo Mulero Advisor: Rubén Pérez Pérez.
Jaime Echave-Sustaeta Osuna Advisors: Paloma Arroyo Huidobro, Fco. José García Vidal.
Antonio Miguel Bosch Fernández Advisor: Rubén Pérez Pérez.
Eva Ortiz Mansilla Advisor: Jorge Bravo Abad.
Enrique Arévalo Rodríguez Advisor: Ferry Prins.
Amalia Coro González Advisor: Ferry Prins.
Ignacio Sardinero Sánchez Advisor: Pablo Burset Atienza.
Swagata Mallik Advisors: Johannes Feist, Antonio I. Fernández Domínguez.
Pranav Pradeep Advisor: Saúl Vélez.
Arin Escobar Advisor: Juan Luis Aragonés.
Silvia Riera Villapún Advisor: Alicia Palacios Cañas.

Postdoctoral researchers

Enrico Russo Supervisors: Johannes Feist and Fco. José García Vidal.
Vincenzo Macrì Supervisors: Johannes Feist and Diego Martín Cano.
Rodrigo Gil San Millán Supervisor: Ana Platero.
Manuel Eduardo Moratalla Supervisor: Miguel Ángel Ramos.
Loukopoulos Edouardos Supervisor: Ana Platero.
Sergio Royuela Collado Supervisor: Félix Zamora.
Aritz García Arribas Supervisor: Rafael Delgado.
Sanja Djurdic Mijin Supervisor: Snezana Lazic.
Beilun Wu Supervisor: Isabel Guillamón.

Technical support

Carlos Roldán Piñeiro Research assistant, at Linda Zotti´s lab.
Joel Fallaque Najar IT
Jesús Nevado Rodríguez Laboratory
Patricia Marqués Gallego Outreach

UPCOMING EVENTS

MEETINGS

Fuerzas y Túnel (FyT) conference - from 3 to 5 July 2023 at the Fundación Rei Afonso Henriques in Zamora (ES) (co-organized by Guilherme de Vilhena and Miriam Jaafar). This biennial conference serves as a platform for the global scientific community to meet and explore the latest developments in Scanning Probe Microscopy (SPM).

First Spanish Soft Matter 1 ½ Day – from 29 to 31 October at Centro de Ciencias de Benasque Pedro Pascual (ES) (co-organized by Laura Rodríguez Arriaga and Juan Luis Aragonés). The inaugural 1st Spanish Soft Matter 1 ½ Day event aims to unite researchers in the dynamic field of soft matter within Spain, promoting collaboration and knowledge exchange.

SB06—Experimental and Computational Advances in Biomolecular Electronics within the MRS Fall Meeting - from 26 November to 1 December at Boston (USA) (co-organized by Linda Zotti).

IFIMAC Colloquium

Jascha Repp
6 October 2023
Universität Regensburg

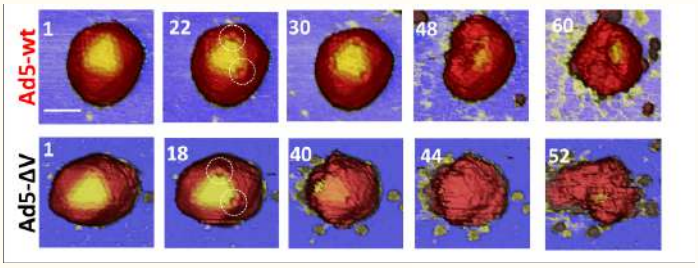
Olivier Dauchot
3 November 2023
CNRS, ESPCI Paris

SOCIAL

On the last Thursday of every month, IFIMAC members have been meeting at the cafeteria of the Facultad de Filosofía y Letras, and later at the cafeteria of the Facultad de Psicología, to have some after-work drinks and talk about the philosophy of life, quantum mechanics, condensed matter... or whatever, in a relaxed atmosphere. Similarly, on several occasions this year IFIMAC members have gotten together to play football and basketball at the UAM campus facilities, serving as great opportunities to interact outside of the usual work environment and get some outdoor exercise.

RESEARCH HIGHLIGHTS

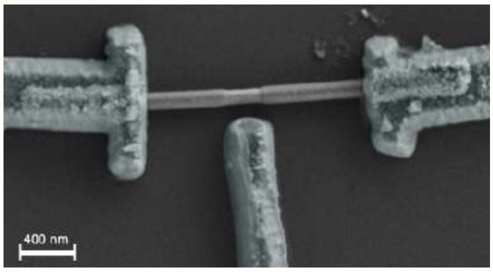
Adenovirus core protein V reinforces the capsid and enhances genome release from disrupted particles



Researchers from IFIMAC have discovered the role of protein V in the stability and biomechanics of human adenovirus. Protein V connects the inner capsid surface to the outer genome layer and provides mechanical reinforcement, facilitating genome release during virus disruption. These findings have important implications for the development of new treatments for Ad5 infections.

Science Advances 9, eade9910 (2023)

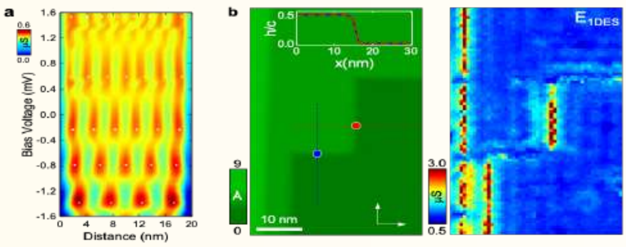
Joule spectroscopy of hybrid superconductor-semiconductor nanodevices



IFIMAC researchers developed a technique based on the Joule effect to characterise superconductivity in hybrid SC-semiconductors. By observing temperature increases the transition from superconducting to normal state is detected, providing valuable information on disorder-related fluctuations, coherence length, and inverse superconducting proximity effects.

Nat Commun 14, 2873 (2023)

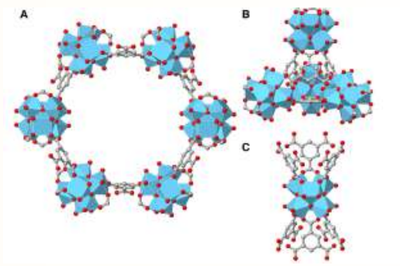
Quantum-well states at the surface of a heavy-fermion superconductor



IFIMAC researchers have observed quantized states at the surface of URu_2Si_2, a superconducting heavy fermion compound. Two-dimensional surface heavy fermions scatter at steps, forming a quantization pattern. The electron effective mass extracted is 17 times the free electron mass, connecting the surface heavy fermions to bulk superconductivity.

Nature 616, 465–469 (2023)

Synergistic binding sites in a metal-organic framework for the optical sensing of nitrogen dioxide



IFIMAC researchers enhanced MOF-808's sensing capabilities, achieving unprecedented NO_2 detection. The Cu-MOF-808-based sensor has a low limit of detection (16 ppb), the lowest reported for luminescent MOFs. DFT calculations attribute the performance to synergistic interactions between Zr_6O_8 clusters and copper sites, opening new detection posibilities with MOFs.

Nat Commun 14, 2506 (2023)

and
more

For the following newsletter we would love to hear from you:
outreach.ifimac@uam.es

We invite you to fill in the google form for any news related to your research:

Communication Committee:
Carlos Antón Solanas
Pablo Ares García
Paloma Arroyo Huidobro
An[illegible] I. Fernández Domín[illegible]
Akashdeep Kamra
Diego Martín Cano
Ferry Prins

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Technical support: Patricia Marques