Jornadas del ICTEA 2025 - ICTEA Research Days 2025

Informe de contribuciones

ID de Contribución: **43** Tipo: **sin especificar**

Signal Drop in Mass Density Profiles: Combining Lensing Simulations and Observations

viernes, 20 de junio de 2025 10:05 (15 actas)

Gravitational lensing magnification bias is a valuable tool for studying mass density profiles, with submillimetre galaxies (SMGs) serving as ideal background sources. The satellite distribution in galaxy clusters also provides insights into their mass distribution. This study aims to investigate the signal drop in mass density profiles from magnification bias measurements, assessing the role of satellite galaxies through observational data and lensing simulations. Using a stacking technique, we analyze the radial distribution of satellites in clusters from the Zou et al. (2021, 2022) catalog and measure the magnification bias on background SMGs via angular cross-correlations. A gravitational lensing simulator aids in interpreting the results. Our analysis confirms that satellite distributions align with a Navarro-Frenk-White profile on large scales. However, a signal drop at ~10 arcseconds suggests strong lensing effects from massive central galaxies or interacting groups. The study provides new insights into the mass density profiles derived from gravitational lensing and their relation to satellite distributions within galaxy clusters. The introduction of a gravitational lensing simulator helps to explain the emergence of an "Einstein Gap"induced by strong lensing effects that suppresses the expected signal. These findings provide a deeper understanding of how satellite galaxies influence gravitational lensing and offer a framework for improving mass density profile estimations in future studies

Autores: CRESPO IGLESIAS, David (Universidad de Oviedo); GONZÁLEZ-NUEVO, Joaquín (ICTEA/Universidad de Oviedo); BONAVERA, Laura (ICTEA - universidad de Oviedo); FERNÁNDEZ FERNÁNDEZ, Rebeca (Universidad de Oviedo)

Presentador: CRESPO IGLESIAS, David (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **44** Tipo: **sin especificar**

Magnification bias on multi-catalogue Herschel submillimetre galaxies

jueves, 19 de junio de 2025 18:30 (15 actas)

Submillimetre galaxies (SMGs) are exceptional background sources for magnification-bias studies, but the inherently limited sky coverage in the submillimetre band constrains their statistical power. Beyond H-ATLAS, Herschel has produced additional submm catalogues, although not optimised for statistical lensing analyses.

Our goal is to enhance the cosmological constraints derived from SMG magnification bias by exploiting the full submm sky surveyed by Herschel.

We augmented the SMG sample by incorporating other Herschel catalogues that overlap with SDSS spectroscopic lens samples. Random catalogues were generated via kernel density estimation to compute the cross-correlation functions . Markov Chain Monte Carlo techniques were then employed to extract both astrophysical and cosmological parameters for each individual catalogue and for the combined dataset.

Individual Herschel catalogues yield reasonable central values for Ω_M and σ_8 but suffer from large uncertainties. The combined analysis—dominated by the statistically superior H-ATLAS dataset —nonetheless improves precision sufficiently to place for the first time a full constraint on the Hubble parameter, finding $\Omega_M = 0.25^{+0.03}_{-0.05}, \sigma_8 = 0.74^{+0.06}_{-0.05}, h = 0.74^{+0.11}_{-0.20}$.

Submillimetre galaxies (SMGs) prove to be excellent background sources for magnification bias, but the limited sky coverage in the submillimetre remains a major constraint. Wider surveys specifically designed for lensing would make it possible to probe larger angular scales via cross-correlation, ultimately delivering more competitive constraints. In that context, magnification bias could become an independent and complementary probe in cosmological analyses.

Autores: CRESPO IGLESIAS, David (Universidad de Oviedo); GONZÁLEZ-NUEVO, Joaquín (ICTEA/Universidad de Oviedo); CASAS GONZÁLEZ, José Manuel (Universidad de Oviedo); CANO DÍEZ, Juan Alberto (Universidad de Oviedo); BONAVERA, Laura (ICTEA - universidad de Oviedo); M. CUELI, Marcos (SISSA); FERNÁNDEZ FERNÁNDEZ, Rebeca (Universidad de Oviedo)

Presentador: FERNÁNDEZ FERNÁNDEZ, Rebeca (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **45** Tipo: **sin especificar**

Neural Networks for CMB polarisation recovery

jueves, 19 de junio de 2025 18:00 (15 actas)

The study of the cosmic microwave background (CMB) and its anisotropies is crucial for understanding the cosmology and formation processes of the Universe. Investigating the E and B modes of CMB polarization provides insights into early Universe density and gravitational perturbations, respectively. B-mode polarization, in particular, offers vital information regarding the existence of primordial gravitational waves and serves as a test for inflationary cosmological models, though it poses significant challenges for characterization.

In this study, we simulate the CMB across various frequencies and tensor perturbation intensities, accounting for contamination from galactic foreground signals (thermal and synchrotron emission), extragalactic point sources, and instrumental noise. We develop a Fully Convolutional Neural Network (FCNN) capable of recovering the CMB with the aim of determining up to which value of the tensor-to-scalar ratio this method is able to retrive the signal. This tool aims to enhance next-generation high-resolution experiments for the precise extraction of the CMB signal and the characterization of background components.

This presentation will provide an overview of the problem, outline our objectives, and detail the development and results of the implemented artificial intelligence approach.

Autor: RODRÍGUEZ CABO, Sara (Universidad de Oviedo)

Presentador: RODRÍGUEZ CABO, Sara (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **46** Tipo: **sin especificar**

Recent advances in neuromorphic computing and artificial intelligence for calorimetry

jueves, 19 de junio de 2025 18:15 (15 actas)

Neuromorphic computing is based on encoding information across a "time" component: the so-encoded information can be processed in a nontrivial way with spiking neural networks. We simulate hadrons impinging on a homogeneous lead-tungstate calorimeter and detect the resulting light via an array of light-sensitive sensors whose signals we process using a neuromorphic computing system. We show that the extracted primitives offer valuable topological information about the timestamped shower development in the material, without needing to increase the granularity of the medium itself (https://arxiv.org/abs/2502.12693).

Furthermore, I will show how hadrons identification at high energies can be improved using the topology of their energy depositions in dense matter, along with the time of the interactions. We focus on the impact of calorimeter granularity by progressively merging detector cells and extracting features like energy deposition patterns and timing information. Our results indicate that fine segmentation improves particle discrimination, with higher granularity yielding more detailed characterisation of energy showers (https://arxiv.org/abs/2502.10817).

Autor: Dr. VISCHIA, Pietro (Universidad de Oviedo and Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Presentador: Dr. VISCHIA, Pietro (Universidad de Oviedo and Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **47** Tipo: **sin especificar**

Candidate Gravitationally Lensed Submillimeter Galaxies in Herschel-ATLAS Associated with WISE Elliptical Counterparts

viernes, 20 de junio de 2025 13:45 (15 actas)

We present a new and independent methodology to identify gravitational lens candidates using data from the H-ATLAS and AllWISE surveys. Unlike previous approaches, which are typically biased toward bright, strongly lensed submillimeter galaxies (SMGs), our method targets fainter systems with lower magnifications. This enables the identification and individual study of lensing events that would otherwise only be accessible through statistical weak lensing analyses. Our approach focuses on high-redshift SMGs from H-ATLAS in the range $1.2 < z < 4.0$, and searches for associated AllWISE sources within an angular distance of 18 arcseconds. Candidate lenses are selected based on their WISE colors ($0.5 < W2 - W3 < 1.5$ mag), consistent with those of elliptical galaxies, and further filtered using $J-W1$ color and photometric redshift to reduce stellar contamination. This conservative selection yields 68 new lens candidates. We then performed SED fitting with CIGALE across UV to sub-mm wavelengths to estimate the physical properties of both the lenses and the background SMGs, and to assess the lensing nature of these candidates. Despite uncertainties, we constrained key parameters such as stellar and dust masses, infrared luminosities, and SFRs. In addition, the estimated magnifications for most candidates are modest, consistent with the weak lensing regime ($\mu \simeq 1$–1.5), although a few sources may require further modeling. Future efforts could refine this methodology to recover additional candidates outside our selection, and high-resolution follow-up observations will be essential to confirm the lensing nature of these sources and to further investigate their physical properties.

Autor: CANO DÍEZ, Juan Alberto (University of Oviedo)

Coautores: GONZÁLEZ-NUEVO, Joaquín (ICTEA/Universidad de Oviedo); BONAVERA, Laura (ICTEA - universidad de Oviedo); MUÑIZ CUELI, Marcos (SISSA); Sr. BAKX, Tom (Chalmers University of Technology, Nagoya University); CASAS, José Manuel (Universidad de Oviedo); CRESPO IGLESIAS, David (Universidad de Oviedo); FERNÁNDEZ FERNÁNDEZ, Rebeca (Universidad de Oviedo, ICTEA)

Presentador: CANO DÍEZ, Juan Alberto (University of Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **48** Tipo: **sin especificar**

Analysis of the binary star TIC 33477093

jueves, 19 de junio de 2025 16:05 (15 actas)

The Arcturus stream is an overdensity of stars surrounding the star Arcturus, whose origin remains uncertain. One hypothesis suggests that it could have an extragalactic origin, which would offer a unique opportunity to detect exoplanets originating from outside our Galaxy. After conducting a search for stars and downloading their TESS photometry, we detected that one of the stars (TIC 33477093) shows transit-like signals. Following a thorough analysis, including the use of HARPS spectra, we discovered that it is not an exoplanet in orbit, but rather a close binary system causing anomalous rotation in the primary star. Therefore, we carried out a complete characterization of the system with the aim of establishing it as a reference within the Arcturus Stream, as no other confirmed binary systems are currently known within it.

Autor: IGLESIAS ÁLVAREZ, Santiago (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias)

Presentador: IGLESIAS ÁLVAREZ, Santiago (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **49** Tipo: **sin especificar**

Scale separated AdS3 Vacua from String Theory

viernes, 20 de junio de 2025 10:20 (15 actas)

Modern theoretical physics suggests that our universe might be just one of many possible solutions allowed by string theory, a leading candidate for a theory of everything. These possible solutions, often called the "string landscape," describe different ways in which extra dimensions can be compactified so as to produce different physical universes. While much of the focus has traditionally been on four-dimensional vacua, three-dimensional compactifications provide a highly controlled setting to explore deep questions about vacuum structure, stability, and the Swampland constraints.
In this talk, I will present recent work on Type II orientifold flux compactifications to three dimensions, incorporating gauge and metric fluxes, orientifold planes, and D-branes. We focus on a class of models we call RSTU-models, which allow for an effective description via half-maximal gauged supergravity. These models give rise to a rich vacuum structure, including perturbatively stable, both supersymmetric and non-supersymmetric, AdS3 and Minkowski vacua. One of the most exciting results is the discovery of stable, non-supersymmetric AdS3 solutions exhibiting parametrically-controlled scale separation, a feature typically hard to achieve and essential for connecting to real-world physics.

Autor: ARBOLEYA MEGIDO, Álvaro (Universidad de Oviedo)

Presentador: ARBOLEYA MEGIDO, Álvaro (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **50** Tipo: **sin especificar**

5d SCFTs, Brane Webs, Geometric Engineering and the Tangram

viernes, 20 de junio de 2025 13:15 (15 actas)

Supersymmetric QFTs in 5 dimensions are a surprising result coming from string theory. In this talk, we will present two powerful methods from which they are constructed: one using geometries called Calabi-Yau (CY) 3-folds in M-theory, and another involving networks of 5-dimensional branes that form intricate structures called brane webs. A singular CY engineers a superconformal theory. The ways how such singularities can be removed (resolutions/deformations) encode information about the vacua of the 5d QFT (extended Coulomb/Higgs branch). If the CY is toric, then the deformations can be mapped in a straightforward way to the brane web via toric diagrams. One can go beyond the toric case by introducing 7-branes and making several external 5-branes end on them, these are Generalized Toric Polygons (GTPs). The fundamental junction of these GTPs are called T-cones, corresponding to a certain type of smoothable singularity. T-cones can be combined to tessellate the toric diagrams in the so-called 5d Tangram. We also clarify how certain transformations in the brane setups, known as Hanany-Witten transitions, map onto smooth changes in the CY geometry.

Autor: CARREÑO BOLLA, Ignacio (University of Oviedo, ICTEA)

Presentador: CARREÑO BOLLA, Ignacio (University of Oviedo, ICTEA)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **51** Tipo: **sin especificar**

Summary of European Strategy for Particle Physics from RECFA

viernes, 20 de junio de 2025 11:30 (45 actas)

In this talk I will describe the process in place to produce the third update to the European Strategy for Particle Physics (ESPP) that should be ready in 2026. I will go through the more than 200 inputs received as of March 31^{st} and the decisions taken during the process. All this information will be discussed during an open symposium that will be held in Venice at the end of June.

Autor: MARTÍNEZ RIVERO, Celso (IFCA (Csic-UC))

Presentador: MARTÍNEZ RIVERO, Celso (IFCA (Csic-UC))

Clasificación de la sesión: Presentaciones invitadas

Clasificación de temas: FPAUO

ID de Contribución: **52** Tipo: **sin especificar**

From Higgs to Di-Higgs

jueves, 19 de junio de 2025 11:15 (45 actas)

Autor: CEPEDA, Maria

Presentador: CEPEDA, Maria

Clasificación de la sesión: Presentaciones invitadas

Clasificación de temas: FPAUO

ID de Contribución: **53** Tipo: **sin especificar**

Holography, supergravity and string theory

viernes, 20 de junio de 2025 9:45 (20 actas)

We will review the different lines of research carried out by the institute members working in the field of holography, supergravity and string theory.

Autor: LOZANO, Yolanda (University of Oviedo)

Presentador: LOZANO, Yolanda (University of Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **54** Tipo: **sin especificar**

INTREPID: INnovative TRiggEr techniques for beyond the standard model PhysIcs Discovery at the LHC

jueves, 19 de junio de 2025 12:50 (20 actas)

We will discuss the progress of the project.

Autor: FOLGUERAS, Santiago (Universidad de Oviedo)

Presentador: FOLGUERAS, Santiago (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **55** Tipo: **sin especificar**

A simplified model of the knee coronal plane alignment

jueves, 19 de junio de 2025 17:45 (15 actas)

A clinical case in which a patient exhibits knee valgus after a hip replacement motivates research into what caused this previously asymptomatic condition and, specifically, into how changing the morphology of the hip could cause varus or valgus depending on the knee morphology as classified by CPAK.
We have developed a simplified model of the knee, which allows for quick parametric iteration over the CPAK input space, showing which type of knees are more vulnerable to extreme valgus (CPAK III) and varus (CPAK VII) due to their morphology.

Autores: RODRÍGUEZ PEREIRA, César; GRACIA RODRÍGUEZ, Jaiver (Universidad de Oviedo); SÁNCHEZ LASHERAS, Fernando (Universidad de Oviedo); Dr. MURCIA ASENSIO, Antonio (Hospital Universitario Reina Sofía)

Presentador: RODRÍGUEZ PEREIRA, César

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **57** Tipo: **sin especificar**

Physics with the CMS detector in the Run 3 of the LHC and upgrade of the L1 trigger and muon systems for the phase-2 of the LHC at CERN

viernes, 20 de junio de 2025 12:15 (20 actas)

The project described in this proposal has two main goals. The first one focuses on the upgrade of the CMS Muon and trigger systems in the context of the High-Luminosity LHC (HL-LHC), representing a technological advance with the objective of providing better technologies for particle detectors, while the second goal targets the physics analysis of the CMS data, aiming for a deeper understanding of the ultimate components of matter.

Autor: CUEVAS, Javier

Presentador: CUEVAS, Javier

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **58** Tipo: **sin especificar**

Exploring the Solar System through Astronomical Observations

jueves, 19 de junio de 2025 17:25 (20 actas)

In this talk, I will present the different observational projects I am involved in, for which I am actively seeking support in the form of master's and PhD students, as well as collaborations within the ICTEA and the University of Oviedo.

One of the main projects is ESSTE-JWST, which builds upon the success of previous programs such as DiSCo and GTO-KBOs, both operational since 2022. ESSTE-JWST aims to investigate the surface properties of a diverse and representative sample of primitive small bodies in our Solar System, spanning from the inner asteroid belt to the trans-Neptunian region. We are particularly interested in understanding how non-icy materials—such as dry or hydrated silicates and complex organics—vary across these populations and how they connect to key processes that delivered water and organic matter to the early Earth.

This project combines the unprecedented capabilities of the James Webb Space Telescope (JWST) with expertise from the IAC and my team to generate insights that address fundamental questions about planetary formation and the origin of life. Beyond its scientific goals, ESSTE-JWST has a strong educational component, providing opportunities for new generations of researchers to work with cutting-edge space mission data.

In the coming years, and thanks to ESSTE-Webb, the plan is to extend these studies of small body materials from the domain of ices to include asteroids—particularly near-Earth objects (NEAs)—by leveraging not only JWST observations but also other resources, primarily those available at the Observatorio del Teide (OT). I look forward to fostering collaborations that will strengthen this effort and contribute to the broader understanding of the composition and evolution of small bodies in our Solar System.

Autor: PINILLA-ALONSO, Noemí (ICTEA)

Presentador: PINILLA-ALONSO, Noemí (ICTEA)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **59** Tipo: **sin especificar**

Cosmology @ICTEA

jueves, 19 de junio de 2025 12:30 (20 actas)

Summary of the cosmology activities @ICTEA. It will cover both the gravitational lensing activities as well as the Neural Network applications to the CMB images.

Autores: GONZÁLEZ-NUEVO, Joaquín (ICTEA/Universidad de Oviedo); Dr. BONAVERA, Laura (ICTEA-UO)

Presentador: GONZÁLEZ-NUEVO, Joaquín (ICTEA/Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **60** Tipo: **sin especificar**

Exploring Optical Neural Networks for Real-Time Adaptive Optics in Large Telescopes

jueves, 19 de junio de 2025 15:45 (20 actas)

In recent years, neural networks have been extensively employed within our group to address challenges in adaptive optics, leading to several innovative approaches, including sensorless wavefront correction and the prediction of atmospheric turbulence. Despite their potential, a major limitation of these methods lies in the substantial computational demands associated with real-time implementation in large-aperture telescopes—demands that remain challenging even for modern GPU-based systems.

To overcome this constraint, we are currently investigating the use of **Optical Neural Networks (ONNs)**, which offer the promise of ultra-fast computation by leveraging the intrinsic parallelism of light propagation. Specifically, we aim to implement ONNs through **Spatial Light Modulators (SLMs)**, enabling the execution of neural network operations at photonic speeds, thereby significantly reducing latency and enhancing the feasibility of real-time adaptive optics correction.

Autor: GONZÁLEZ GUTIÉRREZ, Carlos (Universidad de Oviedo)

Presentador: GONZÁLEZ GUTIÉRREZ, Carlos (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **61** Tipo: **sin especificar**

Mine-to-H2: A Flagship Demonstration of Green Hydrogen Production in Post-Coal Regions under the RFCS Big Ticket Framework

jueves, 19 de junio de 2025 17:05 (20 actas)

1. Abstract
   The Mine-to-H2 project is a large-scale European initiative co-funded by the Research Fund for Coal and Steel (RFCS) under the "Big Ticket" mechanism. It aims to repurpose legacy coal infrastructures for the production and distribution of green hydrogen, contributing to the decarbonisation of the energy and transport sectors while supporting the just transition of coal-dependent regions. The project demonstrates a systemic, multidisciplinary approach to energy transformation, regional revitalization, and social inclusion. The hydrogen production plant will be built at the former Fondón coal mine in Asturias (Spain), with a total project duration of 54 months (April 2024 –September 2028) and a budget of €18 million.

2. Introduction
   Coal mining regions across Europe are undergoing profound socio-economic and technological transformations driven by climate neutrality targets. The Mine-to-H2 project represents a paradigm shift in this transition by converting an emblematic post-mining site into a hub for green hydrogen production and clean mobility.
   Funded through the RFCS Big Ticket scheme, the project aligns with the European Green Deal, the Net-Zero Industry Act, and the Just Transition Mechanism by integrating renewable energy, clean fuel generation, industrial decarbonisation, and workforce reskilling into a unified demonstration.

3. Objectives
   The main objectives of the project are:
   • Deploy a modular, renewable-powered green hydrogen production plant based on electrolysis of mine water.
   • Store hydrogen in high-pressure tanks (500 bar) and distribute it via virtual pipeline to regional demand centres.
   • Operate a hydrogen-fuelled intercity bus line connecting key Asturian cities (Oviedo, Gijón, Avilés).
   • Integrate the system with existing geothermal heating infrastructure at Pozo Fondón.
   • Facilitate a Just Transition through training programs targeting former coal workers.

4. Technical Approach and Work Packages
   The project is structured around seven interlinked Work Packages (WPs).
   Work Package 1: Project Coordination and Management
   This package ensures efficient coordination across the consortium, maintaining continuous communication among partners and with the European Commission. It includes the organization of technical and administrative meetings, oversight of project milestones and deliverables, preparation of periodic reports, and integration of Just Transition principles. A key deliverable is the Consortium Agreement, safeguarding intellectual property and governance rights. A Steering Committee comprising representatives from all partners will provide strategic oversight. Additionally, this work package includes the design, development, and maintenance of the official project website as a central dissemination platform.
   Work Package 2: Planning and Engineering
   Structured into three progressive phases, this work package transforms the project's vision into actionable infrastructure. It begins with Preliminary and Executive Design, which translates conceptual ideas into optimized layouts and identifies potential environmental impacts. The Basic Engineering phase develops the technical documentation required to

initiate the permitting process. Finally, Detailed Engineering finalizes all technical specifications, ensuring readiness for procurement, construction, and commissioning. DURO FELGUERA, HUNOSA, and NORTEGAS lead this package, leveraging their complementary expertise in engineering and industrial systems.
Work Package 3: Permitting Procedures and Approvals
This package manages all legal and regulatory procedures necessary for the project's implementation. It includes obtaining the Integrated Environmental Authorization (IEA), which involves preparing environmental impact documentation and engaging stakeholders through public consultation. Subsequent tasks address Administrative Authorizations and Municipal Permits, ensuring full compliance with national and local regulations. A key component is the Power Purchase Agreement (PPA), securing renewable electricity supply for the electrolyser, which reflects the project's commitment to carbon-neutral hydrogen production and alignment with Spain's sustainability targets.
Work Package 4: Procurement and Construction
This work package encompasses the entire procurement cycle and construction of the hydrogen production facility. It starts with competitive tendering for major equipment and materials, followed by rigorous Factory Acceptance Testing (FAT). The mechanical, electrical, and control systems will be assembled and integrated on-site. Civil engineering works will adapt and reinforce existing infrastructure to host the new plant, while a solar photovoltaic (PV) installation will be built to supplement the green energy input. The execution plan emphasizes sustainability, operational safety, and minimal disruption to the local environment.
Work Package 5: Commissioning and Start-Up
This phase validates the functionality and integration of all systems through a structured approach. It begins with the creation of a Digital Twin, enabling virtual simulations of plant operations, including integration with the district heating network. Cold and hot commissioning phases test the system under inactive and operational conditions, respectively. The start-up process emphasizes performance optimization, safety compliance, and reliability, ensuring that the hydrogen production unit operates efficiently. Collaboration among DURO FELGUERA, HUNOSA, and NORTEGAS ensures knowledge transfer and best practices.
Work Package 6: Supporting Measures
Focusing on cross-cutting strategic dimensions, this package includes technical risk assessments—particularly around hydrogen safety—and benchmarking against similar industrial conversions from coal to hydrogen. A Digital Twin will facilitate scenario testing for failure modes and process optimization. A business case will be developed to demonstrate economic feasibility and replicability. Furthermore, a reskilling strategy will be implemented to train former coal workers for employment in renewable energy, underlining the project' s contribution to regional just transition and human capital development.
Work Package 7: Communication, Dissemination, and Exploitation
This package ensures that the project's outcomes are effectively communicated to stakeholders and the wider public. It includes the development of promotional materials, scientific publications, and participation in industry events. Workshops and online platforms will disseminate knowledge and foster dialogue within the renewable energy and coal transition communities. Exploitation strategies will aim at scaling up project results, fostering innovation uptake, and enhancing the visibility of Mine-to-H2 as a flagship European initiative in green hydrogen production from former mining sites.

5. Expected Impacts
The Mine-to-H2 project delivers multiple benefits:
• Technological: Integration of hydrogen production, thermal energy recovery, and mobility in a single post-mining ecosystem.
• Environmental: Reduction of CO_2 emissions through substitution of fossil fuels and valorisation of mine water.
• Socio-economic: Creation of green jobs and re-skilling opportunities for displaced coal workers.
• Replicability: Demonstrates a scalable model adaptable to other post-coal regions in Eu-

rope.

6. Project Partners:

- GIG-PIB (Poland) (Coordinator)
- Universidad de Oviedo
- HUNOSA
- Duro Felguera
- ALSA
- HYREN

1. Conclusions
   Mine-to-H2 is a strategic demonstration of the potential of Big Ticket RFCS projects to support Europe's industrial decarbonisation and energy autonomy. By leveraging existing mining infrastructure for innovative energy systems, the project exemplifies the circular and systemic principles of the Green Deal. The multidisciplinary partnership and high TRL approach ensure technical viability, societal acceptance, and strong potential for regional replication and policy alignment.
2. References
   Mine-to-H2 Project. (s.f.). Mine-to-H2: Hydrogen production from mining areas. Universidad de Oviedo. https://minetoh2project.uniovi.es/

Autores: Dr. SUÁREZ SÁNCHEZ, Ana (Universidad de Oviedo); Dr. MARQUÉS SIERRA, Antonio (Universidad de Oviedo); IGLESIAS RODRÍGUEZ, Francisco Javier (Profesor Titular de Administración de empresas); Dr. FIDALGO VALVERDE, Gregorio (Universidad de Oviedo); Dr. RIESGO FERNÁNDEZ, Pedro (Universidad de Oviedo)

Presentador: IGLESIAS RODRÍGUEZ, Francisco Javier (Profesor Titular de Administración de empresas)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **62** Tipo: **sin especificar**

A Brief History of Black Holes

viernes, 20 de junio de 2025 9:00 (45 actas)

I will review the history of the concept of black hole starting with the Newtonian idea of "dark stars" and finishing with some of the puzzles and paradoxes they lead to, specially when quantum-mechanical effects are taken into account.

Presentador: Prof. ORTÍN, Tomás (IFT UAM/CSIC)

Clasificación de la sesión: Presentaciones invitadas

Clasificación de temas: FPAUO

ID de Contribución: **63** Tipo: **sin especificar**

Continuous symmetry defects and brane/anti-brane systems

jueves, 19 de junio de 2025 16:20 (15 actas)

We study how certain "defects" tied to continuous symmetries affect correlation functions in bosonic field theories. We show that to match expected action, these defects must include a correction term as a kind of singular background gauge field. This fact has deep consequences in holography, where these defects are realized as $D(q-1)$ branes near the boundary of the bulk. We show that the regularization of the defects can be regarded as a system $Dq/\overline{Dq}$ branes that extend into the bulk, tieing with the concept of regularization by "thickening". An explicit example is presented in terms of the baryon symmetry in Klevanov-Witten theory.

Autor: CALVO CASTRO, Hugo (Universida de Oviedo)

Presentador: CALVO CASTRO, Hugo (Universida de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **64** Tipo: **sin especificar**

Study of the feasibility of accelerating MC generation with FPGAs

viernes, 20 de junio de 2025 12:55 (20 actas)

Monte Carlo (MC) event generation is a crucial component of high-energy physics simulations, yet its computational cost poses significant challenges, particularly in the era of increasing data volumes. Recently, new solutions are being explored by developers of MC generators, that aim to accelerate the process of integrating matrix elements in GPU architechtures. These solutions achived great performance and speedups, with a non negligible cost on consumption power. A solution based on Field Programmable Gate Arrays (FPGAs) could benefit from the inherent parallelism and low-latency of FPGAs, with an expected gain in power consumption cost. This talk explores the feasibility of accelerating MC generation using We discuss key implementation strategies, performance benchmarks, and the implications of FPGA-accelerated MC generation for future experiments and large-scale simulations.

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Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **65** Tipo: **sin especificar**

AstroExploration

viernes, 20 de junio de 2025 12:35 (20 actas)

This contribution will present the main results obtained by the ICTEA in various areas of astrophysical research over the past few years.

One of the research lines focuses on studying the spin state and morphology of Near-Earth Asteroids (NEAs). For this, photometric techniques are applied, specifically light curve inversion, which allows for the reconstruction of 3D models and the determination of the spin properties of these objects.

Furthermore, we will address the application of Machine Learning techniques in the field of exoplanet detection and characterization. We'll showcase the progress made in developing algorithms to identify and analyze the transit signals of these extrasolar worlds.

Finally, we will present the second phase of the K2-OjOs Project, a pro-am collaboration spearheaded by ICTEA. In this stage, significant advancements have been made in the search for exomoon candidates using light curves from the main Kepler mission, highlighting the synergy between professional research and the contributions of amateur astronomers.

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Clasificación de la sesión: Sesión ICTEA

ID de Contribución: **66** Tipo: **sin especificar**

X2O Testing and Validation

viernes, 20 de junio de 2025 10:35 (15 actas)

Testing and validation of the CMS X2O boards at UFL

Autor: PRADO, Javier

Presentador: PRADO, Javier

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **67** Tipo: **sin especificar**

Confining models in Holography

jueves, 19 de junio de 2025 18:45 (15 actas)

String Theory and Holography provide a framework which geometrically describes Quantum Field Theory (QFT) phenomena. This has been particularly fruitful for the study of confining QFT, whose strong coupling regime is not accessible through standard QFT techniques. The geometries realizing these type of theories usually have a submanifold that shrinks to zero size at some point. We review some confining models, focusing on the case where the submanifold is a circle, and comment on how it is possible to preserve some amount of supersymmetry in the process.

Autor: STUARDO, Ricardo (Universidad de Oviedo)

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Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: FPAUO

ID de Contribución: **68** Tipo: **sin especificar**

Aplications of artifical neural networks to CMS observations

viernes, 20 de junio de 2025 13:30 (15 actas)

Traditional methods for component separation, while effective, often require extensive masking to mitigate contamination from galactic and extragalactic foregrounds, limiting the amount of usable sky for analysis and introducing residual biases and systematic uncertainties. By employing modern neural network (NN) architectures, such as convolutional neural networks (CNNs) and fully convolutional neural networks (FCNNs), this project aims to overcome these limitations, delivering a more accurate and efficient separation of the CMB signal from foreground contaminants with minimal masking or developing methods capable of directly estimating power spectra. This novel approach not only increases the efficiency of data analysis but also enhances the accuracy of polarization measurements, particularly for the challenging BB-mode signal, which is a key observable for probing inflationary gravitational waves.

Nevertheless, since most FCNNs are designed for 2D image processing, their use for our purposes introduces challenges in capturing large-scale CMB fluctuations, transitioning from patch-based analyses to full-sky representations, and introducing potential polarization leakage effects at patch boundaries. Having this into account, the first part of the research proposed, which is the subject of the present talk, has been devoted to investigate these methodological issues, seeking to optimize patch size and resolution and evaluate reprojection techniques that may mitigate boundary artifacts and improve the accuracy of power spectrum estimation.

Autor: FRANCO VELÁSQUEZ, Valentina (Universidad de Oviedo)

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Presentador: FRANCO VELÁSQUEZ, Valentina (Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

Clasificación de temas: MOMA

ID de Contribución: **69** Tipo: **sin especificar**

El Laboratorio Subterráneo de Canfranc

jueves, 19 de junio de 2025 10:30 (45 actas)

El Laboratorio Subterráneo de Canfranc (LSC) es una ICTS española localizada entre el túnel carretero de Somport y el antiguo túnel ferroviario, de unos 8 km, en la frontera España-Francia, y diseñado para la investigación en física de neutrinos, materia oscura y otros fenómenos inusuales en la naturaleza que requieren muy baja radioactividad ambiental para ser observados.
Su director, Carlos Peña Garay, hará una descripción de esta instalación singular en España, sus características y sus objetivos.

Autor: Prof. PEÑA GARAY, Carlos (Director del Laboratorio Subterráneo de Canfranc)

Presentador: Prof. PEÑA GARAY, Carlos (Director del Laboratorio Subterráneo de Canfranc)

Clasificación de la sesión: Presentaciones invitadas

Clasificación de temas: MOMA

ID de Contribución: **70** Tipo: **sin especificar**

The New Robotic Telescope: Advancing Time-Domain Astronomy with Precision Engineering and Autonomous Operation

jueves, 19 de junio de 2025 15:00 (45 actas)

The New Robotic Telescope (NRT) is a 4-meter-class, robotic and fully autonomous optical telescope under development at the Roque de los Muchachos Observatory in La Palma, Canary Islands. The design of the NRT is motivated by the challenges of time-domain astronomy, aiming to support rapid-response observations of transient events such as supernovae, gamma-ray bursts, and variable active galactic nuclei.

The telescope's segmented primary mirror will be made up of 18 one-meter hexagonal segments. This design allows for a lighter structure and faster repositioning of the telescope, but it also requires precise alignment of the segments. To meet this challenge, a custom Shack-Hartmann wavefront sensor has been developed. Using a lenslet array, the sensor detects misalignments within individual segments as well as any tilt between the primary and secondary mirrors. It is built to be robust, cost-effective, and capable of functioning autonomously. The sensor has been successfully validated in laboratory tests and on the Liverpool Telescope.

Alongside the wavefront sensor, the other major subsystems of the NRT are progressing well through critical design phases. In particular, the M3 fold mirror system—which redirects the optical beam to various instrument ports—has completed manufacturing and is currently in the verification stage after a successful design review. he project remains on track for first light by 2030.

This presentation will review the scientific goals driving the NRT, discuss its technical architecture, and provide an update on the progress of key systems. Special attention will be given to the wavefront sensing strategy, which plays a vital role in achieving the precise alignment needed for the segmented primary mirror.

Autor: MIOSSEC, Chloe (LJMU Liverpool)

Presentador: MIOSSEC, Chloe (LJMU Liverpool)

Clasificación de la sesión: Presentaciones invitadas

Clasificación de temas: MOMA

ID de Contribución: **71** Tipo: **sin especificar**

Machine Learning-Based Approaches for Initial Neutron Tagging in Hyper-Kamiokande

jueves, 19 de junio de 2025 13:10 (20 actas)

Hyper-Kamiokande (HK) is a next-generation neutrino experiment in Japan featuring a large water-Cherenkov detector. It aims to tackle key questions in fundamental physics, including precise neutrino oscillation measurements, the study of astrophysical neutrinos (like those from supernovae and the Diffuse Supernova Neutrino Background), and searches for proton and exotic nucleon decays.

Building on over a decade of experience from its predecessor, Super-Kamiokande, HK leverages neutron tagging to enhance sensitivity in these investigations. Neutrons from interactions in HK thermalize and are captured by hydrogen, emitting a faint 2.2 MeV photon—too weak for the standard trigger, requiring post-event PMT scan analysis.

This study introduces a neural network-based method to identify PMTs likely to detect this delayed signal. The approach significantly improves neutron signal selection, boosting efficiency from 58% to 75% over traditional threshold-based methods, while also enhancing candidate purity and aiding in subsequent signal reconstruction.

Autor: SUÁREZ GÓMEZ, Sergio Luis (University of Oviedo, Department of Mathematics)

Presentador: SUÁREZ GÓMEZ, Sergio Luis (University of Oviedo, Department of Mathematics)

Clasificación de la sesión: Sesión ICTEA