IAC REPORT

Instituto de Astrofísica de Canarias

2024

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PUBLIC CONSORTIUM

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ÍNDICE

First orbit completed

This July, it has been year since I took up the position of director of the Instituto de Astrofísica de Canarias (IAC). It has been an intense and exciting year, during which I have been able to see first-hand how the IAC continues to be an international reference in Astrophysics, capable of attracting top-level scientific and technological projects.

During this time, we have experienced significant changes. In September, the Consejo Rector appointed Prof. Eva Villaver Sobrino as the new deputy director, a key step in strengthening the centre's structure.

We have also promoted coordination between our two major observatories, Roque de los Muchachos and Teide, which are now under the responsibility of Emilio García García. The objective is clear: to unify procedures and make better use of our resources. In the area of Instrumentation, we have had a very special development: Marcos Reyes García-Talavera has been appointed as the new head, becoming the first engineer trained entirely at the IAC to occupy this important position. It is a milestone that fills us with pride.

As for major international projects, the Observatorios de Canarias continue to consolidate their global leadership in high-energy Astronomy. We already have four LST telescopes from the future Cherenkov Telescope Array Observatory in various stages of construction at the ORM, and the progressive installation of the ASTRI telescopes at the OT continues.

The European Solar Telescope, one of our leading projects for studying the Sun, has successfully passed the Preliminary Design Review of its optical system and is steadily moving towards its construction and definitive internationalisation.

We are also continuing to work on key improvements for the Gran Telescopio Canarias (GTC), such as the development of its adaptive optics system, which includes several components such as GRANCAIN, FRIDA and the laser guide star.

Thanks to the excellent collaboration between the technical teams at the GTC and the IAC, we are getting closer and closer to achieving the co-phasing of the primary mirror, a crucial improvement for the telescope's performance.

Meanwhile, IACTEC continues to consolidate its position as a platform for technological innovation, especially in the field of New Space. Noteworthy developments include progress on the Constelación Canaria de Satélites and the launch of in-house capabilities for manufacturing precision optics, which opens new doors for collaboration with companies in the sector.

This year has allowed us to reflect on our priorities and align them with a strategy to modernise the centre. Among the objectives are to promote synergies between our scientific lines, to promote cross-cutting projects such as the development of instrumentation, to renew the telescope time management system at the Observatorios de Canarias (OCAN), to apply artificial intelligence in astrophysics and to improve the distribution of scientific data from our observatories. In line with these efforts, we have also presented the new OCAN Strategic Plan, strengthening our international projection.

However, we are also aware of the challenges that lie ahead. The most pressing ones relate to funding and the very high administrative workload, which is putting our operations to the test. Management is actively working to find sustainable solutions in the medium term. In the meantime, we need to continue to make a collective effort to adapt to the current situation in a realistic manner.

We are convinced that, with the commitment and dedication of everyone who forms part of the IAC, and with the support of our consortium administrations, we will be able to overcome these challenges and continue to strengthen the role of the IAC as a leading institution in astrophysics worldwide.

With confidence and gratitude, please accept our warmest regards.

Valentín Martínez Pillet and Eva Villaver Sobrino,
Managment of the Instituto de Astrofísica de Canarias

Astrophysics Research

Scientific production in numbers

751 papers in international journals

103 Astrophysical Journal
334 Astronomy & Astrophysics
175 MNRAS
7 Nature
9 Nature Astronomy
123 Others

243 Research Team
80 permanent staff
93 postdoctoral staff
70 predoctoral staff

288 presentations and talks at scientific conferences

8 reviews and guest talks
186 presentations at international conferences
94 presentations at national conferences

The Instituto de Astrofísica de Canarias has achieved a historic record in terms of scientific output and publications in highimpact journals, with 751 papers in international journals during 2024. In addition, it has been present at numerous national and international conferences, with almost 300 participations, including review and guest lectures.

Jesús Falcón Barroso, Research Area coordinator

Research in Astrophysics is one of the fundamental objectives of the Instituto de Astrofísica de Canarias (IAC). The IAC's staff continues to grow every year, with high scientific output and international impact. We work in various fields of research and cover a wide range of the electromagnetic spectrum, from gamma rays to radio waves. We make use of the infrastructure installed at the Observatorios de Canarias and other observatories, as well as space missions from ESA, NASA and other agencies, in addition to supercomputing infrastructure for theoretical work.

This teamwork helps to advance international knowledge from the Canary Islands' infrastructure.

IAC scientists detect a sub-Earth orbiting Barnard's star, the nearest isolated star to the Sun

The sub-Earth exoplanet Barnard b orbits the closest isolated star to the Sun, Barnard's Star. It has at least three times the mass of Mars and orbits its star rapidly, so its year lasts just over three Earth days.

After the triple star system Alpha Centauri, Barnard's Star is the closest star to the Solar System, just six light-years away.

This proximity, and its status as a red dwarf, have led astronomers to study it since 2018 with the ESPRESSO instrument on the VLT telescope. During these years, the research team's efforts focused on the search for possible exoplanets within the habitable zone, the temperate zone of Barnard's Star, where water could exist on the surface of a planet.

Scientific reference: González Hernández et al. "A sub-Earth-mass planet orbiting Barnard's star" 2024, A&A, 90, A79

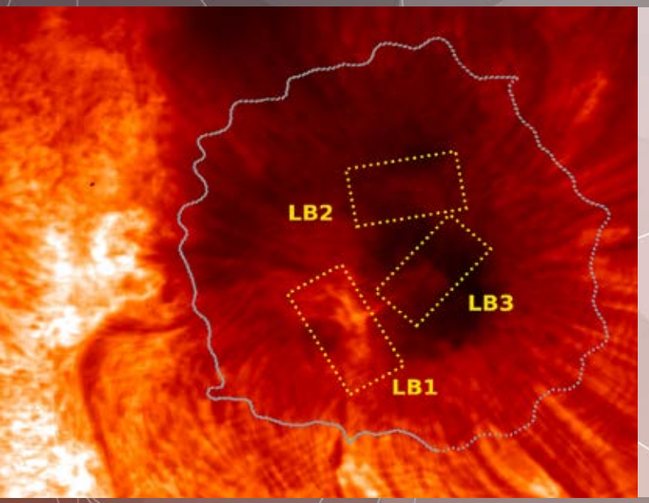
The icy objects beyond Neptune give us clues about the formation of the Solar System

In the outer reaches of the Solar System, beyond the ice giant Neptune, are a series of objects called Centaurs and Transneptunian Objects (TNO's). Spectra obtained with the James Webb Space Telescope (JWST) have shed new light on the composition and evolution of the populations of small bodies in the outer Solar System.

The observations with the JWST have permited an analysis in unprecedented detail of the transformations in the surface composition of these objects, picking out how the sublimation of ices, and other thermal processes have shaped their surfaces as they have come nearer to the Sun. This study shows that the Centaurs are not only an intermediate link between the TNO's and the comets, but also provide key information on the thermal evolution of icy bodies in the Solar System.

Scientific reference: Licandro et al. "Thermal evolution of trans-Neptunian objects through observations of Centaurs with JWST" 2024, Nature Astronomy, 9, 245

Dissecting light bridges for the stratification of their physical properties in geometric height



Light bridges are elongated and bright structures protruding into the umbra of sunspots. The presence of light bridges has a significant role in the evolution of sunspots and the heating of their overlying atmosphere. Therefore, investigating these structures is crucial to understanding fundamental aspects of sunspots.

By applying innovative codes, it has been found that each light bridge shows a different physical scenario. The filamentous light bridge shows properties that may be related to increased chromospheric activity. On the other hand, regions with a granular morphology reveal more abrupt stratifications with characteristics compatible with the injection of hot plasma through convective cells located in favourable positions with a weaker magnetic field.

Scientific reference: Esteban Pozuelo et al. "Properties of sunspot light bridges on a geometric height scale" 2024, A&A, 689, A255 / IMAGEN: NASA

The mystery of the fullerenes in space explained

A pioneering study from the Instituto de Astrofísica de Canarias (IAC) which combines laboratory chemistry with astrophysics, has shown for the first time that grains of dust formed by carbon and hydrogen in a highly disordered state, known as HAC, can take part in the formation of fullerenes, carbon molecules which are of key importance for the development of life in the Universe, and with potential applications in nanotechnology.

Fullerenes are carbon molecules which are very big, complex and highly resistant. Previous infrared spectroscopic data obtained from space telescopes of the planetary nebula Tc1 show spectral lines indicating the presence of fullerenes, but also show broader infrared bands, which are widely detected in the Universe, from small bodies in the Solar System to distant galaxies.

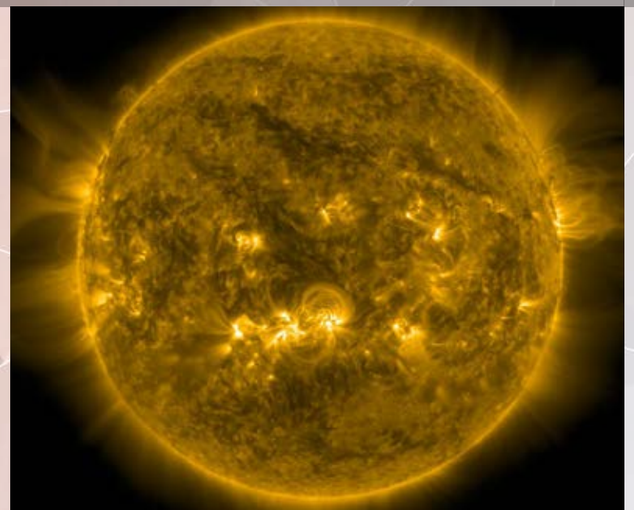
Scientific reference: Gómez-Muñoz et al. "Hydrogenated amorphous carbon grains as an alternative carrier of the 9–13 μm plateau feature in the fullerene planetary nebula Tc1" 2024, A&A, 682, L18

Mapping the Magnetic Field in the Chromosphere of Solar Active Regions

The magnetic field in the solar chromosphere plays a key role in the heating of the outer solar atmosphere and in the build-up and sudden release of energy in solar flares. However, uncovering the magnetic field vector in the solar chromosphere is a difficult task because the magnetic field leaves its fingerprints in the very faint polarization of the light, which is far from easy to measure and interpret.

We found evidence of the magnetic origin of plasma heating in the chromosphere of the active region plage and in the overlying mossy region, with a correlation between temperature, electron density, and vertical magnetic field flux. In the super-penumbra, we found that the hottest regions are located between concentrations of vertical magnetic field flux, suggesting that the heating mechanism may differ from that of the plage, but that the magnetic field continues to play a key role.

Scientific reference: Li et al. "Mapping the Longitudinal Magnetic Field in the Atmosphere of an Active Region Plage from the Inversion of the Near-ultraviolet CLASP2.1 Spectropolarimetric Data" 2024, ApJ, 974, 154



Blue supergiant stars can be formed by the merger of two stars

A pioneering study using data from the FLAMES instrument on the VLT telescope has uncovered clues about the nature of some of the brightest and hottest stars in our Universe, known as blue supergiants. Although these stars are frequently observed, their origin has long been a mystery.

This study simulated detailed models of stellar mergers and analysed a sample of 59 early-type B blue supergiants in the Large Magellanic Cloud, a satellite galaxy of the Milky Way. This study is a breakthrough in solving an old problem about the formation of blue supergiants and indicates the important role of stellar mergers in the morphology of galaxies and their stellar populations. The next part of the study will attempt to explore how these blue supergiants explode and contribute to the landscape of neutron stars and black holes.

Scientific reference: Menon et al. "Evidence for Evolved Stellar Binary Mergers in Observed B-type Blue Supergiants" 2024, ApJL, 963, L42

The metal poor edge of the Milky Way's thin disk

The formation and evolution of the disk of the Milky Way, remains an enigma in Astronomy. The relationship between the thick disk and the thin disk is still unclear. Understanding the chemical and dynamical properties of the stars within these disks is crucial, especially in the parameter spaces where their characteristics overlap.

Using data from the Gaia satellite and the GALAH and APOGEE surveys, further research has been conducted into the discovery of a group of stars with lower metallicity that move at speeds similar to those of the thin disc. Within this group, most stars with characteristics typical of the thin disc have metallicities between -1 and -0.7. Although uncertainty about the origin of the disc persists, studies such as this one help to shed more light on the matter.

Scientific reference: Fernández-Alvar et al. "The metal-poor edge of the Milky Way's thin disc" 2024, A&A, 685, A151

Machine learning reveals the merging history of nearby galaxies

The hierarchical model of galactic evolution suggests that mergers have a substantial impact on the complex processes that drive stellar assembly within a galaxy. However, accurately measuring the contribution of accretion to a galaxy's total stellar mass and its balance with in situ star formation poses a persistent challenge, as it is not directly observable nor easily inferred from observational properties.

Using a machine learning model trained with simulated MaNGA analogues (MaNGIA), obtained from a cosmological simulation, it is revealed that in situ stellar mass dominates almost the entire stellar mass spectrum. Only in the most massive galaxies does accreted mass contribute substantially, reaching 35-40% of the total mass.

Scientific reference: Angeloudi et al. "Constraints on the in situ and ex situ stellar masses in nearby galaxies obtained with artificial intelligence" 2024, Nature Astronomy, 8, 1310

Baryonic properties of nearby galaxies across the stellarto-total dynamical mass relation

Despite the fundamental role that dark matter halos play in our theoretical understanding of galaxy formation and evolution, the interplay between galaxies and their host dark matter halos remains highly debated from an observational perspective. This lack of conclusive observational evidence ultimately arises from the inherent difficulty of reliably measuring dark matter (halo) properties.

This study demonstrates that, at fixed stellar mass, the observed baryonic properties of galaxies in the CALIFA survey have a secondary dependence on total dynamical mass. It also finds a relationship between total dynamical mass and halo masses, both in observed and simulated galaxies. The results indicate that the properties and formation pathways of dark matter halos may have an impact on the observed properties of galaxies.

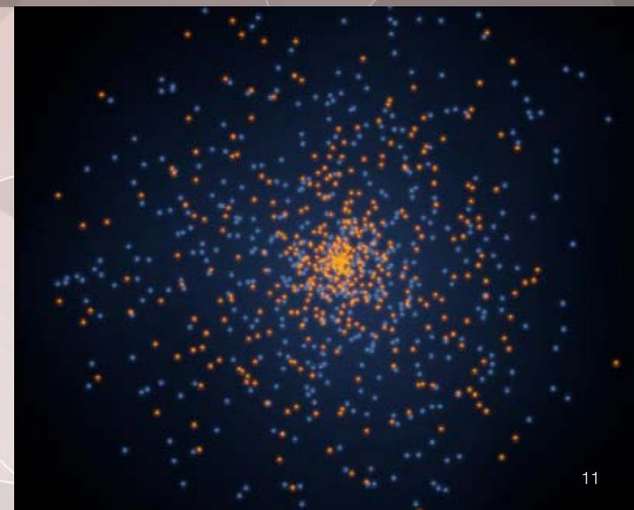
Scientific reference: Scholz-Díaz et al. "Baryonic properties of nearby galaxies across the stellar-tototal dynamical mass relation" 2024, Nature Astronomy, 8, 648

The dark matter experiences forces beyond gravity

The existence of dark matter is likely one of the most perplexing problems facing the scientific community, and unraveling its nature has become one of the primary goals of modern Physics. In simple terms, we do not know what dark matter is made of, despite accounting for 85% of all the matter in the Universe.

In its simplest description, it is composed of particles that interact with each other and with ordinary matter only through gravity. However, this description does not correspond to any physical model. Finding out what dark matter is requires finding evidence of interaction of this matter beyond gravity. This work demonstrates what could be the first evidence in this regard. The study suggests that collisions between dark matter particles or other alternatives to CDM shape these galaxies.

Scientific reference: Sánchez Almeida, et al. "The Stellar Distribution in Ultrafaint Dwarf Galaxies Suggests Deviations from the Collisionless Cold Dark Matter Paradigm" 2024, ApJL, 973, L15



Scientific meetings

CARMENES, exoplanet hunter scientific meeting

The 19th scientific meeting of CARMENES, a collaboration of more than 100 scientists from 11 Spanish-German institutions aimed at studying extrasolar planets around M-type dwarf stars, the lowest mass stars, was held at the IACTEC facilities.

XI Coronal Loops Workshop

The IAC hosted the biennial Coronal Loops meeting, which since 2002 has focused on the observation and modelling of magnetically confined solar plasma in active solar regions. On this occasion, around seventy people attended.

The Whole Sun 2024 Scientific Meeting

Some of the members of The Whole Sun Project, funded by the European Research Council (ERC) through a Synergy Grant, met in Tenerife to share their knowledge about the dynamics and magnetism of the Sun.

Canary Islands Winter School

The IAC and the Universidad de La Laguna (ULL) organised the 25th edition of the Canary Islands Winter School of Astrophysics, which took place in October in La Laguna, Tenerife. This edition, entitled `Baryonic cycle across space&time´, welcomed sixty master's, doctoral and postdoctoral students from thirteen different countries, who received a comprehensive and exhaustive overview of the evolution of galaxies.

Kick-off Meeting of the UNDARK Consortium

The members of the UNDARK Consortium had the opportunity to hold their first meeting at the IAC, where they shared their scientific objectives.

15th Day of Our Science

The scientific community at the IAC keeps alive the tradition of sharing its studies and advances at a conference attended by all research staff.

Spanish Optical Design Meeting

In February, IACTEC hosted a meeting that analysed the current situation regarding various important projects related to optical design in Astronomy and Astrophysics.

SONG 2024 Science Meeting

The SONG24 meeting celebrated its 'Ten Years of Science and the Future with SONG´at IACTEC in 2024. There, dozens of specialists in this field shared their experience in stellar and exoplanet Astrophysics using high-resolution, time-resolved spectroscopy from the Stellar Observation Network Group (SONG).

LSST@ Europe 6 Conference

In September, La Palma hosted the LSST@Europe 6 International Conference, where 140 people from the field of astrophysical research from more than twenty countries presented the latest advances in the LSST project, a cutting-edge initiative in the exploration of the universe.

Solar MHD II Conference

The IAC hosted the second Solar MHD conference (UKUS 7), following the success of the first edition held in Eastbourne. Around fifty international experts gathered to discuss the latest advances in solar magnetohydrodynamics.

Technological Development

Technological production in numbers

74.000 engineering hours in2024
(8% more than in 2023)

86 people in the Instrumentation Area
- 70% Engineering
- 28% technical staff
- 2% coordination and administration

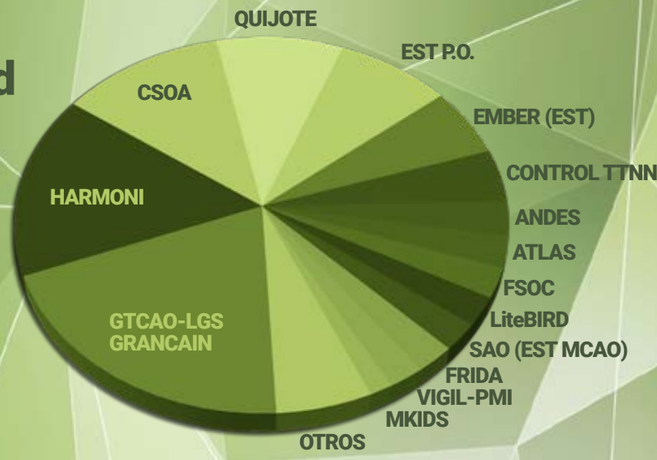
16 students welcomed

84% time spent on projects

13% time spent on management and services

3% time spent on training

Project-based dedication



Marcos Reyes García-Talavera, head of the Instrumentation Department

The fundamental mission of the Instrumentation Department is to design and develop instruments to carry out the IAC's Astrophysics Research programmes, providing technological support to the different groups in the Research Department. We also develop and promote the IAC's technological capabilities, train technical staff and encourage technology transfer.

Our strength comes from an excellent team of professionals, made up of 61 engineers organised into five departments (Optics, Mechanics, Electronics, Software and Projects) and 23 technicians in our Mechanics, Electronics and Optics workshops.

Adaptive Optics System for the Gran Telescopio Canarias (GTCAO) and Laser Guide Star System (LGS)

The GTCAO Project aims to equip the Gran Telescopio Canarias with an Adaptive Optics system to correct atmospheric turbulence, enabling high spatial resolution science. The Laser Guide Star (LGS) system extends this capability by creating an artificial star, extending coverage to any point in the sky.

In 2024, GTCAO commissioning campaigns were carried out, integrating functionalities such as acquisition sequencing, atmospheric dispersion correction and rotation tracking. The performance of the closed-loop system was evaluated with satisfactory results.

The detailed opto-mechanical design of the LGS transfer system responsible for adapting the high-power laser to the launch telescope has been completed. The detailed design of the structure on which the LGS system is mounted on the GTC telescope's elevation ring is being carried out in collaboration with GRANTECAN, SA staff.

HARMONI, the first light instrument for the Extremely Large Telescope (ELT)

HARMONI is an optical-infrared spectrograph with integral field capabilities, high angular resolution operating in cryogenic conditions and with high spectral resolution. This concept has been selected as one of the first light instruments in the Nasmyth focus for the 39-metre Extremely Large Telescope (ELT).

HARMONI can operate from low-order turbulence correction to the diffraction limit. The IAC is responsible for the design and supply of the spectrograph's Pre-Optics (IPO), which configures the optical scales, and HARMONI's Global Control Electronics (ICE).

The IAC's work packages have progressed and the IPO has passed design reviews. The international project is being reorganised and the IAC has continued to develop prototype component tests and work on the preparation of the IPO test cryostat control system.

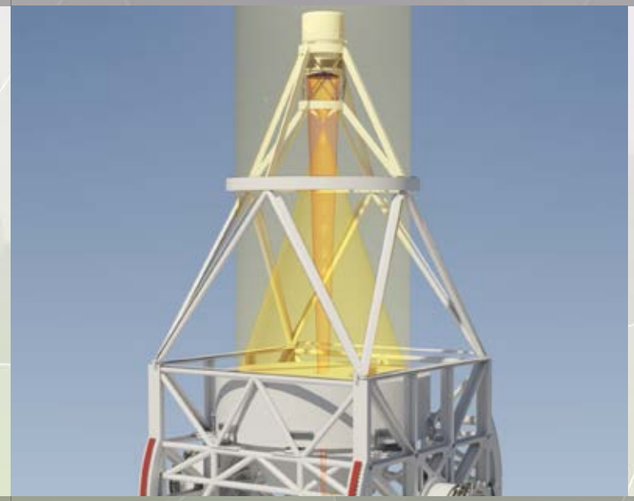
Improvements to QUIJOTE and a suite of instruments for studying the Cosmic Microwave Background

The QUIJOTE-TMS experiment brings together the microwave instrumentation developed at the IAC. As part of this project, two telescopes and two microwave instruments, MFI2 and FTGI, are operating at the Observatorio del Teide.

The MFI2 is a new multi-frequency instrument designed to triple the sensitivity of the data obtained with the first MFI and was installed in November 2023 in QUIJOTE-1. A new acquisition system based on ultra-fast FPGA technology is being developed, which will allow selective filtering of the signal by bands. A prototype of this system, called RIM (Radio Interference MAP), is already available.

The second instrument, the FTGI (Forty and Thirty GHz instrument) operating in QUIJOTE-2, received some improvements, such as the addition of twelve new receivers to the seven existing ones. Work is also underway on the TMS spectrograph, which is in the manufacturing phase, and on the design of the Orthogonal Mode Transducer (OMT).

The IAC is leading the instrumentation for Europe's largest solar telescope: the EST, with a 4-metre primary mirror



The European Solar Telescope (EST) will be the largest solar telescope ever built in Europe. With a 4-metre primary mirror and cutting-edge technology, it will provide solar astrophysicists with a unique tool for understanding the Sun, our star. The IAC leads the EST Project in collaboration with 24 institutions from the 18 member countries of the European Association for Solar Telescopes (EAST).

As the coordinating institution for EST, the IAC has also created the EST Project Office, which is working on the overall design of the telescope. As a technological milestone, the Preliminary Design Review (PDR) of EST began in October with the successful review of the optical design and Adaptive Optics and will end with the overall design review in 2025.

The IAC is responsible for two instruments for the EST, as Spain's contribution to the telescope: the Solar Multi-Conjugate Adaptive Optics (SAO) system and the EMBER spectropolarimeter.

ATLAS Project, technology for the early detection of asteroids

The ATLAS (Asteroid Terrestrial-impact Last Alert System) project, developed by the University of Hawaii and funded by NASA, involves the participation of the Instituto de Astrofísica de Canarias (IAC) through the new unit at the Teide Observatory: ATLAS-Teide.

Its objective is the early detection of asteroids at risk of impacting Earth. With an innovative design that includes sixteen 28 cm telescopes, it stands out for its sensitivity and celestial coverage, as well as contributing to research on supernovae and transient events. The installation of fibre optics and the electrical panel for the servers has been completed. The instrument was developed throughout 2024 and was received in December for integration into the OT. Its completion will strengthen the global ATLAS network, ensuring continuous surveillance of the sky.

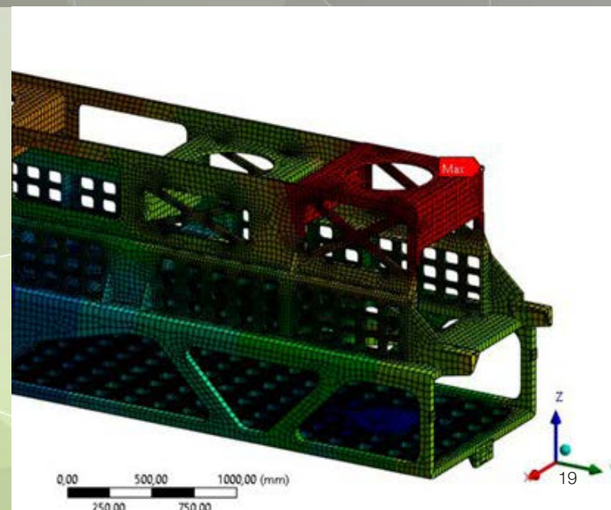
FOTO: Baader Planetarium (2025)

ANDES project for the ELT telescope, a spectrograph designed to search for signs of life on exoplanets

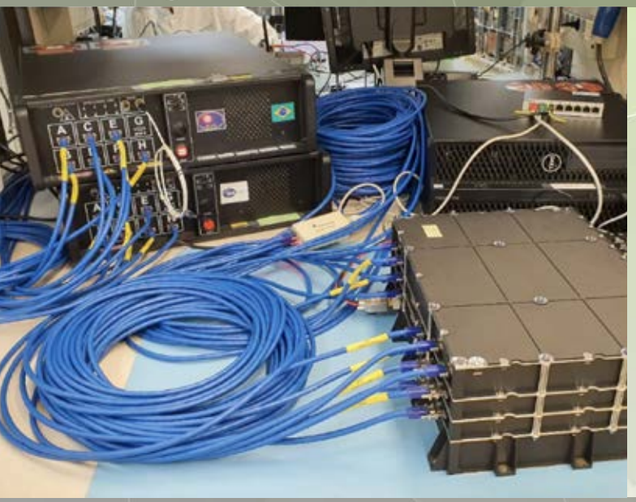
ANDES (High Dispersion Echelle Spectrograph), formerly known as HIRES, is a spectrograph designed to search for signs of life on Earth-like exoplanets, discover the first stars born in the Universe, test possible variations in the fundamental constants of physics, and measure the acceleration of the expansion of the Universe.

The IAC is part of the ANDES consortium, which involves thirteen countries, and is responsible for Spain's participation, coordinating the IAA and the CAB. Spain is responsible for the design and supply of the optical benches for the RIZ and UBV arms, as well as the design and supply of much of the opto-mechanics for these arms.

The preliminary designs, modelling and simulations of the optical benches (RIZ and UBV) and the twenty-two optical mounts for the spectrographs have been completed, with the PDR documentation for the mounts finalised and 80% of that for the benches completed, together with the delivery of all the RAMS analyses of the opto-mechanics.



The PLATO space mission is powered by technology designed in the IAC laboratories



The IAC's responsibility in the PLATO Project is to provide the power supply and monitoring for the Main Electronic Unit (MEU), which aims to configure the twenty-four cameras on the PLATO satellite and process the data. The MEU power supply (MEU-PSU), using energy provided by the satellite, supplies and monitors the status of the MEU unit's internal power supplies, acquires the unit's internal telemetry and establishes communication with the instrument via SpaceWire.

The Prototype Flight Model (PFM), Flight Model (FM) and Flight Spare (FS) models of the MEU-PSU have been manufactured, and in September a meeting was held at the headquarters of CRISA/AIRBUS in Madrid, attended by representatives of ESA, CRISA/AIRBUS, TASE and the IAC, a meeting was held to confirm the flight qualification of the IAC equipment, which will lead to its integration with the rest of the payload as part of the satellite that will be launched in 2026 with an Ariane 6 propellant.

The development of the Centre for Advanced Optical Systems (CSOA) is complete

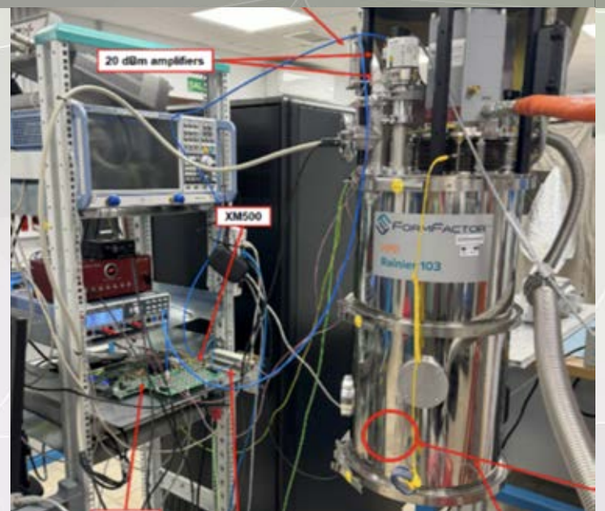
This Project aims to establish an advanced optics production centre based on knowledge in the design and integration of optical elements for astronomical instrumentation. This centre will enable the manufacture of cutting-edge optical components that can be used in other fields of research and for commercial applications beyond astrophysics.

The centre has infrastructure for the generation, cutting, polishing and coating of optics with a diameter of up to 0.5 m, within the laboratory called CSOA 0.5, at the IAC headquarters. In addition, it has a polisher and an optical coating system to produce optics up to 1.5 m in diameter, which is the CSOA 1.5 laboratory located at the IACTEC headquarters. CSOA 1.5 will enable the optical requirements of future ground-based telescopes to be met. All this infrastructure makes the IAC the only technology centre in Spain with the capacity to manufacture large optics, placing it at the forefront in Europe.

MKID detectors are positioned as the benchmark detection technology

Since 2022, the IAC has been working on tasks aimed at familiarising itself with the use of detectors based on superconducting materials, such as Microwave Kinetic Inductance Detectors (MKIDs), whose applications in multiple fields, including astrophysics, position them as the benchmark detection technology. Currently, there are astrophysical instruments that use these superconducting detectors and operate in microwaves, and their application to the visible and infrared range is being explored.

Progress has been made in the development of detectors for applications through three interconnected lines of work. A cryogenic system capable of operating detectors at sub-Kelvin temperatures has been implemented and commissioned. A first array of MKIDs, superconducting detectors that exploit variations in their kinetic inductance caused by incident radiation to quantify the received power, has been tested and characterised. A digital system based on FPGAs is being developed to acquire data from the MKIDs.

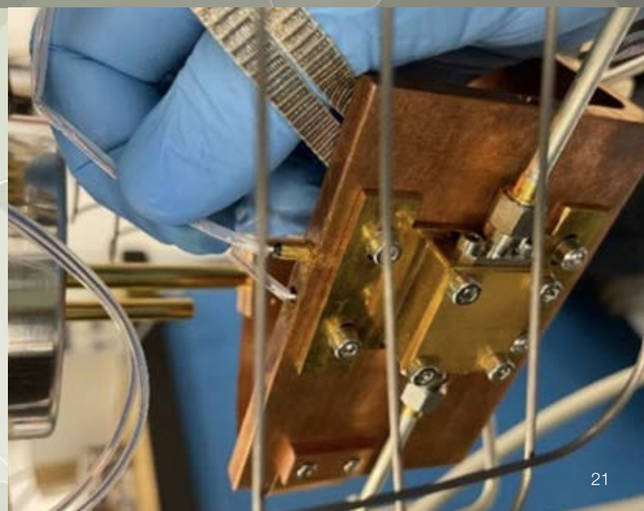


The IAC contributes to the LiteBIRD space mission, led by Japan

The IAC is contributing to the LiteBIRD space mission, a project led by the Japan Aerospace Exploration Agency (JAXA) and scheduled for launch in 2032. LiteBIRD is fundamental to cosmological science, as it seeks to obtain the most accurate measurement of the polarisation of the Cosmic Microwave Background for the study of the processes of the early Universe.

The mission is currently undergoing a design review, exploring the possibility of a single telescope covering all frequency bands, with CNES (France) leading the instrument consortium.

The IAC's technological contribution focuses on the design of the thermometry reading and control system for the telescope. A design proposal has also been prepared and the IAC is actively participating in the ongoing design review process, in the validation of electronic components, especially temperature sensors.



IACTEC, Technology Centre

IACTEC in numbers

53 people at IACTEC
11 at Espacio
3 at Tecmed
3 FSOC
1 CSOA
22 EST
2 maintenance
2 administration

2 laboratories measuring 250 m²
4.729 m² of land

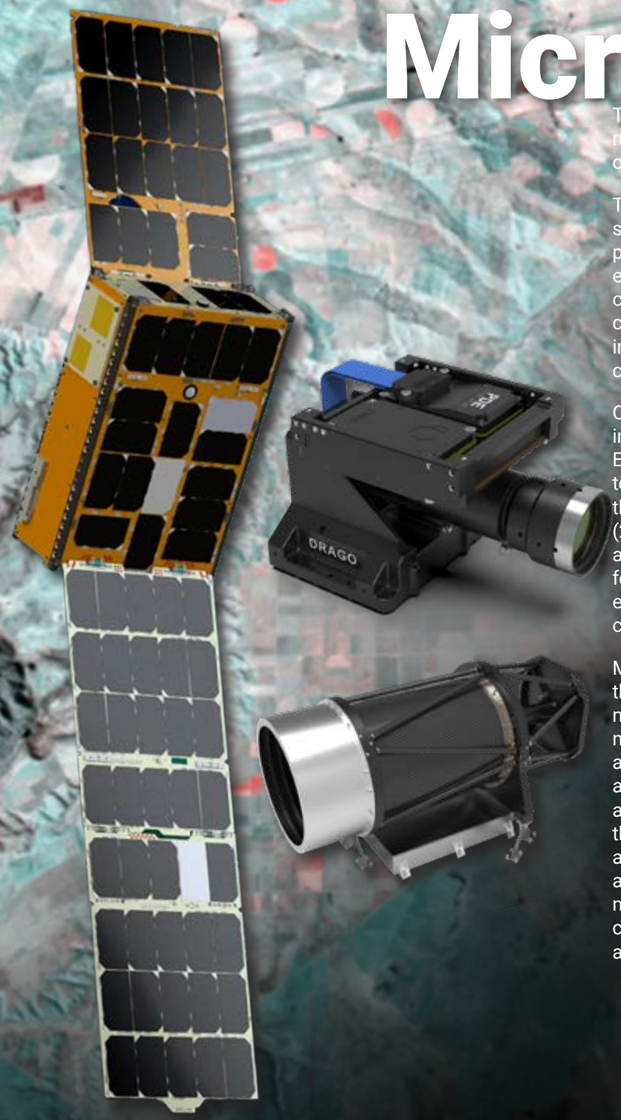
Since its establishment in 2016, IACTEC has strongly promoted technological development in Tenerife, thanks in large part to the financial contribution of the Cabildo Insular de Tenerife.

This collaboration has not only enabled the training of specialised personnel, but also guarantees the continuity of research lines in Space, Medical Technology and Advanced Optics Manufacturing.

At IACTEC, activities focus on the development of microsatellites and optical communications with Space, the creation of medical imaging devices and cancer detection software, and advanced optical manufacturing for Astronomy. Additionally, it participates in large-scale telescope projects such as CTAO, EST, NRT and SELF, and houses the Opto-Mechanical Innovation Laboratory (LIOM).

These initiatives position IACTEC as a benchmark in innovation and technological development, strengthening the local economy and the international projection of research in the Canary Islands.

Microsatellites

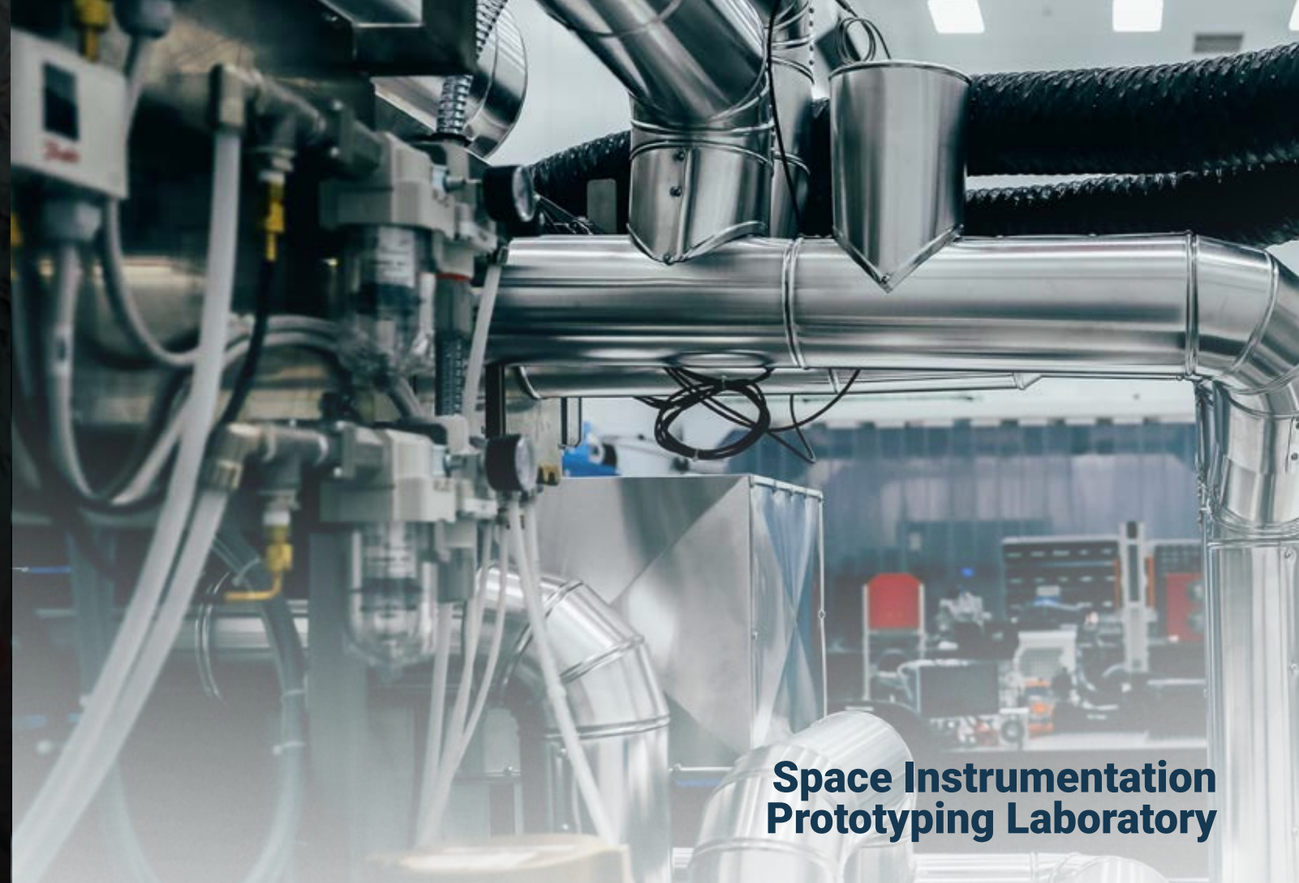


This year has been crucial for IACTEC-Espacio, marking significant milestones in the development of space missions and advanced optical technologies.

The ALISIO-1 satellite, the first space mission led by the IAC, successfully completed its commissioning and operational phase following its launch in December 2023. This nanosatellite, equipped with the DRAGO-2 camera and an experimental optical communications module, has demonstrated its operational capability by providing more than 50,000 high-quality SWIR images, used in applications such as forest fire tracking, climate change studies and marine spill monitoring.

One of the DRAGO cameras, developed by IACTEC-Espacio, was integrated into ALISIO-1. These instruments are now a mainstay of Earth observation in the SWIR (short-wave infrared) range, thanks to their patented technology, which allows them to operate without the need for active cooling. Following the success of DRAGO-1 (2021) and DRAGO-2 (2023), the development of DRAGO-3 was announced this year, which will offer improved spatial resolution, four SWIR observation bands and a modular design, thus expanding its versatility and accuracy for future Earth observation constellations.

Meanwhile, progress is being made on the development of the IACSAT-1 project, which aims to provide the IAC with a mini-satellite for astronomical observation from LEO orbit. Its main payload, the ASTRO-1 instrument, will integrate a 24 cm aperture telescope, designed to achieve exceptional photometric accuracy, crucial for the detection and monitoring of exoplanets and other astrophysical phenomena of interest. The contract for the preliminary design of the platform and the development of a prototype of the attitude and orbit control system (AOCS) was awarded to AIRBUS, while the internal IACTEC-Espacio team made progress in the development of the instrument, successfully completing the Requirements Review (SRR) documentation in accordance with ESA (ECSS) standards.



Space Instrumentation Prototyping Laboratory

During 2024 the acquisition and commissioning of equipment for the IAC's Space Instrumentation Prototyping Laboratory was completed, consolidating its capacity as a strategic infrastructure for the development, integration and validation of advanced space payloads. This laboratory provides the IAC with the necessary means to verify that the instrumentation developed internally complies with the demanding environmental and mechanical requirements imposed by launch service providers.

The laboratory has a comprehensive environmental testing infrastructure, including both a climatic chamber and a thermal vacuum chamber capable of operating within a pressure range down to 10^{-6} mbar and temperatures between -70 °C and +150 °C. In addition, it features integration areas in cleanrooms classified up to ISO 6, ensuring optimal conditions for handling and integrating sensitive optical and electronic components.

The Prototyping Laboratory is a benchmark in the field of space instrumentation verification, strengthening the capacity of the IAC and IACTEC to tackle space projects of greater technological complexity and increase their competitiveness on the international scene.

Satellite Control Station

This year saw the completion of the installation and commissioning of the Satellite Control Station (ECS. its acronyum in Spanish), a new infrastructure located at the headquarters of the Instituto de Astrofísica de Canarias (IAC) in La Laguna. Its purpose is to monitor and control the satellites placed in orbit by the IAC, as well as to develop new capabilities for receiving and managing data from other satellites of interest.

Following its commissioning, the ECS is now operational and capable of communicating with satellites in LEO orbit to transmit and receive data in the S and UHF bands, marking a milestone in the IAC's operational autonomy in the field of space missions.

Optical Communications

The Optical Communications (FSOC) line is a strategic area within the IAC, in collaboration with organizations such as ESA (European Space Agency), Instituto Nacional de Técnicas Aeroespaciales (INTA), and many other public and private institutions.

It has been promoted since 2021 through significant funding from the Spanish Government's Recovery and Transformation Plan and the Cabildo de Tenerife. It also benefits from several R&D contracts with leading private companies such as INDRA, SENER, IDOM and Thales Alenia, among others.

Among the projects in this line is ENLACE, approved by the Centro para el Desarrollo Tecnológico y de la Innovación (CDTI), which investigates ultrashort pulse optical links for terrestrial and space communications, with the IAC developing adaptive optics to compensate for atmospheric turbulence, with field tests scheduled for 2025 between the JKT Telescope located at the Observatorio del Roque de los Muchachos (La Palma) and the OGS station at the Observatorio del Teide (Tenerife).

In addition, quantum key distribution (QKD) projects are being developed for satellite-to-ground links (Uplink and Downlink LEO QKD) and geostationary satellite-to-ground links (Downlink GEO QKD - GARBO), to which the IAC is contributing adaptive optics and link budgets. Participation in FCAS projects includes the study of atmospheric laser propagation and the development of integrated photonic components.

Furthermore, the European OPTIMAS project seeks to develop bidirectional optical communication systems with adaptive optics for various scenarios. In addition, the IAClink infrastructure is being developed to establish a permanent link between the Observatorio del Roque de los Muchachos in La Palma and the Observatorio del Teide in Tenerife for optical system testing and turbulence characterisation, incorporating the ALISIO-1 satellite for testing in space.

Opto-Mechanical Innovation Laboratory (LIOM)

The Opto-Mechanical Innovation Laboratory (LIOM) began its work in February 2023 with funding from the European Union, with the long-term goal of building large optical systems to detect life in the atmospheres of exoplanets. LIOM, composed of a team of experts in Physics, Astrophysics and Engineering, is dedicated to developing innovative optical and photonic technology to reduce the weight and cost of future large telescopes.

LIOM, composed of a team of experts in Physics, Astrophysics and Engineering, is dedicated to developing innovative optical and photonic technology to reduce the weight and cost of future large telescopes. Its disruptive technologies include Fizeau interferometry for hybrid telescopes over 30 m, photonic devices for greater stability and energy savings, ultra-light and ultra-thin mirrors with new polishing techniques, tensegrity designs for active lightweight structures, optimisation of optomechanical supports, and wavefront detection to correct atmospheric aberrations using neural networks.

CELESTE Project

IACTEC has actively participated in the drafting and consolidation of the CELESTE proposal, an ambitious project led by the IAC that has been awarded European, regional and local funding under the Horizon Europe Programme.

CELESTE aims to transform IACTEC into a Centre of Excellence in Advanced Optics and Space, strengthening its capacity to develop innovative space technologies and collaborating with the European Space Agency (ESA) and the Centre National de la Recherche Scientifique (CNRS).

Medical Technology

Technology initially developed for Astronomy can be transferred and effectively applied in other areas of development. IACTEC has been working in the field of medical technology for years.

The CosmicBrain programme aims to explore the application of analysis tools developed for cosmology to the modelling of the neural network and connectome in the human brain.

PROMISSE seeks to develop a microwave-based system for the detection and analysis of subcutaneous anomalies. It focuses on improving the sensitivity and accuracy of measurements of electromagnetic variations associated with biological structures, enabling the identification of tissues with pathological alterations.

PatologIA is working on the classification of tumour tissue, based on a pre-existing AI model and the manual labelling of histological images by doctors specialising in colorectal cancer. Today, tumours are detected with high accuracy, very few false positives and no false negatives. Work is currently underway to differentiate between adenomas and pre-tumour tissues.

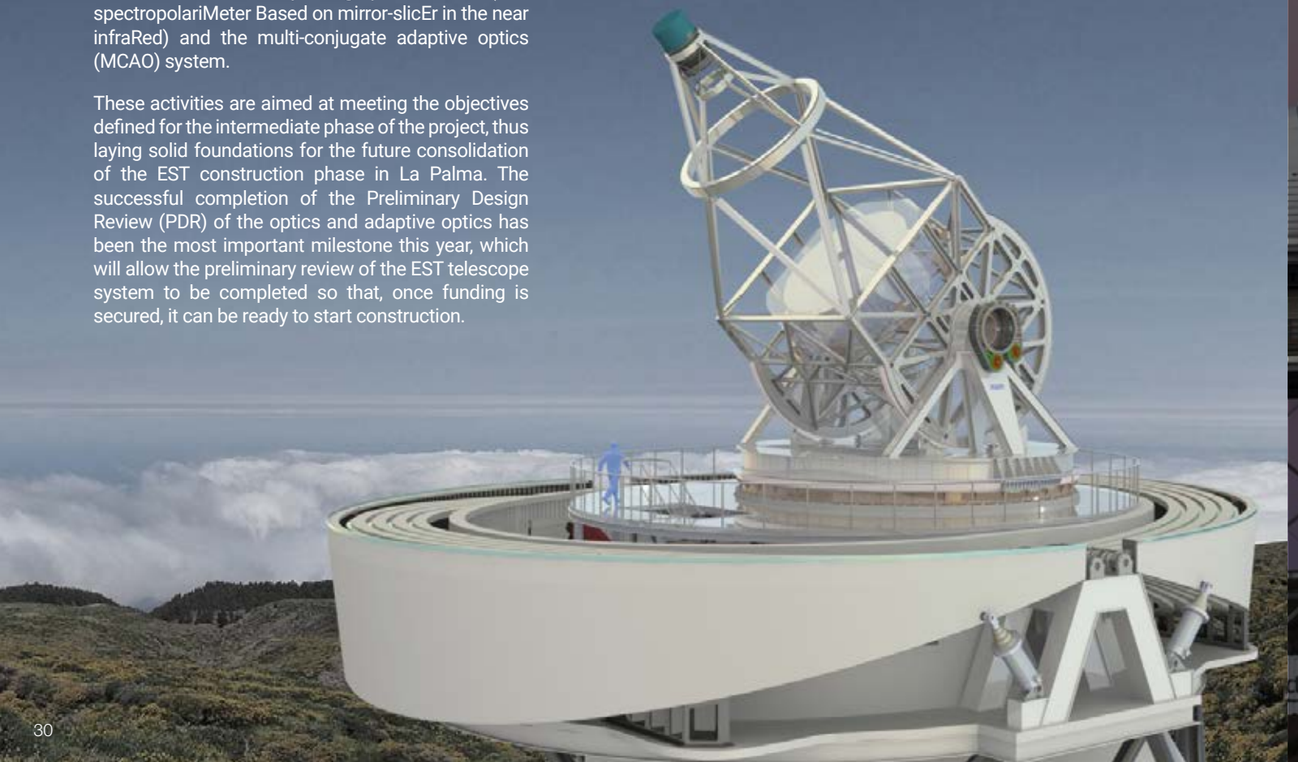
The PINRELL Prototype (Prototype for infrared analysis of the lower extremities) seeks to detect abnormal temperature patterns for diagnostic purposes in diseases such as diabetic foot.

Large Telescopes

European Solar Telescope (EST)

During 2024, progress has been made in the preliminary design of the European Solar Telescope (EST), as well as in the development of the designs for the EST/IFS-IR spectrograph: EMBER (EST spectropolariMeter Based on mirror-slicEr in the near infraRed) and the multi-conjugate adaptive optics (MCAO) system.

These activities are aimed at meeting the objectives defined for the intermediate phase of the project, thus laying solid foundations for the future consolidation of the EST construction phase in La Palma. The successful completion of the Preliminary Design Review (PDR) of the optics and adaptive optics has been the most important milestone this year, which will allow the preliminary review of the EST telescope system to be completed so that, once funding is secured, it can be ready to start construction.



Cherenkov Telescope Array (CTAO)

The CTAO construction project at the ORM (La Palma) continues to progress, with the installation of the large telescopes (LST) known as LST-2, LST-3 and LST-4, which together with the LST-1 prototype will complete the subset of four LSTs.

In December the mechanical installation of the LST-3 and LST-4 telescopes was completed and the entire installation is expected to be finished by the end of 2025. Meanwhile, the LST-1 telescope continues to collect data for the production of first science. Work continues to define the construction project for the medium-sized telescope (MST) sub-array, and the design review process for the first of these has been completed.

New Robotic Telescope (NRT)

The 4-metre New Robotic Telescope (NRT) project at the ORM (La Palma) is progressing, positioning itself as the largest of its kind, in collaboration with Liverpool John Moore University and the Universidad de Oviedo.

The detailed design phase has begun and will be completed in 2026. The IAC is leading the optical and optomechanical design and the TLS control software.

The IAC is manufacturing the telescope optics, a milestone that has led to the creation of the CSOA Optical Centre. Between 2022 and 2024, equipment for the manufacture and metrology of the primary and secondary mirrors has been acquired.

Small Exo-Life Finder (SELF)

The Small-ELF, a 3.5-metre telescope, acts as a technology demonstrator for the future 30-metre ELF (Exo-Life Finder), with the aim of validating disruptive technologies that will enable radical improvements in direct imaging and contrast capabilities.

The project, supported by the PRTR+ICTS programmes of the MCIU and the EU's ERA Chair programme, involves key institutions such as the University of Hawaii, Georgia State University and CNRS+CRAL in Lyon.

The optical design of the Small-ELF, with sub-apertures of lightweight primary mirrors, is progressing and the construction permits for the Observatorio del Teide are ready.

Observatorios de Canarias

Emilio García García, advisor for the Coordination of the Observatorios de Canarias (OCAN)

The Observatorios de Canarias (OCAN), located at the Observatorio del Teide (OT) in Tenerife and the Observatorio del Roque de los Muchachos (ORM) in La Palma, are an essential part of the IAC. In 2024, a new organisational structure was implemented, grouping functions into three main categories: Administrative Management of Facilities and Services, Engineering and Infrastructure Operation and Maintenance. It includes two cross-cutting units: Observatory Administration and Management and the Observatory Projects Technical Office; and four specific units: OT and ORM Infrastructure and Common Services, Telescopic Facilities and Instrument Maintenance, and the Technical Office for the Protection of Sky Quality (OTPC). The Coordination of the Observatorios de Canarias has been created as the body that encompasses these activities.

In addition, the Observatorios de Canarias are firmly linked to the island communities and are a symbol on all the islands, both through institutional coordination, with agreements such as the one with the Cabildo de La Palma for the management of the ORM Visitor Centre, and through multiple initiatives such as school visits and open days.

Observatorio del Teide

OT

EXTENSION: 50.00 hectares
ALTITUDE: 2.390.00 metres
LATITUDE: 28°18’04” N
LONGITUDE: 16°30’38” W

ARTEMIS - SPECULOOS. Search for habitable Planets ECLipsing Ultra COOl Stars, 100cm (BE, US, ES)
ASTRI. 9X400cm (IT)
ATLAS. Astroid Terrestrial impact Laser Alert System, 11X56 cm (ES, US)
COAST. Completely Autonomous Service Telescope, 43 cm (UK)
DIMMA. Automatic Seeing Monitor, 20 cm (ES)
GONG. 7 cm (US)
GREGOR. 150cm (DE)
GroundBIRD. Experiment, 40 cm (JP, KR, ES)
IAC-80. Telescopio, 82 cm (ES)
IZN-1 - ELRS. Izaña 1 European Laser. Ranging Station, 80 cm (ESA)
LABORATORIO SOLAR. Integral Spectrophotometer: MARK-I, 30 cm (ES)
LCOGT-Teide Norte. Las Cumbres Observatory Global Telescope, 2X100 cm + 2X40 cm (US)
LSPE/STRIP. Short-Wavelength Instrument for the Polarization Explorer, 150 cm (IT, ES)
MONS. Telescope, 50 cm (BE)
OGS. Optical Ground Station, 100 cm (ESA)
PIRATE. Telescopio Robótico Explorador de Innovaciones Físicas, 60 cm (UK)
QUIJOTE I+II. Q U I JOint TEnerife, 2X 250cm (ES, UK)
SLOOH. Optical Telescope Array (OTA), 2X30cm + 2X40cm (US)
SONG. Stellar Observations Network Group, 100 cm (DK, ES)
STC. Astrophotography Sky treasure, (ES)
STELLA. STELLar Robotic obsrevatory, 2X120 cm (DE)
TCS. Telescopio Carlos Sanchez, 150 cm (ES)
THEMIS. Télescope Héliographique pour l’Étude du Magnétisme et des Instabilités Solaires, 90 cm (FR)
TTT. Two Twin Telescope, 2X80 cm + 2X200 cm + 1X100 cm (private)
VTT. Vacuum Tower Telescope, 70 cm (DE)

Observatorio del Roque de los Muchachos

ORM

EXTENSION: 189.00 hectares
ALTITUDE: 2396.00 metres
LATITUDE: 28°45’22” N
LONGITUDE: 17°53’30” W

CLASP. Chromospheric Layer Spectro-Polarimeter, 2x36 cm (UK)
DIMMA. DIMM Automatic Seeing Monitor, 20.3 cm (ES)
FACT. First G-APD Cherenkov Telescope, 340 cm (CH)
FRAM. FRAM Telescope, 25 cm (CZ)
GOTO. Gravitational-wave Optical Transient Observatory, 40 cm (UK)
GTC. Gran Telescopio Canarias, 1.135 cm (ES)
INT. Isaac Newton Telescope, 250 cm (GB, NL, ES)
JKT. Jacobus Kapteyn Telescope, 100 cm (ES)
LST. (1,2,3,4) Large Size Telescope, 2.300 cm (Internacional CTAO)
LT. Liverpool Telescope, 200 cm (UK)
MAGIC. (1,2) Major Atmospheric Gamma Imaging Cherenkov Telescope, 1.700 cm (Consorcio internacional MAGIC)
MARVEL. Mercator Array for Radial Velocities, 4x80 cm (BE)
MERCATOR. Mercator Telescope, 120 cm (BE)
NOT. Nordic Optical Telescope, 256 cm (DK, FI, IS, NO, SE)
SST. Swedish Solar Telescope, 97 cm (SE)
STING. Cameras, 4x20 cm (UK)
TNG. Telescope Nazionale Galileo, 350 cm (IT)
TNG-DIMM. DIMM Seeing Monitor (IT)
W1T. Warwick Telescope, 100 cm (UK)
WHT. Willian Herschel Telescope, 420 cm (ES)

Infrastructure improvements

The Observatorios de Canarias (OCAN) have continued to evolve, constantly improving the service infrastructure provided to the telescopes and instruments installed and to the staff of both the IAC and the user and collaborating institutions.

At the Observatorio del Roque de los Muchachos (ORM), the fuel tanks at the residence were renovated. Both observatories benefited from a new contract to improve the redundancy of their digital connectivity.

At the Observatorio del Teide (OT), the renovation of the main entrance was completed and improvements were made to the residence, while alternatives for expanding computing capabilities are being explored.

Environmental sustainability

The privileged location of the OCANs requires an active commitment to environmental protection and sustainability. All the work carried out at both observatories has received favourable reports from the management bodies of the Protected Natural Areas and National Parks.

Among the energy sustainability measures, the installation and/or renovation of photovoltaic panels in both residences stands out, as does the support for the management of the deployment of photovoltaic panels by the user institutions within their facilities. The ORM Administration has processed the necessary licences for this with the Gran Telescopio de Canarias and the Nordic Optical Telescope, which began their deployment in the last half of 2024. The OT Administration is carrying out the renovation of the solar garden connected to the boiler.

IAC scientific facilities and Time Allocation Committee

One of the purposes of the OCANs is to manage both the facilities and instruments belonging to the IAC and those with which there are collaboration agreements in the Observatorios de Canarias. There are three types of facilities in the OCANs: Instruments, Telescopes and Experiments (ITE).

The first group includes those developed by the IAC that are currently in operation. Telescopes include those belonging to the IAC (Carlos Sánchez Telescope (TCS); the IAC-80, MONS, etc., the time reserved for Spain in the OGS or the telescopes of the SARA network (JKT, KP and CT) and nights at foreign facilities (TNG, INT and NOT) and Spanish facilities (GTC) managed by the Time Allocation Committee (CAT).

Likewise, review tasks or small interventions are carried out on other telescopes such as SPECULOOS, OU or LCOGT. With regard to experiments, there are three groups: the CMB complex, the Solar Laboratory and small telescopes and experiments such as DIMMA or TIZON.

Given this variety of facilities, the objective has been achieved of ensuring that they function properly during the periods available to the international astrophysics community; adapting the facilities to new technologies and making improvements that provide users with a more user-friendly working environment and maximise the scientific benefit obtained by ITE user personnel.

Protecting the sky at the Observatorios de Canarias

In 2024, the Technical Office for the Protection of Sky Quality (OTPC) continued to issue reports and carry out lighting inspections. Enforcement of the so-called Ley del Cielo remains a serious problem, especially in La Palma.

The OTPC's workload has increased due to the verification of LED projects and the increase in installations and complaints, which has slowed down the resolution of cases, with 235 complaints from Tenerife and La Palma pending since 2021. There is active collaboration with the International Commission on Illumination (CIE) to update recommendations and with the STARLIGHT initiative and the Spanish Network for the Study of Light Pollution (REECL). Outdoor lighting audits were also carried out in hotels in Adeje, Arona and Puerto de la Cruz, in Tenerife; and in the Puertos de Las Nieves, Las Vueltas, in La Palma; and Playa Santiago, in La Gomera.

IAC telescopes

Various actions have been carried out on the GroundBIRD, QUIJOTE and VTT telescopes and instruments. The agreements for MONS, Warwick, SARA and Mercator and the procedures for SONG have been reviewed. On the other hand, work has begun on the laser control system at OCAN. Finally, progress has been made on the new polarimeter for the IAC-80.

Carlos Sánchez Telescope (TCS)

At the Carlos Sánchez Telescope (TCS) at the Observatorio Teide, major repairs were carried out on its dome and work began to improve its structure. The MuSCAT2 instrument was updated and procedures were initiated to renew its usage agreement.

New guiding systems were successfully tested at both the TCS and the IAC-80 using real-time images from CARONTE and FastCam, and an external system at the TCS.

Solar Laboratory

The Mark-I/BiSON, GONG, SONG and Solar-SONG instruments and experiments in the SolarLab area (van der Raay Pyramid and Night Sky) of the Observatorio del Teide have been operating continuously, with daily observations. Work and repairs were carried out to ensure that observations could continue.

IAC-80 Telescope

The IAC-80 telescope at the Observatorio del Teide was used to carry out observations, calculations and the implementation of a new pointing map, improving the telescope's pointing accuracy.

Since January, the new CMOS CARONTE camera has been available for the IAC-80, offering better performance than the previous one. With regard to this instrument, various problems with its interface, filter wheel and saturation have been solved, making it fully operational. In addition, a pointing and exposure time estimator has been developed. As for CAMELOT2, the main instrument of the IAC-80 telescope, a highly complex fault was successfully repaired.

Special observations

The IAC has joined the BHTOM initiative, including the IAC-80 in the network of telescopes for routine observations of time domain astronomy objects. Meetings were held with the Observatorio de La Armada, el Mando Aéreo y Espacial Español and ISDEFE for Space Surveillance and Tracking (SST) observations of objects in LEO, MEO and GEO orbits.

An ESA project led by the Universdad de Sevilla was awarded for SST observations. The SST and megaconstellation observation pipeline was updated, and a report was also produced on the possible non-detection of NEOs due to the effect of megaconstellations.

Other user facilities at OCAN

Observatorio del Roque de los Muchachos

At the Observatorio del Roque de los Muchachos (ORM) on La Palma, the largest infrastructure currently being installed is the set of four large CTAO telescopes. Of these 23-metre diameter Cherenkov telescopes, one is already in operation and the other three are under construction. The target date for the start of operations of the three new CTAO telescopes remains the last quarter of 2025.

The Mercator telescope, operated by KU Leuven, is being complemented by Marvel, a set of four robotic telescopes. Both instruments, Mercator and Marvel, will be operated in an integrated manner. In addition, the agreement for this facility has been renewed for four years.

Studies are continuing for the location and design of the NRT (New Robotic Telescope), the 4-metre robotic telescope being built in collaboration with the University of Liverpool.

The Gran Telescopio de Canarias (GTC) has completed the renovation of its control room, which is now operational.

Finally, negotiations are underway to renew the agreement for the telescopic facilities of the University of Warwick and the MAGIC consortium.

The Mercator telescope, operated by KU Leuven.

The Gran Telescopio Canarias (GTC).

One of the Cherenkov-type telescopes.

The Transient Survey Telescope (TST).

The Vacuum Tower Telescope (VTT).

One of the telescopes in the ASTRI network.

Observatorio del Teide

At the Observatorio del Teide in Tenerife, several 1-metre robotic telescopes are in operation, such as STELLA (STELLar LAboratory), SONG (Stellar Observations Network Group), SPECULOOS (Search for habitable Planets Eclipsing Ultra- COOL Stars), LCOGT (Las Cumbres Observatory Global Telescope Network) and the TTT (Two-meter Twin Telescope).

Construction of the 1-metre Transient Survey Telescope (TST) has been completed, and the ATLAS Project, focused on planetary defence against potentially hazardous asteroids, is nearing completion.

The European Space Agency (ESA) has operated the ELRS's 80 cm telescope, used for laser communication prototypes and space debris tracking, as well as astrophysical results.

This year, the Izaña1 support telescope called Izaña2 was installed, and the three large solar installations Vacuum Tower Telescope (VTT), GREGOR and Télescope Héliographique pour l'Étude du Magnétisme et des Instabilités Solaires (THEMIS) remain in operation.

The installation of the first prototype of Astrofisica con Specchi a Tecnologia Replicante Italiana (ASTRI) was completed in July 2022, and the platforms for the remaining eight have already been built. The Italian centre Istituto Nazionale di Astrofisica (INAF) is expected to send more telescopes in 2025 and the infrastructure is expected to be completed in 2026. In 2024, the renewal of the ASTRI Network installation agreement was completed.

In addition to these actions, progress has been made on an agreement with the University of Southampton for the repair of the MONS telescope dome for its commissioning.

International Scientific Committee (CCI)

The International Scientific Committee (CCI, in its Spanish acronyum), chaired by Seppo Mattila from the University of Turku and representing the Finnish Academy of Sciences, is the body established in the international agreements that founded the OCANs to ensure effective participation by user institutions in decision-making related to their use and improvement.

The members of the CCI met on 20 and 21 November in La Laguna with the aim of sharing and analysing scientific and technical information related to the OCANs. The meeting provided an opportunity to discuss the latest advances in astronomical research and coordinate efforts for the future.

During this meeting, the vice-presidency of this committee was transferred from the former director of the IAC, Rafael Rebolo López, to the current director, Valentín Martínez Pillet, as well as the transfer of the Scientific Secretariat of the Committee from Johan Knapen to Helmut Dannerbauer, both researchers at the IAC.

The members of the CCI shared information on the scientific discoveries made at the OCANs in the previous year, as well as on future facility projects.

In addition, the meeting participants discussed the importance of international collaboration in Astronomy and Astrophysics and the joint projects they are working on. The meeting also discussed the impact that satellite constellations may have on astronomical observation.

On 20 November 2024, the SUCOSIP (Site Properties Sub-Committee) meeting was held at the IAC.

Postgraduate Training

Artemio Herrero Davó, Coordinator of the Postgraduate Training Area

The Postgraduate Training Area is responsible for organising and coordinating the IAC's activities for the dissemination of astrophysical knowledge, collaboration with university education specialising in astrophysics, and the training and education of scientific and technical staff in all related fields, particularly the training of people pursuing a PhD in astrophysics.

All this work is carried out in coordination with the Universidad La Laguna (ULL). The Area is headed by the Postgraduate Training Coordinator, who is also the director of the Department of Astrophysics at the ULL.

Astrophysics education in numbers

70 pre-doctoral research staff
13 doctoral theses defended
6 scholarships for initiation into Astrophysical Research
6 new doctoral students

70 scientific seminars
2 colloquiums

Master's Degree in Astrophysics
(in collaboration with the Universidad de La Laguna)

90 etcs credits
59 registrations 2024-2025
24 Master's degree final projects

Master's Degree in Astrophysics

The IAC collaborates with the Universidad de La Laguna (ULL) in teaching the Master's Degree in Astrophysics through the Department of Astrophysics, whose professors are members of the IAC.

Internationally renowned research staff at the IAC carry out teaching tasks, contributing their experience in the field and enhancing the quality of teaching.

Last year, their collaboration covered all branches from Solar Physics to Cosmology, including exoplanets, stars and galaxies, dark matter, and the supervision of Master's Theses.

In addition, the IAC facilitates access for Master's students to carry out internships at the Teide and Roque de los Muchachos observatories, contributes to the operation of the Master's students' Computing Centre, and also collaborates in the teaching of the Physics Degree.

Scholarship prgramme

The IAC offers scholarships for Introduction to Research in Astrophysics, such as the Summer Programme, which in 2024 awarded six scholarships to master's students to join IAC research groups and another six to join groups working on instrumentation and technologies related to astrophysics.

In addition, the IAC welcomed students from Spanish and foreign universities for short stays, who were mentored by senior research and engineering staff.

Pre-doctoral training

The IAC trains highly specialised scientific and technical personnel in Astrophysics within the ULL Doctoral Programme.

More than sixty research and technological development projects were offered for the various astrophysics doctoral training programmes offered by the IAC: places at the IAC itself, the INPhINIT-Severo Ochoa programme in collaboration with La Caixa, international doctoral students and FPI, FPI-SO and FPU programmes, in addition to those receiving grants from the Gobierno de Canarias.

In 2024, nineteen students from eight countries joined the various programmes to begin their doctoral theses, including six for the Astrophysics Residents programme, for which seventy-five applications were received.

The IAC also welcomes students from international networks and joint doctoral programmes with European universities.

Colloquiums and seminars

Training does not end after obtaining a doctorate, but continues throughout the teaching and research career of the staff. Therefore, following the programme initiated in 1991, the IAC organises a series of conferences and seminars of special relevance, attended by internationally renowned figures in the scientific field.

Following the programme of informal weekly seminars and informative talks for Institute staff, the IAC has been hosting a series of informative talks on the individual scientific work of IAC staff and visitors under the title Seminars.

In 2024, seventy seminars have been held, organised and run in collaboration between the Research and Postgraduate Training departments, in addition to the conferences, congresses and other scientific meetings hosted and organised by the IAC.

In addition to these meetings, colloquiums are organised with renowned professionals, including Professor Rob Fender (University of Oxford) and PhD Isabel Pérez Grande (Spanish Space Agency).

General Services

Jesús Burgos Martín, general Administrator

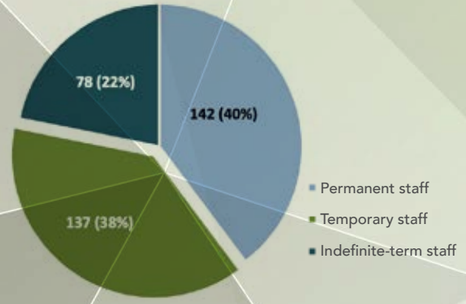
General Services is the driving force behind the IAC in terms of its economic-financial, administrative, operational, human resources, document management and library management. It is also responsible for the centre's General Registry, which is part of the General State Administration's registry network. It is also responsible for relations with the IAC's consortium administrations, in matters within its competence, and with the State Legal Service and the Ministry of Finance, in all matters relating to applicable regulations and other legal and economic issues. It is also responsible for processing agreements and accords related to the centre's activities.

It reports directly to the director of the IAC and is made up of an Economic and Budgetary Management Unit, which includes Accounting, Treasury, Procurement and External Funds; Operational Management, which includes Civil Maintenance; Human Resources, with the Personnel, Selection and Recruitment, and Occupational Risk Prevention units; Library; and the Unit Secretariat, which includes the General Registry.

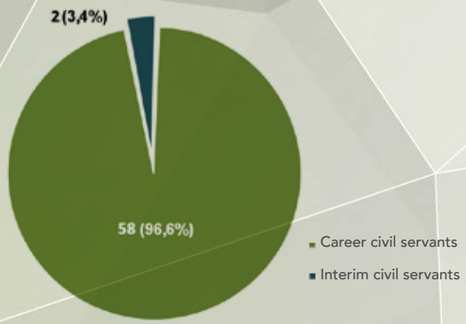
In pursuit of its objectives, its activity is based on four fundamental pillars: user orientation; process optimisation; resource efficiency; and electronic administration.

IAC Staff (419)

Labour Staff

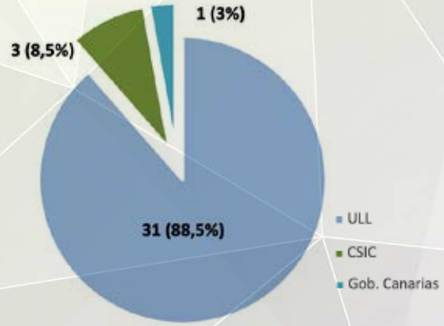


Civil Servants



IAC Staff and consortium administrations (454)

Staff assigned to the IAC from other consortium administrations



TOTAL 454

IAC management in numbers

Quantitative data is presented on the IAC's most representative activities during the financial year in terms of economic and financial management, administrative contracting, human resources, operational management and maintenance, external financing, agreements, registration and bibliographic management.

40,6 million euros expenditure execution

6,3 million euros added to inventory

130 staff recruitment processes

44 contracting meetings held

17 tenders awarded

852 minor contracts

125 grants worth 8,5 million euros

174 requests from funding agencies processed

26 financial audits

282 freight transport files

6 new major work or installations

New **Energy** certification granted for the IAC headquarters

543 training activities in occupational risk prevention

31 new national and international agreements processed

106 subscriptions to specialized journals

53 legal reports

+100 generic requests handled by the electronic portal

74 FNMT certificated issued

2.600 civil manteinance actions

+4.500 files per register

The General Administration in 2024 had other milestones such as Spanish representation on the Administration and Finance Committee of CTAO GmbH; the approval of the IV Equality Plan 2024-2028; the administrative management of the activities of the Astronomy Infrastructure Network (RIA, in its Spanish acronym)); and collaboration with the Court of Auditors in relation to the IAC Audit Report for the 2022 financial year.

Economic and budgetary activity

2024 Budget

In 2024, the contribution of the Administración del Estado to the IAC budget amounted to €11,410,000, including a final transfer for the transitional phase of the European Solar Telescope (EST). This amount was distributed as follows: €10,000k in current expenditure, €150k in capital expenditure, €60k as a contribution to the RIA and three final transfers worth €600k (ING), €100k (CTAO) and €500k (EST). For its part, the contribution from the Comunidad Autónoma de Canarias amounted to €5,410,000, divided into €4,750,000 for current expenditure and €660,000 for capital.

The Consejo Rector approved a spending ceiling of €19,410,000, which was supplemented by €2,590,000 from the IAC's cash surplus. The final execution of the income and expenditure budget as of 31 December 2024 is shown in the attached table.

The largest expenditure item, which is growing steadily, is once again personnel expenses, amounting to €12,641,000 in 2024 (€12,171,000 in 2023), as a result of salary increases, as well as the Public Employment Offer (OEP) in open competition and promotion, and the replacement rate.

2024 Expenditure Budget

2024 expenditure (excl. PRTR)	thousand of euros
Staff	12.641,62
Operation	3.510,67
ING transfer, CTA and scholarships	726,15
Transf. Acc. Transitional Phase EST	350,00
Investments	771,06
Financial	418,34
TOTAL	**18.417,82**

2024 Revenue Budget

Revenue 2024 (Extended Budget)	thousand of euros
BUDGETS	**15.620,00**
Administración del Estado	10.210,00
Comunidad Autónoma de Canarias	5.410,00
OTHER INCOME	**1.050,00**
ING and CTA (AGE) named grants	700,00
Transf. Cont. Transitional Phase EST	350,00
CASH SURPLUS USED	**1.747,82**
TOTAL	**18.417,82**

Implementation of the Recovery, Transformation and Resilience Plan

In 2024, the funds from the Recovery, Transformation and Resilience Plan (PRTR) allocated to the IAC in 2021 and 2022 continued to be used to develop actions related to 'cutting-edge technologies for astrophysical instrumentation' and to turn IACTEC into a 'centre for advanced optical technologies'.

As of 31 December 2024, cumulative expenditure amounted to €14,132.85 k. In addition, additional expenditure commitments amounting to €4,139.28 k were made, representing an execution rate of more than 83% of the €22 million allocated.

Concept	Budget	Expenses 18/12/24	Committed expenses	Total Execution	% Execution
Investments (MRR)	22.000,00	14.132,85	4.139,28	18.272,13	83,1%

*

** Amounts expressed in thousands of euros*

It should also be noted that throughout December, the IAC received modifications to the Transfer Orders relating to these contributions for 2021 and 2022, indicating that the final date for the execution of expenditure has been moved to 31 August 2026, which allows for additional time beyond that initially planned, with which it is hoped that the execution of these funds can be completed in full.

Implementation of external funding

The competitiveness of the IAC is largely based on attracting external funding and its continued implementation by the different areas of the centre, with the support of the General Services Administration Unit, which ensures proper technical, accounting, financial, economic, administrative and budgetary management.

Source of Funding	Staff	Operating expenses	Investments	Total
Administración General del Estado	4.632	1.238	1.480	7.350
Agreements MICIU. FEDER	61	27	1.719	1.807
Regional and local	967	238	35	1.240
UE programmes	1.448	1.905	3.907	7.260
Other agreements and contributions	1.530	359	249	2.138
Observatories	2	2.647	327	2.976
TOTAL	**8.640**	**6.414**	**7.717**	**22.771**

*

** Amounts expressed in thousands of euros*

Throughout 2024, various externally funded research and instrumentation projects have continued to be carried out, as well as, as in previous years, important scientific infrastructure projects for both the observatories and their work centres, together with actions aimed at strengthening technological capabilities, especially at IACTEC.

Almost €23 million has been spent from this external funding, a figure very similar to that spent in the previous year. The following table summarises this expenditure by type of item and source of funding.

Image of the Cherenkov-type telescopes installed at the Observatorio del Roque de los Muchachos, in La Palma / Daniel López (IAC).

Appointment of director and deputy director of the IAC

In 2024, the Instituto de Astrofísica de Canarias (IAC) underwent changes in its management. Following the end of Prof. Rafael Rebolo López's term of office, on 17 January 2024, the Governing Council agreed to appoint Prof. Valentín Martínez Pillet as director of the IAC, effective from 1 July 2024.

On 19 September, at the director's proposal, the Governing Council appointed PhD Eva Villaver Sobrino as deputy director, taking office on 1 October 2024.

Talk given by the new director of the IAC, Valentín Martínez Pillet, to staff after taking office. / IAC

Audit Report of the Tribunal de Cuentas

In 2024, the Tribunal de Cuentas carried out an audit process at the Instituto de Astrofísica de Canarias, a routine but highly comprehensive review of fiscal year 2022. This audit, the first specific one since the creation of the Consortium, was initiated due to the relevance of the IAC as a Public Research Organization (OPI) within the Spanish Science, Technology, and Innovation System.

The process covered thirteen key areas, with 82 control points, and relied on the extensive collaboration of the various IAC departments.

The Tribunal de Cuentas approved its final Audit Report in December, including a series of recommendations for both the IAC and the Ministerio de Ciencia, Innovación y Universidades. Among them, it particularly highlighted the urgency of adopting appropriate measures to enable the IAC to secure more specialized staff in order to strengthen its General Services Administration Unit, taking into account the growing administrative workload it faces and the potential risks identified.

Environment and sustainability

The main area of progress in 2024 has been in energy production. In particular, photovoltaic panels continue to be installed on the available roofs of the IAC headquarters. A pilot pergola equipped with photovoltaic panels has also been installed in the car parks, whose energy is used 'in situ', with four charging points for electric vehicles. Depending on the results obtained, other similar pergolas will be installed.

A new 100% electric vehicle has been purchased for the headquarters, and conventional lighting has been replaced by LED technology in several modules of the headquarters building, and streetlights on the sports field have also been replaced by LED technology.

Protocols are in place to assess the carbon footprint of travel undertaken by IAC staff, and the replacement of desktop computers with laptops continues, with significant progress having been made in this area over the last two years.

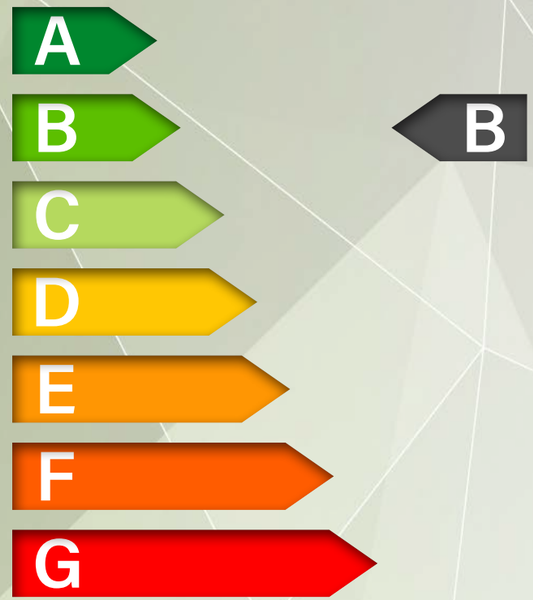
Furthermore, the Environment and Sustainability Committee, set up to draw up and monitor proposals, has renewed its membership this year.

New B Energy Certification

The IAC headquarters achieved a notable improvement in its energy certification, reaching a B rating in the main areas (Management, Administration, Research and Postgraduate Training and Instrumentation), according to the audit carried out in the second half of the year. This advance represents a leap from the C and D ratings obtained in 2014.

Since the first audit in 2011, various energy-saving and efficiency measures have been implemented, such as electrical installations, the almost total replacement of lighting with LED technology, the optimisation of air conditioning systems with efficient equipment and free cooling, and the modernisation of servers and computer equipment.

Although the IAC headquarters is a building that is over 40 years old, work continues to achieve the maximum A rating by 2030, extending these efforts to other buildings.



Gender equality

The IAC Equality Committee focused on the drafting, approval, publication and registration of the IV Equality Plan 2024-2028, together with the Protocol for Action against Sexual Harassment, Gender Discrimination and Discrimination based on Sexual Orientation and Identity.

The IAC actively participates in networks and meetings of equality units at national and international level and in projects to raise the profile of women in coordination with the Outreach and Scientific Culture Unit (UC3), such as "Habla con ellas" or the activities surrounding 8M and 11F.

Health and safety

In 2024, the IAC updated its Psychosocial Risk Assessment and is currently working on defining preventive measures.

A safety audit was carried out at all work centres to identify non-compliance issues in the facilities.

There were no serious accidents in 2024, and 352 medical examinations and a total of 543 training sessions were carried out.

Risk assessments for the five centres and 54 positions were updated, and emergency plans are in the process of being updated, with drills scheduled for 2025.

Agreements

Last year, a total of 31 national and international agreements were signed, representing a 15% increase over the previous year. This increase is partly explained by the process begun in 2019 to adapt various agreements to Law 40/2015, including those previously considered outside its scope, such as educational cooperation agreements. The experience gained in applying this legislation has allowed for more streamlined processing, especially in the management of extensions, which has also encouraged the signing of numerous addenda. In addition, the recent regulatory update on student Social Security contributions prompted the formalisation of new educational cooperation agreements, revising previous agreements and adapting them to the new legal requirements.

The agreements signed reflect the diversity of the IAC's lines of collaboration with public and private entities, covering areas such as astronomical observation, student training, technology transfer, and scientific dissemination. These agreements respond to the IAC's operational needs and allow for the structuring of cooperation, ensuring regulatory compliance and providing legal certainty for ongoing projects. It is expected that this pace of formalisation will be maintained in the coming years, consolidating existing collaborations and establishing new ones, with the support of the General Services Administration to ensure their correct regulatory adaptation and monitoring.

Training activities

In 2024, approximately 30 training activities were funded for a total of €65.43K, and 15 training grants were awarded.

Code of Ethics and Anti-Fraud Measures Plan

The IAC Code of Ethics, approved by the Comité de Dirección in November, was formally approved by the Consejo Rector at its meeting on 17 January 2024. This Code establishes a framework for the management and daily operations of the IAC, as well as for interaction with collaborators, users, customers, suppliers, other public administrations and the society in general, promoting transparency and good governance.

The documents of the IAC's Anti-Fraud Policy and Action Plan were updated and formally approved by the Consejo Rector in January 2024, and include the launch of the IAC's ethics channel which, in compliance with Law 2/2023, offers a secure and confidential way to report irregular conduct.

The Ethics Code Committee was expanded to carry out the proper management of the Anti-Fraud Measures Plan and was renamed the Ethics and Anti-Fraud Committee.

Talk by the 2024 Ethics and Anti-Fraud Committee.

IT Services

The IT Services of the Instituto de Astrofísica de Canarias work to ensure that other departments can perform their duties with maximum efficiency.

During 2024, the IAC's IT Services provided comprehensive support for scientific, technical and administrative activities at all sites, managing 7,106 incidents through the User Support Centre (CAU) and improving on-site and remote support services.

In terms of networks and communications, capacity and security have been reinforced, notably with the new 10 Gbps link between IACTEC and La Laguna, the expansion of secure networks and the redundant fibre optic cable connecting the main sites to the RedIRIS network.

SECURITY AND REGULATORY COMPLIANCE

With regard to security, the project to comply with the National Security Scheme has been the main line of work, and progress has been made in improving the security of information equipment, servers and workstations. In addition, two-factor authentication (2FA) has been implemented in the VPN, and work has continued on developing a network access control (NAC) system, which will enable the centralised identification, classification and management of all devices connecting to the IAC's infrastructure, thereby strengthening perimeter security and internal control.

NETWORKS AND COMMUNICATIONS

In 2024, the IAC strengthened its network and communications infrastructure, which is essential for all its technological activities. At IACTEC, a redundant 10 Gbps link was activated with the headquarters in La Laguna in collaboration with RedIRIS, and a project was launched to improve internal connectivity.

Continuing with network optimisation, IP telephony was integrated for the Galileo Galilei Foundation (FGG) and the Telescopio Nazionale Galileo (TNG), and a new direct optical channel was established between the TNG and the FGG. Security was reinforced in key project networks such as ATLAS and EST at IACTEC, and new isolated networks were created for IoT devices, ensuring secure management.

A crucial milestone in the PRTR fibre optic redundancy project has been the significant progress made in the installation of redundant accesses. These were successfully completed in La Laguna, CALP - Francisco Sánchez and CICA (Seville). In addition, acontract was awarded that secures the right to use dark fibre for 30 years to establish terrestrial redundancy. This connection will be made between La Laguna and the Observatorio del Teide, and between CALP - Francisco Sánchez and the Observatorio del Roque de los Muchachos. The dark fibre is scheduled to go into production in June 2026.

SUPERCOMPUTING

In the field of supercomputing, in 2024 the IAC reaffirmed its commitment to providing high-performance resources to the scientific community, consolidating its role as a centre of excellence in this field. In particular, the LaPalma supercomputing node, integrated into the Spanish Supercomputing Network, provided 23 million hours of computing time throughout the year, in addition to scientific storage services, reaching an effective use of 119.5 TiB of the 900 TiB available.

It has also participated in the development of the national quantum ecosystem through Quantum Spain.

ADMINISTRATIVE MODERNISATION

In 2024, the IAC prioritised administrative modernisation and digital transformation, improving the efficiency and security of its processes. A comprehensive technical update of the SAP manager was carried out and 646 direct incidents and 32 evolutionary improvements were addressed, optimising its performance.

In Electronic Administration, progress was made in updating the IAC's electronic headquarters to the Acceda (SGAD) platform, and the implementation of the AGE's Portafirmas was initiated.

WEB PORTAL AND ASSOCIATED SERVICES

Improvements were implemented on the IAC web portal in the intranet and forms for the management of institutional activities, including open days and observatory reservations.

An automatic metadata cleaning system was deployed to reinforce privacy and progress was made in the publication of data for interoperability with other applications. At the technical level, the content manager was updated and the infrastructure stabilised. The IAC also advised on the implementation of the Astronomy Infrastructure Network portal and provided ongoing training to content editors, reaffirming its commitment to a modern and secure portal.

Relationship with Society

Verónica Martín Jiménez, head of the Outreach and Scientific Culture Unit (UC3)

Since its creation, the IAC has set itself the goal of scientific and technological excellence and of bringing scientific knowledge to society in a broad sense.

Scientific communication and dissemination are part of the IAC's DNA as a structural element in all departments, under the coordination of the Outreach and Scientific Culture Unit (UC3). This Unit, which reports to the Directorate, manages and implements the centre's internal and external communication strategies, as well as non-university educational and dissemination projects.

The IAC, with its observatories that received more than 100,000 visitors in 2024, is a window to the Universe, but also a window to the world, transmitting its knowledge and spreading its curiosity.

The IAC in the media

One of the essential elements of the IAC for maintaining its link with society is through its relationship with the media and its own digital media, such as the IAC website and social media.

123 press releases

13.292 news items in the media

An audience of **1.99** billion people

43,4 million euros in valuation

157.000 followers on social media

3,2 millones de impressions on social media

1.178 posts on social media

63 videos with scientific content

3 spots

In 2024, we collaborated with production companies and television networks such as Insularia Films, which is preparing the film "La partitura del Cosmos"; CanariasAerial; the Movistar network, which filmed at the IAC to prepare a documentary on the "Futuro Carrera Espacial" and the El Paso City Council, which has promoted a video clip and encouraged a blackout in its municipality to promote the so-called Sky Law, among others.

Editions and videos

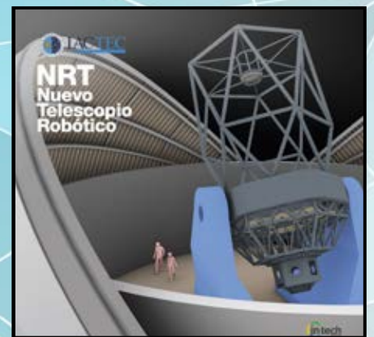
Memoria gráfica 2023

Special 40th Anniversary 2025 Calendar

Monthly collaboration with Astronomy magazine

Paralajes magazine monograph 'Astrophysics in La Palma'

"Multimessenger Astronomy" by John Beckman



Update of the NRT institutional brochure

Update of the CSOA institutional brochure.

CCI Annual Report 2023

UC3 is the department responsible for publications and audiovisual products that the IAC produces for different audiences and purposes. In 2024, 10 project brochures, two official reports (IAC and CCI) and the 2024 calendar were designed and published.

A new edition of John Beckman's book 'Multimessenger Astronomy' and the monographic magazine 'Paralajes: Astrophysics in La Palma' have been produced, and the monthly collaboration with the ASTRONOMÍA magazine has continued.

The IAC's audiovisual production is extensive, with almost 70 videos released this year, including scientific and technical content and commercials made for display on social media at events and on screens at various workplaces.

The IAC in the classroom

Educational activities are part of the IAC's raison of being. In addition to university education, UC3 coordinates various initiatives to bring training in physics and astrophysics concepts to classrooms at other levels.

Schoolchildren visit the IAC

All IAC locations are open to serve as classroom extensions, welcoming students from different educational levels, with more than 6,600 visits this year. Specifically, more than 600 students visited the IAC's facilities in Tenerife. In addition, there were school visits and visits by interest groups to the OCAN: 2,855 schoolchildren and 1,475 people from other organisations visited the OT through an agreement with the company Volcano Teide. On the island of La Palma, more than 1,000 students of different levels visited the ORM, in addition to the 700 who participated in the 'Our Students and the ORM' programme, which includes talks in schools: more than 20 this year, in addition to the visit.

PETeR, observing from the classroom

The project allows schoolchildren to carry out observations and research projects using robotic telescopes from OCAN and other observatories. More than 485 educational centres throughout Spain are affiliated, reaching more than 10,000 students per year at different levels. This project has generated more than 20 presentations and guest lectures at national conferences and workshops (IAU-MASTED, IAU-Shaw, IAU AstroEdu, IAU CAP Conferences, EAS Meetings) to disseminate it and has received several national and international awards (Science on Stage).

During the summer season, the 10th International Summer School 'Astronomical Educational Adventure in the Canary Islands' took place, with teachers from 61 countries participating.

It currently participates in Astro-Journeys (Erasmus+), Global Sky Partners (LCO), Exoclock, Mediterranean Under One Sky, National Astronomical Education Coordinators (NAECs) and CESAR (ESA).

AMANAR, Holidays in peace

It is a day of astronomy talks and workshops organized in collaboration with the Canary Association of Friendship with the Sahrawi People and the Museum of Science and the Cosmos (MCC). The event includes a visit to the IAC headquarters for Sahrawi children from the 'Holidays in Peace' programme and their host families in Tenerife. This year, 28 people took part.

Habla con Ellas, Mujeres en Astronomía

CosmoLAB, Training de trainers

CosmoLAB is a comprehensive training programme for Primary, Secondary and Vocational Education teachers, under the title 'CosmoJourney: From the Classroom to the Universe'. Within the project, astrophysics talks are given by IAC researchers, along with workshops designed to bring these topics into the classroom. More than 30 schools in Tenerife have participated, with over 90 teachers trained, who in turn have carried out activities with more than 4,000 students. In addition, astronomical events have been organised, including workshops and stargazing sessions, reaching more than 1,000 members of the general public.

The sixth edition of the project took place between January and November 2024. It included more than 20 videoconferences with Early Childhood, Primary and Secondary schools, led by 15 female astrophysicists and engineers from the IAC and other institutions connected to the IAC and the Observatorios de Canarias (OCAN). Through these activities, more than 1,300 students across five Spanish autonomous communities were reached.

Education and Outreach in Numbers

90 teachers trained with CosmoLAB

20 videoconferences with astronomers and technologists featuring Habla con ellas

61 countries at the International Summer School

6.600 school visits

100.000 visitors to the Observatorios de Canarias

12 science fairs

100.000 people reached through fair activities

1.000 visitors at the OT open days

700 participants Nuestros alumnos y el ORM

29,6 million viewers for IAC POP

10.000 students observe the sky with PETeR

The IAC and Society

The IAC has a strong social commitment and, for this reason, devotes part of its time and resources to offering outreach activities that are both a recreational opportunity for the public and a way to communicate the Centre's research and technological activities, while also emphasizing the importance of preserving the quality of the Canary skies.

The IAC goes to fairs

As a way to connect with different audiences, the IAC has participated in twelve fairs and events, offering workshops, talks, and exhibition stands, reaching a total audience of over 100,000 people. Some of these events include: Astrofest in El Paso, La Palma; the Innovation Lab Fair at the Parque Científico y Tecnológico de Tenerife; Cuánto Talento Fair, organized by the Cabildo de Gran Canaria; the Mini Science and Innovation Fairs in the Canary Islands, organized by the Agencia Canaria de Investigación, Innovación y Sociedad de la Información (ACIISI) of the Gobierno de Canarias; the PHE Festival in Puerto de la Cruz; and TLP Tenerife at the Tenerife Trade Fair Centre.

POP Science for all Audiences

This year, a pilot project called IAC POP was launched with the aim of using the most popular astronomical events to spark interest in astronomy and the work of the IAC, including eclipses, meteor showers, conjunctions and comets, among others.

A highlight of the project was the passage of Comet Tsuchinshan/Atlas, which generated 411 news items with a potential audience of 29.6 million people.

Open Days at the Observatorio del Teide

On June 22 and 23, around 900 people visited the facilities of the Observatorio del Teide (OT) in Izaña, Tenerife. This initiative involved 81 IAC staff members. This year, an evening "Closed Doors" session was also held for IAC personnel on June 21.

In addition to these visits, the UC3 organized visits for professionals in the field of communication, such as guests of TLP Tenerife or the influencer El Típico de Tenerife.

Open Day at the Observatorio del Roque de los Muchachos

On August 16, the traditional Open Day of the Roque de los Muchachos Observatory (ORM) was held for the residents of the Villa de Garafía, La Palma as part of the local Patron Saint Festivities where the Observatory is located. This event, fostering a relationship between the town and the scientific, technical, and administrative staff working at the Observatory, has been held since the early years of its opening and marked its XXXIX edition this year.

We have been visited by...

Isabel Pérez Grande,
director of Science, Technology, and Innovation at the Spanish Space Agency

Claude Nicollier,
astrophysicist and astronaut

Takahiro Nakamae,
ambassador of Japan to Spain

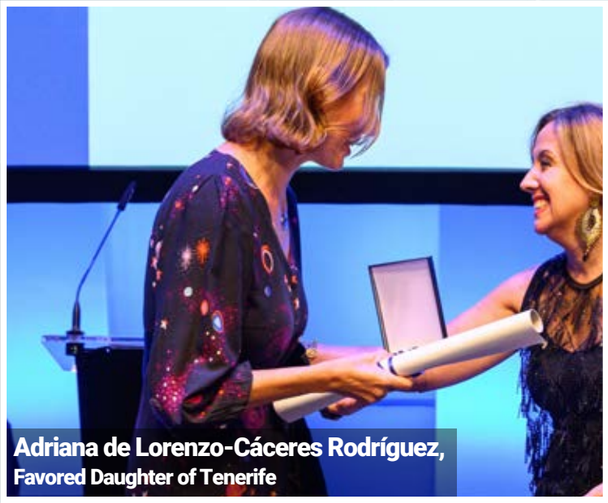
Jocelyn Bell, astrophysicist and discoverer of pulsars

Eva Ortega-Paíno,
secretary General for Research at the Ministry of Science, Innovation and Universities

Juan Carlos Cortés,
director of the Spanish Space Agency

Cecilia Hernández Rodríguez,
head of the Science Department at the Spanish Space Agency

Awards and Distinctions



Adriana de Lorenzo-Cáceres Rodríguez,
Favored Daughter of Tenerife

Antonia Varela Pérez,
Gold Medal of the Canary Islands 2024

Irene González Hernández, Eponym of the Honorary Award of the Solar Physics Division (SPD) of the American Astronomical Society.

Casiana Muñoz-Tuñón,
Bandera de Andalucía

Begoña García Lorenzo, Coordinator of the Astronomical Infrastructure Network

Eva Villaver Sobrino, Research Award of the Spanish Geographical Society

Francisco Sánchez
eponym of the Astrophysics Center in La Palma.

Arianna Di Cintio, Junior Research Award on the Institutional Day of the Universidad de La Laguna (ULL)

Institutional Action and Transfer Office

Team of the Institutional Action and Transfer Office(OTAI).

External Funding and Knowledge Transfer in Numbers

94 proposals submitted and 34 granted

38 million in project funding

1,7 million in scientific-technological equipment

12 institutional forums and working groups

12 ongoing European projects

12 confidentiality agreements for technological collaboration

+200 processes for justifications, requirements, signatures, and requests through platforms

4 procedures regarding IPR as part of the new OTC

In 2024, the Institutional Action and Transfer Office (OTAI, in its Spanish acronym) has continued to consolidate its role as a key unit supporting the IAC's institutional activities, while also strengthening coordination with the new Directorate since its incorporation in mid-year. Among the main achievements are its involvement in the management of various strategic I+D+i projects, including new research infrastructures exceeding €50 million; support for the acquisition of external funding with 34 new funded initiatives; reinforcement of its work in Knowledge Transfer; and the preparation of the new Strategic Plan for the OCAN. With a small but specialized team, the Office has strengthened its function as a bridge between the Directorate, research and development groups, funding agencies and national and international collaboration networks.

Technology transfer

In the field of technology transfer, the OTAI processed the recognition of its Knowledge Transfer Office (OTC, in its Spanish acronym) incorporating it into the Registry of Knowledge Transfer Offices by the MICIU.

The Office actively supported the activities of IACTEC, the IAC's technology-business collaboration centre, serving as its secretariat until June and assisting the IAC's participation in CIDIHUB and CYBERCAN.

In addition, twelve Confidentiality Agreements for technological collaboration were signed, the portfolio of active patents continued to be monitored, and various I+D+i contracts were managed. Finally, internal documentation was developed to formalize procedures for Intellectual Property (IPR) management and the recognition of knowledge-based entities.

Institutional projects and plans

The IAC has been actively involved in the development and execution of various strategic projects and plans, both internal and external. In 2024, efforts focused on the implementation of its 2022– 2025 Strategic Plan, the Strategic Plan for the Observatorios de Canarias, and the Severo Ochoa Programme 2020–2025, whose accreditation was received in September 2024.

Within the framework of the Severo Ochoa Programme, nine researchers participated in the Visiting Researchers Programme of the Fundación Occident during 2024, with funding provided by the Foundation.

In addition, attention was given to projects included in the IAC's Recovery, Transformation and Resilience Plan, as well as to large telescope projects previously mentioned elsewhere in this document, such as EST, CTA, NRT and SELF, among others. Other projects managed include the ERC Advanced Grant Substellar Science with Euclid Space Mission (SUBSTELLAR), NANOSPACE, IACPLUS, EPIC-FINANCE, EDUCADO, EXGAL-TWIN, and UNDARK.

SUBSTELLAR

During the first quarter of the year, the SUBSTELLAR project team, consisting of postdoctoral and predoctoral researchers, the Principal Investigator and the project manager, was consolidated. Significant progress was made in the processing of data from the Euclid mission (ESA), resulting in scientific publications and their dissemination.

NanoSpace

The NanoSpace Project, led by the IAC and funded by COST (European Cooperation in Science and Technology), aims to advance the understanding of the physics and chemistry of cosmic carbon nanomaterials and their relevance in non-terrestrial environments. NanoSpace organized several events, including the Second Joint Scientific Meeting in Istanbul.

Visit of the Fundación Occident to the Observatorio del Teide

Miembros del Proyecto EDUCADO.

IAC-PLUS

The IAC-PLUS Project advanced in 2024 with the aim of strengthening the IAC's participation and leadership in I+D+i programs, notably Horizon Europe and the Spanish State Research Plan.

The initiative seeks to consolidate experience in managing European projects in the Canary Islands, increasing economic returns and improving the Archipelago's position in the I+D+i ecosystem. Among the 2024 outcomes, participation in Widening proposals stands out, including the CELESTE project.

EPIC-FINANCE

The EPIC-FINANCE Project continued its implementation this year, focusing on consolidating the European Programmes Section within the OTAI and enhancing the IAC's leadership in European I+D+i projects. Its 2024–2025 Activity Plan, funded by the Spanish State Research Agency, aims to strengthen the European Programmes Section structure, increase the IAC's participation in European programs, improve staff training, and foster strategic consortia.

EDUCADO

The EDUCADO Project combines Astronomy and Computational Science to develop advanced methods for analyzing observational data. Its goal is to reliably and reproducibly detect extremely faint galaxies in wide-area surveys. The IAC led the implementation, consolidating the hiring of key personnel, including 11 doctoral students and one project manager, and reinforcing collaboration with European institutions.

ExGAL-Twin

The ExGAL-Twin Project is a Horizon Europe Twinning initiative aimed at strengthening the IAC's research capacity and impact in the study of galaxies. This is achieved through collaboration with the University of Groningen, the Observatoire Astronomique de Strasbourg (CNRS-ObAS), and Durham University (ICC), experts in radio astronomy, exploitation of observational surveys and numerical modeling, respectively. The IAC led the launch of the project, with the Kick-Off Meeting as a key milestone.

Members of the UNDARK Team.

UNDARK

The UNDARK Project (Unravelling the Dark Universe from the Canary Islands Observatories) is a Horizon Europe Twinning initiative that seeks to investigate dark matter and dark energy in the Universe, addressing fundamental questions in Astrophysics, Cosmology, and Particle Physics. The IAC leads the consortium, contributing its expertise and the Canary Islands Observatories, while partners such as CERN, IFAE, CNRS-LAPTh and the Weizmann Institute of Science provide knowledge in theoretical Cosmology.

"Amigos del IAC" programme

The "Amigos del IAC" Programme, coordinated by the OTAI in collaboration with the UC3, aims to bring the IAC's activities closer to society through a range of outreach initiatives.

Among the activities carried out are introductory talks on Astrophysics, streamed online and later shared on social media, as well as in-person events such as lectures and visits to the IAC facilities. In 2024, the programme had the participation of more than one thousand members, consolidating itself as a platform for interaction and scientific outreach for the public interested in Astrophysics.

One of the "Amigos del IAC" activities at the Observatorio del Teide / IAC.

Reappearance of Saturn after the Moon, captured on 21 August 2024 at 04:05:05 UT by Daniel López (IAC)

Comet C/2023 A3 Tsuchishan/Atlas D. López / Astrógrafo STC (IAC)

IAC REPORT 2024

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