Universitat de les Illes Balears

IAC3 Institut d'Aplicacions Computacionals de Còdi Comunitari

IAC3 ANNUAL REPORT 2024

1. Director Letter

This annual report aims to provide both an overview and a detailed account of the institute's activities throughout 2024, including research initiatives, outreach efforts, and the organization of scientific events. At the IAC3, we strongly believe in the importance of giving visibility to all our scientific and institutional work, as it represents one of the core pillars of the institute.

The year 2024 has been a milestone for the IAC3. After a long-awaited opportunity to establish our own physical space, we are now proud to be headquartered in the Balearic Research Complex, located in Parc Bit. This marks the beginning of a new era for the institute, in which sharing a common space among members is expected to foster synergies across research lines, strengthen collaboration with visiting researchers, and enrich our seminar programs and other academic activities. Ultimately, we believe this will significantly enhance the overall research impact of the institute.

We would like to express our sincere gratitude to the Regional Government and the University of the Balearic Islands (UIB) for their support and commitment in turning this long-standing aspiration into a reality. Having a dedicated facility with offices, a meeting room, a small kitchen, and a rest area is a meaningful step forward in our collective pursuit of excellence.

Research at the IAC3 is structured into four main lines: Computational Astrophysics, Gravitational Wave Astronomy, Nonlinear Dynamical Systems and Computing, and Applied Mathematics for Image Analysis and Data Processing. The institute's six research groups are aligned with one or more of these lines, depending on the nature of their work. This structure encourages synergy and collaboration, helping to optimize resources and promote interdisciplinary approaches.

A shared feature among all research lines—beyond their dedication to scientific excellence—is their focus on the development of advanced numerical methods and codes. The IAC3 places a strong emphasis on collaboration, both in theoretical modeling and in the shared development of computational tools. This strategy is seen as a clear competitive advantage, freeing up resources and boosting scientific productivity across the board.

Throughout 2024, the IAC3 has continued its research and outreach activities with the aim of deepening its social impact. While some activities—such as attendance at conferences and congresses—faced challenges, our commitment to scientific dissemination and education remained strong. Through high-quality research, we aim to serve society by training new generations of scientists and promoting the values of science. Public engagement and making our work accessible beyond the academic community are essential for fostering a broader understanding of and participation in scientific progress.

I would also like to take this opportunity to welcome the new members who have joined the IAC3 during this year. To those who have completed their PhDs and moved on to postdoctoral positions at other research centers, I wish continued success in their scientific careers.

Finally, I extend my heartfelt thanks to all the research groups and individuals who make up the IAC3 community—full-time researchers, collaborators, scientific advisors, postdoctoral fellows, and visiting scholars—for their dedication to advancing excellence in research, securing funding, and sharing their work with society. The achievements of the IAC3 are made possible by your collective effort and commitment.

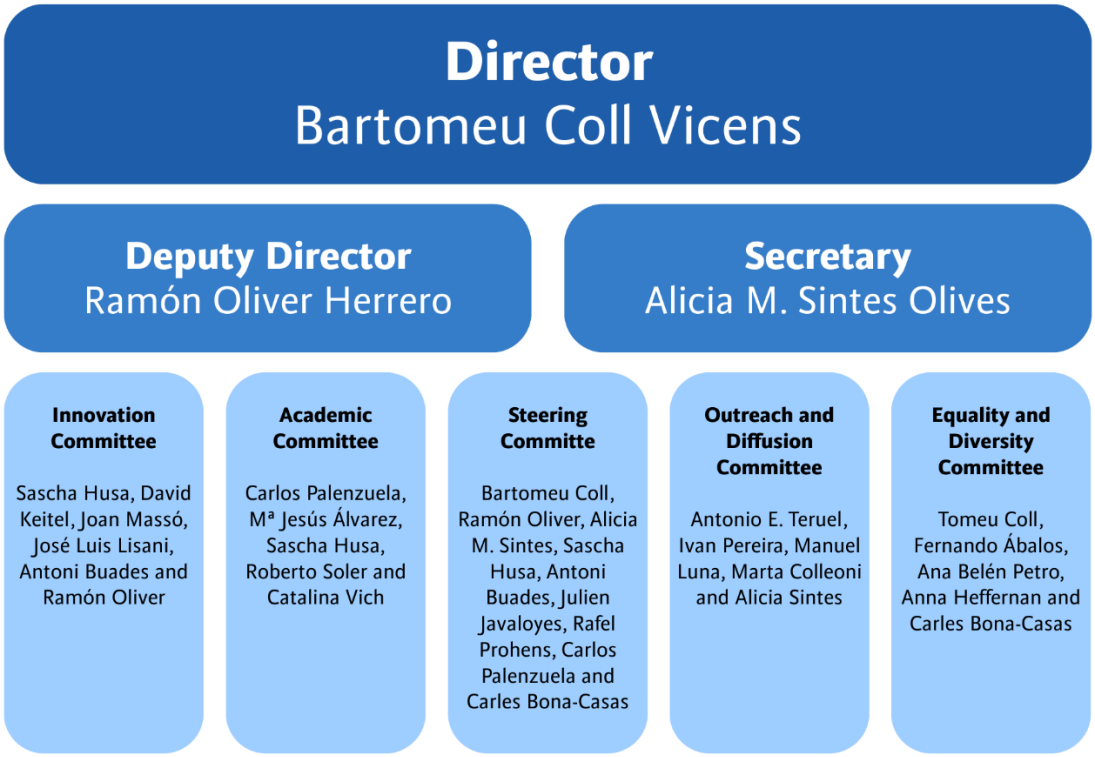
Director: Bartomeu Coll Vicens

P.S.: This text was written shortly after our institute held elections for the position of director, on April 4th. I am pleased to announce that Professor Alicia Sintes, principal investigator of the Gravitational Wave Astronomy line, has been elected as the new director. I am confident that under her leadership, and with the support of the new management team, the institute will continue to reach new heights in its pursuit of excellence.

2. About the Institute of Applied Computing with Community Code

The Institute of Applied Computing with Community Code (IAC3, http://iac3.uib.es) was created by the University of the Balearic Islands (UIB) in 2008 to foster synergies between different UIB research groups driven by the quest for excellence and their common focus on computational modelling and a modern approach to code sharing and development. The creation of the IAC3 recognizes the increasingly important role of computationally intensive modelling and the processing of massive data sets in fundamental and applied science, as well as the need to provide a common infrastructure for research groups with common interests in the physics and mathematics departments of UIB. Since its creation IAC3 has grown to encompass 7 research groups and 99 members. Common themes of research are wave phenomena and nonlinear dynamical processes, and the processing of complex data sets, which result in a unique blend of fundamental research and knowledge transfer with real world applications.

ORGANIZATION



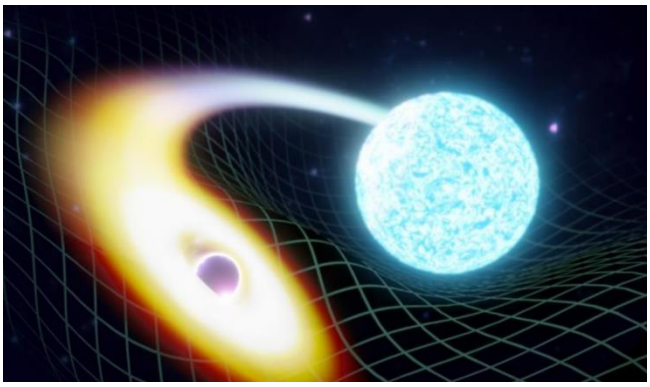
RESEARCH LINES

RL1: Computational Astrophysics

Research Line LR1 applies advanced methods in computational fluid dynamics, magnetohydrodynamics (MHD), and numerical relativity (i.e., numerical solutions of Einstein's equations) to address key questions in solar physics and in the modeling of gravitational-wave and multi-messenger astrophysical sources.

In solar physics, the group contributes to a deeper understanding of the dynamic behaviour of cold plasmas in the solar atmosphere. Its work improves knowledge of the magnetic structure of solar

prominences and their environment through seismological analyses of large-amplitude oscillations, and refines estimates of the energy transported by upward-propagating MHD waves from the photosphere to the chromosphere and prominences—an essential step toward resolving the long-standing problems of coronal and chromospheric heating.



This research is also of broader relevance, as the magnetic structures and partially ionised plasmas studied are analogous to those found in other stellar atmospheres, the interstellar medium, and planetary magnetospheres. High-resolution observational studies have enabled the inference of magnetic fields and temperature profiles along solar spicules and in coronal rain using spectroscopic inversions based on data from the 1-m Swedish Solar Telescope and the Interface Region Imaging Spectrograph, placing new constraints on the plasma structure of the lower solar atmosphere. As part of the objectives of RL1, both the interaction between coronal holes and large-scale coronal waves and the magnetohydrostatic equilibria governing solar coronal structures have been further characterised.

In parallel, RL1 makes substantial contributions to the study of compact object mergers through numerical simulations in general relativity. The group is among the few worldwide capable of conducting detailed and physically realistic simulations of binary neutron star (BNS) mergers—astrophysical laboratories for testing gravity, plasma physics, and dense matter under extreme conditions. These efforts gained renewed importance following the multi-messenger detection of GW170817, which marked a turning point in observational astrophysics. The group also investigates the phenomenology of exotic compact objects (ECOs), such as boson stars, and studies neutron stars within alternative theories of gravity (e.g., scalar-tensor and K-essence models). These explorations support the development of waveform models that allow the identification or distinction of such objects in gravitational-wave data.

Finally, RL1 contributes to mapping the parameter space of coalescing black hole binaries. Led by S. Husa, this effort underpins gravitational-wave data analysis through extensive numerical relativity surveys, including the construction of a catalogue of spinning binary systems with orbital eccentricity—a key milestone in waveform modelling.

Achievements and Outcomes

In 2024, within the framework of Research Line RL1, the Solar Physics Group made significant advances in the theoretical and numerical study of magnetohydrodynamic (MHD) phenomena in the solar atmosphere, with particular emphasis on partially ionised plasmas, coronal holes, and coronal rain.

Three-dimensional MHD simulations demonstrated that nonlinear torsional Alfvén waves can generate turbulence at the boundaries of prominence threads, with the turbulent region expanding over time. Synthetic Hα imaging was employed to identify potential observational signatures of this process. In parallel, the nonlinear propagation of Alfvén waves and their coupling to slow magnetoacoustic modes were investigated using semi-analytical methods, considering dissipation mechanisms such as ambipolar diffusion. These studies contribute to a better understanding of wave-mediated energy transport in the chromosphere and in solar prominences.

Further contributions in 2024 within RL1 include a review article and a book chapter that consolidate recent theoretical progress on MHD wave propagation in nonuniform and partially ionised plasmas. Numerical simulations have also clarified how coronal hole geometry affects wave reflection, showing that concave shapes amplify reflected density signals and generate complex interference patterns—underlining the importance of observational path selection.

Additionally, a tool based on convolutional neural networks was developed to detect oscillations in solar filaments using H-alpha data from the GONG project. The technique combines Bayesian spectral analysis with deep learning, enabling automated and systematic exploration of large databases and representing a key advance in the study of dynamic behaviour in solar plasma.

Finally, the first successful spectroscopic inversions of coronal rain using Mg II h & k lines have revealed consistent temperatures (5000–7000 K), stratified velocity structures, and subtle differences between the formation regions of the two lines. These results provide new insight into the thermodynamics and dynamics of coronal rain events.

RL2: Gravitational Wave Astronomy

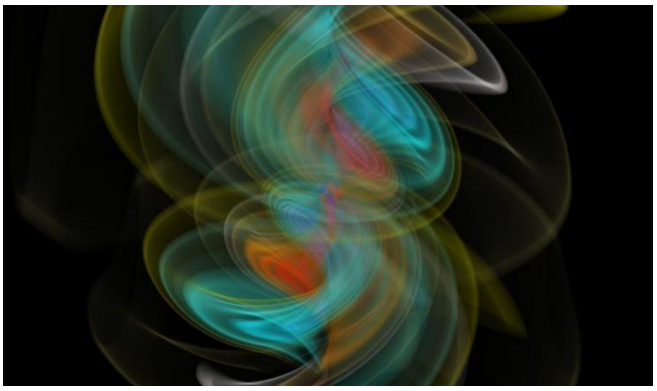
This research line aims to advance the scientific and technical frontiers of gravitational wave (GW) research through active involvement in major international collaborations such as LIGO, LISA, and the Einstein Telescope (ET). Our work focuses on deepening the understanding of compact objects and strong-field gravity by developing data analysis techniques, waveform models, and astrophysical source characterizations.

We concentrate on two key research areas: (1) the modeling and analysis of compact binary mergers—the source of all GW signals detected so far, and (2) the search for continuous wave sources, requiring novel computational strategies beyond brute-force methods. High-performance computing and open-source software development are central to both.

In addition to scientific goals, RL2 contributes to detector characterization and noise mitigation, and is committed to training the next generation of researchers. Students gain hands-on experience through their involvement in international GW collaborations.

Aligned with national and European strategic priorities, RL2 also plays an active role in shaping the scientific vision and roadmap for future GW observatories, reinforcing IAC3's leadership in this dynamic field.

Achievements and Outcomes



As active members of the LIGO-Virgo-KAGRA (LVK) collaboration, the group contributed significantly to the ongoing O4 observing run. Highlights include leadership in continuous wave (CW) searches—such as all-sky and Vela pulsar analyses—waveform modeling, and Bayesian inference. Rafel Jaume and Joan-René Mérou carried out extended stays at LIGO Livingston observatory. Group members also participated in paper writing teams and code review activities. In waveform development, foundational work was completed to prepare for the release of next-generation binary merger models in 2025—essential for extracting physical information from GW signals. In CW research, the group led efforts on GPU-accelerated methods like *SkyHough*, and *Fasttracks*. Leadership within the collaboration was further solidified: Dr. Antoni Ramos Buades (Beatriz Galindo Investigator) became co-chair of the LVK Waveform Working Group and joined the ET Science Board. Dr. David Keitel led efforts in long-transient and gravitational lensing searches.

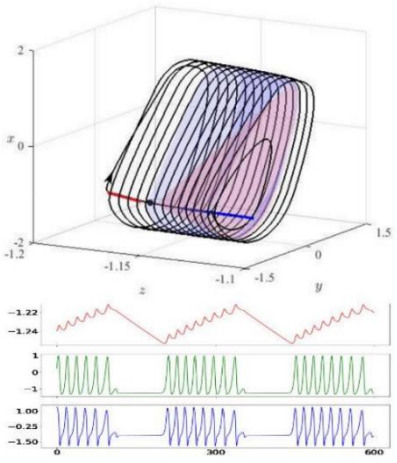
With LISA formally adopted in January 2024 and a launch target of 2035, IAC3 played a central role in science planning and consortium restructuring. Dr. Anna Heffernan co-chaired the Waveform Work Package Team and served on the Consortium Constituent Council and its Steering Group. She also led the LISA communications team and was appointed by ESA as the European waveform expert on the

official LISA Science Team. Dr. Marta Colleoni was elected co-chair of the LISA Consortium Waveform Working Group. Dr. Sascha Husa assumed a leadership role in the Distributed Data Processing Centre, with Dr. Ramos Buades coordinating the massive black hole binary science unit.

IAC3 researchers contributed substantially to the ET "Blue Book," a major scientific document outlining the objectives and vision of the next-generation ground-based GW observatory. This work, developed over two years with the ET collaboration, has been submitted to *JCAP* and is publicly available on arXiv.

RL3: Nonlinear Dynamical Systems and Computing

In this research domain, we delve into the intricate realm of nonlinear dynamical systems, exploring them through a variety of lenses. Our approach is multifaceted, encompassing rigorous mathematical analysis, bespoke software development tailored for general Differential Equation systems, and practical applications spanning neuroscience, computational biomechanics, and photonics. Our modeling strategies are diverse, drawing from a rich toolkit that includes ordinary and partial differential equations, time-delayed systems (TDSs), and piecewise (non-smooth) dynamical systems.



We leverage our expertise across multiple disciplines, ranging from multiscale physics to singular slow-fast system reductions, and employ techniques such as multiple timescales analysis and hybrid models. These models, such as delayed PDEs for photonics or non-smooth TDSs for interacting neurons, serve as powerful frameworks for understanding complex phenomena.

On the mathematical front, we harness the qualitative theory of ordinary differential equations to unravel the intricate nonlinear dynamics exhibited by both real-world and synthetic systems. Whether studying individual elements or interconnected networks, we employ mathematical tools such as topological descriptions of solutions in phase space, identification of attractors, and analysis of stable and unstable manifolds to gain insights into system behavior. Statistical tools for data treatment are also needed. The presence of long-range interactions and multi-scale phenomena presents formidable challenges for high-performance computing. To address these challenges, we focus on developing computational frameworks capable of handling highly scalable codes. Furthermore, we explore the integration of machine learning techniques to minimize the computational burden associated with long-range interactions, thereby paving the way for novel computational approaches. The study of time-delayed systems and their parallels with spatially extended systems offers a fertile ground for fundamental scientific discoveries. Additionally, we leverage our analytical tools to investigate circuit-level mechanisms underlying adaptive decision-making within cortico-basal ganglia-thalamic networks, shedding light on fundamental aspects of neural computation. Through our interdisciplinary approach and cutting-edge methodologies, we aim to advance our understanding of nonlinear dynamical systems and their multiple applications across diverse scientific domains.

Achievements and Outcomes

Within Research Line RL3, the global dynamics of a family of rigid planar polynomial systems of low-degree have been characterised, including a detailed study of centres, singularities, and limit cycles on the plane and on the Poincaré sphere. Alongside this, substantial progress has been made using piecewise-linear (PWL) models to analyse nonlinear dynamical systems with multiple time scales. These models have clarified complex behaviours such as canard explosions, spike-adding transitions, and bifurcation-induced delays, extending classical results to the nonsmooth setting. Altogether, these advances demonstrate the power of the piecewise-linear approach to describe and classify critical

dynamical transitions in multiscale systems, offering constructive tools for their rigorous mathematical analysis.

Parallel efforts have focused on computational neuroscience, particularly the cortico-basal ganglia-thalamic (CBGT) network. Brain plasticity and its role in adaptive behaviour have been explored through simulations of neural connectivity under changing behavioural conditions. Mathematical models have been developed to capture both synaptic adaptation mechanisms and emergent dynamics, using rate-based and drift-diffusion frameworks to represent decision-making processes.

We have shown how the dipolar mismatch between polymers and colloidal particles can be used to create tools to manipulate, filtrate and retain microscopic and nanoscopic particles. Our work on quantum metrology concerned quantum witnesses and their corresponding experimental verification on public quantum computers, such as IBM Quantum and IonQ. We explored the rich nonlinear dynamics of photonic systems through the lens of time-delayed and pattern formation, in particular Kerr solitons in normal dispersion injected micro-resonators, spatial patterns mediate by optical aberrations in degenerated cavities, and harmonic mode-locking occuring in actively mode-locked resonators. Finally, we demonstrated how delayed feedback can endow optoelectronic systems with neuronal-like dynamics.

RL4: Applied Mathematics for Image Analysis and Data Processing

Imaging plays a central role in daily life and scientific observation, spanning fields from industry and security to astronomy and even entertainment. To serve this diverse user base, image science must deliver multi-image processing pipelines and leverage modern data science and image processing algorithms. Addressing the data deluge requires active knowledge exchange across research fields, including data science, statistics, and computer science. Pooling ideas and resources while ensuring efficient lines of communication between these fast-moving fields can yield significant benefits.

Machine learning (ML) techniques, and especially convolutional neural networks (CNN), have largely replaced classical mathematical modelling methods for imaging tasks. While now state of the art in imaging and computer vision, training these models is challenging, and although much effort is dedicated toward explainability, they often remain black boxes. To enhance both performance and interpretability, we believe that neural networks must be brought together with classical mathematical formulations.

This research line focuses on applied mathematics for imaging, transitioning from single to multi-image analysis and from traditional modeling tools to ML techniques. We are bringing together neural networks and classical mathematical formulations. Constraining the network structure to specific mathematical models is expected to reduce overfitting, improve generalization capabilities, and to promote model interpretability.

We have adopted this framework to advance in different specific subjects of research such as video processing and computation photography, medical, underwater and hyperspectral imaging.


Satellite image provided by CNES

Achievements and Outcomes

Over the past year, the research group has made significant progress in applying advanced image processing techniques across a range of domains, through fruitful collaborations with national and international partners.

In collaboration with the *Centro de Investigación y Tecnología Agroalimentaria de Aragón*, the group developed new methods for three-dimensional image

analysis of almond fruits. These techniques enable the extraction of geometric features and shape descriptors from 3D scans of almond endocarps, offering potential applications in agriculture and food quality assessment.

Together with the *Huawei Research Center in Nice*, the group explored a joint framework for denoising and high dynamic range (HDR) reconstruction in RAW image sequences. By addressing both tasks simultaneously, this approach improves the visual quality and robustness of RAW imaging workflows and opens the door to more efficient mobile or embedded imaging systems.

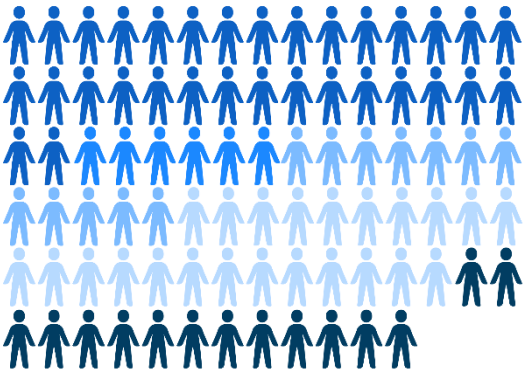
The ongoing collaboration with the *IMEDEA (Mediterranean Institute for Advanced Studies)* has also yielded important outcomes. One project provided a comprehensive analysis and reproducible implementation of the dark channel prior method for image dehazing, helping to better understand its strengths and limitations in various visibility conditions. Another resulted in the development of an open-source video annotation tool for underwater scenes (UVAT), designed to support marine biologists in efficiently labelling and analyzing underwater footage. This tool strengthens the interface between computer vision and marine ecology and fosters interdisciplinary research.

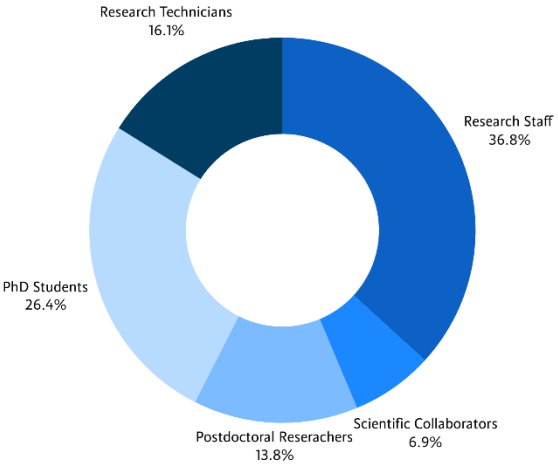
These achievements reflect the group's continued commitment to innovation, collaboration, and the development of practical solutions in computational imaging and visual analysis.

IAC3 2024 BY THE NUMBERS

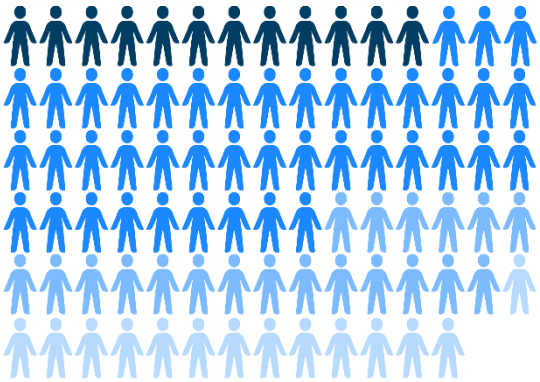
By the end of 2024 we were **88 members**,

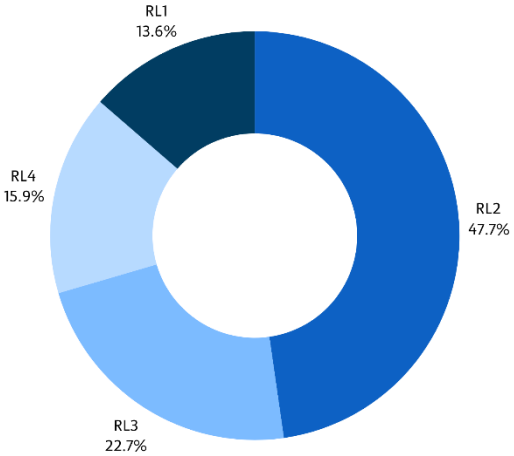
between research staff, collaborators, postdocs, PhD students and technicians, distributed among our four research lines.



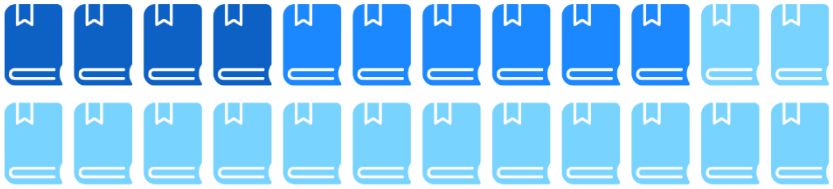


Distribution of the 88 members of the Institute according to their professional category: research staff, scientific collaborators, postdoctoral researchers, PhD students and research technicians.



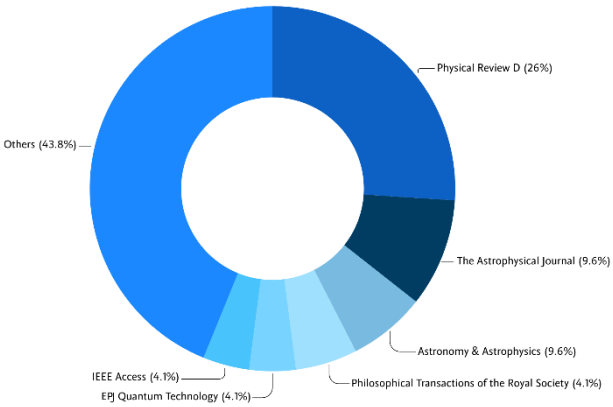


Distribution of members in each research line: Computational Astrophysics (RL1), Gravitational Wave Astronomy (RL2), Nonlinear Dynamical Systems and Computing (RL3) and Applied Mathematics for Image Analysis and Data Processing (RL4).

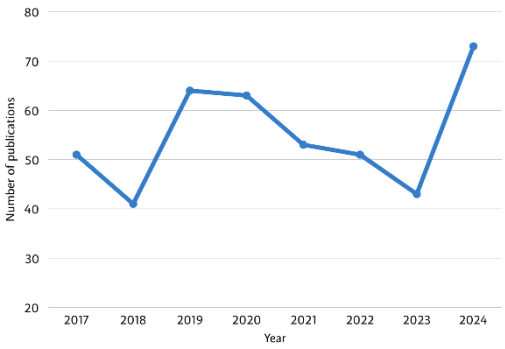


IAC3 members supervised **24 theses:** 4 PhDs, 6 Master's and 14 Bachelor's

Our members achieved **73 publications** in 2024, **a new record!**



Number of publications by journals: more than 50% of the articles have been published in a set of 6 journals, emphasizing the transfer of knowledge among different working groups.



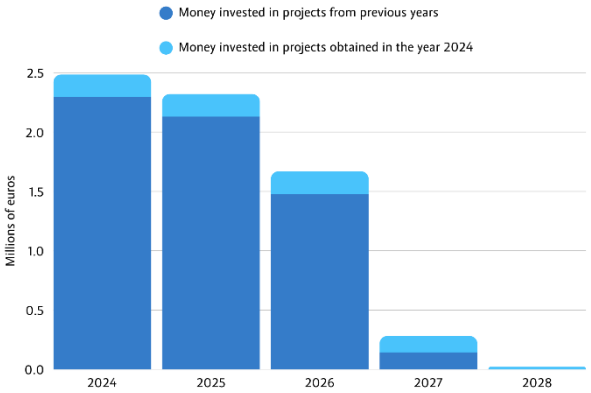
Number of publications by year: 2024 has been a great year for the institute, breaking the publications record of 2019, which was of 64 publications.

We organized **45 IAC3 seminars** covering different topics.

We obtained **4 new projects**, 2 of which were national and 2 international.

Our total budget was of **2.485 M€**

Planning the funding obtained through projects: In the year 2024, a total of 2.485.472,62€ have been secured to allocate towards the research activities of the members.



2.1. Research Staff

- Ábalos, Julio Fernando[2]
- Álvarez Torres, María Jesús[3]
- Batle Vallespir, Josep[3]
- Bona Casas, Carles[3]
- Bona Garcia, Carles[2,3]
- Buades Capó, Antoni[4]
- Calderón Pérez, Luis Ángel[3]
- Carot Giner, Jaume[2]
- Cerdà Pino, Joan Josep[3]
- Coll Vicens, Bartomeu[3,4]
- Covas Vidal, Josep Blai[2]
- Duran Grimalt, Joan[4]
- Javaloyes, Julien Joseph Pierre[3]
- Jiménez Forteza, Francisco[2]
- Keitel, David Benjamin[2]
- Lisani Roca, José Luis[4]
- Luna Bennasar, Manuel[1]
- Martorell Nadal, Onofre[4]
- Massó Bennàsar, Joan[2,3]
- Navarro Oliver, Julia[4]
- Oliver Herrero, Ramón[1]
- Palenzuela Luque, Carlos[2]
- Petro Balaguer, Ana Belén[4]
- Prohens Sastre, Rafel[3]
- Ramos Buades, Antoni[2]
- Sbert Juan, Catalina[4]
- Sintes Olives, Alicia M.[2]
- Soler Juan, Roberto[1]
- Terrades Calafell, Jaume[1]
- Teruel Aguilar, Antonio Esteban[3]
- Vich Llompart, Catalina[3]

2.2. Scientific Collaborators

- Aguiar-Kriginsky Silva, Matheus[1]
- Barceló Forteza, Sebastià
- Bezares Figueroa, Miguel Ángel Andrés[2]
- Gurevich, Svetlana[3]
- Husa, Sascha[2]
- Tenorio Márquez, Rodrigo[2]

2.3. Postdoctoral Researchers

- Cerrato, Antonio[3]
- Colleoni, Marta[2]
- Hamilton, Eleanor Zaida[2]
- Heffernan, Anna[2]
- Henry, Quentin Laurent Gerard[2]
- La Rosa, Iuri[2]
- Piantschitsch, Isabell[1]
- Pillado González, Alejandra Renee[2]
- Schianchi, Federico[2]

[1] Computational Astrophysics
[2] Gravitational Wave Astronomy
[3] Nonlinear Dynamical Systems and Computing
[4] Applied Mathematics for Image Analysis and Data Processing

- Sharma, Aditya Kumar[2]
- Singh, Neha[2]
- Xu, Yumeng[2]
- Yelo Sarrión, Jesús[3]

2.4. PhD Students

- Aguilera Miret, Ricard[2]
- Alcover Borràs, Maties Francesc[4]
- Cantallops Palmer, Miquel[1]
- Carretero Montero, Juan Antonio[2]
- Castelló Barceló, Guillem[1]
- Felsy, Varsha[1]
- Garrón Fernández-Pacheco, Ángel[2]
- Giossi, Cristina[3]
- Gómez Gómez, Samuel[2]
- Jaume Amengual, Rafel[2]
- Llobera Querol, Joan[2]
- Melis Sánchez, Llorenç[1]
- Mérou Mestre, Joan-René[2]
- Pereira Sánchez, Iván[4]
- Planas Llompart, Maria de Lluc[2]
- Ramis Vidal, Felip Antoni[2]
- Rodríguez Izquierdo, Manuel[2]
- Rosselló Sastre, María[2]
- Sánchez Beeckman, Marco[4]
- Seidel, Thomas[3]
- Torres Rullán, Daniel[4]
- Valencia Gómez, Jorge[2]
- Weng, Ruiling[3]
- Yébana Carrillero, Jesús[2]

2.5. Technicians

- Calafat Jaso, Alicia[2]
- Camps Nebot, Marina[2]
- Castell Cladera, Biel[1]
- Comellas Fluxa, Cristian[4]
- Delicado Moll, Rosa Maria[3]
- Ferrer Martínez, Maria Antònia[2]
- Fuster Aparisi, Alberto[3]
- Garau Verger, Bartomeu[4]
- Gil Merino, Rodrigo[2]
- Montava Agudo, Arnau[2]
- Muñoz Matas, Maria Antònia
- O'Hare, Alex Gwyn[3]
- Pareek, Shrey[2]
- Soubrié, Elie[1]

2.6. Scientific cooperation students

- Camps, Joan[4]

2.7. Scientific cooperation participants

- Arbona Nadal, Antoni
- Adrover González, Andrés[1]

3. Highlights

Six IAC3 research groups earn consolidated status and UIB funding for 2024-2026

The University of the Balearic Islands (UIB) has recognized six research groups within the Institute of Applied Computational Science and Technology (IAC3) as consolidated groups. These groups have been awarded funding through the "Programa de Foment de la Recerca i la Innovació 2024-2026," aimed at supporting their ongoing research activities. The recognized research groups are SOLPHYS (Solar Physics), GRAVITY (Gravitational Physics: Theory and Observation), GRAC (Gravitation, Relativistic Astrophysics, and Computing), ONL (Optics and nonlinear sciences), SSDD (Dynamic Systems), MIA (Mathematics, Imaging, and Learning).

Celebrating Catalina's 60

On December 11th, the members of the applied mathematics groups gathered to celebrate the 60th birthday of one of their members, Catalina Sbert. Her colleagues, collaborators, and PhD students organized a surprise seminar where they shared their joint work over the years, along with many anecdotes and laughs.

The second season of *Territorio Gravedad* hits the screens

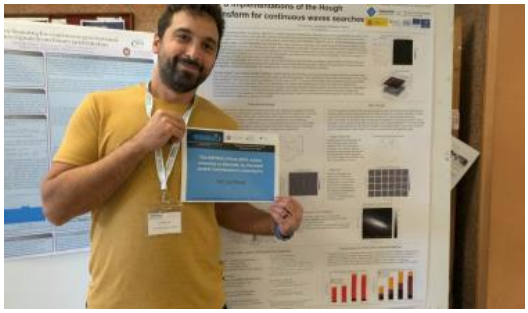
The UIB has co-financed this science outreach series on the sciences that study the cosmos, featuring prominent members of the scientific community, including Dr. Alícia Sintes and Dr. Sascha Husa.

The second and final season of *Territorio Gravedad*, produced by the CSIC, begins in 2015, with the first and long-awaited detection of gravitational waves. The remaining two episodes focus on the search for physics' "holy grail": the unification of the theories of general relativity and quantum mechanics.

Gravitational Waves on Rails at *Ciència a Tot Tren!*

On November 9th, nearly 300 people boarded the "train of knowledge" for the second edition of *Ciència a Tot Tren*, an initiative that blends science outreach with tourism in a unique setting: the historic Sóller Train. During the hour-long journey from Palma to Sóller, 15 scientists delivered engaging talks on topics ranging from stellar plasma and worms to diabetes and gravitational waves. The talk on gravitational waves came straight from IAC3, delivered by Alícia Sintes, who faced the exciting challenge of giving a talk in a very special setting to an especially attentive audience—making it a phenomenal experience. Other members of IAC3 also took part in the activity, including Maria Rosselló and Maria Antònia Ferrer.

Iuri La Rosa Wins Prestigious GEMMA 2 Prize for Outstanding Poster Contribution



Dr. Iuri La Rosa has been awarded the "GEMMA 2 Prize 2024" for his exceptional poster presentation at the Gravitational-waves, ElectroMagnetic and dark-MAtter Physics Workshop (GEMMA 2). This accolade brings with it a prize of 500 EUR and recognizes his significant contributions to the field of gravitational wave research. The winning poster, titled "GPU implementations of the Hough Transform for Continuous Waves Searches," showcases innovative computational techniques to enhance the detection of gravitational waves.

The IGFAE organises 'A natureza do espazo-tempo', an outreach event with leading figures in fundamental physics

The Instituto Galego de Física de Altas Enerxías (IGFAE) organized the conference 'A nautreza do espazo-tempo' on Friday 13 September. This meeting, open to the general public, brought together scientific and outreach referents who constructed a joint narrative about the birth of space-time, its dynamics, its intimate nature and its frontiers. The event brought together in Santiago de Compostela four leading scientists in different areas of fundamental physics: José Alberto Rubiño (Instituto de Astrofísica de Canarias), Alicia Sintes (UIB – IAC3), Alejandra Castro (University of Cambridge), and Gastón Giribet (New York University).

IAC3 Takes Part in the 2024 European Researchers' Night

The European Researchers' Night returned to Palma on September 27 with a wide range of science activities open to the public. Among the highlights of this edition is an activity featuring the Institute of Computational Applications with Community Code (IAC3): *"Physicists and Mathematicians: The Universe's Image and Sound Engineers."* Visitors got to see themselves transformed into a Van Gogh paintingand were guided through the fascinating world of gravitational waves and black holes.

End-of-Year Celebration for the 2023–2024 Academic Year

On July 25th, members of the IAC3 enjoyed a summer party to celebrate the end of the 2023–2024 academic year. Among the activities during the event were a trivia contest that pitted physicists against mathematicians and a lively water gun battle.

UIB Researcher Among 18 International Scientists Overseeing the LISA Space Mission

Dr. Anna Heffernan was selected by the European Space Agency to join the science team of the mission that will launch the first

space-based gravitational wave observatory. Dr. Sascha Husa will co-chair two working groups focused on waveform decoding and defining the technical standards for LISA's software development. Dr. Heffernan is one of 11 scientists selected by ESA, joining six others chosen by NASA and one by the LISA Consortium, a global collaboration of over 1,800 scientists. "I'm delighted to have been selected. LISA will open a new window to our universe, and there's so much science to be done. Helping to maximize the output of such an innovative mission is a privilege," said Dr. Heffernan. She is the only researcher based at a Spanish institution to join the committee for the next three years.

Daniel Torres accepted as an FPU fellow

The FPU fellowships are grants designed to fund research contracts aimed at obtaining a PhD, while also promoting teaching skills. Daniel Torres was one of the candidates selected for an FPU fellowship in the field of Mathematical Sciences and Computer Science. As a result, Daniel Torres began working on his doctoral thesis titled "*Integrating nonlocal variational models with multi-head attention networks for underwater and satellite imaging*", under the supervision of Dr. Joan Duran and Dr. Catalina Sbert.

Two invited talks by GRAVITY/IAC3 researchers at Iberian GravitationalWaves Meeting

Two researchers from the GRAVITY group at IAC3 had the honour to give two of the eight invited talks at the 13th Iberian Gravitational Waves Meeting hosted by the University of Salamanca, demonstrating the leadership of the group in international gravitational-waves collaborations and its recognition by the national community. Dr. Anna Heffernan's talk covered the topic of "Waveforms for LISAA", while Dr. David Keitel spoke of "LIGO-Virgo-KAGRA results so far and status of the O4 run".

Several IAC3 researchers among the 1,000 most prominent in Spain according to the CSIC

A total of 16 researchers from the Balearic Islands were ranked among the 1,000 most prominent in Spain, according to the Webometrics Ranking of World Universities 2024. The list is led by Dr. Alicia Sintes, the only one among the top 100 and is the fourteenth female researcher in Spain. In addition, other IAC3 researchers are also featured on the list, such as Dr. Sascha Husa (103rd) and Dr. David B. Keitel (271st) position, both from the same research group.

A New Space for Research at UIB

The new Balearic Islands Research Complex brings together various research groups and institutes from different public centers at ParcBit, aiming to improve research capacity, contribute to competitiveness, and foster the generation of synergies.

From the University of the Balearic Islands (UIB), the Balearic Centre for Biodiversity (CBB-UIB), the Institute of Computational Applications of Community Code (IAC3-UIB),

the Institute for Agro-environmental Research and Water Economics (INAGEA-UIB), the Geographic Information Systems and Remote Sensing Service (SSIGT-UIB), and part of the Interdisciplinary Institute of Physics and Complex Systems (IFISC-UIB-CSIC) have been installed at the new complex.

The inauguration ceremony was attended by Marga Prohens, President of the Government; Valentina Corsetti and Diego Villalba from the European Commission; Esperanza Samblás, Director-General of European Funds for the Government of Spain; Jaume Carot, Rector of the University of the Balearic Islands (UIB); as well as various authorities and representatives from research centers, clusters, former regional research officials, and representatives from economic entities.

Ramón Oliver Gives a Talk at CaixaForum as Part of the "Windows to the Universe I" Course

On June 4, Ramón Oliver delivered an insightful talk at CaixaForum Palma as part of the "Windows to the Universe I" astronomy course. This course, which took place from May 14 to June 4, 2024, was coordinated by Benjamín Montesinos Comino from the Department of Astrophysics at the Center for Astrobiology in Madrid, and covered various aspects of astronomy in an accessible and rigorous manner.

Ramón Oliver's session, titled "The Sun and the Stars", concluded the lecture series with an in-depth exploration of our star, the Sun. During his talk, Oliver explained the Sun's role in generating solar storms, which can trigger aurora borealis, and discussed the main characteristics of the total solar eclipse that will be visible from the Balearic Islands on August 12, 2026. He also provided a detailed account of the life cycle of stars, describing how they are born, evolve, and eventually die.

Scientific Collaboration Between the UIB Dynamic Systems Group and the UNESP Dynamic Systems Group

The Dynamic Systems Group at the University of the Balearic Islands (UIB) has initiated a scientific collaboration with the Dynamic Systems Group at São Paulo State University Julio de Mesquita Filho (UNESP) at Sao José de Rio Preto. This collaboration focuses on the qualitative theory of differential equations and aligns with the objectives of the PID2020-118726GB-I00 project, overseen by Rafel J. Prohens and José Luis Bravo, and the "Piecewise Smooth Vector Fields" project, overseen by Professors Paulo Ricardo da Silva and Claudio Aguinaldo Buzzi. The collaboration has thus far included participation in the XII Workshop on Dynamical Systems, held from November 6-9, 2023, at the IBILCE center at UNESP, by Professors M. Jesús Álvarez, Tomeu Coll, and Rafel J. Prohens. Additionally, Professor Antonio E. Teruel conducted a two-week scientific visit to the IBILCE center at UNESP.

IAC3 Participates in the "Ciència Per a Tothom" Fair 2024

On May 9, 10, and 11, members of IAC3 participated in the new edition of the "Science for Everyone" Fair 2024. The fair was open for schools to attend on the mornings of Thursday, May 9, and Friday, May 10, and was also open to families on the evening of Friday, May 10, and the morning of Saturday, May 11. Nearly a hundred stalls were set up, showcasing various scientific theories, experiments, and paradigms with the aim of educating and sparking interest in the sciences, especially among younger

audiences. Events like these are essential for stimulating the next generations of scientists, and IAC3 was excited to be involved, presenting our research lines in the clearest and most engaging way possible.

Alicia Sintes Participated in the "International Girls in ICT Day" Organized by the Catalan Women's Institute

On Thursday, April 25, 2024, the International Girls in Information and Communication Technologies (ICT) Day was commemorated with a special event at the Administrative District of the Generalitat de Catalunya, located on Carrer del Foc, 57, in Barcelona. Alicia Sintes participated in a workshop organized by the Catalan Women's Institute. Around fifty fifth-grade students, from the Bernat Metge School in El Prat de Llobregat and the Frederic Mistral School in L'Hospitalet de Llobregat, gathered to delve into the fascinating world of Science, Technology, Engineering, Arts, and Mathematics (STEAM). The purpose of this event, held annually on the fourth Thursday of April, was to present the Encyclopedia of Women in STEAM.

The UIB Participates in the Detection of a Neutron Star and Unknown Compact Object Merger

A team of researchers from the GRAVITY group at the University of the Balearic Islands (UIB) participated in the detection of the gravitational wave signal GW230529, detected by the LIGO-Virgo-KAGRA collaboration's detectors on May 29, 2023. This gravitational wave is believed to have been caused by the merger of a neutron star with a mass between 1.2 and 2 solar masses and an unknown compact object with a mass between 2.5 and 4.5 solar masses. The mass of the unknown object is larger than expected for a neutron star but smaller than that of a black hole. The mass of this unknown object challenges current models of black hole and neutron star populations, which suggested the existence of a gap in the distribution of compact objects where no objects could exist between 3 and 5 solar masses.

Alicia Sintes from IAC3 Shines in the "Spain Public Universities Rankings 2024" by AD Scientific Index

Alicia Sintes received a prestigious recognition in the "Spain Public Universities Rankings 2024" by AD Scientific Index. The ranking measures scientific performance and the added value of each researcher's productivity. It considers the H-index, i10-index, and citation count on Google Scholar over the past six years. Alicia Sintes stands out in this ranking, securing the 25th position nationally, the 264th regionally, and the 636th globally. Furthermore, she holds the top spot as the Best Scientist at the University of the Balearic Islands (UIB). Other distinguished researchers from IAC3 are Sascha Husa (2nd), David Keitel (4th), Ramon Oliver (26th), Carlos Palenzuela (29th), Carles Bona Garcia (86th), Julien Javaloyes (59th), Joan Massó (92nd), Carles Bona Casas (139th), Jose Luis Lisani (153rd), Manuel Luna (186th), Antonio E. Teruel (251st), Maria Jesus Alvarez (253rd), and Paolo Cremonese (391st).

Alicia Sintes, One of the 50 Leading Figures in the 'Guide to Women Leaders in the Science and Health Sector' by 'Yo, Jefa' from Trescom

'Yo, jefa', the program by **Trescom** aimed at promoting female leadership in professional environments, included **Alicia Sintes**, secretary of **IAC3**, in its list of 50 leading figures in the **'Guide to Women Leaders in the Science and Health Sector'**. The goal of this guide is to highlight the achievements of prominent women in the scientific and healthcare sectors in Spain.

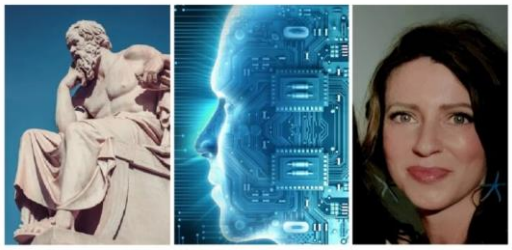
The European Space Agency Approves the LISA Space Mission, with Participation from the UIB

On Thursday, January 25, the European Space Agency (ESA) confirmed that the LISA space mission had successfully passed the study phase and has now entered the implementation phase to make the first gravitational wave space observatory a reality. The plan is for LISA (Laser Interferometer Space Antenna) to be launched into orbit in the mid-2030s. The LISA mission is made possible by the collaboration between ESA, which leads the initiative, the space agencies of its member states, NASA, and the international scientific consortium LISA Consortium, in which the University of the Balearic Islands (UIB) participates.

Joan-René Mérou's Success at the VIII TalenTIC Awards by Inetum and the UIB

The University of the Balearic Islands (UIB) and Inetum celebrated academic excellence during the eighth edition of the TalenTIC Awards, held on January 22, 2024. Among the honorable mentions, Joan-René Mérou, a PhD student in the Gravitational Physics Group: Theory and Observation (Gravity), stood out for his work "GPU-Accelerated Searches for Long-Duration Transient Gravitational Waves from Newborn Neutron Stars," supervised by Alicia Sintes and Rodrigo Tenorio. Mérou, with his innovative approach, explored new pathways in gravitational wave research, using GPUs to detect long-duration gravitational waves emitted by the merger of a binary neutron star system. This exceptional contribution earned him an honorable mention, solidifying his place as a rising star in the field of gravitational wave astronomy.

Dr. Isabell Piantschitsch receives grant for interdisciplinary research on artificial intelligence



Dr. Piantschitsch, postdoctoral researcher of the Solar Physics research group at the University of the Balearic Islands (UIB), has received a grant, funded by the Styrian government in Austria, for conducting her project "DeLPhi: Deep Learning & Philosophy – On the epistemic role of deep learning in science".

4. Research Projects

National Sources

- *Low dimensional dynamical systems and applications to Neuroscience (LdiDySAN).*
  Ministerio de Ciencia, Innovación y Universidades
  Ref. PID2023- 151974NB-I00
  PI: Maria Jesús Álvarez and José Luis Bravo
  Amount: 110.000,00 €
  Dates: 01/09/2024-31/08/2028

- *Solar Atmospheric Plasma Processes (SoPla)*
  Ministerio de Ciencia e Innovación
  Ref. PID2023-147708NB-I00
  PI: Jaume Terradas and Roberto Soler
  Amount: 225.625 €
  Dates: 01/09/2024-31/08/2027

- *Decision dynamics in cortico-basal ganglia-thalamic networks (ddCBGT)*
  Ministerio de Ciencia e Innovación (MICINN).
  Ref. PCI2023-145982-2
  PI: Catalina Vich Llompart.
  Amount: 176.000 €.
  01/12/2023-30/11/2026.

- *Dynamical processes in the solar atmosphere (DynSun)*
  Ministerio de Ciencia e Innovación
  Ref. PID2020-112791GB-I00
  PI: Ramón Oliver and Manuel Luna
  Amount: 226.875 €
  Dates: 01/09/2021-31/08/2024

- *Nuevas fronteras en la física de ondas gravitacionales: observaciones a la sensibilidad de diseño y más allá*
  Proyectos de Generación de Conocimiento 2022. Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación. Fondo Europeo de Desarrollo Regional (FEDER)
  Ref. PID2022-138626NB-I00
  PI: Alicia M. Sintes, Sascha Husa
  Amount: 572.125,00 €
  Dates: 01/09/2023 - 31/08/2027

- *Jets, kilonovas y ondas gravitationales: conectando simulaciones numéricas de colisiones de estrellas de neutrones y agujeros negros con observaciones de multimensajeros*
  Ministerio de Ciencia e Innovación
  Ref. PID2022-138963NB-I00
  PI: Carlos Palenzuela Luque, Juan Massó Bennásar
  Amount: 174.300 €
  Dates: 01/09/2023-31/08/2026

- *Nuevas técnicas para las próximas primeras detecciones en la astrofísica de ondas gravitacionales*
  Ministerio de Ciencia e Innovación (Plan de Recuperación, Transformación y Resiliencia – NextGenerationEU) Ayudas para Incentivar la Consolidación Investigadora
  Ref. CNS2022-135440
  PI: David Keitel
  Amount: 199.577 €
  Dates: 01/09/2023 - 31/08/2025

- *Multidark*
  Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación. Redes de Investigación.
  Ref. RED2022-134411-T Temáticas
  PI: Miguel A. Sánchez-Conde, David Keitel (UIB)
  Amount: 20.300 €
  Dates: 01/06/2023 - 31/05/2025

- *Participación española en estructuras europeas de investigación en física de partículas, astropartículas y nuclear*
  Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación. Redes de Investigación
  Ref. RED2022-134204-E Estratégicas
  PI: Antonio Pich Zardoya, Alicia M. Sintes (UIB)
  Amount: 60.000 €
  Dates: 01/06/2023 - 31/05/2025

- *Detección y clasificación de residuos marinos flotantes mediante imágenes satelitales hiperespectrales (MaLiSat))*
  Ministerio de ciencia e Innovación
  Ref: TED2021-132644B-100
  PI: Joan Duran; Maria de la Salud Deudero Company
  Amount: 212.750 €
  Dates: 01/12/2022 - 31/09/2025

- *Combinando técnicas de modelización y aprendizaje automático para el procesamiento y análisis matemático multi-imagen. (MoMaLIP)*
  Ministerio de ciencia e Innovación
  Ref. PID2021-125711OB100
  PI: Antonio Buades and José Luis Lisani
  Amount: 145.200,00 €
  Dates: 01/09/2022-31/08/2026

- *Tecnologías avanzadas para la exploración del universo y sus componentes*
  Ministerio de Ciencia e Innovación (Fondos MRR) - Conselleria de Fons Europeus, Universitat i Cultura con fondos de la European Union NextGenerationEU (PRTR-C17.I1). Programa de I+D+I en el marco del plan complementario en el área de astrofísica y física de altas energías.
  Ref. SINCO2022/6719

PI: Alicia M. Sintes
Amount: 2.000.000 €
Dates: 22/04/2022 - 30/09/2025

- *Comportamientos oscilatorios en sistemas dinámicos. Bifurcaciones, técnicas y aplicaciones (COSSDDBTA).*
  Ministerio de Ciencia e Innovación (MICINN).
  Ref. PID2020-118726GB-I00
  PI: Rafel J. Prohens Sastre; José Luis Bravo Trinidad.
  Amount:45.738 €.
  Dates: 01/09/2021-31/08/2024.

- *Investigación colaborativa: CRCNS US-Spain Propuesta de investigación: Mecanismos de toma de decisiones adaptativos a nivel de circuito.*
  Ministerio de Ciencia e Innovación (MICINN).
  Ref. PCI2020-112026,
  PI: Catalina Vich Llompart.
  Amount: 130.450 €.
  01/09/2020-31/08/2024.

International Sources

- *Do not fear to be eccentric! Unveiling the origin of binary black holes. NWO Talent Programme 2022.*
  Ref. VI.Veni.222.396
  PI: Antoni Ramos Buades
  Amount: 159.567,16 €
  Dates: 31/12/2024 - 30/09/2026

- *MEMORY:Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)*
  DFG (524947050)
  PI: Svetlana V. Gurevich (UIB participant: Julien Javaloyes)
  Amount:236.619€
  01/04/2024 - 31/03/2027.

- *Observe local think global: What solar observations can teach us about multiphase plasmas across astrophysical scales*
  International Space Science Institute, Bern, Switzerland
  Ref. 545
  PI: Patrick Antolin (University of Northumbria, United Kingdom), Clara Froment (University of Orléans, France)
  Amount: 50.000 €
  Dates: 01/01/2023-31/12/2024

- *ET-PP - Preparatory Phase for the Einstein Telescope Gravitational Wave Observatory*
  European Commission Framework Programme Horizon Europe. Coordination and Support action under grant agreement 101079696
  Ref. HORIZON-INFRA-2021-DEV-02
  PI: Mario Martinez, Alicia Sintes (UIB)
  Amount: 3.450.000 €
  Dates: 01/09/2022 - 31/08/2026 (48 months)

Regional Sources

- *Desarrollo de técnicas de deep-learning para la detección y clasificación de peces en vídeos submarinos,*
  Plans Complementaris (component 17) del Pla de Recuperació, Transformació i Resiliència (CAIB),
  PI: José Luis Lisani,
  Amount: 81.582,25 €
  Dates: 01/05/2023-31/07/2025

- *Plataforma HiTech – Instituto de Aplicaciones Computacionales y de Código Comunitario Biodiversidad (HiTech-IAC3-BIO)*
  Consejería de Fondos Europeos, Universidad y Cultura del Gobierno de las Illes Balears con fondos FEDER
  Programa Operativo 2021-2027
  Ref. SINCO 2022/18146
  PI: Maria Capa, Alicia Sintes, Sascha Husa
  Amount: 2.788.000 €
  Dates: 01/11/2022 - 30/09/2026

- *Retos en la observación de ondas gravitacionales por la red internacional de detectores terrestres en su cuarto periodo de observación (ReGWO4)*
  Comunitat Autònoma de les Illes Balears through the Conselleria de Fons Europeus, Universitat i Cultura and the Direcció General de Política Universitaria i Recerca with funds from the Tourist Stay Tax Law ITS 2017-006
  Ref. PDR2020/11
  PI: Alicia M Sintes Olives
  Amount: 92.661,60 €
  Dates: 01/12/2021 - 15/10/2024

Computational grants

- *Artemisa call 2024.3: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)*
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/11/2024-28/02/2025

- Artemisa call 2024.3*: "Accelerating the search for continuous gravitational-wave signals from unknown millisecond neutron stars in binaries"*
  PI: Rodrigo Tenorio, David Keitel
  Dates: 01/11/2024 – 28/02/2025

- *Artemisa call 2024.2: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)*
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/07/2024-31/10/2024

- Artemisa call 2024.2*: "Accelerating the search for continuous gravitational-wave signals from unknown millisecond neutron stars in binaries"*
  PI: Rodrigo Tenorio, David Keitel
  Dates: 01/07/2024 – 31/10/2024

- *Artemisa call 2024.1: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)*
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/03/2024-30/06/2024

- *Artemisa call 2023.3: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)*
  Refs (UIB): uib107.
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/11/2023 - 29/02/2024

- Artemisa call 2022.3: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)
  Refs (UIB): uib107.
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/11/2023 - 29/02/2023

- Artemisa call 2022.2: Floating marine litter detection and classification using hyperspectral satellite imagery (MaLiSat)
  Refs (UIB): uib107.
  PI: Joan Duran.
  Amount: Dynamical allocation.
  Dates: 01/07/2023 - 31/10/2023

- Artemisa call 2023.2: "*Gravitational-wave data analysis and modelling with neural networks and GPUs*"
  PI: David Keitel, Alicia M. Sintes
  Dates: 01/07/2023 - 31/10/2023

- Artemisa call 2023.1: "*Gravitational-wave data analysis and modelling with neural networks and GPUs*"
  PI: David Keitel, Alicia M. Sintes
  Dates: 01/03/2023 - 30/06/2023

- Artemisa call 2024.1: *"Accelerating the search for continuous gravitational-wave signals from unknown millisecond neutron stars in binaries"*
  PI: Rodrigo Tenorio, David Keitel
  Dates: 01/03/2024 - 30/06/2024

- Artemisa call 2022.3: "*Convolutional Neural Networks for long-duration transient gravitational waves from glitching pulsars*"
  PI: David Keitel, Alicia M. Sintes
  Dates: 01/11/2022 - 28/02/2023

RES - Red Española de Supercomputación

- *RES-BSC/MN5-ACC: "Preparations for the Spanish Contribution to the LISA Distributed Data Processing Centre"*
  Ref. AECT-2024-3-0033
  PI: Sascha Husa
  Amount: 1.000kh
  Dates: 01/11/2024 – 28/02/2025

- *RES-BSC/MN5-ACC: "Preparations for the Spanish Contribution to the LISA Distributed Data Processing Centre"*
  Ref. AECT-2024-3-0033
  PI: Sascha Husa
  Amount: 1.000kh
  Dates: 01/11/2024 – 28/02/2025

- *RES-BSC/MN5-ACC: "Exploring the phenomenology of eccentric coalescences of black hole binaries"*
  Ref. AECT-2024-3-0027
  PI: Sascha Husa
  Amount: 7.200kh
  Dates: 01/11/2024 – 28/02/2025

- *RES-BSC/MN5-ACC: "Initial Data for High-Mass-Ratio Compact Binaries"*
  Ref. AECT-2024-3-0026
  PI: Anna Heffernan
  Amount: 1.935,6kh
  Dates: 01/11/2024 – 28/02/2025

- *RES-BSC Picasso (UMA): "In-depth gravitational lensing studies with the LVK*

network at O4 sensitivity and beyond"
Ref. AECT-2024-3-0019
PI: David Keitel
Amount: 800kh
Dates: 01/11/2024 – 28/02/2025

- *RES-BSC/MN5-GPP: "Searching for continuous gravitational-wave signals from unknown sources in Advanced LIGO O4 data"*
  Ref. FI-2024-3-0013
  PI: Rodrigo Tenorio
  Amount: 650kh
  Dates: 01/11/2024 – 28/02/2025

- *RES-BSC/MN5-GPP: "Preparations for the Spanish Contribution to the LISA Distributed Data Processing Centre"*
  Ref. AECT-2024-2-0036
  PI: Sascha Husa
  Amount: 85kh
  Dates: 01/07/2024 – 31/10/2024

- *RES-BSC/MN5-GPP: "Preparations for the Spanish Contribution to the LISA Distributed Data Processing Centre"*
  Ref. AECT-2024-2-0036
  PI: Sascha Husa
  Amount: 985kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC/MN5-ACC: "Exploring the phenomenology of eccentric coalescences of black hole binaries"*
  Ref. AECT-2024-2-0032
  PI: Sascha Husa
  Amount: 60kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC/MN5-GPP: "Exploring the phenomenology of eccentric coalescences of black hole binaries"*
  Ref. AECT-2024-2-0032
  PI: Sascha Husa
  Amount: 7000kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC Picasso (UMA): "Extremely large microlensing magnification patterns for extragalactic strong gravitational lenses studies"*
  Ref. AECT-2024-2-0030
  PI: Rodrigo Gil-Merino y Rubio
  Amount: 120kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC Picasso (UMA): "Testing state-of-the-art gravitational waveform models for the fourth LIGO-Virgo-KAGRA observational period"*
  Ref. AECT-2024-2-0017
  PI: Marta Colleoni
  Amount: 300kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC Picasso (UMA): "In-depth gravitational lensing studies with the LVK network at O4 sensitivity and beyond"*
  Ref. AECT-2024-2-0028
  PI: David Keitel
  Amount: 960kh
  Dates: 01/07/2024 - 31/10/2024

- *RES-BSC Pirineus (CSUC): "Preparations for a catalog of generic gravitational wave signals from binary black hole coalescence"*
  Ref. AECT-2024-1
  PI: Sascha Husa
  Amount: 2.635kh
  Dates: 01/03/2024 - 30/06/2024

- *RES-BSC Picasso (UMA): "Robust parameter estimation and lensing studies with the LVK network at O4 sensitivity and beyond"*
  Ref. AECT-2023-3-0020
  PI: David Keitel
  Amount: 1.400kh
  Dates: 01/11/2023 – 29/02/2024

- *RES-BSC Marenostrum: "Preparations for a catalog of generic gravitational wave signals from binary black hole coalescence"*
  Ref. AECT-2023-3-0022
  PI: Sascha Husa
  Amount: 5.300kh
  Dates: 01/11/2023 – 29/02/2024

5. Research Visits

Visitor	Visiting Institute	Arrival – Departure
Anna Heffernan	University College Dublin, Dublin, Ireland	09/12/2024 - 21/12/2024
David Keitel	University of British Columbia, Vancouver, Canada	25/11/2024 - 26/11/2024
Maria de Lluc Planas Llompart	National Institute for Subatomic Physics (Nikhef), Amsterdam, Netherlands	30/09/2024 - 17/12/2024
Joan-René Mérou & Rafel Jaume	Laser Interferometer Gravitational-Wave Observatory (LIGO) Livingston Observatory, Livingston, United States	21/09/2024 - 21/12/2024
Ángel Garrón	Institute of Cosmology and Gravitation (ICG), University of Portsmouth, Portsmouth, United Kingdom	12/09/2024 - 12/12/2024
Rodrigo Gil-Merino y Rubio	Instituto de Física de Cantabria (IFCA), Universidad de Cantabria, Santander, Spain	01/07/2024 - 31/07/2024
Maria de Lluc Planas Llompart	National Institute for Subatomic Physics (Nikhef), Amsterdam, Netherlands	19/06/2024 - 19/07/2024
Antonio E. Teruel	UNESP Sao José do Rio Preto, Sao José do Rio Preto, Brazil	15/05/2024-31/05/2024
David Keitel & Rodrigo Tenorio	Institute for Gravitational Research (IGR), University of Glasgow, Glasgow, United Kingdom	22/04/2024
David Keitel & Ángel Garrón	ICG, University of Portsmouth, Portsmouth, United Kingdom	13/03/2024 - 15/03/2024
David Keitel	Scientific Computing Group, Durham University, Durham, United Kingdom	07/03/2024-08/03/2024
Onofre Martorell Nadal	University of Siegen, Siegen, Germany	29/02/2024-31/08/2024
David Keitel	STAR Institute, University of Liège, Liège, Belgium	22/02/2024
Cristina Giossi	Istituto Italiano di Tecnologia, Genoa, Italy	01/02/2024-01/03/2024

6. Visitors

Name	Home Institute	Arrival-Departure	Line of Research
Shichao Wu	Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany	13/11/2024 - 18/11/2024	Gravitational Wave Astronomy
Nicola Brandonisio, Denis Bujoreanu, Jinhui, Chen Yuchen	Huawei Nice Research Center	30/10/2024-30/10/2024	Applied Mathematics for Image Analysis and Data Processing
Sayak Datta	Gran Sasso Science Institute, L'Aquila, Italy	27/10/2024 - 06/11/2024	Theoretical and computational astrophysics
Lorenzo Mirasola	University of Cagliari, Sardinia, Italy	23/10/2024 - 23/10/2024	Gravitational Wave Astronomy

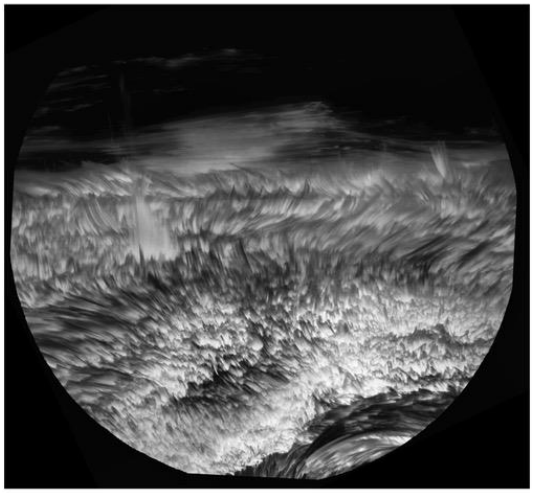
Philippe Moesta	University of Amsterdam	09/10/2024 - 12/10/2024	Computational Astrophysics
Andrew Lawrence Miller	National Institute for Subatomic Physics (Nikhef), Amsterdam, Netherlands	30/09/2024 - 04/10/2024	Gravitational Wave Astronomy
Quentin Henry	Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany	18/09/2024 - 20/09/2024	Gravitational Wave Astronomy
Antoni Ramos Buades	National Institute for Subatomic Physics (Nikhef), Amsterdam, Netherlands	09/09/2024 - 23/09/2024	Gravitational Wave Astronomy
Oscar Reula	Universidad de Cordoba (Argentina)	15/08/2024 - 14/10/2024	Computational Astrophysics
Dr Thomas Neukirch	Applied Mathematics in the School of Mathematics and Statistics. UK at the University of St Andrews	23/06/2024 - 28/06/2024	Computational Astrophysics
Valeriia Liakh	Centre for mathematical Plasma Astrophysics of the Faculty of Science of the KU Leuven. Belgium	11/06/2024 - 22/06/2024	Computational Astrophysics
Patrick Chi Kit Cheong	New Hampshire University (USA)	19/05/2024 - 21/05/2024	Computational Astrophysics
Lionel London	King's College London, United Kingdom	09/05/2024 - 15/05/2024	Gravitational Wave Astronomy
Martina Di Cesare	University of Naples Federico II, Naples, Italy	29/04/2024 - 20/12/2024	Gravitational Wave Astronomy
Adrian Abac	Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany	29/02/2024 - 19/03/2024	Gravitational Wave Astronomy
Francois Foucart	University of New Hampshire, New Hampshire, United States	21/04/2024 - 24/04/2024	Computational Astrophysics, Gravitational Wave Astronomy
Joan Torregrossa	Universitat Autònoma de Barcelona, Barcelona, Spain	12/03/2024 – 26/03/2024	Non Linear Systems and Computing
Luis Lehner	Perimeter Institute (Canada)	28/02/2024 - 20/03/2024	Computational Astrophysics
Armengol Gasull	Universitat Autònoma de Barcelona, Barcelona, Spain	18/01/2024 - 01/02/2024	Non Linear Systems and Computing

7. Academic Achievements

7.1. Doctoral Theses

Title: On the physical nature of chromospheric spicules and coronal rain
Author: Matheus Kriginsky
Directors: Ramon Oliver
Date: 19 July 2024

Abstract:



Our star plays host to a myriad of fascinating and astounding phenomena. Its atmosphere, marked by the interplay between the radiation field and the magnetised plasma, serves as an intriguing plasma physics laboratory.

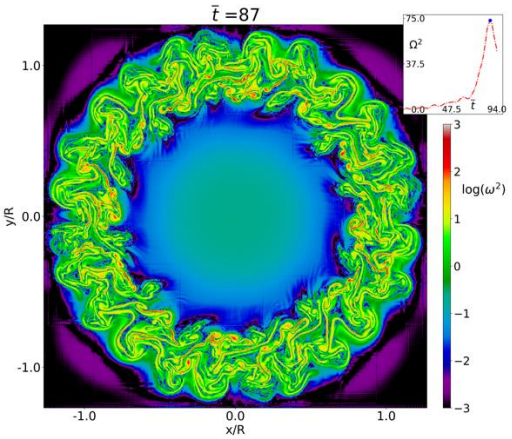
The chromosphere, where the magnetic pressure and the gas pressure battle each other for the dominance over the overall dynamics of the plasma, is filled with hair-like dense structures. When observed near the solar limb, those features are named spicules. This denomination becomes less homogeneous on the solar disc, where fibrillar structures are classified less broadly into mottles, dynamic fibrils, long fibrils, and the list goes on. Spicules, with their dynamic nature marked by their short lifetimes, the presence of propagating waves and their abundance, can play a crucial role in the transport of mass and energy through the solar atmosphere. Therefore, their correct modelling is a crucial part of solar physics in general. This modelling heavily relies on observational constraints.

Additionally, another spectacular and puzzling physical phenomenon that connects all the different layers of the solar atmosphere is coronal rain. Coronal loops, acting as highways for the circulation of the plasma in the solar corona, are often subjected to inhomogenous heating sources, mainly concentrated at their footpoints. This footpoint heating generates flows of heated plasma that rise along the magnetic field lines. Since the radiative losses are not compensated for far away from the footpoints, the plasma finds itself in a state of thermal non-equilibrium. This leads to a catastrophic cooling of the material inside the coronal loop that becomes increasingly dense and cold, eventually cooling down to chromospheric temperatures. This material will eventually evacuate the coronal loop in the form of what is known as coronal rain. The nature of the heating sources that lead to coronal rain are still a matter of intense research. Therefore, additional observational information about the state of the coronal rain plasma is necessary in order to understand this phenomenon. Additionally, coronal rain clumps, being cold intruders in the million-degree corona, can act as coronal magnetic field sensors.

The small size of coronal rain clumps and spicules has made it impossible for past instruments to properly resolve them, and progress in understanding them was slow. Over the past two decades, with a massive improvement on the spatial and temporal resolution of instruments, a new boom on the study of these structures has started. At the same time, advances in computational power have allowed for the once forbiddingly time consuming task of performing inversions of spectral lines a common practice. We aim on this thesis to benefit from both these instrumentational and computational advances by providing more observational constraints on the nature of spicules and coronal rain clumps through the analysis of high-resolution, high-cadence observations.

Title: Nonlinear evolution of torsional Alfvén waves in solar atmospheric flux tubes.
Author: Sergio Díaz Suárez
Director: Roberto Soler
Date: 17 July 2024

Abstract:



The Sun is a dynamic star made of plasma with a magnetized atmosphere, where magnetohydrodynamic (MHD) waves are frequently observed. In this Thesis, the nonlinear evolution of standing torsional Alfvén waves in solar coronal structures, such as coronal loops, prominence threads, and coronal flux ropes, is investigated using three-dimensional numerical simulations. The open-source PLUTO code is used, which solves the nonlinear MHD equations using a finite volume formulation and implements the Adaptive Mesh Refinement technique. A coronal loop and a prominence thread are modeled as straight flux tubes filled with plasma that is denser than their environment. In turn, a coronal flux rope is modeled as a twisted magnetic field embedded in a uniform coronal plasma. The effect of the solar photosphere is included in the models through the line-tying boundary condition at the feet of the structures.

Standing torsional Alfvén waves are excited by perturbing the component of velocity perpendicular to the magnetic field lines. Owing to the spatially-varying Alfvén frequency across the flux tube, caused by the nonuniformity of density and/or magnetic field, Alfvén waves oscillate independently from each other in adjacent magnetic surfaces. As a result, such waves develop phase mixing, which generates shear flows and transports the wave energy towards larger and larger perpendicular wavenumbers as time increases. In this initial phase, the dynamics is quasi-linear. Simultaneously, other MHD waves can appear during the evolution due to either linear or nonlinear coupling. Slow magnetoacoustic waves are nonlinearly generated due to the ponderomotive force, while fast magnetoacoustic sausage waves are linearly generated if magnetic twist is present.

Eventually, the phase-mixing shear flows trigger the Kelvin-Helmholtz instability (KHi), whose onset is unavoidable in flux tubes with a straight magnetic field. In weakly twisted tubes, the onset of the KHi is delayed, but the dynamics is similar to that in straight tubes. However, in strongly magnetically twisted tubes, the magnetic tension can nonlinearly inhibit the KHi growth. The KHi onset time depends on several parameters of the model, such as the length of the flux tube, the initial velocity amplitude, or the transverse nonuniformity length scale. The KHi excites higher azimuthal modes than the torsional mode, and increases dramatically the values of vorticity and current density with respect to those found during the previous quasi-linear stage

During the nonlinear evolution of the KHi, turbulence is naturally driven as the large KHi vortices break into smaller and smaller vortices. Turbulence is anisotropic and develops predominantly across the magnetic field direction. It further accelerates the energy transport to small scales initiated by the phase mixing. In a prominence thread, important dissipative mechanisms in the partially ionized prominence plasma, such as Ohm's and ambipolar diffusion, are considered. However, it is found that the heating caused by these effects is irrelevant. In a coronal flux rope, the nonlinear KHi evolution leads to the presence of secondary instabilities that cause plasma compression. Such dynamics spontaneously generates permanent overdense filaments that are locally aligned with the magnetic field.

Finally, possible observational imprints of the described evolution are explored using synthetic modelling of EUV emission in the case of the coronal plasma and of the H alpha line in the case of prominence

threads. It is found that some stages of the dynamics could be discernible in observations with a sufficiently high spatial resolution.

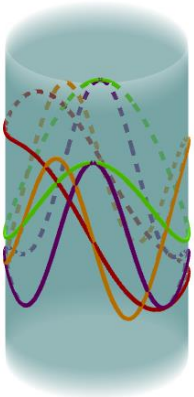
Title: Curvas invariantes y ciclos límite en ecuaciones de Abel
Author: Luis Ángel Calderón Pérez
Directors: José Luis Bravo Trinidad, Ignacio Ojeda Martínez de Castilla
Date: 21 may 2024

Abstract:

Bounding the number of periodic solutions of the Abel equation

$$x' = A(t)x^3 + B(t)x^2 + C(t)x,$$

where $A(t)$, $B(t)$, $C(t)$ are periodic smooth functions, is an open problem known as the Smale-Pugh problem. This problem has been studied because of the own interest of the equation but, most importantly, because it can be seen as a special case of Hilbert's 16th problem.



In this doctoral thesis, we improve a technique used by J. Huang, H. Liang and J. Llibre, by using the existence of invariant curves of the equation. As it would be interesting to check if this method can be generalized, the rest of the results of this thesis are devoted to study the number of certain types of invariant curves that an Abel equation can have without it being integrable.

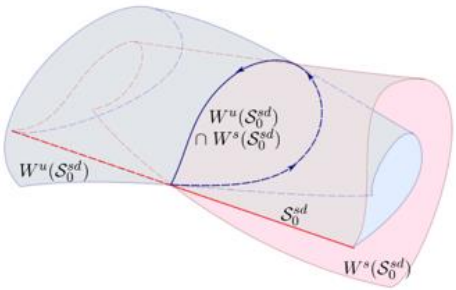
Title: Neuronal piecewise linear models reproducing bursting dynamics
Author: Jordi Penalva Vadell
Directors: Dr. Antonio E. Teruel, Dra. Catalina Vich and Dr. Mathieu Desroches
Date: 24 January 2024

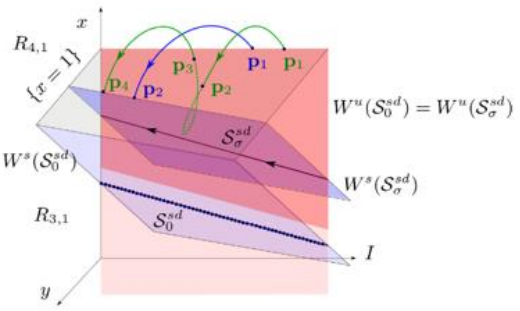
Abstract:

In this thesis, we propose a piecewise linear version of the original planar Morris-Lecar model which we study qualitatively and for which we characterize several bifurcations related to different types of bursting dynamics obtained by adding one or two slow variables. In doing so, we will make the first theoretical study of the slow-passage phenomenon in the context of piecewise linear slow-fast systems.

We divide the contents of the thesis in two parts. In the first part, we introduce our piecewise linear version of the Morris-Lecar model (PWL-ML). This model reproduce some dynamic behaviors observed in the original Morris-Lecar model and we identify and study adequate dynamical regimes where all parameters but three can be fixed. We study and categorize the bifurcation structure inherent to the PWL-ML model, revealing the presence of diverse bifurcation phenomena, primarily encompassing Hopf-like bifurcations, SNIC bifurcations, and homoclinic bifurcations, with the potential for other yet unexplored forms.

In the second part, we study slow-passage phenomena through different bifurcations of the PWL-ML model. In this endeavor, we adopt a slow-fast system perspective, with the PWL-ML model constituting the fast subsystem and the main bifurcation parameter studied in part I serving as the slow variable. Slow-passage phenomena are the results of the interplay between fast and slow components, emerging as a consequence of the gradual drift close to a bifurcation point of the fast subsystem. In our case, we study the slow-passage through a Hopf-like bifurcation, through a homoclinic connection and finally through a SNIC bifurcation. The synthesis of these findings opens the door to explore the intricate bursting dynamics appearing in the PWL-ML model, which includes: elliptic bursting, for the Hopf-like bifurcation; square-wave bursting, for the homoclinic connection; and parabolic bursting, for the SNIC bifurcation.





7.2. Ongoing Doctoral Theses

- Title: *Nonlocal theory for variational problems and partial differential equations*
  Student: Maties Francesc Alcover Borràs
  Directors: Joan Duran and Catalina Sbert
  Predoctoral contract

- Title: *Jets, kilonovas y ondas gravitacionales: conectando simulaciones numéricas de colisiones de estrellas de neutrones y agujeros negros con observaciones de multimensajero*
  Student: Juan Antonio Carretero Montero
  Directors: Carlos Palenzuela and Julio Fernando Abalos

- Title: *Long-duration gravitational waves: studies in gravitational lensing and machine learning applications*
  University: University of the Balearic Islands
  Student: Alicia Calafat Jaso
  Director: Dr. David Keitel, Dr. Alicia M. Sintes Olives
  Plataforma HiTech - Institut d'Aplicacions Computacionals i de Codi

- Title: *Automated study of solar prominence oscillations using machine learning and Big Data*
  Student: Guillem Castelló i Barceló
  Director: Manuel Luna Bennasar, Jaume Terradas Calafell

- Title: *Efficient and Explainable Deep Learning for Video Restoration and Enhancement: Applications to Underwater Videos*.
  Student: Cristian Comellas Fluxá
  Directors: Antoni Buades and Julia Navarro
  Research Project BIO002A.1

- Title: *Coronal rain and thermal non-equilibrium in coronal loops*
  Student: Varsha Felsy
  Director: Ramón Oliver Herrero, Jaume Terradas Calafell
  FPI

- Title: *Integro-differential equations for image processing*
  Student: Bartomeu Garau Verger
  Directors: Joan Duran and Catalina Sbert

- Title: *Hacia la primera detección del efecto de lente gravitacional en las ondas gravitacionales y sus aplicaciones en cosmología*
  University: University of the Balearic Islands
  Student: Ángel Garrón Fernandez-Pacheco
  Director: Dr. David Keitel
  FPI-CAIB/013/2022

- Title: *Braking ongoing-actions: circuit-level mechanisms of adaptive decision-making.*
  Student: Cristina Giossi.
  Directors: Catalina Vich, Timothy Verstynen.

- Title: *Gravitational Waves and Gravitational Atoms*
  University: University of the Balearic Islands
  Student: Samuel Gómez Gómez
  Director: Dr. Francisco Jimenez Forteza, Dr. Carlos Palenzuela Luque
  Programa de Doctorado de Física R.D. 99/2011.
  Hiring project under the responsibility of the vice-rectorate associated with the Beatriz Galindo Program (BG22/00034)

- Title: *Acelerando la física de ondas gravitacionales con hardware de computación paralela masiva*
  University: University of the Balearic Islands
  Student: Rafel Jaume Amengual
  Directors: Dr. Alicia M. Sintes Olives, Dr. Sascha Husa
  FPI-CAIB/018/2020

- Title: *Polarisation dynamics and localized states in external cavity lasers*
  Student: Shakiba Khajenooriranjbar
  Director: Svetlana V. Gurevich and Julien Javaloyes
  Funding: Overheads

- Title: *Frequency combs in injected Gires-Tournois Kerr resonators*
  Student: Elias Koch
  Director: Svetlana V. Gurevich and Julien Javaloyes
  Funding: Project KOGIT, Agence Nationale de la Recherche (No. ANR-22-CE92-0009) and Deutsche Forschungsgemeinschaft (DFG) via Grant No. 505936983.

- Title: *Black hole waveform models for a new era in gravitational wave astronomy*
  University: University of the Balearic Islands
  Student: Joan Llobera Querol
  Director: Dr. Sascha Husa
  FPI-CAIB/093/2022

- Title: *Heating processes in magnetized plasmas*
  Student: Llorenç Melis Sánchez
  Director: Roberto Soler Juan

- Title: *Search for continuous and long-transient gravitational waves*
  University: University of the Balearic Islands
  Student: Joan-René Mérou Mestre
  Director: Dr. Alicia M. Sintes Olives
  FPU22/01187 Ministerio de Educación y Cultura, Gobierno de España

- Title: *Circuit-level mechanisms of adaptative decision-making.*
  Student: Alex O'Hare.
  Directors: Catalina Vich.

- Title: *Model-based deep learning approaches for multi-modal image super-resolution*
  Student: Ivan Pereira Sánchez
  Directors: Joan Duran and Julia Navarro
  FPU-CAIB

- Title: *Decoding gravitational wave signals from compact binary coalescence: from LIGO design sensitivity toward the LISA space mission*
  University: University of the Balearic Islands
  Student: Maria de Lluc Planas Llompart
  Director: Dr. Sascha Husa

FPU20/05577 Ministerio de Educación y Cultura, Gobierno de España

- Title: *Improving waveform models for black hole neutron star and binary neutron star coalescences*
  University: University of the Balearic Islands
  Student: Felip Antoni Ramis Vidal
  Director: Dr. Marta Colleoni
  FPI-CAIB/092/2022

- Title: *MHD turbulence and neutrino transport: linking numerical simulations of binary neutron stars mergers to multi-messenger observations*
  Student: Manuel Rodriguez Izquierdo
  Directors: Carlos Palenzuela and Joan Massó

- Title: *Efecto de memoria de las ondas gravitacionales desde la fase inspiral hasta el ringdown: Modelado y análisis de datos*
  University: University of the Balearic Islands
  Student: Maria Rosselló Sastre
  Director: Dr. Sascha Husa
  FPU21/05009 Ministerio de Educación y Cultura, Gobierno de España

- Title: *Deep Learning Methods for Medical Image Segmentation*
  Student: Marco Sánchez Beeckman
  Directors: Antoni Buades
  FPU-CAIB

- Title: *Temporal Localized States and Frequency Combs in Kerr Cavities and Mode-Locked Lasers*
  Student: Thomas Seidel
  Director: Svetlana V. Gurevich and Julien Javaloyes
  Funding: Studienstiftung des Deutschen Volkes

- Title: *Combining variational models and deep learning for image processing problems*
  Student: Daniel Torres Rullán
  Directors: Joan Duran and Catalina Sbert
  FPU-CAIB

- Title: *Waveform models beyond the design sensitivity of the advanced gravitational wave detector network*
  University: University of the Balearic Islands
  Student: Jorge Valencia Gómez
  Directors: Dr. Jaume Jesús Carot Giner, Dr. Sascha Husa
  FPU22/02211 Ministerio de Educación y Cultura, Gobierno de España

- Title: *Coherence and phase ordering in mode-locked lasers*
  Student: Ruiling Weng
  Director: Svetlana V. Gurevich and Julien Javaloyes

- Title: *Tests of General Relativity with improved time-domain gravitational waveform models*
  University: University of the Balearic Islands
  Student: Jesús Yébana Carrilero
  Director: Dr. Marta Colleoni
  FPI-AEI/PRE2022-000809

7.3. Master's Theses

- Title: *Dynamics of localized states in the anomalous dispersion regime of injected Kerr–Gires–Tournois interferometers*
  Student: Tim Lohmann
  Directors: Svetlana V. Gurevich and Julien Javaloyes
  Date: 31/12/2024

- Title: *Temporal Localized States in Injected microcavities: The influence of Phase modulation*
  Student: Marc Hunkkemöller
  Directors: Svetlana V. Gurevich and Julien Javaloyes
  Date: 31/10/2024

- Title: *Analysis and improvement of a zero-shot image dehazing method*
  Student: U. Untzilla.
  Directors: José Luis Lisani, Julia Navarro
  Date: 27/09/2024

- Title: *Lensed Gravitational-Wave Ring-Downs as a Probe of General Relativity*
  Student: Arnau Duran Mayol
  Directors: Dr. Xisco Jiménez Forteza
  Date: 09/2024

- Title: *Excitability and Memory in a Time-Delayed Optoelectronic Neuron*
  Student: Jonas Mayer-Martins
  Directors: Svetlana V. Gurevich and Julien Javaloyes
  Date: 28/05/2024

- Title: *Magnetohydrodynamic mode coupling in shear flows: effect of ambipolar diffusion*
  Student: Miquel Cantallops Palmer
  Director: Roberto Soler Juan

7.4. Bachelor's Theses

- Title: *Realización numérica y experimental de un circuito excitable*
  Student: Adam César Maćkowiak Pellón
  Directors: Julien Javaloyes
  Date: 25/09/2024

- Title: *Dynamics of Square Waves in Time-Delayed Kerr Micro-Cavities*
  Student: Lennart Papke
  Directors: Svetlana V. Gurevich and Julien Javaloyes
  Date: 25/09/2024

- Title: *Multimessenger Aspects of Glitching Pulsars*
  Student: Judith Mansilla Rodríguez
  Director: Dr. David Keitel
  Date: 24/09/2024

- Title: *El camino desde la relatividad numérica hasta los modelos de forma de onda para sistemas binarios de agujeros negros*
  Student: Francesc Manzanera
  Director: Dr. Sascha Husa.
  Date: 24/09/2024

- Title: *Deep unfolded model-based methods for optical flow estimation*
  Student: M. Tomás.
  Directors: Julia Navarro, Joan Duran
  Date: 10/09/2024

- Title: *Advances in Computational Neuroscience: Short-Term Plasticity*
  Student: Rosa M. Delicado.
  Directors: C. Vich.
  Date:19/07/2024

- Title: *Models epidemiològics utilitzant equacions diferencials ordinàries*
  Student: Sebastià Crespí.
  Directors: María Jesús Álvarez
  Date: 15/07/2024

- Title: *Problema centre-focus en equacions diferencials*
  Student: Xisco Ribera Ramis
  Directors: María Jesús Álvarez
  Date: 15/07/2024

- Title: *Estudio de soluciones de viscosidad, enfoque al laplaciano infinito y su aplicación a imágenes*
  Student: J. Guerrero.
  Director: Catalina Sbert
  Date: 12/07/2024

- Title: *Partial Differential Equations For An Initial Value Formulation Of The Relativistic Gravity*
  Student: Marina Camps Nebot
  Directors: Dr. Sascha Husa
  Date: 21/06/2024

- Title: *Estratègies d'Anàlisi De Dades De Senyals Gravitacionals Contínues Amb Aprenentatge Automàtic*
  Student: Damià Nicolau Salamanca
  Directors: Dr. Rodrigo Tenorio
  Date: 21/06/2024

- Title: *Simulaciones númericas de sistemes binarios de agujeros negros con precesion de espín*
  Student: Antonio Nova
  Directors: Dr. Marta Colleoni
  Date: 21/06/2024

- Title: *Introducció a les bifurcacions locals en equacions diferencials*
  Student: Rafel Genovart

Directors: María Jesús Álvarez and Jordi Penalva
Date: 15/02/2024

magnetohidrodinámicos
Student: Lucas Romero Fernádez
Director: Roberto Soler Juan

- Title: *Atenuación resonante de armónicos radiales de modos kink*

8. Memorandum of Understanding and Collaboration Agreements

- Memorandum of Understanding with Universitat de les Illes Balears and the Laser Interferometer Space Antenna (LISA).
- Memorandum of Understanding (LIGO-M020265-00) between Universitat de les Illes Balears Relativity and Gravitation Group and the Laser Interferometer Gravitational Wave Observatory (LIGO) since 2002.

9. Societies and Collaborations Memberships

- American Physical Society, APS (David Keitel and Pep Covas).
- DANCE-NET Spanish networki in Dynamical Systems and Nonlinear Dynamics (Bartomeu Coll, Rafel Prohens, M. Jesús Álvarez, Antonio E Teruel, Catalina Vich, Luis Ángel Calderón, Roberto Sebastián Trinidad)
- Deutsche Physikalische Gesellschaft, DPG (David Keitel).
- Einstein Telescope Collaboration (Sayantani Bera, Marta Colleoni, Alejandra González, Anna Heffernan, Sascha Husa, Rafel Jaume, Xisco Jiménez, David Keitel, Joan Llobera Querol, Pierre Mourier, Maria de Lluc Planas, Antoni Ramos Buades, Maria Rosselló, Neha Singh, Alicia M. Sintes, Rodrigo Tenorio and Jorge Valencia).
- European Astronomical Society, EAS (José Luis Ballester, Alicia Calafat, Sascha Husa, David Keitel, Manuel Luna, Joan-René Merou, Ramón Oliver, Alicia M. Sintes, Roberto Soler, Jaume Terradas).
- Instituto de Estudios Espaciales de Cataluña (IEEC) desde 2014.
- Institut Menorquí d'Estudis (Alicia M. Sintes).
- International Astronomical Union, IAU (José Luis Ballester, David Keitel, Ramón Oliver, Roberto Soler, Manuel Luna
- International Society on General Relativity and Gravitation, ISGRG (Jaume Carot, Sascha Husa, David Keitel and Alicia M. Sintes).
- LIGO Scientific Collaboration, GEO project (Jose Alberto Aguilar, Sayantani Bera, Alicia Calafat, Marta Colleoni, Paolo Cremonese, Maria Antònia Ferrer, Diego García, Angel Garrón, Rodrigo Gil Merino, Alejandra González, Eleanor Zaida Hamilton, Anna Heffernan, Quentin Henry, Sascha Husa, Rafel Jaume, David Keitel, Iuri La Rosa, Joan Llobera Querol, Judith Mansilla, Joan-René Merou, Arnau Montava, Pierre Mourier, Damià Nicolau, Antonio Nova Sánchez, Lluc Planas, Felip Ramis,

Maria Rosselló, Rita Santos, Antoni Ramos Buades, Aditya Sharma, Neha Singh, Alicia M. Sintes, Rodrigo Tenorio, Jorge Valencia, Yumeng Xu and Jesús Yébana).

- LISA Consortium (Sayantani Bera, Marta Colleoni, Paolo Cremonese, Eleanor Hamilton, Anna Heffernan, Quentin Henry, Sascha Husa, Rafel Jaume, Xisco Jiménez, David Keitel, Iuri La Rosa, Joan Llobera Querol, Pierre Mourier, Maria de Lluc Planas, Felip Antoni Ramis Vidal, Antoni Ramos Buades, Maria Roselló Sastre, Alicia M. Sintes, Rodrigo Tenorio, Jorge Valencia and Yumeng Xu).
- Real Sociedad Española de Física, RSEF (Pep Covas, Sascha Husa, Joan Llobera Querol, Antoni Ramos Buades, Alicia M. Sintes).
- Royal Astronomical Society, RAS (David Keitel).
- Sociedad Española de Astronomía, SEA (José Luis Ballester, Alicia Calafat, Pep Covas, Sergio Díaz, Rodrigo Gil Merino, Sascha Husa, David Keitel, Matheus Kriginsky, Manuel Luna, Llorenç Melis, Joan-René Merou, Ramón Oliver, Alicia M. Sintes, Roberto Soler, Jaume Terradas)
- Sociedad Española de Gravitación y Relatividad, SEGRE (Jaume Carot, Sascha Husa and Alicia M. Sintes).
- Societat Catalana de Física (Jaume Carot).
- UNESP Dynamic Systems Group. (Antonio E Teruel).
- Virgo-EGO Scientific Forum

10. Patents and Software

- *Black Hole Perturbation Toolkit*
  Anna Heffernan
  bhptoolkit.org
- *cows3 - Continuous-wave search sensitivity simulator*
  Rodrigo Tenorio, Lorenzo Mirasola
  GitHub: Rodrigo-Tenorio/cows3
- Distromax - A python package to empirically estimate the loudest candidate from a gravitational-wave search
  Rodrigo Tenorio, Luana M. Modafferi, David Keitel, Alicia M. Sintes
  DOI: 10.5281/zenodo.5763765
- fasttracks - a massively-parallel engine to evaluate detection statistics for generic CW signals
  Rodrigo Tenorio
  GitHub: Rodrigo-Tenorio/fasttracks
- *foutstep - computing Fourier transforms of step-like signals for gravitational-wave data analysis*
  Jorge Valencia, Rodrigo Tenorio
  A python package to compute Fourier transforms of discrete data with step-like behavior
  GitHub: valencia-jorge/gw-foutstep
- *LALSuite - LVK Algorithm Library Suite*
  Alicia M. Sintes, Sascha Husa, David Keitel, Marta Colleoni, Antoni Ramos-Buades, Rodrigo Tenorio, Aditya Sharma and others (contributors)
  DOI: 10.7935/GT1W-FZ16

- *LeR - Gravitational waves lensing rate calculator*
  Neha Singh, David Keitel
  GitHub: hemantaph/ler
  DOI: latestdoi/626733473

- PycWB - a modularized Python package for gravitational wave burst search
  Yumeng Xu (contributor)
  GitHub: PycWB/pycwb

- *PyFstat - A python package for gravitational wave analysis with the F-statistic*
  Gregory Ashton, David Keitel, Reinhard Prix and Rodrigo Tenorio, Maria-Antonia Ferrer
  DOI: 10.5281/zenodo.3967045

- Self-Force Regularisation Parameters Package
  Anna Heffernan
  DOI: 10.5281/zenodo.6282572

- *A method and apparatus for generating adaptive multiplane images*
  N Sabater, J Navarro, J Fleureau, B Chupeau
  US Patent App. 18/272,446

- *Method and apparatus for generating compact multiplane images*
  N Sabater, J Navarro, J Fleureau, G Boisson
  US Patent App. 18/272,472

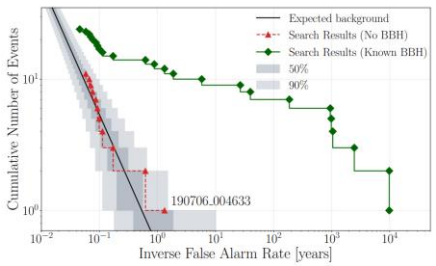
- *Object recognition based on 2D images and 3D models*
  L. Rudin, J. L. Lisani, P. Monasse, J. M. Morel
  Núm. de Solicitud: 7587082
  País de prioridad: Estados Unidos de América
  Fecha de prioridad: 2009
  En explotación por Cognitech

11. Publications

- A.G. Abac et al. (The LIGO Scientific Collaboration, the Virgo Collaboration, the KAGRA Collaboration)
A search using GEO600 for gravitational waves coincident with fast radio bursts from SGR 1935+2154
ApJ 977 255 (2024)
DOI: 10.3847/1538-4357/ad8de0,
18/12/2024
arXiv: 2410.09151, LIGO: LIGO-P2400192

- A.G. Abac (The LIGO Scientific Collaboration, the Virgo Collaboration, the KAGRA Collaboration)
Observation of Gravitational Waves from the Coalescence of a 2.5–4.5 M⊙ Compact Object and a Neutron Star
ApJL 970 L34 (2024), DOI: 10.3847/2041-8213/ad5beb,
26/07/2024
arXiv: 2404.04248, LIGO: LIGO-P2300352

- A.G. Abac et al. (The LIGO Scientific Collaboration, the Virgo Collaboration, the KAGRA Collaboration)
Search for Eccentric Black Hole Coalescences during the Third Observing Run of LIGO and Virgo
ApJ 973 132 (2024)
DOI: 10.3847/1538-4357/ad65ce,
26/09/2024
arXiv: 2308.03822



Cumulative number of events as a function of IFAR recovered by the cWB-eBBH search.

- A. G. Abac et al. (The LIGO Scientific Collaboration, the Virgo Collaboration, the KAGRA Collaboration)
Ultralight vector dark matter search using data from the KAGRA O3GK run
Phys. Rev. D 110, 042001 (2024),
DOI: 10.1103/PhysRevD.110.042001,
22/08/2024,
arXiv: 2403.03004, LIGO: LIGO-P2300250

- R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)
GWTC-2.1: Deep extended catalog of compact binary coalescences observed by LIGO and Virgo during the first half of the third observing run
Phys. Rev. D 109, 022001 (2024), DOI: 10.1103/PhysRevD.109.022001,
05/01/2024
arXiv: 2108.01045, LIGO: LIGO-P2100063

- R. Abbott et al. (LIGO Scientific Collaboration, Virgo Collaboration and KAGRA Collaboration)
Search for Gravitational-lensing Signatures in the Full Third Observing Run of the LIGO–Virgo Network
ApJ 970 191 (2024),
DOI: 10.3847/1538-4357/ad3e83,
31/07/2024
arXiv: 2304.08393, LIGO: LIGO-P2200031

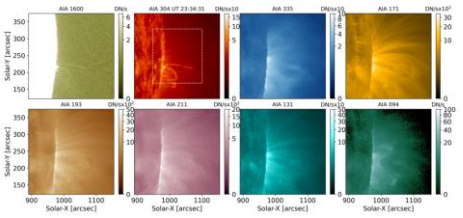
- R. Abbott et al. (LIGO Scientific Collaboration, Virgo Collaboration and KAGRA Collaboration)
Search for gravitational-wave transients associated with magnetar bursts in advanced LIGO and advanced Virgo data from the Third Observing Run
ApJ 966 137 (2024),
DOI: 10.3847/1538-4357/ad27d3,
30/04/2024
arXiv: 2210.10931, LIGO: LIGO-P2100387

- R. Aguilera-Miret, C. Palenzuela, F. Carrasco, S. Rosswog, D. Viganò.
Delayed jet launching in binary neutron star mergers with realistic initial magnetic fields.
Physical Review D 110, 083014.
DOI: 10.1103/PhysRevD.110.083014
02/10/2024

- M.J. Álvarez, JL Bravo, L.A. Calderón.
Quartic Rigid Systems in the Plane and in the Poincaré Sphere.
Qualitative Theory of Dynamical Systems 23 (5), 226
DOI: 10.1007/s12346-024-01083-z
28/06/2024.

- P. Antolin, F. Auchère, E. Winch, E. Soubrié, R. Oliver.
Decomposing the AIA 304 A channel into its cool and hot components.

Solar Physics, 299, 94.
DOI: 10.1007/s11207-024-02337-4
02/07/2024



A snapshot in various SDO/AIA channels closest in time to 13 March 2014 23:34:46UT focusing

- J. L Ballester, R. Soler, J. Terradas & M. Carbonell.
  Nonlinear coupling of Alfvén and magnetoacoustic waves in partially ionized plasmas: the effect of thermal misbalance on propagating waves.
  Philosophical Transactions of the Royal Society A, 382, Issue 2272, id. 20230222.
  DOI: 10.1098/rsta.2023.0222
  01/06/2024

- Josep Batle, Orion Ciftja, Mahmoud Abdel-Aty, Mohamed Ahmed Hafez, and Shawkat Alkhazaleh.
  Effective Piecewise Mass Distributions for Optimal Energy Eigenvalues of a Particle in Low-Dimensional Heterojunctions.
  Nanomaterials 14, no. 22: 1850.
  DOI: 10.3390/nano14221850
  20/11/2024

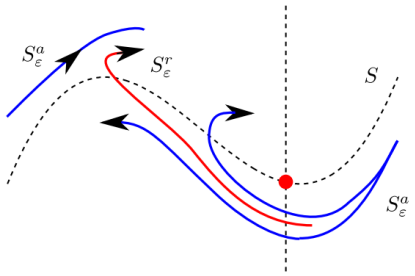
- Josep Batle, Tomasz Białecki, Tomasz Rybotycki, Jakub Tworzydło, and Adam Bednorz.
  Quantum null-hypothesis device-independent Schmidt number witness.
  EPJ Quantum Technology.
  DOI: 10.1140/epjqt/s40507-024-00273-7
  27/09/2024

- Tomasz Białecki, Tomasz Rybotycki, Josep Batle, Jakub Tworzydło, and Adam Bednorz.
  Precise certification of a qubit space.
  EPJ Quantum Technol. 11, 21.
  DOI: 10.1140/epjqt/s40507-024-00230-4
  19/03/2024

- Tomasz Białecki, Tomasz Rybotycki, Josep Batle, and Adam Bednorz.
  Quantum dimension witness with a single repeated operation.
  Phys. Rev. A 109.
  DOI: 10.1103/PhysRevA.109.L020201
  13/02/2024.

- A. Buades, O. Martorell and M. Sánchez-Beeckman.
  Joint Denoising and HDR for RAW Image Sequences.
  IEEE Transactions on Computational Imaging, vol. 10, pp. 277-290. IEEE
  DOI: 10.1109/TCI.2024.3354649
  16/01/2024

- V. Carmona, S. Fernández-Garcia, A. E. Teruel.
  Saddle-node canard cycles in slow-fast planar piecewise linear differential systems.
  Nonlinear Analysis: Hybrid Systems, 52.
  DOI: 10.1016/j.nahs.2024.101472
  01/05/2024.



Draft of the critical manifold $\mathcal{S}$ in the neighborhood of a canard point

- G. Castelló, M. Luna, J. Terradas.
  Fast Bayesian spectral analysis using convolutional neural networks: Applications to GONG Hα solar data.
  Astronomy & Astrophysics, 694, id. A237, 14 pp.
  DOI: 10.1051/0004-6361/202452928
  01/02/2025

- Joan Josep Cerdà, Josep Batle, Carles Bona-Casas, Joan Massó, and Tomàs Sintes.
  Depletion Interactions at Interfaces Induced by Ferromagnetic Colloidal Polymers.
  Polymers 16, no. 6: 820.
  DOI: 10.3390/polym16060820
  15/03/2024

- Orion Ciftja, Josep Batle, Mahmoud Abdel-Aty, Mohamed Ahmed Hafez, and Shawkat Alkhazaleh.
  Spatial Entanglement Between Electrons Confined to Rings.
  Symmetry 16, no. 12: 1662.

DOI: 10.3390/sym16121662
16/12/2024

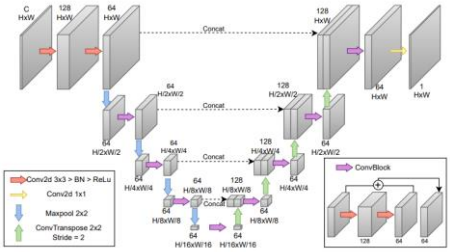
- Orion Ciftja, Josep Batle, Mahmoud Abdel-Aty, Mohammad Ahmed Hafez, and Shawkat Alkhazaleh.
Model and Energy Bounds for a Two-Dimensional System of Electrons Localized in Concentric Rings.
Nanomaterials 14, no. 20: 1615.
DOI: 10.3390/nano14201615
10/10/2024

- A. Chen, P. Cremonese, J.M. Ezquiaga, D. Keitel
Invariance transformations in wave-optics lensing: implications for gravitational-wave astrophysics and cosmology
Phys. Rev. D 110, 123015 (2024), DOI: 10.1103/PhysRevD.110.123015, 06/12/2024
arXiv: 2408.03856, LIGO: LIGO-P2400321

- Marta Colleoni, N. V. Krishnendu, Pierre Mourier, Sayantani Bera, Xisco Jiménez Forteza
Testing Gravity with Binary Black Hole Gravitational Waves
Review Chapter for the book "Recent Progress on Gravity Tests" (Springer Series in Astrophysics and Cosmology, Eds. C. Bambi and A. Cárdenas-Avendaño, Springer, Singapore).
DOI: 10.1007/978-981-97-2871-8_7, 10/07/2024
arXiv: 2403.07682, LIGO: LIGO-P2400048

- Monica Colpi et al. (LISA Science Study Team, ESA Study Team, et al.) (138 autores, incluidos Anna Heffernan y Sascha Husa)
LISA Definition Study Report
LISA definition study report (red book): web/lisa/lisa-redbook, 06/02/2024
arXiv: 2402.07571

- A. Costa, E. Sans, I. Pereira-Sánchez, J. Duran, and J. Navarro.
Improving marine litter segmentation with limited resolution satellite imagery.
Proceedings in International Conference on Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS), IEEE, 2024.
DOI: 10.1109/MIGARS61408.2024.10544681
08/04/2024



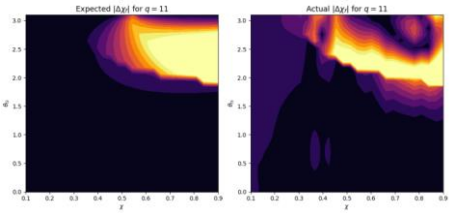
Architecture of a semantic segmentation network

- S. Díaz-Suárez & R. Soler.
Numerical simulations of turbulence in prominence threads induced by torsional oscillations.
Astronomy & Astrophysics, 684, id. A13, 20 pp.
DOI: 10.1051/0004-6361/202348216

- Divyajyoti, N. V. Krishnendu, Muhammed Saleem, Marta Colleoni, Aditya Vijaykumar, K. G. Arun, Chandra Kant Mishra
Effect of double spin-precession and higher harmonics on spin-induced quadrupole moment measurements
Phys. Rev. D 109, 023016 (2024), DOI: 10.1103/PhysRevD.109.023016, 10/01/2024
arXiv: 2311.05506, LIGO: LIGO-P2300337

- C. Fletcher et al. (Fermi GBM Team, LIGO Scientific Collaboration, Virgo Collaboration and KAGRA Collaboration, and others)
A Joint Fermi-GBM and Swift-BAT Analysis of Gravitational-wave Candidates from the Third Gravitational-wave Observing Run
ApJ 964 149 (2024), DOI: 10.3847/1538-4357/ad1eed, 27/03/2024
arXiv: 2308.13666, LIGO: LIGO-P2100436

- Cheng Foo, Eleanor Hamilton
Systematic bias due to mismodelling precessing binary black hole ringdown
Phys. Rev. D 110, 104024 (2024), DOI: 10.1103/PhysRevD.110.104024, 12/11/2024
arXiv: 2408.02671, LIGO: LIGO-P2400328



Expected (left) and actual (right) spin difference between inspiral and merger

- C. Giossi; J.E. Rubin; A. Gittis, T. Verstynen; C. Vich.
  Rethinking the external globus pallidus and information flow in cortico-basal ganglia-thalamic circuits.
  European Journal of Neuroscience 60.9 6129-6144.
  DOI:10.1111/ejn.16348
  24/04/2024

- C. Giossi; J. Bahuguna; J.E. Rubin; T. Verstynen; C. Vich.
  Arkypallidal neurons in the external globus pallidus can mediate inhibitory control by altering competition in the striatum.
  Proceedings of the National Academy of Sciences 121.47 (2024)
  DOI: 10.1101/2024.05.03.592321
  05/05/2024

- Svetlana V. Gurevich, Felix Maucher, Julien Javaloyes.
  Aberration-driven tilted emission in degenerate cavities.
  Phys. Rev. Res. 6, 013166
  DOI: 10.1103/PhysRevResearch.6.013166
  14/02/2024

- Eleanor Hamilton, Edward Fauchon-Jones, Mark Hannam, Charlie Hoy, Chinmay Kalaghatgi, Lionel London, Jonathan E. Thompson, Dave Yeeles, Shrobana Ghosh, Sebastian Khan, Panagiota Kolitsidou, and Alex Vano-Vinuales
  Catalog of precessing black-hole-binary numerical-relativity simulations
  Phys. Rev. D 109, 044032 (2024),
  DOI: 10.1103/PhysRevD.109.044032,
  15/02/2024
  arXiv: 2303.05419, LIGO: LIGO-P2300054

- Frank W. Hammond, Catalina Sbert, and Joan Duran.
  Two nonlocal variational models for Retinex image decomposition.
  Proceedings in 29th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP), INSTICC, 2024.
  DOI: 10.5220/0012396800003660
  27/02/2024

- A. S. Hillier, B. Snow, M. Luna.
  Partially ionized plasma of the solar atmosphere: recent advances and future pathways.
  Philosophical Transactions of the Royal Society A, 382, Issue 2272, id. 20230230.
  DOI: 10.1098/rsta.2023.0230
  01/06/2024

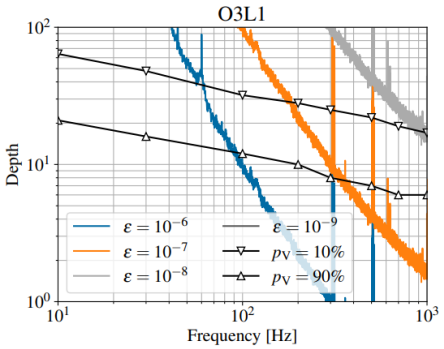
- M.R. Izquierdo, F. Abalos, C. Palenzuela.
  Guided moments formalism: A new efficient full-neutrino treatment for astrophysical simulations.
  Physical Review D 109, 043044.
  DOI: 10.1103/PhysRevD.109.043044
  26/02/2024

Classical model of reactive inhibition

- M.R. Izquierdo, M. Bezares, S.Liebling and C. Palenzuela.
  Large eddy simulations of magnetized mergers of black holes and neutron stars.
  Physical Review D 110, 083017.
  DOI: 10.1103/PhysRevD.110.083017
  03/10/2024

- Rafel Jaume, Rodrigo Tenorio, Alicia M. Sintes
  Assessing the Similarity of Continuous Gravitational-Wave Signals to Narrow Instrumental Artifacts
  Universe 2024, 10(3), 121 (2024),
  DOI: 10.3390/universe10030121,
  04/03/2024
  arXiv: 2403.03027, LIGO: LIGO-P2300463

- Elias R. Koch, Svetlana V. Gurevich, Julien Javaloyes.
  Pulse instabilities in harmonic active mode-locking: a time-delayed approach.
  Opt. Lett. 49, 5663–5666.
  DOI: 10.1364/OL.537288
  01/10/2024.



Expected sensitivity depth for an optimistic source consistent with a NS located at 20 pc as observed by the Advanced LIGO Livingston detectors during O3

- M. Kriginsky, R. Oliver.
  Thermal and kinetic coronal rain diagnostics with Mg II h & k lines.
  Astronomy & Astrophysics, 683, id. A127, 10 pp.
  DOI: 10.1051/0004-6361/202348443
  29/03/2024

- T. A. Kucera, J. A. Klimchuk, M. Luna.
  Modeling of Condensations in Coronal Loops Produced by Impulsive Heating with Variable Frequencies and Locations.
  The Astrophysical Journal, 965, Issue 1, id. 53, 16 pp.
  DOI: 10.3847/1538-4357/ad25fc
  01/04/2024

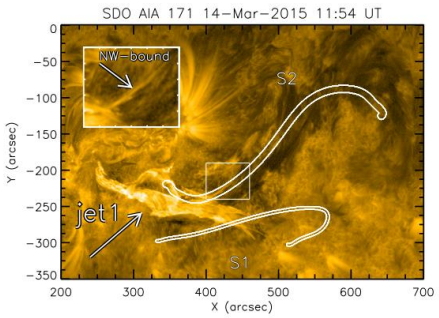
- M. Luna, R. Joshi, B. Schmieder, F. Moreno-Insertis, V. Liakh, J. Terradas.
  Study of the excitation of large-amplitude oscillations in a prominence by nearby flares.
  Astronomy & Astrophysics, 691, id. A354, 17 pp.
  DOI: 10.1051/0004-6361/202450869
  01/11/2024

- Jonas Mayer Martins, Svetlana V. Gurevich, Julien Javaloyes.
  Excitability and memory in a time-delayed optoelectronic neuron.
  Phys. Rev. Appl. 22,
  DOI: 10.1103/PhysRevApplied.22.024050
  19/08/2024.

- Guillermo A. Mena Marugán, Antonio Vicente-Becerril, Jesús Yébana Carrilero
  Analytic and Numerical study of Scalar Perturbations in Loop Quantum Cosmology
  Phys. Rev. D 110, 043508 (2024),
  DOI: 10.1103/PhysRevD.110.043508,
  06/08/2024
  arXiv: 2404.04595

- Guillermo A. Mena Marugán, Antonio Vicente-Becerril, Jesús Yébana Carrilero
  Comparing Analytic and Numerical Studies of Tensor Perturbations in Loop Quantum Cosmology
  Universe 2024, 10(9) (2024)
  DOI: 10.3390/universe10090365,
  11/09/2024
  arXiv: 2409.18302

- Hannah Middleton et al. (including David Keitel)
  Communicating the gravitational-wave discoveries of the LIGO-Virgo-KAGRA Collaboration
  JCOM 23(07), N03 (2024),
  DOI: 10.22323/2.23070803,
  21/10/2024
  arXiv: 2407.18638, LIGO: LIGO-P2400039



The figure shows jet1 (white arrow) interacting with the filament, which will be split in two.

- Andrew L. Miller, Neha Singh, Cristiano Palomba
  Enabling multi-messenger astronomy with continuous gravitational waves: early warning and sky localization of binary neutron stars in Einstein Telescope
  Phys. Rev. D 109, 043021 (2024),
  DOI: 10.1103/PhysRevD.109.043021,
  12/02/2024
  arXiv: 2309.15808, LIGO: LIGO-P2300290

- Lorenzo Misarola and Rodrigo Tenorio
  Towards a computationally-efficient follow-up pipeline for blind continuous gravitational-wave searches
  Phys. Rev. D 110, 124049 (2024)
  DOI: 10.1103/PhysRevD.110.124049
  19/12/2024
  arXiv: 2405.18934, LIGO: LIGO-P2400221

- M. Modestov, E. Khomenko, N. Vitas, A. de Vicente, A. Navarro, P. A. González-Morales, M. Collados, T. Felipe, D. Martínez-Gómez, P. Hunana, M. Luna, M. Koll Pistarini, B. Popescu Braileanu, A. Perdomo García, V. Liakh, I. Santamaría, M. M. Gómez Míguez.
MANCHA3D Code: Multipurpose Advanced Nonideal MHD Code for High-Resolution Simulations in Astrophysics.
Solar Physics, 299, Issue 2, id. 23.
DOI: 10.1007/s11207-024-02267-1
01/02/2024

- Pierre Mourier, Asta Heinesen
Splitting the spacetime: A systematic analysis of foliation dependence in cosmic averaging
JCAP 04(2024)067 (2024),
DOI: 10.1088/1475-7516/2024/04/067,
23/04/2024
arXiv: 2401.09170, LIGO: LIGO-P2400120

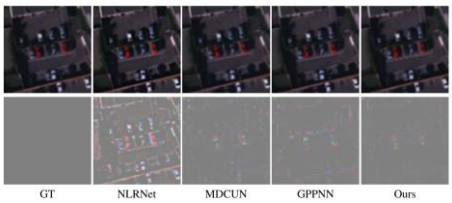
- S. Parenti, M. Luna, J. L. Ballester.
Future prospects for partially ionized solar plasmas: the prominence case.
Philosophical Transactions of the Royal Society A, 382, Issue 2272, id. 20230225.
DOI: 10.1098/rsta.2023.0225
01/06/2024

- J. Penalva, M. Desroches, A. E. Teruel, C. Vich.
Dynamics of a Piecewise-Linear Morris–Lecar Model: Bifurcations and Spike Adding.
J. Nonlinear Sci. 34, 52
DOI: 10.1007/s00332-024-10029-3
09/04/2024.

- I. Pereira-Sánchez, E. Sans, J. Navarro, J. Duran.
A Comprehensive Overview of Satellite Image Fusion: From Classical Model-Based to Cutting-Edge Deep Learning Approaches.
Series: Unsupervised and Semi-Supervised Learning. Springer Cham; 2024 edition (November 18, 2024).
ISBN-10: 3031681053.
DOI: 10.1007/978-3-031-68106-6_8
18/07/2024

- I. Pereira-Sánchez, E. Sans, J. Navarro, and J. Duran.
A simple nonlocal back-projection unfolded network for pansharpening.
Preceding in International Conference on Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS), IEEE, 2024.
DOI: 10.1109/MIGARS61408.2024.10544825
08/04/2024

- I. Pereira-Sánchez, E. Sans, J. Navarro, and J. Duran.
Beyond variational models and self-similarity in super-resolution: Unfolding models and multi-head attention.
Proceedings in 29th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP), INSTICC, 2024.
DOI: 10.5220/0012395400003660
27/02/2024



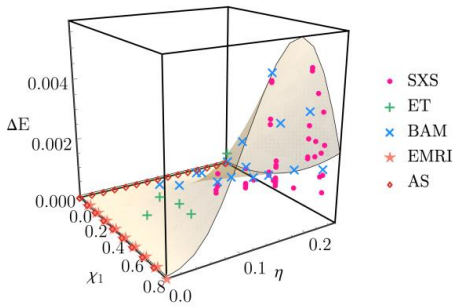
Top row displays the fused products and bottom row shows the image differences

- A. Pérez-Cevera, A. E. Teruel.
Slow passage through a transcritical bifurcation in piecewise linear differential systems: canard explosion and enhanced delay.
Communications in Nonlinear Science and Numerical Simulation,135.
DOI: 10.1016/j.cnsns.2024.108044
01/08/2024

- I. Piantschitsch, J. Terradas, E. Soubrie, S. G. Heinemann, S. J. Hofmeister, R. Soler, and M. Temmer.
Effects of different coronal hole geometries on simulations of the interaction between coronal waves and coronal holes.
Astronomy & Astrophysics, 687, id. A200, 14 pp.
DOI: 10.1051/0004-6361/202348003
12/07/2024

- Maria de Lluc Planas, Joan Llobera-Querol, Sascha Husa
Building a bridge between comparable and extreme mass ratio black hole binaries: a single spin precessing model for the final state
Phys. Rev. D 109, 124028 (2024),
DOI: 10.1103/PhysRevD.109.124028,
11/06/2024
arXiv: 2401.13342, LIGO: LIGO-P2400012

- Yi Qiu, Xisco Jiménez Forteza, Pierre Mourier
  Linear vs. nonlinear modelling of black hole ringdowns
  Phys. Rev. D 109, 064075 (2024),
  DOI: 10.1103/PhysRevD.109.064075,
  26/03/2024
  arXiv: 2312.15904, LIGO: LIGO-P2300451



Numerical evaluation of ΔE

- Maria Rosselló-Sastre, Sascha Husa, Sayantani Bera
  Waveform model for the missing quadrupole mode from black hole coalescence: Memory effect and ringdown of the (l=2, m=0) spherical harmonic
  Phys. Rev. D 110, 084074 (2024),
  DOI: 10.1103/PhysRevD.110.084074,
  28/10/2024
  arXiv: 2405.17302, LIGO: LIGO-P2400208

- Tomasz Rybotycki, Tomasz Białecki, Josep Batle, and Adam Bednorz. *Device-Independent Dimension Leakage Null Test on Qubits at Low Operational Cost*. Adv. Quantum Technol, 8, 1.
  DOI: 10.1002/qute.202400264
  08/10/2024

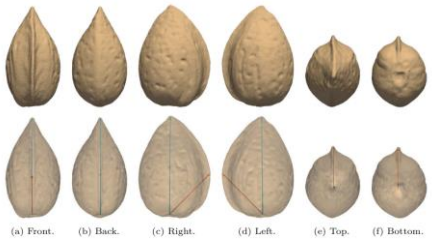
- P.A. Sánchez, A. Cerrato, J.J. Cerdà, C. Bona-Casas, T. Sintes, J. Massó.
  Dynamic response of a ferromagnetic nanofilament under rotating fields: effects of flexibility, thermal fluctuations and hydrodynamics.
  Nanoscale, 16, 11724-11738
  DOI: 10.1039/d4nr01034e
  31/05/2024

- J. Sánchez-Baena, Thomas Pohl, Fabian Maucher.
  Superfluid-supersolid phase transition of elongated dipolar Bose-Einstein condensates at finite temperatures.
  Phys. Rev. Res. 6, 023183
  DOI: 10.1103/PhysRevResearch.6.023183
  17/05/2024.

- Marco Sánchez-Beeckman, Jaume Fornés Comas, Onofre Martorell, José M. Alonso Segura, Antoni Buades.
  Three-dimensional image analysis for almond endocarp feature extraction and shape description.
  Computers and Electronics in Agriculture, vol. 226. Elsevier, November 2024.
  DOI: 10.1016/j.compag.2024.109420
  04/09/2024

- Thomas G. Seidel, Julien Javaloyes, Svetlana V. Gurevich.
  Normal dispersion Kerr cavity solitons: beyond the mean-field limit.
  Opt. Lett. 49, 7008–7011 –
  DOI: 10.1364/OL.538135
  06/12/2024.

- R. Soler.
  Magnetohydrodynamic waves in the partially ionized solar plasma.
  Philosophical Transactions of the Royal Society A, 382, Issue 2272, id. 20230223.
  DOI: 10.1098/rsta.2023.0223
  01/06/2024



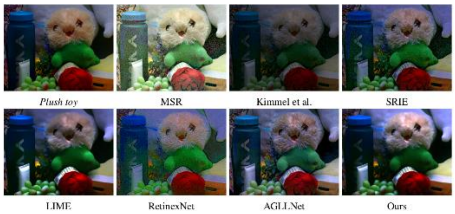
3D views of an almond endocarp mesh of the Rutló variety

- J. Terradas, N. Magyar.
  Magnetohydrodynamic instabilities and transition to turbulence: MHD instabilities and turbulence.
  In: A.K. Srivastava, M. Goossens, I. Arregui, Magnetohydrodynamic Processes in Solar Plasmas. Elsevier; Edition 1, pp. 273-319
  DOI: 10.1016/B978-0-32-395664-2.00012-8
  01/05/2024

- Jonathan E. Thompson, Eleanor Hamilton, Lionel London, Shrobana Ghosh, Panagiota Kolitsidou, Charlie Hoy, and Mark Hannam
  Phenomenological gravitational-wave model for precessing black-hole binaries with higher multipoles and asymmetries
  Phys. Rev. D 109, 063012 (2024),

DOI: 10.1103/PhysRevD.109.063012, 11/03/2024
arXiv: 2312.10025, LIGO: LIGO-P2300437

- Daniel Torres, Catalina Sbert, and Joan Duran.
Combining total variation and nonlocal variational models for low-light image enhancement.
Proceedings in 29th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP), INSTICC, 2024.
DOI: 10.5220/0012386300003660
27/02/2024



Enhanced image of a plush toy

- Jorge Valencia, Rodrigo Tenorio, Maria Rosselló-Sastre, Sascha Husa
Frequency-domain analysis of gravitational-wave memory waveforms
Phys. Rev. D 110, 124026 (2024)
DOI: 10.1103/PhysRevD.110.124026, 11/12/2024
arXiv: 2406.16636, LIGO: LIGO-P2400263

- Quentin Vigneron, Áron Szabó, Pierre Mourier
Topologically modified Einstein equation: a solution with singularities on S^3
The European Physical Journal C 84, 1206 (2024)
DOI: 10.1140/epjc/s10052-024-13545-4, 22/11/2024
arXiv: 2311.06927, LIGO: LIGO-P2300444

- Yumeng Xu, Maria Rosselló-Sastre, Shubhanshu Tiwari, Michael Ebersold, Eleanor Z Hamilton, Cecilio García-Quirós, Héctor Estellés, Sascha Husa
Enhancing Gravitational Wave Parameter Estimation with Non-Linear Memory: Breaking the Distance-Inclination Degeneracy
Phys. Rev. D 109, 123034 (2024),
DOI: 10.1103/PhysRevD.109.123034, 28/06/2024
arXiv: 2403.00441, LIGO: LIGO-P2400063-v3

- Yong-Chang Zhang, Thomas Pohl, Fabian Maucher.
Metastable patterns in one- and two-component dipolar Bose-Einstein condensates.
Phys. Rev. Res. 6, 023023
DOI: 10.1103/PhysRevResearch.6.023023
05/04/2024.

12. Management and participation in scientific committees

Organization of R&D activities

- L.A. Calderón. Member of organizing committe: Recent Trends in Nonlinear Science 2024 (RTNS 2024). Universidad de Extremadura, Badajoz. 29 January - 2 February 2024.

- Alicia Sintes. Member of the organizing committee: Topics in Astroparticle and Underground Physics (TAUP 2021). Venue: Valencia Conference Center, Spain. 30 August - 3 Setember.

Scientific, technical and/or assessment committees

- María Jesús Álvarez. Member of the academic committee for the PhD in Tecnologia de la Informació i les Comunicacions.
- María Jesús Álvarez. Secretary of the Centre d'Estudis de Postgrau. Universitat de les Illes Balears
- Jaume Carot. Member of the R + D + I executive committee in the CRUE commission sector.
- Jaume Carot. CRUE member working in the Iberian Agenda of 'Knowledge' group.
- Jaume Carot. Member of the inter-departmental science and technology committee of the regional government of the Illes Balears.
- Marta Colleoni. Co-chair of the "LISA Waveforms Working Group" of the LISA Consortium (since 2024).
- Joan Josep Cerdà Pino, Member of the Plataforma Española de tecnologías de modelización, simulación, y optimización en un entorno digital.
- Anna Heffernan. Member of the "Consortium Constituent Council" of the LISA Consortium.
- Anna Heffernan. Member of the LISA Science Team, a group of 17 researchers from Europe and the United States selected by ESA and NASA as the scientific advisory team for the LISA mission (2024).
- Anna Heffernan. Member of the "LISA Internal Networking Committee for Science".
- Anna Heffernan. Co-chair of the "Waveforms Work Package"of the LISA Consortium.
- Julien Javaloyes: Quantum Electronics and Optics Division of EPS (QEOD) board member.
- Julien Javaloyes: NUSOD Conference board member
- David Keitel. Member of the "program committee" of the LIGO Scientific Collaboration (2021 - 2024).
- David Keitel. Co-chair of the "Continuous Waves working group" of the LIGO Scientific Collaboration (since 2022).
- David Keitel. Member of the "management team" of the LIGO Scientific Collaboration.
- David Keitel. Coordinator and reviewer of outreach science summaries of the LIGO-Virgo-KAGRA Collaboration (2018 - 2024).
- David Keitel. Member of the academic commission, Master in Advanced Physics and Applied Mathematics, Universitat de les Illes Balears (since 2024)
- Joan Llobera Querol. Member of the "Diversity, Equity & Inclusion Committee" of the LIGO scientific collaboration (since 2024).
- Joan Llobera. Member of the Organizing Committee: National Meeting of Physics Students (ENEF 2024). Venue: Granada, Spain. 3/09/2024 - 7/09/2024.
- Ramón Oliver. External evaluator of the Master program in Physics and Astronomy of the Ilia State University in Tbilisi, Georgia.
- Alicia M. Sintes. Second principal member of the Access Committee that will evaluate the position for "Profesores titulares de universidad" in the field of "Física Teórica", code: K033K01/RP01032, at the University of Valladolid, as published in the Boletín Oficial del Estado on 24/09/2024.
- Alicia M. Sintes, Sascha Husa and David Keitel. Members of the LIGO Scientific Collaboration council.
- Alicia M. Sintes. Member of the Virgo Award Committee.
- Alicia M. Sintes. Member of the GEO600 Executive Committee.

- Alicia M. Sintes. Member of Max Planck Research School (IMPRS) on Gravitational Wave Astronomy Committee.
- Alicia M. Sintes. Member of the scientific advisory board of the Gadea foundation.
- Alicia M. Sintes. Member of the LSC Speakers and Awards Committee.
- Alicia M. Sintes. Evaluator of the R&D projects of the la Agencia Estatal de Investigación.
- Alicia M. Sintes. Panel member for the ERC Synergy-2024, Panel PE9 – Universe Sciences. (2023 - 2024).
- Alicia M. Sintes. Member of the Access Committee of the Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS) in the area of Physics (FI) since May 2023.
- Alicia M. Sintes. Member of the evaluation committee for the BBVA Foundation Research Program "Fundamentals" – 2022, in the area of Physics and Chemistry (2023–2024).
- Alicia M. Sintes. Member of the Evaluation Panel for the ERC 2024 Synergy Grant call.
- Alicia M. Sintes. Panel member of the ERCEA-ADG-2022 Panel PE9 – Universe Sciences.
- Alicia M. Sintes. Panel member of the BMBF call for proposals “ErUM, Universum 2023 - 2026”. Deutsches Elektronen-Synchrotron DESY.
- Alicia M. Sintes. Reviewer for ERC Consolidator Grant proposals for the Fundamental Physics panel.
- Alicia M. Sintes. International Advisory Board member QuantumFrontiers Cluster of Excellence.
- Alicia M. Sintes. Member of the international advisory board of the Cluster of Excellence QuantumFrontiers “Light and Matter at the Quantum Frontier: Foundations of and Applications in Metrology”, Leibniz Universität Hannover, Technische Universität Braunschweig, Physikalisch-Technische Bundesanstalt Braunschweig und Berlin.
- Alicia M. Sintes Olives, alternate full member of Tribunal No. 22 in the selection process for the recruitment of 281 positions in the Scale of Tenured Scientific Staff of the Public Research Organizations, 14/06/2024.
- Roberto Soler. Member of the Spanish Time Allocation Committee (CAT) of the solar telescopes of the Canary Islands observatories, Spain.

R&D management

- Jaume Carot. Rector of the Universitat de les Illes Balears.
- Joan Josep Cerdà: vice-director of the ASEC (Experimental and Tecno-Scientific support Area)
- Joan Duran. Head of studies of the mathematics degree (Until 06/2024)
- Joan Duran. Deputy director of Escola Politècnica Superior.
- Ramon Oliver. Treasurer of the Sociedad Española de Astronomía.
- Alicia M. Sintes. Member of the Comissió d’Investigació de la Universitat de les Illes Balears.
- Alicia M. Sintes. Secretary of the Institute of Computational Applications and Community Code (IAC3), Universitat de les Illes Balears, Palma, Illes Balears, Spain.

13. Organization of I+D+I Activities

Conferences and Workshops

- Alicia M. Sintes, member of the Scientific Organizing Committee of the International GEMMA2 workshop in Rome, 16/09/2024 - 19/09/2024
- Alicia M. Sintes, member of the Scientific Organizing Committee of the XLXI International Meeting on Fundamental Physics 2024, Benasque, Aragón, Spain, 09/09/2024 - 13/09/2024
- Anna Heffernan, member of the Scientific Organizing Committee and session chair, Fundamental Physics Meets Waveforms, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam Germany, 02/09/2024 - 6/09/2024
- Workshop on "Solving the Boltzmann Equation for Neutrino Transport in Relativistic Astrophysics"
  Institute for Computational and Experimental Research in Mathematics (ICERM) Brown University, Providence (USA)
  08/07/2024-12/07/2024
- Anna Heffernan, session chair, 13th Iberian Gravitational Wave Meeting, Salamanca, Spain, 25/06/2024
- Alicia M. Sintes, member of the Scientific Organizing Committee of the 13th Iberian Gravitational Wave Meeting, Salamanca, Spain, 24/06/2024 - 26/06/2024
- David Keitel, session chair, 13th Iberian Gravitational Wave Meeting, Salamanca, Spain, 24/06/2024
- David Keitel, session chair, workshop "Continuous gravitational waves and neutron stars", Hannover, Germany, 18/06/2024
- Anna Heffernan, session chair, 27th Capra Meeting on Radiation Reaction in General Relativity, National University of Singapore, Singapore, 17/06/2024 - 21/06/2024
- David Keitel, member of the Scientific Organizing Committee, workshop "Continuous gravitational waves and neutron stars," Hannover, Germany, 17/06/2024 - 20/06/2024
- David Keitel, session chair, AIslands Arran 2024 workshop, Brodick, United Kingdom
- David Keitel, co-chair, Continuous Waves Working Group face-to-face meeting, LIGO-Virgo-KAGRA meeting, Louisiana State University, Baton Rouge, United States, 11/03/2024 - 12/03/2024
- David Keitel, session convener WG3 "Fundamental problems in high-energy and gravitational physics", workshop "JENAS Initiative Gravitational Wave Probes of Fundamental Physics", Rome, Italy, 12/02/2024 - 16/02/2024

IAC3 seminar

- *All-sky analysis for continuous gravitational waves from neutron stars with the Frequency Hough pipeline and Convolutional Neural Network (CNNs)*
  Martina Di Cesare
  Istituto Nazionale di Fisica Nucleare Napoli / Istituto Nazionale di Fisica Nucleare Roma, Italy
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  16/12/2024
- *Transitioning from a PhD in the LSC to a Google Sales Account Executive: Exploring Career Paths for Physics PhDs and the Interplay Between Public Research and the Private Sector*
  Miquel Trias
  Google, Madrid, Spain
  Aula 01, Planta 0, Complexe I+D+I, ParcBit,

Palma, Spain
13/12/2024

- *Dinámica discreta y continua de campos vectoriales nilpotentes*
  Salomón Rebollo Perdomo
  Universitat de les Illes Balears. Palma. Spain.
  10/12/2024

- *Reconstructing binary black hole properties without waveforms models: Case of wobbly orbits*
  Shubhanshu Tiwari
  University of Zurich, Switzerland
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  05/12/2024

- *Dynamical Thermal Instability in Coronal Loops*
  Varsha Felsy, Ramon Oliver & Jaume Terradas
  PhD control
  Universitat de les Illes Balears. Palma. Spain.
  01/12/2023

- *Pulsar Timing Arrays and ultra-low-frequency Gravitational Waves*
  Prerna Rana
  University of Cape Town, Cape Town, South Africa
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  22/11/2024

- *LISA+3G coherent multiband parameter estimation of SOBHB and IMBHB using PyCBC*
  Shichao Wu
  Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  15/11/2024

- *Tidal heating: hunt for the horizon*
  Sayak Datta
  Gran Sasso Science Institute, Italy
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  31/10/2024

- *Regularity Theory for Linear and Nonlinear Poisson-Type Equations*
  Bartomeu Garau Verger
  Universitat de les Illes Balears. Palma. Spain.
  23/10/2024

- *Magnetically-powered explosions in the multimessenger era*
  Philipp Mösta
  GRAPPA/API/IoP University of Amsterdam, Netherlands
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  11/10/2024

- *Long-lived sources of gravitational waves: (mini) extreme mass ratio inspirals, inspiraling primordial black holes and neutron stars*
  Andrew Lawrence Miller
  National Institute for Subatomic Physics (Nikhef) / Utrecht University, Netherlands
  Aula 01, Planta 0, Complexe I+D+I, ParcBit, Palma, Spain
  01/10/2024

- *Surface waves and KHi in a prominence-corona interface: effect of the ambipolar diffusion*
  L. Melis & R. Soler
  PhD Control
  Universitat de les Illes Balears. Palma de Mallorca. Spain
  20/06/2024

- *Improving waveform models for black hole neutron star and binary neutron star coalescences*
  Felip Antoni Ramis Vidal
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  19/06/2024

- *Bridging the gap between extreme and comparable mass ratios in black-hole binaries*
  Jesús Yébana Carrilero
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  19/06/2024

- *Fast Bayesian spectral analysis using Convolutional Neural Networks (CNN): Applications over GONG Hα data*

G. Castelló, M. Luna & Jaume Terradas
PhD Control
Universitat de les Illes Balears. Palma de Mallorca. Spain
19/06/2024

- *Mind the step: On the frequency-domain analysis of gravitational-wave memory waveforms*
  Jorge Valencia Gómez
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  18/06/2024

- *Characteristic Critical Collapse with Null Infinity*
  Rita Santos
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  18/06/2024

- *Aligning and Constructing Hybrid Waveforms for Precessing Binaries*
  Joan Llobera Querol
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  18/06/2024

- *Towards building a phenomenological aligned spin eccentric model: PhenomTEHM*
  Maria de Lluc Planas Llompart
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  17/06/2024

- *Modeling the full (l=2, m=0) spherical harmonic: memory effect and ringdown oscillations*
  Maria Rosselló Sastre
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  17/06/2024

- *All-sky searching for continuous gravitational-wave signals from unknown neutron stars in binary systems in the O4a run data*
  Joan René Mérou Mestre
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  14/06/2024

- *Improved analysis of gravitationally lensed gravitational waves*
  Ángel Garrón
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  14/06/2024

- *Continuous Gravitational Waves: Machine Learning Applications and Gravitational* Lensing Searches
  Alicia Calafat
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  14/06/2024

- *The Black Hole Threshold*
  David Hilditch
  CENTRA, Instituto Superior Técnico, Lisboa, Portugal
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  7/06/2024

- *Inspiral-Merger-Ringdown waveform modeling to estimate spins of astrophysical black holes*
  Shrobana Ghosh
  Max Planck Institute for Gravitational Physics, Hannover, Germany
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  31/05/2024

- *Black holes in effective field theories - dynamics and new observational signatures*
  Daniela Doneva
  Eberhard-Karls-Universität of Tübingen, Germany
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  22/05/2024

- *Learning more from Teukolsky's radial equation quasi-normal modes*
  Lionel London
  King's College London, London, United Kingdom
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  10/05/2024

- *More limit cycles for complex differential equations with three monomials*.
  María Jesús Álvarez Torres
  08/05/2024

- *Search for hyperbolic encounters of compact objects in the third LIGO-Virgo-KAGRA observing run*
  Sophie Bini
  University of Trento, Trento, Italy
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  26/04/2024

- *From chirps to gold: colliding neutron stars as a laboratory for extreme physics*
  Francois Foucart
  University of New Hampshire, Durham, New Hampshire, United States
  Seminari 1, PB-004, Complexe I+D+I, ParcBit, Palma, Spain
  23/04/2024

- *From LVK to LISA: Extending BILBY to perform Bayesian inference with space-based gravitational-wave observatories*
  Charlie Hoy
  University of Portsmouth, United Kingdom
  Campus UIB, Antoni Maria Alcover building, room 05b, Palma, Spain
  12/04/2024

- *Gravitational memory as a tool for observational science*
  Michael Ebersold
  Laboratoire d'Annecy de Physique des Particules, France
  Campus UIB, Antoni Maria Alcover building, room 05b, Palma, Spain
  22/03/2024

- *Unraveling neuronal dynamics under the effects of synaptic plasticity*.
  R.M. Delicado-Moll.
  18/03/2024

- *Beyond General Relativity and the strongly gravitating/dynamical regime*
  Luis Lehner
  Perimeter Institute for Theoretical Physics, Canada
  Campus UIB, Antoni Maria Alcover building, room 05b, Palma, Spain
  08/03/2024

- *Two Nonlocal Variational Models for Retinex Image Decomposition*
  Frank W. Hammond
  Universitat de les Illes Balears. Palma. Spain.
  22/02/2024

- *Beyond Variational Model and Self-Similarity in Super-Resolution: Unfolding Models and Multi-Head Attention*
  Ivan Pereira- Sánchez
  Universitat de les Illes Balears. Palma. Spain.
  22/02/2024

- *The averaging problem in relativistic cosmology: the consequences of spatial inhomogeneity and the choice of space+time split*
  Pierre Mourier (presenting), Asta Heinesen, Thomas Buchert, Xavier Roy
  Campus UIB, Antoni Maria Alcover building, room 03b, Palma, Spain
  21/02/2024

- *Quartic rigid systems in the plane and in the Poincaré sphere*
  Luis Ángel Calderón Pérez
  14/02/2024

- *Gravitational waves and multi-messenger astronomy*
  Neha Singh
  UIB. Campus UIB, Antoni Maria Alcover building, room 05b, Palma, Spain
  09/02/2024

14. Contribution to conferences and workshops

Invited Talk

- David Keitel
  Long gravitational-wave transients and their detectability
  LIGO-G2402331
  NT workshop "Discovering Continuous GW with Nuclear, Astro and Particle Physics"
  Seattle, Estados Unidos
  22/11/2024

- David Keitel
  Individual neutron stars as GW sources: continuous and long-transient signals
  LIGO-G2401742
  GraSP24 workshop
  Pisa, Italy
  25/10/2024

- Alicia M. Sintes Olives
  Multi-messenger Astronomy with current and future gravitational-wave facilities
  INTEGRAL Workshop 2024
  INTEGRAL catching results and discoveries, ESA/ESAC, Madrid, Spain
  21/10/2024 - 24/10/2024

- Anna Heffernan
  Overview of the LISA Science Team
  LISA Spain Meeting
  Barcelona, Spain
  15/10/2024 - 16/10/2024

- David Keitel
  LIGO-Virgo-KAGRA status, future and Spanish contributions
  LIGO-G2402128
  RENATA & 21st MultiDark joint meeting
  Santander, Spain
  09/10/2024

- David Keitel
  Continuous Waves group: a mid-O4 update
  LIGO-G2401821
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  26/09/2024

- Eleanor Hamilton
  Key features of precession in gravitational wave signals
  Fundamental Physics Meets Waveforms with LISA,
  Max Planck Institute for Gravitation Physics, Potsdam
  05/09/2024

- Marta Colleoni
  Phenomenological GW models for future detectors
  Fundamental Physics Meets Waveforms with LISA
  Max Planck Institute for Gravitation Physics, Potsdam
  05/09/2024

- J. Javaloyes, S.V. Gurevich, T. Seidel, M. Marconi, M. Guidici, A. Garnache, A. Bartolo
  Multistable Kuramoto splay states in a crystal of mode-locked laser pulses
  XLIV Dynamics Days Europe
  Bremen, Germany
  29/07/2024-02/08/2024

- J. Javaloyes, S.V. Gurevich, E. Koch, T. Seidel
  Square wave generation and temporal localized states in vertical external-cavity Kerr-Gires-Tournois interferometers
  European Nonlinear Dynamics Conference (ENOC 2024)
  Deflt, Netherlands
  22/07/2024 - 26/07/2024

- Eleanor Hamilton
  Imprints of precession
  50 years of Gravity at Cardiff
  Cardiff, United Kingdom
  19/07/2024

- Marta Colleoni
  LIGO-Virgo-KAGRA observational results
  LIGO-G2401362
  17th Marcel Grossman meeting

Pescara, Italy
12/07/2024

- David Keitel
  Continuous Waves review: an introduction & LVK results
  LIGO-G2401393
  BNU continuous gravitational waves workshop
  Beijing, China
  12/07/2024

- David Keitel
  LVK Searches and Results
  LIGO-G2401388
  Continuous Waves School at KIAA
  Beijing, China
  09/07/2024

- David Keitel
  Continuous Gravitational Waves: Detection and data analysis
  LIGO-G2401380
  Continuous Waves School at KIAA
  Beijing, China
  07/07/2024

- David Keitel for the LIGO-Virgo-KAGRA Collaboration
  LIGO-Virgo-KAGRA results so far and status of the O4 run
  LIGO-G2400387
  13th Iberian Gravitational Waves Meeting
  Salamanca, Spain
  24/06/2024

- Anna Heffernan
  EMRI Waveforms for LISA
  13th Iberian Gravitational Waves Meeting
  Salamanca, Spain
  24/06/2024

- J. Yelo-Sarrión, F. Leo, S.-P. Gorza
  Mode-Locking in active PT-symmetric dimers
  CLEO US
  Charlotte, NC, EEUU
  06/06/2024 – 10/06/2024

- Anna Heffernan, on behalf of CCC Engagement Subcommittee
  CCC Engagement survey report
  LISA Consortium Call
  03/06/2024

- Anna Heffernan
  Self-Force: Waveforms for EMRIs
  LIGO-G2401125
  Testing Aspects of General Relativity-III
  Univ. of Lethbridge, Canada and Indian Institute of Technology, Gandhinagar (IITGN)
  Online
  15/05/2024 - 16/05/2024

- Anna Heffernan, Joey S. Key
  CCC Engagement Report
  LIGO-G2401128
  LISA CCC Meeting
  Barcelona, Spain
  15/04/2024 - 16/04/2024

- David Keitel
  False positives: the gravitational wave perspective
  LIGO-G2400227
  Royal Society Theo Murphy meeting "Multi-messenger Gravitational Lensing"
  Manchester, United Kingdom
  12/03/2024

- Onofre Martorell:
  Joint fusion and denoising for multi-exposure sequences
  University of Siegen.
  29th April 2024

- Cristian Comellas Fluxá
  Light and Explainable Joint Denoising and Demosaicing
  Universitat de les Illes Balears. Palma. Spain.
  30/10/2024

- M. Luna
  Solar Prominences and Their Relationship to Coronal Rain, Jets, and Flares
  COSPAR 2024 45th Scientific Assembly
  Busan, South Korea
  13/07/2024 – 21/07/2024

- María Jesús Álvarez
  More limit cycles for complex differential equations with three monomials
  Workshop on Periodic Orbits
  Barcelona, Spain
  07/02/2024-09/02/2024

Contributed Talks

- Jesús Yébana Carrilero
  Bridging the gap between extreme and comparable mass ratios in black hole binaries
  JUGAR II Workshop
  IEM-CSIC, Madrid, Spain
  03/12/2024 – 05/12/2024

- A. E. Teruel
  Slow passage through a homoclinic bifurcationby PWL differential systems.
  MAT80: XIII Workshop on Dynamical Systems. Celebrating the 80th birthday of Marco Antonio Teixeira. Campinas. Brasil.
  24/11/2024-29/11/2024

- G. Castelló, M. Luna & J. Terradas
  Spectral analysis of solar filaments using Convolutional-Neural Networks (CNNs)
  European Solar Physics Online Seminars - PhD Control
  Universitat de les Illes Balears. Palma de Mallorca. Spain
  17/10/2024

- Yumeng Xu
  Time-frequency domain coherent search from ground-based detector to LISA
  LIGO-G2500185
  LISA Spain Meeting
  Barcelona, Spain
  15/10/2024 - 16/10/2024

- Jorge Valencia
  Data analysis efforts at UIB from the ground up
  LIGO-G2402533
  LISA Spain Meeting
  Barcelona, Spain
  15/10/2024 - 16/10/2024

- Marta Colleoni, Eleanor Hamilton
  PhenomXPNR: An improved frequency-domain precessing model
  LIGO-G2402029
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  24/09/2024

- Joan Llobera Querol, Sascha Husa, Maria de Lluc Planas Llompart
  Building hybrid waveforms for precessing quasi-circular systems: a systematic approach
  LIGO-G2401990
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  24/09/2024

- Neha Singh, David Keitel
  Vela glitch: Transient F-statistic search
  LIGO-G2401985
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  24/09/2024

- Maria de Lluc Planas (speaker), Antoni Ramos-Buades,Cecilio García-Quirós, Sascha Husa, Maria Haney, Héctor Estellés, Quentin Henry
  PhenomTEHM: Time-domain phenomenological multipolar waveforms for aligned-spin binary black holes in elliptical orbits
  LIGO-G2401994
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  24/09/2024

- Rodrigo Tenorio, Joan-René Mérou, Alicia Sintes
  A one-stop hardware-accelerated strategy to search for long-duration gravitational-wave signals
  LIGO-G2401870
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  23/09/2024

- Joan-René Mérou, Rodrigo Tenorio, Rafel Jaume, Alicia M. Sintes
  O4a all-sky binary update
  LIGO-G2401756
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  23/09/2024

- Joan-René Mérou, Rodrigo Tenorio, Alicia M. Sintes

GPU-accelerated searches for long-transient gravitational waves from newborn neutron stars
LIGO-G2401387
XVI Reunión Científica de la SEA 2024
Granada, Spain
15/07/2024 - 19/07/2024

- L. Melis, R. Soler, J. Terradas
Self-consistent models of prominence thin threads including Alfvén wave heating
XVI Reunión Científica de la SEA
Granada, Spain
15/07/2024 - 19/07/2024

- M. Luna, R. Joshi, B. Schmieder, F. Moreno-Insertis, V. Liakh, J. Terradas
On the Triggering of The Huge Filament Oscillations Of March 15, 2015
COSPAR 2024 45th Scientific Assembly
Busan, South Korea
13/07/2024 – 21/07/2024

- M. Luna, R. Oliver, J. Terradas, R. Soler
Generating MHD Waves by Magnetic Reconnection in A Coronal Arcade
COSPAR 2024 45th Scientific Assembly
Busan, South Korea
13/07/2024 – 21/07/2024

- María Jesús Álvarez
Rigid systems in the plane. Overview and new results
Recent Advances in Dynamical Systems.
Santiago de Compostela, Spain
08/07/2024-12/07/2024

- Sayantani Bera
Gravitational-wave Cosmology with Large-scale Structure Correlations
LIGO-G2401481
17th Marcel Grossman meeting
Pescara, Italy
07/07/2024 - 12/07/2024

- A. E. Teruel
Fenómeno de paso lento a través de la bifurcacióntranscritica en sistemas lineales a trozos.
VI Encuentro RSME SMM. Universitat Politècnica de Valencia. Valencia. Spain
01/07/2024-05/07/2024

- V. Felsy, R. Oliver, J. Terradas
Dynamical Thermal Instability in Coronal Loops
11th Coronal Loops Workshop
Instituto de Astrofísica de Canarias (IAC), La Laguna, Spain
25/06/2024 - 28/06/2024

- David Keitel
Status of the O4 run and LVK searches
LIGO-G2400497
Workshop Continuous gravitational waves and neutron stars
Hannover, Germany
17/06/2024

- Neha Singh, David Keitel, Tomasz Bulik, A. Olejak
Improving the understanding of evolution of binary neutron stars with Einstein Telescope
LIGO-G2401293
Workshop "Continuous gravitational waves and neutron stars"
Hannover, Germany
17/06/2024 - 20/06/2024

- Marc Casals (speaker), Anna Heffernan, Chris Kavanagh, Adrian Ottewill, Barry Wardell
Scalar self-force in Kerr spacetime via the Green function with quasinormal modes and branch cut integral
The 27th Capra meeting on radiation reaction in general relativity
The National University of Singapore (NUS)
17/06/2024 - 21/06/2024

- C. Vich
Three-factor cortico-striatal plasticity shifts activity of cortico-basal ganglia-thalamic subnetworks to maximize reward rate in decision-making tasks. International Conference on Mathematical Neuroscience (ICMNS2024). Dublín, Irlanda.
11/06/2024-14/06/2024

- A. E. Teruel
Slow passage through loss of stability bifurcations by PWL systems.
Equadiff2024. Karlstads. Sweden.
10/06/2024-14/06/2024

- Sayantani Bera
Using Large-scale structure correlations in Gravitational-wave Cosmology: A Bayesian Approach
LIGO-G2401482

La primera reunión de Planes Complementarios AstroHEP
4/06/2024 - 7/06/2024

- Maria Rosselló (speaker), Sascha Husa, Sayantani Bera, Jorge Valencia, Rodrigo Tenorio
A fast waveform model for the complete l=2, m=0 spherical harmonic
LIGO-G2401166
Gravitational Wave Physics and Astronomy Workshop
University of Birmingham, Birmingham, United Kingdom
28/05/2024

- V. Felsy, R. Oliver, J. Terradas
Dynamical Thermal Instability in Coronal Loops
The Coronal Cooling Conference: rain, prominences and eruptions (CoCo-Con)
KU Leuven, Leuven, Belgium
21/05/2024 - 24/05/2024

- L. Melis, R. Soler, J. Terradas
Self-consistent models of prominence threads
The Coronal Cooling Conference: rain, prominences and eruptions (CoCo-Con)
KU Leuven, Leuven, Belgium
21/05/2024 - 24/05/2024

- R. Soler, S. Díaz-Suárez
Turbulence in prominence threads induced by torsional oscillations
The Coronal Cooling Conference: rain, prominences and eruptions (CoCo-Con)
KU Leuven, Leuven, Belgium
21/05/2024 - 24/05/2024

- Alicia M. Sintes for the LIGO-Virgo-KAGRA Collaborations
Search for continuous gravitational waves
3rd BIG&C Meeting
ICE, Barcelona
17/05/2024

- Sascha Husa
Waveform modelling for current and future gravitational wave detectors
3rd BIG&C Meeting
ICE, Barcelona
17/05/2024

- V. Felsy, R. Oliver, J. Terradas
Local and dynamical thermal instability
ISSI Team Meeting: 'Observe Local Think Global: What Solar Observations can teach us about Multiphase Plasmas across Astrophysical Scales'
International Space Science Institute (ISSI), Bern, Switzerland
13/05/2024 - 17/05/2024

- V. Felsy, R. Oliver, J. Terradas
Dynamical Thermal Instability in Coronal Loops
ISSI Team Meeting: 'Observe Local Think Global: What Solar Observations can teach us about Multiphase Plasmas across Astrophysical Scales'
International Space Science Institute (ISSI), Bern, Switzerland
13/05/2024 - 17/05/2024

- David Keitel
Opening up new discovery spaces with machine learning: Long-duration transient gravitational waves
LIGO-G2400224
AIslands Arran 2024 workshop
Brodick, United Kingdom
25/04/2024

- Rodrigo Tenorio
Kaggle competition to detect continuous gravitational-wave signals
AIslands Arran 2024 workshop
Brodick, United Kingdom
23/04/2024

- I. Pereira-Sánchez.
A simple nonlocal back-projection unfolded network for pansharpening.
International Conference on Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS), IEEE, 2024. Wellington, New Zealand.
08/04/2024

- Eleanor Hamilton
Catalog update
LIGO-Virgo-Kagra (LVK) Collaboration Meeting
Louisiana State University
Baton Rouge, Louisiana, USA
11/03/2024 - 15/03/2024

- Maria de Lluc Planas (speaker), Antoni Ramos-Buades, Maria Haney, Sascha Husa, Cecilio García-Quirós
Towards building eccentric aligned spin phenomenological waveforms in the time

domain
LIGO-G2400695
LIGO-Virgo-Kagra (LVK) Collaboration Meeting
Louisiana State University, Baton Rouge, Louisiana, USA
11/03/2024 - 15/03/2024

- Maria Rosselló (speaker), Sascha Husa
  A fast waveform model for the complete l=2, m=0 spherical harmonic
  LIGO-G2400709
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Louisiana State University, Baton Rouge, Louisiana, USA
  11/03/2024 - 15/03/2024

- Alicia Sintes
  Escuchando al Universo, últimos avances con las ondas gravitacionales
  Congreso Nacional de Estudiantes de Física organizado por la Asociación Nacional de Estudiantes Universitarios de CIencias Físicas (NUSGREM)
  Universidad de Córdoba, Córdoba, Spain
  08/03/2024

- M. Luna, R. Joshi, B. Schmieder, F. Moreno-Insertis, V. Liakh, J. Terradas
  Study of the excitation of a large amplitude oscillation in a prominence by a nearby flare
  WHOLESUN project meeting
  Institut Pascal of the Université Paris-Saclay, Paris, France
  04/03/2024 – 22/03/2024

- I. Pereira-Sánchez.
  Beyond variational models and self-similarity in super-resolution: Unfolding models and multi-head attention.
  29th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Application (VISIGRAPP), INSTICC, 2024.
  Rome, Italy.
  27/02/2024

- Jesús Yébana Carrilero (speaker), Guillermo A. Mena Marugán, Beatriz Elizaga Navascués
  Effects of the inflaton potential on the primordial power spectrum in Loop Quantum Cosmology
  11th Tux Workshop on Quantum Gravity
  19/02/2024 - 23/02/2024

- David Keitel, Elisa Maggio
  Fundamental problems in high energy and gravitational physics
  LIGO-G2400285
  Bottom-Up Cross-Cutting Workshop @JENAS Initiative Gravitational Wave Probes of Fundamental Physics
  Rome, Italy
  13/02/2024

- C. Vich.
  GPe arkypallidal neurons can mediate inhibitory control by altering competition in the striatum.
  Presentación comunicación. SWEBAGS24, En línia.

Posters

- Joan J. Cerdà, A. Fuster-Aparisi
  Depletion forces in dipolar brushes and dipolar colloidal systems: external field modulation of system properties.
  2nd Spanish Soft Matter 1 ½ day, Benasque,
  03/11/2024-06/11/2024.

- Felip Antoni Ramis Vidal, Marta Colleoni
  Improved Waveform Models for Neutron-Star Black-Hole Binaries
  LIGO-G2401521
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain
  23/09/2024 - 26/09/2024

- Iuri La Rosa
  Continuous-Wave Hierarchical Search on Graphical Processing Units
  LIGO-G2401633
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain.
  23/09/2024 - 26/09/2024

- Iuri La Rosa

GPU implementations of the Hough transform for continuous waves searches
LIGO-G2401714
Gravitational-waves, ElectroMagnetic and dark-MAtter Physics Workshop (GEMMA 2)
Sapienza University, Rome, Italy
16/09/2024 - 19/09/2024

- Alicia Calafat, David Keitel, Alicia M. Sintes
A machine learning approach for gravitational waves searches associated with pulsar glitches
LIGO-G2401386
DOI: 10.5281/zenodo.15019491
XVI Reunión Científica de la SEA 202
Granada, Spain
15/07/2024 - 19/07/2024

- Jorge Valencia, Rodrigo Tenorio, Sascha Husa, Maria Rosselló-Sastre
A fast and robust Fisher matrix code for LISA
LIGO-G2401847
15th International LISA Symposium
Dublin, Ireland
07/07/2024 - 12/07/2024

- R.M. Delicado-Moll; A. Guillamon; A.E. Teruel; C. Vich.
Excitatory and Inhibitory conductances. How can they be estimated? International Conference on Mathematical Neuroscience (ICMNS 2024).
Dublín, Irlanda.
11/06/2024-14/06/2024

- F. Alcover, J. Duran, C. Sbert, R. Oliver-Bonafoux.
Weighted nonlocal Sobolev space and total variation.
Barcelona Analysis Conference (BAC24), CRM, 2024. Barcelona, Spain.
06/06/2024

- R.M. Delicado-Moll; G. Huguet; C. Vich.
Exploring the dynamics of UP and DOWN states in cortical networks undergoing short-term synaptic plasticity.
Barcelona Computational, Congnitive and systems Neuroscience (BARCCSYN 2024).
Barcelona, Spain.
30/05/2024-31/05/2024

- A. Costa, E. Sans, I. Pereira-Sánchez, J. Duran, and J. Navarro.
Improving marine litter segmentation with limited resolution satellite imagery.
International Conference on Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS), IEEE, 2024. Wellington, New Zealand.
08/04/2024

- Ángel Garrón, David Keitel
Waveform systematics in identifying strongly gravitationally lensed gravitational waves: Posterior overlap method
LIGO-G2400426
Royal Society Theo Murphy meeting "Multi-messenger Gravitational Lensing"
Mánchester, United Kingdom
11/03/2024 - 12/03/2024

- MC. Giossi, J. Bahuguna, J. Rubin, C. Vich, T. Verstynen
GPe arkypallidal neurons can mediate inhibitory control by disrupting competition in the striatum.
COSYNE 2024.
Lisboa, Portugal.
28/02/2024-05/03/2024

- Daniel Torres, Catalina Sbert, and Joan Duran.
Combining total variation and nonlocal variational models for low-light image enhancement.
29th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP), INSTICC, 2024. Rome, Italy.
27/02/2024

- M.J. Álvarez, J.L. Bravo, L.A. Calderón.
Quartic rigid systems in the plane and in the Poincaré sphere.
Recent Trends in Nonlinear Science 2024 (RTNS 2024). Universidad de Extremadura, Badajoz.
29/01/2024 - 02/02/2024.

Seminars and Colloquiums

- Anna Heffernan
  Waveforms for LISA
  Science Coffee, Advanced Concepts Team, ESTEC, European Space Agency (ESA), Netherlands
  06/12/2024

- Ángel Garrón, Ian Harry
  Coherent search of sub-threshold lensed images
  LIGO-G2402486
  Institute of Cosmology & Gravitation (ICG), University of Portsmouth, Portsmouth, England
  05/12/2024

- Maria de Lluc Planas, Antoni Ramos Buades, Cecilio García Quirós, Sascha Husa, Maria Haney, Héctor Estellés, Quentin Henry
  PhenomTEHM: time-domain phenomenological multipolar waveforms for aligned-spin binary black holes in elliptical orbits
  LIGO-G2402589
  National Institute for Subatomic Physics (Nikhef), Amsterdam, Netherlands
  04/12/2024

- David Keitel
  Long-duration transient gravitational waves from newborn neutron stars and glitching pulsars
  LIGO-G2402369
  Special Gravity seminar, University of British Columbia, British Columbia, Canada
  26/11/2024

- Anna Heffernan
  LISA CCC Communications Plan
  LISA Consortium Monthly Call. Online.
  25/11/2024

- Maria Rosselló Sastre, Sascha Husa, Sayantani Bera
  A waveform model for the missing quadrupole mode from black hole coalescence: memory effect and ringdown of the (l=2, m=0) spherical harmonic
  LIGO-G2401295
  Presentación en el LISA memory group. Online.
  25/06/2024

- A. E. Teruel.
  Slow passage through a PWL transcritical bifurcation.
  Seminário de sistemas dinâmicos. São José do Rio Preto. Brasil.
  27/05/2024

- A. E. Teruel.
  Saddle Node Canard Cycles in PWL Systems.
  Seminário de sistemas dinâmicos. São José do Rio Preto. Brasil.
  22/05/2024

- Asta Heinesen, Pierre Mourier (joint presentation)
  Splitting Spacetime: A Systematic Analysis of Foliation Dependence in Cosmic Averaging
  LIGO-G2401023
  STRONG group seminar, Niels Bohr International Academy, Niels Bohr Institute, Copenhagen, Denmark. Online.
  25/04/2024

- Pierre Mourier, Asta Heinesen (joint presentation)
  Splitting Spacetime: A Systematic Analysis of Foliation Dependence in Cosmic Averaging
  LIGO-G2401022
  Center for Relativity and Cosmology Seminar, Troy University, Alabama, USA. Online.
  11/04/2024

- Ángel Garrón, David Keitel
  Waveform systematics in identifying gravitationally lensed gravitational waves: Posterior overlap method
  LIGO-G2400760
  Institute of Cosmology & Gravitation (ICG), University of Portsmouth, Portsmouth, England
  14/03/2024

- R. Oliver
  From thermal instability to coronal rain. Invited seminar at Ilia State University

Tbilisi, Georgia (online).
08/03/2024

- David Keitel
  Gravitational-wave astronomy: what we've found so far and what we're still looking for
  LIGO-G2400432
  Durham University, Durham, England
  08/03/2024

- David Keitel
  Future "firsts" in GW observations: lensing, CWs and long transients
  LIGO-G2400235
  Space sciences, Technologies and Astrophysics Research (STAR), Université de Liège,Liège, Wallonia, Belgium
  22/02/2024

Attendance

- Antoni Buades, Cristian Comellas and Marco Sánchez Beeckman
  European Conference on Computer Vision (ECCV)
  Milan, Italy
  29/09/2024-04/10/2024

- Alicia Calafat, Maria Antònia Ferrer
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Institut de Física d'Altes Energies (IFAE), Barcelona, Spain. Online.
  23/09/2024 - 26/09/2024

- Pierre Mourier, Maria de Lluc Planas Llompart, Jorge Valencia
  Fundamental Physics Meets Waveforms With LISA (Workshop)
  Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany
  02/09/2024 - 06/09/2024

- Jorge Valencia
  3rd MaNiTou Summer School
  Université de Toulouse III - Paul Sabatier, Toulouse, France
  01/07/2024 - 06/07/2024

- Rodrigo Tenorio
  LISA DDPC Kick-off Workshop
  Pullman Toulouse Centre Ramblas, Toulouse, France
  10/06/2024 - 12/06/2024

- Maties Francesc Alcover
  Barcelona Analysis Conference (BAC24)
  Barcelona, Spain.
  03/06/2024-07/06/2024

- Maties Francesc Alcover, Joan Duran and Daniel Torres.
  International Conference on Machine Intelligence for Geoanalytics and Remote Sensing. Wellington, New Zealand.
  08/04/2024-10/04/2024.

- Joan Llobera Querol
  LIGO-Virgo-Kagra (LVK) Collaboration Meeting
  Louisiana State University, Baton Rouge, Louisiana, USA
  11/03/2024 - 15/03/2024

- Joan Duran, Julia Navarro, Eloi Sans and Catalina Sbert.
  International Conference on Computer Vision, Theory and Applications.
  Rome, Italy.
  27/02/2024-29/02/2024.

- Maties Francesc Alcover and Daniel Torres
  Variational Models in Materials Science II
  Naples, Italy
  21/02/2024-23/02/2024

- Ángel Garrón
  SIGRAV International School 2024 - Measuring Gravity
  Vietri sul Mare, Italy. Online.
  19/02/2024 - 23/02/2024

- Joan-René Mérou, Alicia Calafat
  SIGRAV International School 2024 - Measuring Gravity
  Lloyd's Baia Hotel, Vietri sul Mare, Italy
  19/02/2024 - 23/02/2024

Awards

- Second finalist in the prize for the Final Degree Project of the Degree in Telematics Engineering of the Universitat de les Illes Balears by *OmniAccess Company*
  R.M. Delicado-Moll.
  Palma de Mallorca, Balearic Islands, Spain
  29/11/2024

- Winner of the prize for the Final Degree Project of the Degree in Mathematics of the Universitat de les Illes Balears by *Societat Balear de Matemàtiques SBM-XEIX*
  R.M. Delicado-Moll
  Palma de Mallorca, Balearic Islands, Spain
  29/11/2024

- GEMMA 2 Prize 2024
  Iuri La Rosa
  Gravitational-waves, ElectroMagnetic and dark-MAtter Physics Workshop (GEMMA 2), Sapienza University, Rome, Italy
  16/09/2024 - 19/09/2024

- Prize for the Best Poster Contribution at the *BARCCSYN2024* congress for the work: "*Exploring the dynamics of UP and DOWN states in cortical networks undergoing short-term synaptic plasiticity*" by Centre de Recerca Matemàtica
  R.M. Delicado-Moll
  Barcelona, Catalonia, Spain
  31/05/2024

- Classical and Quantum Gravity: Outstanding Reviewer Award 2023
  David Keitel
  Institute of Physics Publishing (IOPP), *Classical and Quantum Gravity*
  19/03/2024

- Honourable mention in the *8th TalenTIC Awards* for their Master's Thesis
  Joan-René Mérou Mestre
  University of the Balearic Islands (UIB), Palma
  22/01/2024

- Premi extraordinari als estudis de: Doble titulació Matemàtiques i Enginyeria Telemàtica by Comissió Acadèmica UIB.
  R.M. Delicado-Moll
  Academic year 2023/24

- Premi al treball de fi de grau proposat per la USIB a «*Advances in computational Neuroscience: Short Term Plasticity*»
  R.M. Delicado-Moll
  Estudis realitzats: doble grau de Matemàtiques i Enginyeria Telemàtica
  Academic year 2023/24

15. Outreach

Public Talks and Round Tables

- *La Materia Tova*
  Joan Josep Cerdà
  Conferències adreçades als estudiants de la Facultat de Ciències de la UIB
  22/10/2024

- *Escuchando al Universo, últimos avances con las ondas gravitacionales*
  Alicia Sintes
  Session "A natureza do espazo-tempo", part of the "Salto Cuántico" series, a program by the Centro de Supercomputación del Galicia (CESGA) and the Centro Galego de Arte Contemporánea (CGAC), with the collaboration of the Instituto de Física de Altas Enerxías (IGFAE)
  Santiago de Compostela, Galicia, Spain
  13/09/2024

- *Una guía desordenada a los doctorados y las becas*
  Joan Llobera Querol
  Within Encuentro Nacional de Estudiantes de Física

Facultad de Ciencias, Universidad de Granada, Granada, Spain
06/09/2024

- *Sol i estrelles*
  Ramón Oliver
  Ventanas al Universo I, Caixaforum, Palma de Mallorca, Spain
  04/06/2024

- Ones gravitacionals: d'Einstein a una nova ciència
  Alicia Sintes
  Acte Exposició dia de la Dona i la Nina científica
  3r ESO, Sant Vicenç de Paül, Manacor, Balearic Islands, Spain
  21/02/2024

- *Escuchando al Universo, últimos avances con las ondas gravitacionales*
  Alicia Sintes
  2ª Jornada de Investigación Científica de Bachillerato
  Colegio San Cayetano, Palma, Balearic Islands, Spain
  13/02/2024

- *Ones gravitacionals: d'Einstein a una nova ciència*
  Alicia Sintes
  Dia de la dona i la nina a la ciència
  IES Ramon Llull, Aula Magna, Palma, Balearic Islands, Spain
  12/02/2024

- *Escuchando al Universo, últimos avances con las ondas gravitacionales*
  Alicia Sintes
  Agrupación Astronómica de Sabadell
  Sabadell, Barcelona, Spain
  31/01/2024

Events

- *Ciència a Tot Tren 2024*
  Talk by Alicia Sintes "*Einstein i les seves ones revolucionant l'Univers*"
  Alicia Sintes with the participation of Maria Rosselló and Maria Antònia Ferrer
  Palma, Balearic Islands, Spain
  09/11/2024

- *Nikhef Open Day*
  Maria de Lluc Planas
  National Institute for Subatomic Physics (Nikhef), Amsterdam Science Park, Netherlands
  05/10/2024

- Nit Europea de la Recerca: *Físics i matemàtics, els tècnics d'imatge i so de l'univers*
  Maties Francesc Alcover Borràs, Alicia Calafat Jaso, Marina Camps Nebot, Maria Antònia Ferrer Martínez, Cristina Giossi, Arnau Montava Agudo, Ivan Pereira Sánchez, Marco Sánchez Beeckman, Daniel Torres Rullán, Jorge Valencia Gómez, Jesús Yébana Carrilero
  Palma, Illes Balears, Spain
  27/09/2024

- *Jugam amb les ones gravitacionals*
  XV Campus Cientificotècnic d'Estiu, Seràs UIB
  Felip Ramis, Rafel Jaume, Jesús Yébana, Jorge Valencia, Maria Rosselló
  Palma, Balearic Islands, Spain
  27/06/2024

- Ciència per a tothom 2024
  Alicia Calafat, Diego García, Ángel Garrón, Rafel Jaume, Joan Llobera, Joan-René Mérou, Damià Nicolau, Maria de Lluc Planas, Felip Ramis, Maria Rosselló, Jorge Valencia, Jesús Yébana
  Palma, Balearic Islands, Spain
  09/05/2024 - 11/05/2024

- Ciència per a tothom 2024
  Quin filtre hem aplicat a la foto? Les matemàtiques et contesten.
  Ana Belén Petro, Julia Navarro, Joan Duran, Catalina Sbert, José Luis Lisani, Ivan Pereira-Sànchez, Marco Sánchez-Beeckman.
  09/05/2024 - 11/05/2024

- Ciència per a tothom 2024
  Sol, solet vine'm a veure
  José Luis Ballester, Guillem Barceló,

Héctor Carril, Sergio Díaz-Suárez, Manuel Luna, Llorenç Melis, Ramón Oliver, Roberto Soler, Jaume Terradas
Ciència per a tothom, UIB
09/05/2024 - 11/05/2024

- Ciència per a tothom 2024
  El joc de la vida
  M.J. Álvarez, A. E. Teruel,
  Palma, Illes Balears, Spain
  09/05/2024 - 11/05/2024

- *L'albufera amb ulls matemàtics.*
  Ana Belén Petro, Ivan Pereira-Sànchez.
  Què s'investiga a la UIB? Agenda 2023.
  17/02/2024.

Lectures

- *Demostracions sense paraules*
  E. Teruel, Gemma Radó
  Estalmat
  19/10/2024

- *Fractals: la geometria de la natura*
  M. J. Álvarez, A. E. Teruel
  Estalmat
  13/04/2024

- *1 hour of science outreach in 1º and 2º of Bachillerato*
  Maria de Lluc Planas
  Bellver International College, Palma, Balearic Islands, Spain
  09/02/2024

- *1 hour of science outreach in 3º and 4º of ESO*
  Maria de Lluc Planas
  IES el Brocense, Cáceres, Extremadura, Spain
  09/02/2024

Participation in television series

- *Premiere of episode 9 "Ondas gravitacionales: la primera detección" of the series "Territorio gravedad"*
  Alicia Sintes y Sascha Husa
  Consell Superior d'Investigacions Científiques (CSIC) en colaboración con Lipssync Medialab y con el soporte de la Universitat de les Illes Balears (UIB).
  Filmin and Vimeo
  29/11/2024

- *Recording of episode 8 of the series "Vides de rondalla" by IB3 Televisión titled "Alicia Sintes i la Llegenda de* Ramon Llull"
  Alicia Sintes
  Monestir Miramar, Valldemossa, Balearic Islands, Spain
  05/11/2024

Interviews

- 27/07/2024 – Alicia Sintes interview with Celestí Oliver for IB3 Ràdio
- 22/06/2024 – Alicia Sintes interview "Astronomía de ondas gravitacionales" for Cienciaes.com
- 11/06/2024 – Alicia Sintes interview in the Myotragus Radio Program for Escola CEIP Rei Jaume I, Palma, Balearic Islands, Spain
- 03/06/2024 – Alicia Sintes interview in the podcast "Tampoco es el fin del mundo", episode 35: La misteriosa señal extraterrestre de nuestro tiempo: ondas gravitacionales, con Alicia Sintes
- 10/04/2024 – Alicia Sintes interview for Radio Nacional de España

- 10/04/2024 – Alicia Sintes interview for Canal 4
- 08/04/2024 – Alicia Sintes interview for IB3 Notícies
- 08/04/2024 – Alicia Sintes interview for Catalunya Ràdio
- 03/02/2024 – Alicia Sintes interview in IB3 Ràdio for Nautilus program,
- 31/01/2024 – Alicia Sintes interview with Luis Soler Dauchy in Cadena SER for Radio Menorca

Translations

- *Cerca de coalecències excèntriques de forats negres durant el tercer període d'observació de LIGO i Virgo*
  Maria Antònia Ferrer y Arnau Montava
  LIGO-G2402443
  Catalan translation
  29/11/2024

- *Una cerca sensible d'ones gravitacionals contínues de Scorpius X-1 en O3*
  Maria Antònia Ferrer y Arnau Montava
  LIGO-G2402382
  Catalan translation
  13/11/2024

- *GW230529: Observació de la fusió d'un estel de neutrons i un objecte compacte desconegut*
  Joan Llobera Querol y Rodrigo Tenorio
  LIGO-G2400842
  Catalan translation
  02/04/2024

16. In the media

- 12/11/2024 – Diari de la UIB: "La segona temporada de «Territorio gravedad» arriba a les pantalles"
- 11/11/2024 – La Vanguardia: "El CSIC estrena la segunda temporada de su docuserie sobre el cosmos "Territorio gravedad""
- 11/11/2024 – CSIC: "'Territorio gravedad', la serie española sobre el cosmos producida por el CSIC, presenta su segunda temporada"
- 11/11/2024 – Infobae: "El CSIC estrena la segunda temporada de su docuserie sobre el cosmos '*Territorio gravedad*'"
- 09/11/2024 – Última Hora: "El primer tren a la ciencia"
- 09/11/2024 – Diario de Mallorca: "Diario de Mallorca se estrena con éxito en el Open House Palma"
- 24/09/2024 – IGFAE: "ESCUCHANDO AL UNIVERSO CON LAS ONDAS GRAVITACIONALES | Alicia Sintes"
- 23/09/2024 – Diario de Mallorca: "Una radio escolar en Mallorca para fomentar el catalán entre los alumnos"
- 16/09/2024 – La Voz de Galicia: "Alicia Sintes: «La curiosidad, el hacerse preguntas e intentar darles respuestas me llevó a la ciencia»"
- 02/08/2024 – Noticias UPV: "Dones de ciència: Alicia Sintes. La física Alicia Sintes, protagonista de un nuevo mural del proyecto Dones de Ciència"
- 11/07/2024 – Última Hora: "Una investigadora de la UIB, entre los 18 científicos internacionales que supervisarán la misión espacial LISA"
- 11/07/2024 – dBalears: "Presència de la UIB a la missió de l'Agència Espacial Europea LISA per posar en òrbita un observatori d'ones gravitacionals"

- 09/07/2024 – Alpha Galileo: “ESA LISA mission formally announces Irish scientist Dr Anna Heffernan as ‘waveform’ expert”
- 09/07/2024 – Silicon Republic: “Dr Anna Heffernan named top expert in major space mission”
- 09/07/2024 – UCD Dublin: “LISA project confirms UCD alum as mission waveform expert”
- 02/07/2024 – MallorcaDiario: “Alicia Sintes: “Vienen jóvenes por un tercio del salario de otros lugares, sólo para trabajar con nosotros en la UIB”
- 25/06/2024 – MenorcaInfo: “Alícia Sintes, la única investigadora balear en el top cien nacional”
- 22/06/2024 – Diario de Mallorca: “La doctora Alícia Sintes, una de los cien mejores investigadores del Estado”
- 21/06/2024 – La Palmesana: “16 investigadores de Baleares entre los 1.000 más destacados de España según el CSIC”
- 12/06/2024 – Diario de Mallorca: “La investigación de la UIB se concentra en un nuevo complejo en el ParcBit”
- 12/06/2024 – Mallorca Informa: “Prohens celebra la inauguración del Complejo Balear de Investigación “después de años de contratiempos”
- 12/06/2024 – Europapress: “Prohens celebra la inauguración del Complejo Balear de Investigación “después de años de contratiempos”
- 12/06/2024 – CAIB: “La presidenta Prohens inaugura el Complejo de Investigación de las Illes Balears”
- 12/06/2024 – Última Hora: “Prohens celebra inaugurar el Complejo Balear de Investigación tras «años de contratiempos»”
- 11/06/2024 – Europapress: “Prohens asistirá este miércoles a la inauguración del Complejo Balear de Investigación en el ParcBit”
- 03/06/2024 – Podcast ‘Tampoco es el fin del mundo’, Episodio 35: Wow!: Alicia Sintes: “Detectamos ondas gravitacionales de objetos misteriosos que no podemos explicar completamente”
- 21/04/2024 – Última Hora: “Los retos de Europa se definen en Palma en una cumbre parlamentaria”
- 11/04/2024 – The Objective: “Un equipo de Baleares detecta la fusión de una estrella de neutrones y un objeto desconocido”
- 11/04/2024 – La Sexta: “Detectan la fusión entre una estrella de neutrones y un objeto desconocido”
- 11/04/2024 – SINC: “Detectada la fusión entre una estrella de neutrones y un objeto desconocido”
- 09/04/2024 – Diario de Ibiza: “Descubrimiento en el espacio: «Hemos detectado un objeto misterioso que ‘no debería’ existir... pero existe»”
- 08/04/2024 – Europa Press: “Un equipo de la UIB participa en la detección de un sistema binario que podría ser un agujero negro primordial”08/04/2024 – Fibwi Diario: “El grupo Gravity de la UIB participa en la detección de una fusión entre una estrella de neutrones y un objeto desconocido”
- 08/04/2024 – Menorca Info: “El objeto cósmico desconocido detectado por la UIB y que desafía todo lo que se sabe sobre el universo”
- 08/04/2024 – OK Diario: “Investigadores de la UIB apuntan al posible descubrimiento de un agujero negro primordial”
- 08/04/2024 – Última Hora: “El objeto cósmico desconocido detectado por la UIB y que desafía todo lo que se sabe sobre el universo”
- 08/04/2024 – 3Cat: “Experts de la UIB participen en la detecció de la fusió d’un estel de neutrons i un objecte insòlit”
- 08/04/2024 – Cadena Ser: “Un descubrimiento en la Universidad de las Islas desafía los modelos astronómicos con un objeto cósmico desconocido detectado en una colisión estelar”
- 08/04/2024 – Diario de Mallorca: “Anna Heffernan, investigadora de la UIB: Era mi primera guardia y llegó el avisó, todos gritábamos, fue muy emocionante”
- 08/04/2024 – Cope: “Un equipo de la UIB participa en la detección de un sistema binario que podría ser un agujero negro primordial”

- 08/04/2024 – Diario de Mallorca: “Alicia Sintes, investigadora de la UIB: Somos 30 investigadores distribuidos en cuatro edificios, pedimos condiciones dignas”
- 08/04/2024 – IB3 Noticíes: “La UIB participa en un nou descobriment d’ones gravitacionals”
- 08/04/2024 – Diario de Mallorca: “Alicia Sintes, investigadora de la UIB: “Hemos detectado un objeto misterioso que no debería existir... pero existe”
- 07/04/2024 – Periódico de Ibiza: “La UIB detecta la fusión entre una estrella de neutrones y un objeto desconocido”
- 06/04/2024 – Crónica Balear: “La UIB participa en la detección de la fusión de una estrella de neutrones y un objeto compacto desconocido”
- 06/04/2024 – OK Diario: “Nuevo hito científico en Baleares: detectada la fusión de una estrella de neutrones y un objeto desconocido”
- 05/04/2024 – Menorca al Día: “Menorca y la detección de la fusión de una estrella de neutrones y un objeto”
- 05/04/2024 – Menorca Info: “Un grupo de la UIB, liderado por Alicia Sintes, detecta la fusión entre una estrella de neutrones y un objeto desconocido”
- 05/04/2024 – Mallorca Diario: “La UIB detecta la fusión entre una estrella de neutrones y un objeto desconocido”
- 05/04/2024 – Última Hora: “La UIB detecta la fusión entre una estrella de neutrones y un objeto compacto desconocido”
- 05/04/2024 – Diario de Mallorca: “La UIB participa en la detección de la fusión entre una estrella de neutrones y un objeto compacto desconocido”
- 05/04/2024 – AraBalears: “La UIB participa en la detecció de la fusió entre un estel de neutrons i un objecte compacte desconegut”
- 24/02/2024 – El País: “Niñas y Ciencia: Cuando Marie Curie ya no es referencia”
- 11/02/2024 – El País: “Sandra Uve, divulgadora científica: Los niños y niñas necesitan referencias actuales porque ya no se van a identificar con una Marie Curie”
- 06/02/2024 – Fet a Sant Feliu: “Una enciclopèdia del 50% que mai s’ha explicat; el recull dels avenços científics i tecnològics amb nom de dones”
- 05/02/2024 – Europapress: “Prohens aboga por la “conciliación y correspondencia” para incentivar la carrera de las mujeres científicas”03/02/2024 – IB3 Radio Nautilis: “Entrevista a Alicia Sintes”
- 31/01/2024 – Alicia Sintes entrevista en la cadena SER para Radio Menorca de Luis Soler Dauchy
- 26/01/2024 – Última Hora: “La UIB analizará los datos del primer observatorio espacial de ondas gravitacionales”
- 26/01/2024 – Periódico de Ibiza “La UIB analizará la información que explica el origen del universo”
- 26/01/2024 – El Gobierno Digital:: “La Universitat de les Illes Balears analizará los datos de LISA, el observatorio espacial de ondas gravitacionales”
- 26/01/2024 – El Gobierno Digital:: “La UIB lidera la investigación para el primer observatorio espacial de ondas gravitacionales”
- 26/01/2024 – Fibwi Diario: “Investigadores de la UIB participan en la misión LISA que permitirá resolver enigmas como la formación del universo”
- 26/01/2024 – Diari UIB: “L’Agència Espacial Europea dona llum verda a la missió espacial LISA, amb participació de la UIB”
- 26/01/2024 – La COPE: “AMP.- la formación del universo o agujeros negros”
- 26/01/2024 – Diari de Mallorca: “Así funcionarán los tres satélites de la misión espacial LISA en la que participa la UIB”
- 26/01/2024 – Mallorca diario: “Luz verde a la misión espacial LISA, con la participación de la UIB”
- 26/01/2024 – Europa Press: “Investigadores de la UIB participarán en un proyecto europeo para estudiar la formación del universo o agujeros negros”
- 26/01/2024 – dBalears: “Investigadors de la UIB participen en la missió espacial LISA”
- 26/01/2024 – Teleprensa: “La formación del universo o agujeros negros”

- 26/01/2024 – IB3 Notícies: “Investigadors de la UIB proposen acollir el centre de dades de la missió espacial LISA”
- 26/01/2024 – Cadena Ser: “Luz verde a la misión espacial LISA que avanza hacia la construcción del primer observatorio de ondas gravitacionales”
- 26/01/2024 – Metro Americas: “La UIB se une al proyecto LISA para analizar datos de ondas gravitacionales”
- 26/01/2024 – Metro Americas: “La Universidad de las Islas Baleares lidera la misión espacial LISA”
- 26/01/2024 – Diari de Mallorca: “La misión espacial LISA, en la que participa la UIB, dará información sobre el origen del universo”
- 26/01/2024 – La COPE: “Investigadores de la UIB participarán en un proyecto europeo para estudiar la formación del universo o agujeros negros”
- 23/01/2024 – Diari de Mallorca: “La UIB premia un trabajo sobre imágenes médicas”
- 22/01/2024 – Diari UIB: “Els VIII Premis TalenTIC premien un treball sobre el processament d’imatges mèdiques mitjançant xarxes neuronals convolucionals”