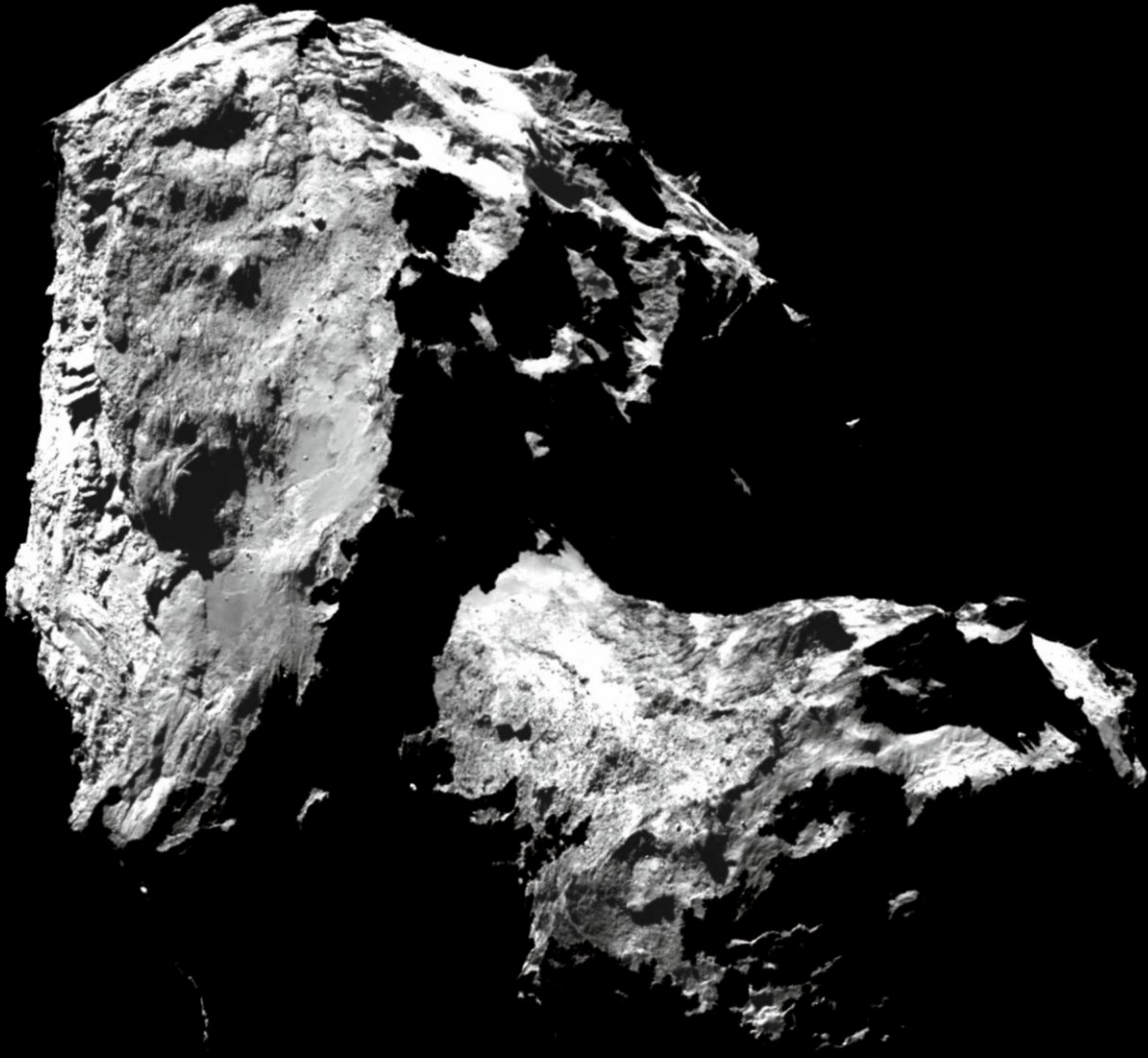
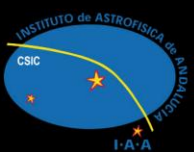
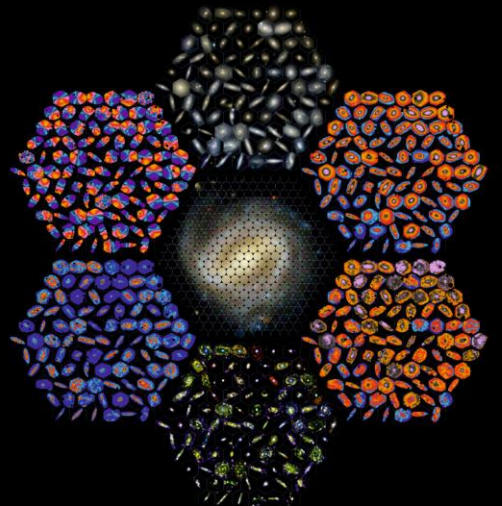


Instituto de Astrofísica de Andalucía
IAA-CSIC



ANNUAL REPORT
2014



Cover Pictures

Main cover picture: image of the comet 67P/Churyumov-Gerasimenko obtained by the OSIRIS cameras on board the *Rosetta* spacecraft, an ESA mission.

The OSIRIS cameras are *Rosetta's* eyes. The IAA-CSIC contributed with hardware to OSIRIS and its staff is currently exploiting the scientific data. The OSIRIS cameras have shown a comet nucleus consisting of two lobes connected by a short neck. This shape raises the question of whether the two lobes merged 4.5 billion years ago, or represent a single body where a gap has evolved via mass loss. Indeed, activity at the present distance from the Sun (>3 astronomical units) predominantly arises from the neck, where jets have been seen consistently. The OSIRIS cameras have also been used to assess the comet rotation period of 12.4 hours.

OSIRIS has witnessed the descent and first touchdown on the surface nucleus of the module Philae on November 12, 2014. The module did not anchor at this first touchdown, but it bounced two times ending at a location where the solar insolation has not been sufficient to keep it alive and working until March 2015.

The story of *Rosetta* around a comet in a fiery environment will continue until September 2016 when the spacecraft will softly land on the surface of the most ever scrutinized primitive body of the Solar System.

Luisa María Lara López

Lower-right corner: the “CALIFA’s mandala”, a mosaic of datacubes of a sample of galaxies observed by CALIFA showing different physical parameters as derived from the spectral analysis.

On 2014 October 1, the CALIFA collaboration released the second public data set (DR2), consisting of 400 datacubes of 200 galaxies. Led by Dr. García Benito (IAA-CSIC), this release was possible as a result of the close collaboration between the scientists of CALIFA and the technical staff of the Observatory of Calar Alto. Among the most impacting results published this year, led from the IAA, we have studied the time evolution of the structure of these galaxies (their mass density, age, metal and dust content) as a function of their total mass and morphology, and how these differ in the inner red bulges and their outer blue disks. A characteristic metal gradient in the gas has been found, in accordance with the metals in the younger stars.

Enrique Pérez Jiménez

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DIRECTOR'S FOREWORD

The IAA is a center of the Spanish CSIC devoted to the production of top research in space science, in conjunction with a high-level technological activity for the construction of front-line instrumentation for ground based telescopes and space missions. The diffusion of the IAA research into the public through a variety of outreach activities is also a key objective.

Though the IAA foundation was originally oriented to the scientific exploitation of the nearby observatories of Sierra Nevada (Granada) and Calar Alto (Almería), soon IAA scientists proved to be very active adding to that the study of the Earth's upper atmosphere and, most notably, the pioneering development of space astrophysics in Spain. At present the IAA has four scientific departments which study the Solar system, stellar physics, extragalactic astrophysics and cosmology, and Galactic structure and radioastronomy, combined with a small but prominent group of theoretical physics. The technological branch allows our institute to afford the construction of new instrumentation whereas keeping the center ready to participate in future technological challenges for space and ground based instrumentation. The proximity and easy access to our observatories represent an extra asset to develop the science of massive ambitious surveys (like **ALHAMBRA**, **CALIFA** and, in the near future, **CARMENES**) and to provide a useful test bench for new instrumentation. The combination of a wide scope in astrophysics research with technology and the observatories made the IAA a unique center in our country.

This annual report shows that the year **2014 has been full of exciting results**, with demanding challenges for the IAA' scientists, engineers and its observatories.

After the successful "wake up" of the Rosetta mission near the end of 2013, during this year public and scientists have been most enthusiastic with this ESA's spacecraft, which was successful entering in orbit around comet 67P/Churyumov-Gerasimenko. The IAA is one of the few centers participating in this unique European mission. The first images of the comet showing its peculiar structure and surface were taken by the OSIRIS

camera, an instrument designed and built by a European consortium where IAA is an active partner. **The Rosetta mission is producing a wealth of new science, with excellent results published in high impact papers.**

ESA's new mission PLATO was approved in 2014, and IAA will participate in the construction of its instrumentation. *PLATO*, planned to launch in 2024, is to begin a completely new chapter in the exploration of extrasolar planets. During this year, IAA was active working on the instrumentation of several other ESA space missions (e.g. *NOMAD* onboard *EXO-Mars TGO* and, *GALA* and *Janus* onboard *JUICE*). *IMAX*, onboard the *SUNRISE* mission –a telescope that observed the Sun from a stratospheric balloon over the Arctic–, unveiled the formation and evolution of a magnetic flux tube on the solar surface. Also in preparation has been the mission *Solar Orbiter* (ESA) expected to orbit the Sun to study both, solar physics and the Sun's influence on the interplanetary medium.

The construction of the **new instruments PANIC** – a wide field near-infrared camera– and **CARMENES** –the state-of-the-art planet hunter with two arms, optical and near infrared– for the Calar Alto telescopes continues at good rate, with **PANIC** reaching already an advanced phase near commissioning by the end of the year.

For the observatory of Calar Alto this has been a critical year, with a strong shortage in operation funds. Nevertheless, the enormous scientific value of the observatory, its competitive instrumentation and high level staff have been able to complete very successful projects. The success of these international projects, which could not be performed in other telescopes, lead the observatory far from previously announced threads. In June 2014 the event "**From CALIFA to CARMENES**" was held at the dome of the **3.5m telescope** to present these "big science" projects. This scientific event, chaired by the Secretary General for Science and Innovation of the *Junta de Andalucía*, counted also with the participation of several Spanish and international delegates and representatives of the wide astronomical community. This event produced a great impact in written press and RTV media.

CALIFA, the large Integral Field Spectroscopy survey conceived at the IAA and carried out at the Calar Alto 3.5m telescope, will provide an

unprecedented view of six hundred galaxies of the local Universe. It will be a reference in the field of galaxy evolution for the next decade. Its legacy is offered to the scientific community and the second data release of this international project took place on September 30.

Other relevant achievements included in this 2014 annual report of the IAA testify to the rich variety and quality of the science produced; which goes from the new challenges about the origin of massive black holes, Gamma Ray Bursts, to the discovery of two (water ice) rings in Chariklo, a Solar system object 250 kilometers in diameter.

The IAA research activity has been steadily increasing in 2014. The production of the IAA in international refereed journals is, on average, equivalent to **an IAA paper published every working day of the year**. This is a very relevant achievement for the IAA especially after the recent downsizing of the national research budget. These difficulties, far from forcing IAA to abandon the race, have encouraged our scientists to compete for funding and support beyond the Spanish borders. Notably **an ERC Consolidator grant was awarded to one of our young scientists, and the IAA was the Coordinator of the new ERC network on Martian space science**. This way, the IAA keeps playing in the "league of stars" of astrophysical research despite recent shortcuts in money and human resources.

The IAA applied in the 2014 call of the Severo Ochoa program for Spanish Research Centers, obtaining a high score (98 over 100). This is encouraging and proves the IAA moves in the right direction. Let me mention just two quantitative indicators to illustrate here the scope and impact of our research: i) the average normalized impact of the IAA publications in the last four years window (including 2014) is close to 250% the world average, and ii) among the 128 CSIC institutes and centers, IAA is the 1st center according to scientific production in space science and the 7th in all disciplines.

This report has been prepared with the aim of showing the reader a panorama of the scientific and technological activity developed at the IAA in 2014. We hope you can share with us the passion for science and enjoy the *Astrophysics at IAA* presented in this annual report.



Prof. José Manuel Vílchez Medina

Director of the Instituto de Astrofísica de Andalucía

RESEARCH ACTIVITY

The Instituto de Astrofísica de Andalucía is a center of the Consejo Superior de Investigaciones Científicas (IAA-CSIC) devoted to basic astronomical research. This research activity is carried out in the framework of four different departments:

1. Extragalactic Astronomy.
2. Radioastronomy and Galactic Structure.
3. Solar System.
4. Stellar Physics.

These departments include a number of research lines that investigate different astrophysical topics. Moreover, research and technical activities are carried out by different units and astronomical observatories, including the Instrumental and Technological Development Unit (UDIT), the Computer Center (CC), and the Observatory of Sierra Nevada (OSN).

The description of the research activity and highlights of these research departments, units and observatory during 2014 are next presented.

Additional information on the Observatory of Calar Alto is included in this document as the IAA is the CSIC reference center for this international astronomical observatory.

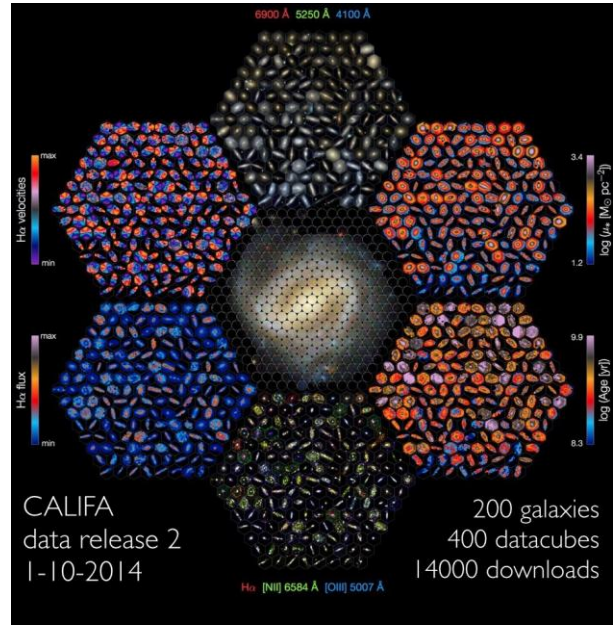
EXTRAGALACTIC ASTRONOMY

Overview

Research in extragalactic astronomy at the IAA is focused on two broad avenues: structure and evolution of galaxies, and quantum and classic gravity. Galaxies are the main focus of study from three different perspectives: (i) by themselves, understanding their dynamics, interstellar medium, and evolution of their star (formation, chemistry, and stellar populations); (ii) how these properties change as a function of their environment, as isolated, groups, and clusters of galaxies; and (iii) their role as tracers of the structure and evolution of the universe, including GRBs as cosmic lighthouses. Many of these studies take advantage of the availability of ground-based and space-borne multiwavelength data, or are performed in the context of large surveys, some led by our researchers, such as ALHAMBRA and CALIFA, both carried out at the Calar Alto Observatory. A group of theoreticians work on Gravitation and its quantum modifications.

Highlights in 2014

- IFS (Integral Field Spectroscopy) data of IZw18, the most metal-poor star-forming galaxy in the local Universe, discover an extended nebular H α 4686-emitting region. The observations, in conjunction with state-of-the-art stellar model predictions, reveal that only (nearly) metal-free ionizing stars, similar to PopIII stars, the first ones that ever shone in the Universe, can explain the H α ionization of IZw18.
- VLT zCOSMOS optical deep spectroscopy along with detailed *HST* imaging has allowed us to enlarge the sample of extreme emission line galaxies up to redshift 1. These galaxies, resembling the building blocks from which larger galaxies were created, are metal-poor, UV luminous, compact galaxies with very high specific star formation rates.
- HII-CHI-mistry is a new code to derive chemical abundances using emission lines from gas ionized by massive star formation processes taking relative abundance ratios into account for the first time and hence improving the understanding of the chemical evolution of galaxies undergoing different types of interactions with their environment.
- AMIGA has shown that, despite the general belief that pseudo-bulges are relatively young and blue structures, in isolated galaxies they display colours comparable with those of ellipticals. After going 3D using SDSS spectroscopy, the catalogue of isolated galaxies that remains isolated without satellites is 88%. AMIGA has been accepted as member of the SKA international consortium designing its Science Data Processor, applying the developments by the group of services for 3D radio data analysis in Grid, Cloud and Supercomputing facilities.



- On 2014 October 1, the CALIFA collaboration released the second public data set (DR2), including 400 datacubes of 200 galaxies. Led by Dr. García Benito (IAA-CSIC), this project has been possible as a result of the close collaboration between the CALIFA scientists and the technical staff of the Observatory at Calar Alto. Among the most relevant results published in 2014 led from the IAA, we have studied the time evolution of the structure of these galaxies (mass density, age, metal, dust content) as a function of their total mass and morphology, and how these differ in the inner red bulges and outer blue disks. A characteristic metal gradient in the gas has been found, in accordance with the metals in the youngest stars.
- Completion of an unprecedented comparison between the spectroscopic and physical properties of quasars with similar bolometric luminosities, but at very different cosmic epochs. We confirm that the two different populations present in the local quasar sample ($z < 0.6$) are also present in the higher redshift sample ($z \sim 2.3$). Metallicities are nevertheless different, what is interpreted as reflecting the chemical evolution of the Universe.
- The ALHAMBRA survey Gold Catalogue provides redshifts and photometry in 20+4 bands for 100000 galaxies, 20000 stars, and 1000 AGN candidates spread over seven sky regions.
- IFU data of the host of the peculiar GRB 060505 confirm that it was associated to a massive star but that GRB sites are not necessarily a region with unique properties within their hosts. High resolution is crucial to make definite statements about the properties of a GRB progenitor inferred from its environment.
- A new symmetry class (non-point symmetries) has been proposed to characterize the solution manifold of Non-Linear Sigma Models as a preliminary essay towards non-canonical quantization of gravitational models.

- The theoretical group has also put forward an alternative proposal for what could be the result of a continued gravitational collapse. They obtained an Honorable Mention in the Gravity Research Foundation Essay competition 2014.

MEMBERS

V. Aldaya, S. Anton, C. Barceló, N. Benítez, J. Blasco Herrera, R. Carballo Rubio, M. Cerviño, L. Cortés Barbado, C. Cortijo, A. del Olmo, G. Favole, M. Fernández Lorenzo, A. Fernández Martín, R. García Benito, J. Garrido Sánchez, R.M. González Delgado, J. Guerrero García, L. Hernández García, J. Iglesias, Y. Jiménez Teja, C. Kehrig, R. López Fernández, I. Márquez, M.A. Martínez Carballo, J. Masegosa, M.J. Moles, A. Molino, J.D. Perea, E. Pérez, E. Pérez Montero, M. Povic, F. Prada, P. Ramírez Moreta, J.E. Ruiz del Mazo, S. Sánchez Expósito, L. Sánchez Menguiani, S.F. Sánchez Sánchez, J.D. Santander Vela, W. Schönell, J. Sulentic, C. Thöne, L. Verdes-Montenegro, J.M. Vílchez

INVITED RESEARCHERS

E. Duarte Lacerda and F. Durret (IAP, France), C. García Meca, M.A. Martínez Caeballo, and O. González Martín (IAC), P. Marziani (INAF-Osservatorio Astronomico di Padova, Italy)

LINES OF RESEARCH

Active Galactic Nuclei.

Cosmic evolution of galaxies.

Environment and hosts of stellar explosions

Galactic clustering and physics of the dark universe.

Modelling the evolution of galaxies in groups.

Observational cosmology and large surveys.

Physics of Quasars.

Quantum and classic gravity in the physics of black holes and Cosmology.

Star formation in galaxies.

The effects of interaction in the evolution of galaxies.

Violent star formation.

RADIOASTRONOMY AND GALACTIC STRUCTURE

The Radio Astronomy and Galactic Structure Department studies the formation, evolution and death of stars at different mass and spatial scales across distinct environments. Early stages of stars and planets formation are studied observationally, mainly through radio interferometric observations, and theoretically, modelling the observed emission.

Since star formation is a multi-scale process, whose spatial pattern mimics the internal structure of the parental clouds, stellar clusters probe the initial physical conditions and early dynamical evolution of recently born stars. To this aim, we observe and compile large cluster catalogues and develop new data-mining tools for their study.

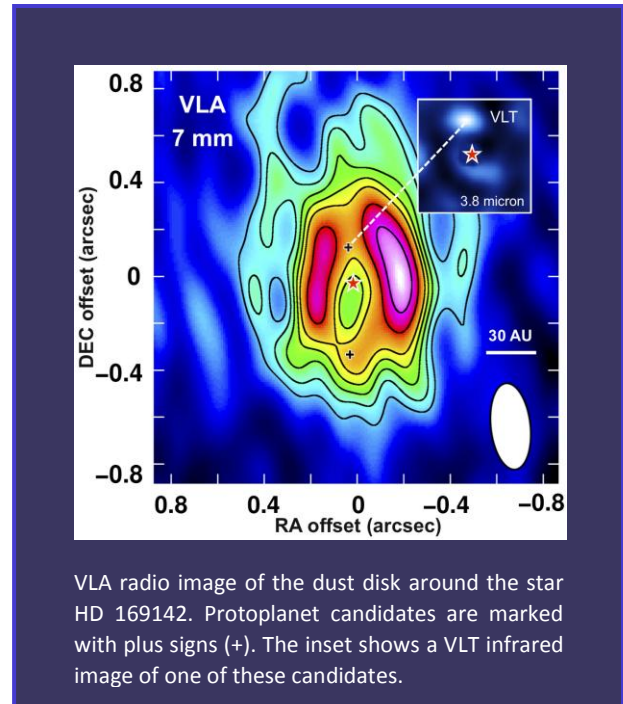
Massive stars play a fundamental role in shaping and driving the energetic balance of the Interstellar Medium (ISM). Cataloguing these stars and determining their physical properties provides information not only about the stars, but also on the characteristics of the surrounding ISM. High angular resolution observations are being used for analysing the multiplicity of massive objects.

The centre of the Milky Way is of fundamental interest for astrophysics because it is the only galactic nucleus that we can resolve on milliparsec scales to study its ISM, stellar population, massive black hole, and the interplay between these components. We study the Galactic Centre on scales from milliparsecs to hundreds of parsecs via high-angular resolution observations in the near-infrared.

The final stages of a star's life are studied by the multi-wavelength characterization of evolved stars and the wind-blown bubbles around them, to understand the processes that shape planetary nebulae and the circumstellar medium around massive stars. Radio interferometric monitoring of supernova explosions and their distribution in Ultra Luminous Infrared Galaxies (ULIRGs) is also carried out to determine the supernova and star formation rates.

High-energy phenomena at different spatial scales are also part of our scientific objectives: in particular, we study relativistic jets, highly collimated fluids with relativistic energies and velocities present in multiple astrophysical sites, from active galactic nuclei to GRBs.

To summarise, we observe the whole electromagnetic spectrum, from radio to X-rays, at different spatial scales, from a few astronomical units to tens of kiloparsecs, using a wide variety of state-of-the-art



VLA radio image of the dust disk around the star HD 169142. Protoplanet candidates are marked with plus signs (+). The inset shows a VLT infrared image of one of these candidates.

observational techniques and facilities at the edge of their sensitivity, spectral and angular resolutions, and field of view. We complement the observations with the development of modelling and statistical tools.

MEMBERS

A. Alberdi, E.J. Alfaro, G. Anglada, A.D. Benítez, G. Busquet, C. Casadio, M.T. Costado, F. Costagliola, A.J. Delgado, H. Dong, M.C. Durán-Rojas, A.K. Díaz-Rodríguez, X. Fang, A.T. Gallego, E. Gallego, J.F. Gómez, J.L. Gómez, M.A. Guerrero, R. Herrero-Illana, E. Macías, J. Maíz Apellániz, G. Manjarrez, R.A. Márquez-Lugo, J.M. Mayen-Gijón, L.F. Miranda, S.N. Molina, F. Nogueras-Lara, M. Osorio, M.A. Pérez-Torres, N. Ramírez, M.I. Rodríguez-Martínez, L. Sampedro, J. Sánchez-Bermúdez, R. Schödel, J.A. Toalá

INVITED RESEARCHERS

J.I. Agudo Rodríguez (JIVE, Netherlands), P. Amaro Seoane (MPI, Germany), J. Arthur (UNAM, Mexico), M.W. Blanco Cárdenas (UNAM, Mexico), V. Bujarrabal (OAN), T. Cantat (Osservatorio Astronomico di Padova, Italy), R. Dobson (ICRAR, Australia), D.A. García Hernández (IAC), J.M. Girart (ICE-CSIC), M.J. Rioja (ICRAR, Australia), R. Rizo (CAB), L. Uzcanga Aguilera (National Observatory of Athens)

LINES OF RESEARCH

Formation and disruption of stellar clusters

Massive stars and their surroundings

Modelling and observation of star and planet formation

Multi-wavelength studies of planetary nebulae and their immediate precursors

Relativistic jets in active galaxies

Stellar endproducts and the ISM in LIRGs and ULIRGs

Stellar populations and gas in the Galactic centre

SOLAR SYSTEM

Solar System research at the IAA covers a broad range of topics, from the Sun and planetary atmospheres to comets, asteroids, and trans-Neptunian objects. In 2014, the following results were obtained.

The solar internetwork was studied and identified as the main source of magnetic flux for the photospheric network. Moreover, the intensification of quiet Sun magnetic structures was investigated using data from IMAx on SUNRISE. Small-scale convective downflows in sunspot penumbrae were characterized and their temporal evolution observed for the first time.

The characteristic "Y" cloud pattern observed on Venus has been explained as a Kelvin-type equatorial wave distorted by winds. Also, infrared spectra measured by VIRTIS-H on Venus Express have been inverted under NLTE conditions to derive the CO concentration and the temperature of the upper atmosphere of Venus.

An analysis of the concentration of CO and CO₂ in the low and middle Earth's atmosphere was carried out using measurements from ACE and MIPAS. A CO₂ increase in the mesosphere from 2004 was observed. This is a factor of two larger than the increase occurred in the troposphere, but The reason is not understood yet.

Several meteoroid impacts on the Moon were detected in collaboration with the Universidad de Huelva. The strongest was recorded on September 13, 2013. A new crater 30 m in diameter was found later by LRO only 2 km away from the observed impact site.

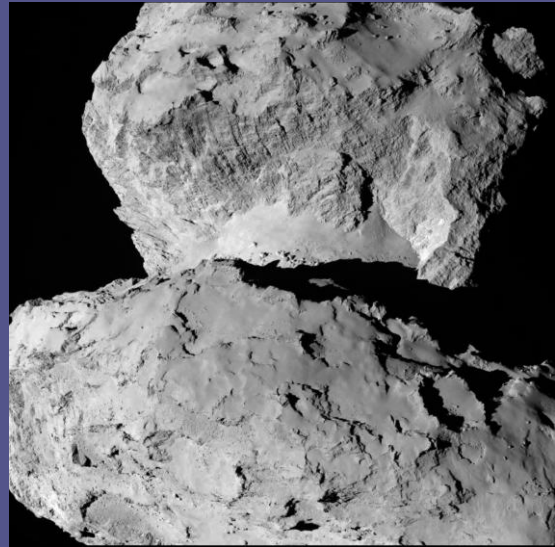
On August 6, 2014, ESA's Rosetta mission arrived at 67P/Churyumov-Gerasimenko to perform continuous observations of the comet surface and coma. Since then it has been providing unprecedented information on the morphology and activity of cometary bodies.

Lightning in Saturn and Jupiter has been modeled theoretically. Electrically active storms may create a localized but long-lasting layer of enhanced ionization below the ionosphere. Lightning emits primarily in H α 656 nm, while other transient luminous events would do so in the UV continuum and Fulcher bands of H₂.

A double ring system was discovered in 10199 Chariklo using stellar occultation data. Chariklo is the first Centaur known to possess rings. This investigation was complemented with a study of changes in the reflectance spectra of Chariklo between 2003 and 2013.

MEMBERS

L. Bellot Rubio, D. Dabrowska, R. Duffard, J. Escobar Cerezo, S. Esteban Pozuelo, E. Fernández Valenzuela, B. Funke, M. García Comas, A. Gardini, F. González Galindo, F. Gordillo Vázquez, M. Gotic, D. Guirado, P.J. Gutiérrez, A.A. Jurado Navarro, L.M. Lara, M.J. López González, A. López Jiménez, J.J. López Moreno, M. López Puertas, M.A. López Valverde, A. Luque, A. Molina, F. Moreno, O. Muñoz, J.L. Ortiz, F.C. Parra



Rosetta arrival at comet 67P/Churyumov-Gerasimenko. This image shows the nucleus up close, as observed by the OSIRIS Narrow Angle Camera on 14 August 2014.



Discovery of a double ring system around Chariklo based on stellar occultation data on 3 June 2013.

Rojas, J. Peralta, F.J. Pozuelos Romero, I.S. Requerey, P. Santos, S. Thonhofer, J.C. del Toro Iniesta

INVITED RESEARCHERS

A. Álvarez-Candal (ON, Brazil), A. Campo-Bagatín (U. Alicante, Spain), C. Haldoupis (U. Crete, Greece), T. Hoder (Masaryk U., Czech Republic), M. Melita (CONICET, Argentina), K. Meraner (MPM, Germany), M. Simek (IPP, Czech Republic), C.R. Stark (U. St. Andrews, UK), G. Stiller (KIT, Germany), D. Utz (IGAM, Austria), Th. von Clarmann (KIT, Germany)

LINES OF RESEARCH

Solar physics

Solar system minor bodies

Terrestrial and planetary atmospheres

Space instrumentation

STELLAR PHYSICS

The research activity of the Stellar Physics department can be divided into two main topics. In the first topic, different aspects of the stellar physics are studied: stellar variability due to the star itself or to planets, stellar statistics, stellar clusters, stellar atmospheres, stellar evolution, and stellar pulsations or asteroseismology. The second research area is focused on the study of transient objects, ranging from close meteors to distant Gamma-Ray Bursts (GRBs). Most of the studies carried out for these transients deal with the final stages of stellar evolution, i.e. neutron stars, magnetars, and very specially GRBs, for which an intense research activity is ongoing.

Both thematic blocks are supported by solid instrumental projects, either for ground-based telescopes (CARMENES, T35, BOOTES, OCTOCAM, EDIPO) or for space observatories (COROT, Kepler, UFFO-p).

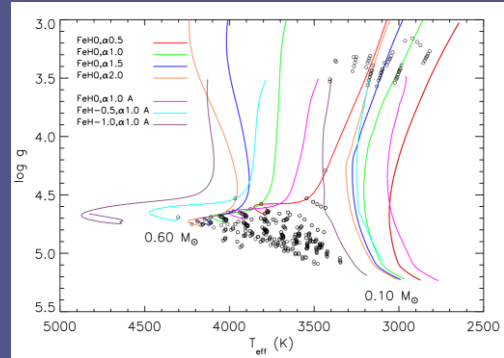
The HETH (High-Energy Transients and their Hosts) group has led the feasibility study of OCTOCAM, a new-generation instrument for the 8.1m GEMINI telescope. It is one out of the four selected and funded by GEMINI, and the only one led by a group external to the consortium. OCTOCAM will be capable of obtaining imaging and spectroscopy at high time-resolution in eight simultaneous channels, covering the visible and near infrared. It will be also able to perform spectropolarimetry and integral field spectroscopy.

One of the major results achieved this year is the first theoretical description of the instability strip of pulsating M dwarf stars in the effective temperature and surface gravity plane (see figure, Rodríguez-López et al. 2014). The description provides a useful guide for observers to the time-scale of the oscillations depending on the M dwarfs' spectral type and evolutionary status. Furthermore, this study yields for the first time theoretical evidence of the potential of M dwarf stars to be Solar-like oscillators.

On the observational side, the search for the first pulsating M dwarf is under way: this is done through high precision fast photometry obtained by the *Kepler* spacecraft and with ground-search observations using the high-resolution spectrographs HARPS and HARPS-N to gather high-cadence radial velocity data of extraordinary precision. These data are also useful to search for close-in planets around M dwarfs and, as a result, we participated in the discovery of two planets around Kapteyn's star (Anglada-Escudé et al. 2014). One of them lies in the habitable zone and is the most ancient planet discovered to date.

MEMBERS

P.J. Amado, Z. Binbin, E. Casal López, A.J. Castro-Tirado, R. Cunniffe, A. de Ugarte Postigo, J.A. Díaz Andreu, D. Díaz Fraile, M. Fernández, R. Garrido, J. Gorosabel, Y. Hu, S. Jeong,



Evolutionary tracks for the 0.10 and 0.60 solar masses of grids of different metallicities and mixing length parameters, and including, or not, an atmosphere. Black circles show unstable models and define the instability strip in terms of effective temperature and surface gravity.

O. Lara-Gil, P. López de Coca, S. Martín, Z. Modroño, S.R. Oates, S.M. Ocando, J.I. Olivares, C.T. Rodríguez López, E. Rodríguez, A. Rolland, R. Sánchez-Ramírez, J.C. Suárez Yanes, J.C. Tello, J. Venegas, M. Villaverde

INVITED RESEARCHERS

M. Besser, J.E. Rodríguez Martín

LINES OF RESEARCH

Asteroseismology of low mass stars along the HR diagram: theoretical models and observations from CoRoT and Kepler, as well as from HARPS y HARPS-N

Gamma-ray bursts

High Energy Transients and their Hosts

Pulsation and stellar evolution of main sequence and pre-main sequence stars of intermediate mass.

Stellar clusters.

The physics of very low-mass stars and their exoplanets

CALAR ALTO OBSERVATORY

The IAA is the reference institute for the **Calar Alto Hispano-Alemán** observatory (CAHA). The German-Spanish Astronomical Center at Calar Alto is located on the mountain range of Los Filabres, in Almería, at a height of 2167m. CAHA is operated jointly by the Max-Planck-Institut für Astronomie (MPIA, Heidelberg, Germany) and the IAA. Calar Alto offers three telescopes with apertures 1.23m, 2.2m, and 3.5m to the general community. Another 1.5m-telescope is operated under the control of the Observatorio Astronómico Nacional (OAN). The ideal conditions for astronomical observations and aperture size of the telescopes at CAHA make of it the most important astronomical observatory in the continental Europe.

CAHA telescopes are equipped with state-of-the-art astronomical instrumentation including direct optical and near-infrared imaging cameras, and intermediate- and high-dispersion spectrographs. The observatory has its own technical installations: clean rooms, electronic, mechanic and computing facilities, and all-sky cameras and sensors to monitor the quality of the night sky. This year CAHA has achieved the record of observing nights in its whole 38-year history. The 191 clear nights and 2477 observation hours make a strong argument in support of the excellent quality of the sky where the observatory is located.

The observatory also offers aluminizing services as it has the largest aluminizing chamber in Europe, capable to host mirrors with diameters up to 4m.

SCIENTIFIC RESULTS IN 2014

SATURN'S HEXAGON FROM CAHA AND FROM SPACE

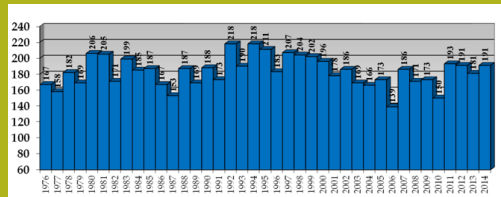
The PlanetCam and AstraLux cameras at CAHA have been used to investigate the hexagonal structure circling the North pole of planet Saturn, a unique feature among the planets of the Solar System discovered only thirty years ago. Using these instruments, the Planetary Sciences Group of the Basque Country University has studied this feature and determined its rotation period. This rotation period may correspond to that of Saturn, which is the only planet whose rotation period is not exactly known. The research has appeared on the cover page of Geophysical Research Letters.

FIRST PLANET CONFIRMED FROM CAHA

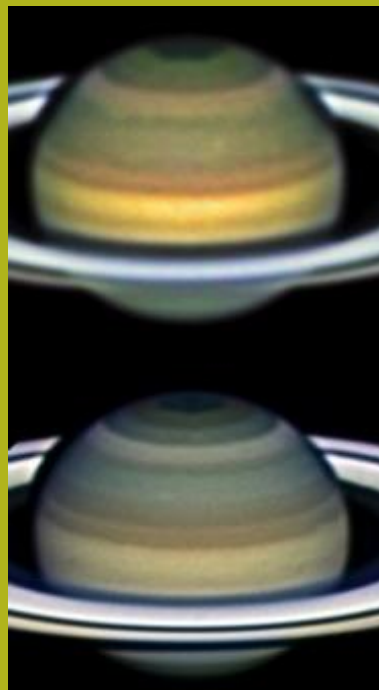
An exoplanet has been confirmed for the first time using an instrument built by the Calar Alto Observatory.



Night view at CAHA.



Historical record of clear nights at CAHA.



Saturn study from CAHA.

It is the first planet orbiting a giant star whose confirmation is beyond any doubt. By analyzing the exquisite radial velocity data obtained with the Calar Alto Fiber-fed Echelle spectrograph (CAFE), an international team (CAB-CSIC, MPIA, Universidade do Porto, UNAM and CAHA) has inferred the presence of a planet with a mass slightly lighter than Jupiter, orbiting very nearby the nearby star KIC8219268, at about 2.32 stellar radii. The results of this work were published in *Astronomy & Astrophysics Letters*.

IZW18: THE GALAXY THAT REVEALS THE UNIVERSE'S HISTORY

The dwarf galaxy IZw18 is the least metal abundant in the nearby Universe, and one of the most akin to the primeval galaxies, allowing thus to unveil the conditions that prevailed in the primordial Universe. Using the PMAS integral field spectrograph at the 3.5m CAHA telescope, researchers from the Instituto de Astrofísica de Andalucía (IAA-CSIC) have obtained the first detailed map of a region of IZw18 containing ionized helium. Supermassive stars, like the ones existing in the very early Universe are suggested as likely responsible for this ionization. This study was published in the journal *Astrophysical Journal Letters*.

THE MERGING HISTORY OF TWO NEARBY STARS

A study of the binary system “MY Camelopardalis” shows that the most massive stars form by the merging of other smaller stars, as theoretical models predict. To study MY Cam, a research team integrated by researchers of University of Alicante, CAB and IAC, obtained a large number of spectra with FOCES, a spectrograph which operated for many years at the 2.2m telescope of Calar Alto. They concluded that the evolution of this binary system will lead to the merger of the two stars into one object with a mass 60 times that of the Sun. The results of this study were published in the journal *Astronomy & Astrophysics*.

TECHNOLOGICAL RESULTS IN 2014

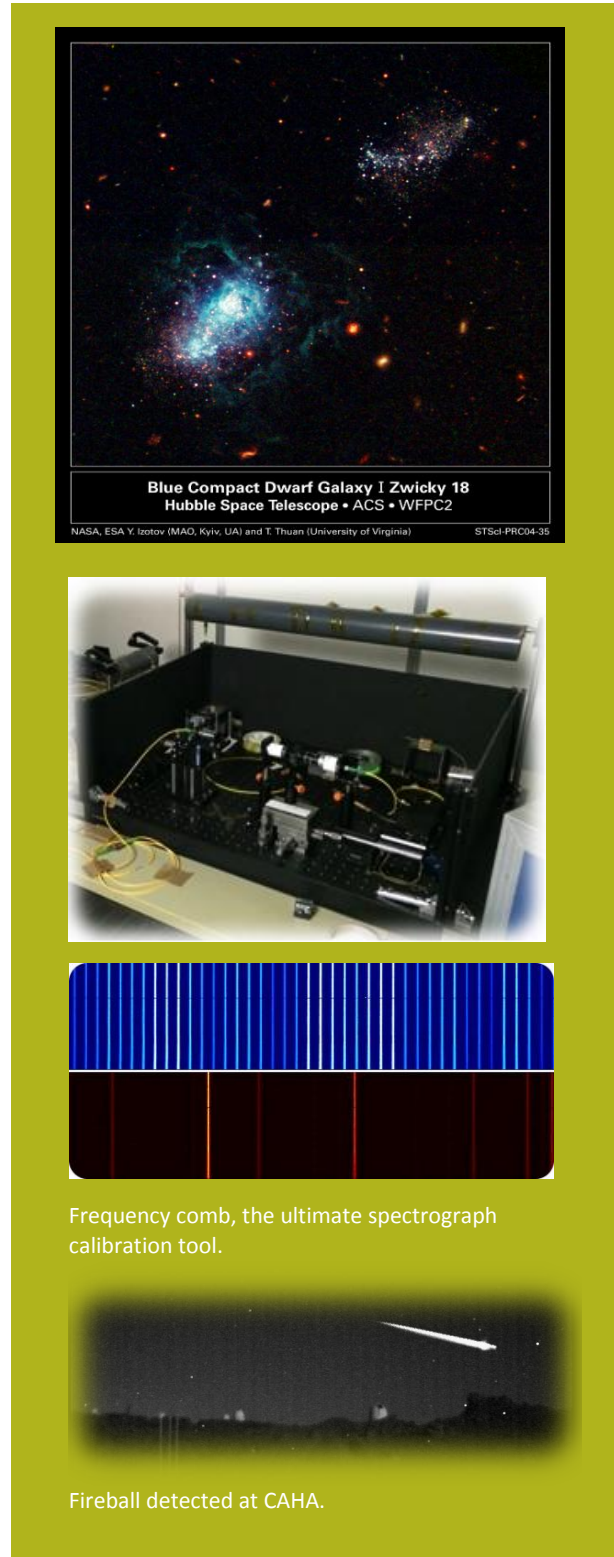
A UNIVERSAL COMB

Optical frequency combs are instruments that allow more accurate astronomical observations. Scientists from the Leibniz Institute for Astrophysics in Potsdam (AIP) and the Centre for innovation competence innoFSPEC have tested a novel optical frequency comb that will improve the calibration of spectrographs and hence their scientific measurements.

This frequency comb has undergone its first practical test on sky at Calar Alto. For this observing campaign, the PMAS spectrograph at the 3.5m telescope was equipped with the frequency comb yielding satisfactory results that will improve our precision in the determination of the rotation velocities of galaxies or the chemical composition of stars.

NEW FIREBALL DETECTION STATION AND RELATED WEB PAGE

Since July 2014, CAHA has a fireball detection station consisting of five high sensitivity CCD cameras. These devices are monitoring the firmament during the whole night and allow automatic identification of meteoroids entering into our atmosphere. These meteoroids are fragments from asteroids, comets or even other planets. The systems installed at Calar Alto for the



Blue Compact Dwarf Galaxy I Zwicky 18
Hubble Space Telescope • ACS • WFPC2
NASA, ESA, Y. Izotov (MAO, Kyiv, UA) and T. Thuan (University of Virginia) STScI-PRC04-35

FOCES spectrograph

Frequency comb, the ultimate spectrograph calibration tool.

Fireball detected at CAHA.

analysis of this interplanetary matter are part of the SMART project, developed in collaboration together with researchers of IAA and Universidad de Huelva. The list of the objects observed with these external surveillance webcams, automatically updated each time a new fireball is detected, can be accessed from the CAHA web site.

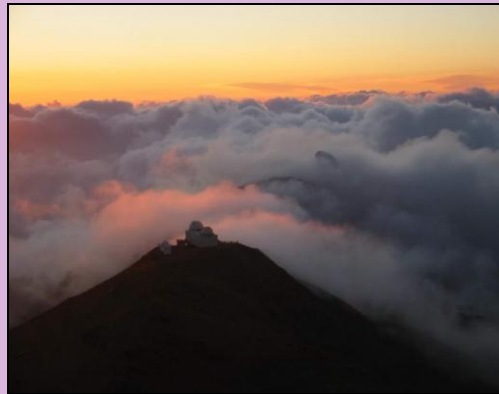
SIERRA NEVADA OBSERVATORY

AN OBSERVATORY AT 3000M

The Sierra Nevada Observatory (OSN) is a high mountain observatory located at Loma de Dílar (2896m altitude) within the Sierra Nevada National Park (Granada, Spain). The observatory is operated and supplied by the IAA. It consists of a main building which hosts two Nasmyth optical telescopes of 90-cm and 1.50-m diameter each (hereafter T90 and T150). The astronomical instruments attached to those telescopes are Strömngren-Crawford simultaneous six-channel photometer, two similar 2048x2048 CCD cameras, and Albireo, a low- and intermediate-resolution optical spectrograph. The technical maintenance of the telescopes and instruments is supported by the UDIT (Instrumental and Technological Development Unit) staff belong to IAA.

Due to the size of their telescopes, the OSN is especially suited for projects requiring a prompt response (Target of Opportunity) and/or monitoring observations during long periods of time. The astronomical observations carried out at OSN respond to proposals submitted by IAA research groups, although the number of observing requests by external collaborators is growing with time. In addition to the typical visitor and service observing modes, the OSN offers the possibility to carry out observations in remote mode. The number of observing proposals accepted for the T90 and T150 telescopes has been 14 and 12 for semesters 2014A and 2014B, respectively. In addition, during this year the observatory has performed observations related to educational activities: observing practices of the Master in Astronomy and Astrophysics organized by the Valencia International University and observing sessions for the PIISA project to introduce Andalusian Secondary students to the research.

Besides the main telescopes, there are secondary astronomical facilities carrying out observations for specific projects: the 60-cm IR semi-automated telescope (T60) for early follow-up of gamma-ray bust (GRB), the 35-cm telescope (T35) for the observation of variable stars, and the Spectral Airglow Temperature Imager (SATI), a Fabry-Perot spectrometer dedicated to the study of the high layers of the Earth's atmosphere. Moreover, two seeing-monitors take continuously dome and open-sky measurements in order to characterize the quality of the Sierra Nevada sky. In



The Sierra Nevada Observatory, sunset view from the 3,394 m Veleta peak.

addition to the instrumentation belonging exclusively to IAA, the OSN hosts astronomical devices in collaboration with other institutions, such as universities and research centres. The OSN fireball detection station is part of the SMART project led by Huelva University to monitor the sky in order to analyse the matter interplanetary matter impacting our planet.

OSN observations are to be used frequently by the IAA PhD students to support their work. The most relevant scientific results of the observations are published in international journals. During 2014, observations obtained at OSN have been used in two doctoral theses and 17 publications (15 ISI publications and 2 proceedings).

The OSN does not only contribute to the scientific production of the IAA and to the formation of its students, but it also participates in multiple outreach activities. It must be particularly emphasized the guided visits, public observations, and talks organized at OSN every summer since 2006.

www.osn.iaa.es/content/visitas-guiadas

MEMBERS

OSN Director: Susana Martín Ruiz

OSN Technical Support Head: Luis Costillo Iciarra

Members: Francisco J. Aceituno Castro, Víctor M. Casanova Escurín, José Luis de la Rosa Álvarez, José Alberto Mirasol Junco, Tomás Pérez Silvente, José Antonio Ruiz Bueno, Alfredo Sota Ballano

COMPUTER CENTER

THE COMPUTER CENTER GRANTS THE TECHNICAL RESOURCES DEMANDED BY THE IAA RESEARCH ACTIVITY AND ITS TECHNOLOGICAL PROJECTS.

The IAA Computer Center (CC – *Centro de Cálculo*) is responsible to service and manage all IAA computers, proving support to all IAA computer users. It also provides communication services. The IAA is an important node of RedIRIS-NOVA, the fast, high capacity optical fiber network connecting all regional communication networks and most important research center in Spain with international academic networks. The IAA CC provides communication services to all CSIC centers in Granada and to the Sierra Nevada Observatory. These are essential services for research projects, management services, and collaboration with enterprises.

In the last year, the technological and scientific challenges afforded by the CC have allowed the IAA to consolidate its communication and scientific computing facilities. Two important milestones have been achieved in this last year:

- Implementation of a statistical system to control users' incidences and communication networks.
- Achievement of the PdP credential for the IRIS-NOVA communication network.
- Starting operations of the new supercomputing facility. This new service has demonstrated a high performance, covering the computing needs of the IAA users.

Members of the CC are also involved in the research projects AYA2013-48623-C2-1-P "Javalambre - Physics of the accelerated universe astrophysical survey" (J. Ruedas) and TIC-2839 "La red de Telescopios de Robóticos en Andalucía como parte de una Red a escala planetaria" (R. Parra).

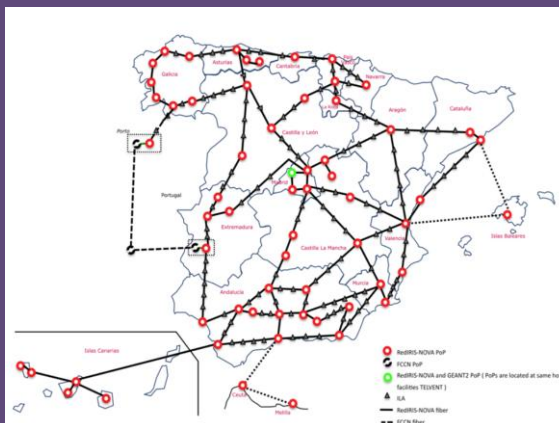
MEMBERS

Service Head: José Ruedas Sánchez

Members: Francisco Manuel Bayo Muñoz, Benigno Cantero Rus, Juan José Guijarro Jiménez, Rafael Parra Garófano



New IAA supercomputing facility.





Unión Europea
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Una Manera de Hacer Europa



Punto de Presencia de RedIRIS-NOVA
Red Avanzada de Comunicación I + D
Proyecto Cofinanciado por la Unión Europea
Programa Operativo Economía Basada en el Conocimiento



RedIRIS-NOVA PdP credential and network maps.

UDIT

INSTRUMENTAL AND TECHNOLOGICAL DEVELOPMENT UNIT

THE **UDIT** PRIME OBJECTIVES ARE THE TECHNOLOGICAL DEVELOPMENT OF SCIENTIFIC INSTRUMENTATION AND TECHNICAL SUPPORT TO THE IAA SCIENTISTS AND OBSERVATORIES.

The Instrumental and Technological Development Unit (Unidad de Desarrollo Instrumental y Tecnológico – UDIT) has been in operation at the IAA since its foundation in 1975. State-of-the-art instruments designed and built at the UDIT for balloon and terrestrial rocket payloads in early times and for space missions and ground-based observatories nowadays have put the IAA on the map as a reference center for technological-challenging research projects.

The technical production at the UDIT can be split into two major lines:

- Analysis, design, integration, and verification of astronomical instruments for ground-based telescopes, especially for the telescopes at Calar Alto Observatory (CAHA) and Sierra Nevada Observatory (OSN).
- Analysis, design, integration, and verification of astronomical instruments for interplanetary scientific missions.

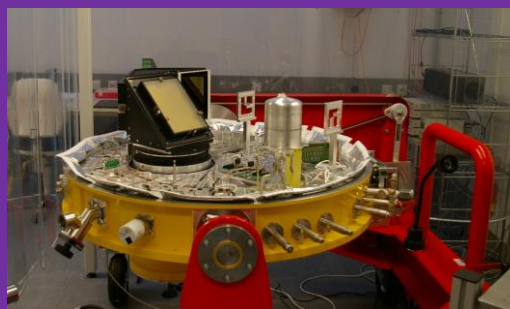
In this chapter we report on a selection of instrumentation projects and their associated technical development.

GROUND BASED INSTRUMENTS:

PANIC is a general purpose Panoramic Near Infrared camera for the 2.2m and 3.5m telescopes at CAHA. During 2013 the Assembly, Integration, and Verification (AIV) has taken place at the Max Planck Institute für Astronomy (MPIA). PANIC is being developed as a 50:50 partnership between the IAA and MPIA. The responsibilities of the IAA UDIT are focused on Optics and high-level Software packages, particularly on:

- Optics design and optimization for the 2.2m and 3.5m CAHA telescopes,
- Development of manufacturing drawings and leadership of the optical system AIV,
- Software observation tool,
- Data reduction pipeline.

After the promising first steps of the AIV we are looking forward to obtaining the first light at CAHA at the end of 2014.



PANIC AIV taking place at MPIA, Heidelberg.



Everything ready for CARMENES at the IAA labs.



Sunrise just before its launch on June 2013.

CARMENES (Calar Alto high-resolution search for M dwarfs with Exoearths with Near-infrared and optical Echelle Spectrographs) is being developed by a consortium of 11 partners, led by LSW (Heidelberg) and IAA. The near-IR (NIR) spectrograph has been designed by the IAA and will be fully assembled at its clean rooms during 2014-2015. IAA is responsible for the (i) NIR/Opto mechanics, (ii) Cooling System, (iii) Control Software and (iv) electronics and exposure meter for the NIR channel. The arrival of the echelle to our laboratories in 2013 marked the AIV start.

SPACE PROJECTS

IMaX (Imaging Magnetograph eXperiment) is a solar spectropolarimeter built by five Spanish institutions (IAC, IAA, INTA, UPM, and GACE at Univ. Valencia). It performed its 2nd successful flight on-board the Sunrise balloon-borne solar Observatory on June 2013.

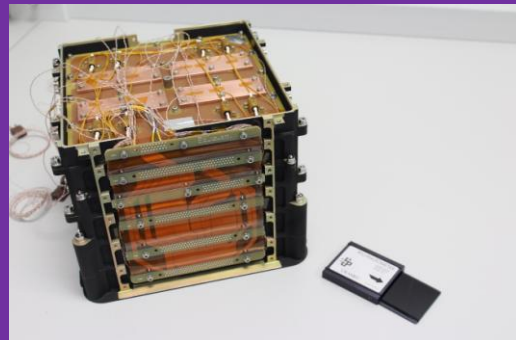
Whereas IMaX is the present of the solar physics space research, the IAA works simultaneously on its future, **PHI**, a Polarimetric and Helioseismic Imager that will flight onboard the ESA Solar Orbiter mission. The IAA is the PHI co-PI institution and its Solar Physics group coordinates the Spanish teams involved in PHI. The IAA is also responsible for the electronics unit and the harness work packages. The STM model has been developed, tested and delivered to ESA in 2013.

NOMAD (Nadir and Occultation for Mars Discovery) is a 3-channel spectrometer that will fly on-board the ESA ExoMars-TGO mission. IAA is the co-PI institution of the international consortium led by IASB-BIRA (Belgium) also including the Open University (UK) and IFSI (Italy). The IAA is responsible for SINBAD, the Spacecraft INterface BoArD with the Power Distribution, CPU and NOMAD onboard SW. After passing the CDR in 2013, the manufacture of the flight model has begun.

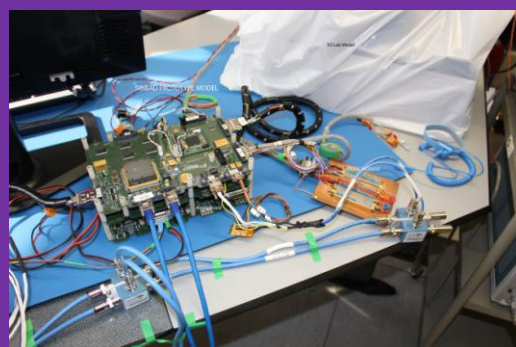
GALA (GANymede Laser Altimeter) and **JANUS** (Jovis, Amorum ac Natorum Undique Scrutator) will fly on-board JUICE, an ESA mission that will study the Jovian system. The IAA is responsible for the power supply modules of both instruments, and the filter wheel and mechanism controller module (FWM-MCM) of the camera JANUS. In 2013, the Instrument Preliminary Readiness Review (IPRR) has been delivered to ESA, and the development models for the power supply of GALA and JANUS and the filter wheel and electronic controller for JANUS have been built.

Members:

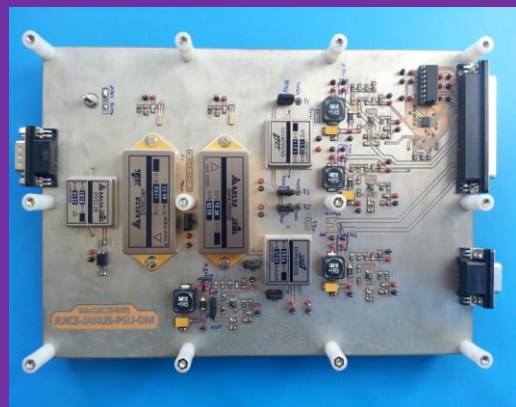
Electronics: M. Abril, D. Álvarez, B. Aparicio, G.P. Candini, J.P. Cobos, L.P. Costillo, J.J. España, F.J. Girela, M. Herranz, J.M. Jerónimo, J. Jiménez, P. Labrousse, H. Magán, I. Martínez, J.L. Ramos, N. Robles, J. Rodrigo, J. Sánchez, M. R., Sanz.



SO/PHI E-UNIT STM model during assembly phase.



Highly successful first test of the SINBAD prototype.



JANUS PSM at the IAA laboratories.

More exciting news @:
<https://udit.iaa.csic.es/>

Mechanics: S. Becerril, I. Bustamante, E. Mirabet, E. Rodríguez, M.A. Sánchez. **Optics:** C. Cárdenas, I. Ferro, D. Pérez, A. Ballesta.

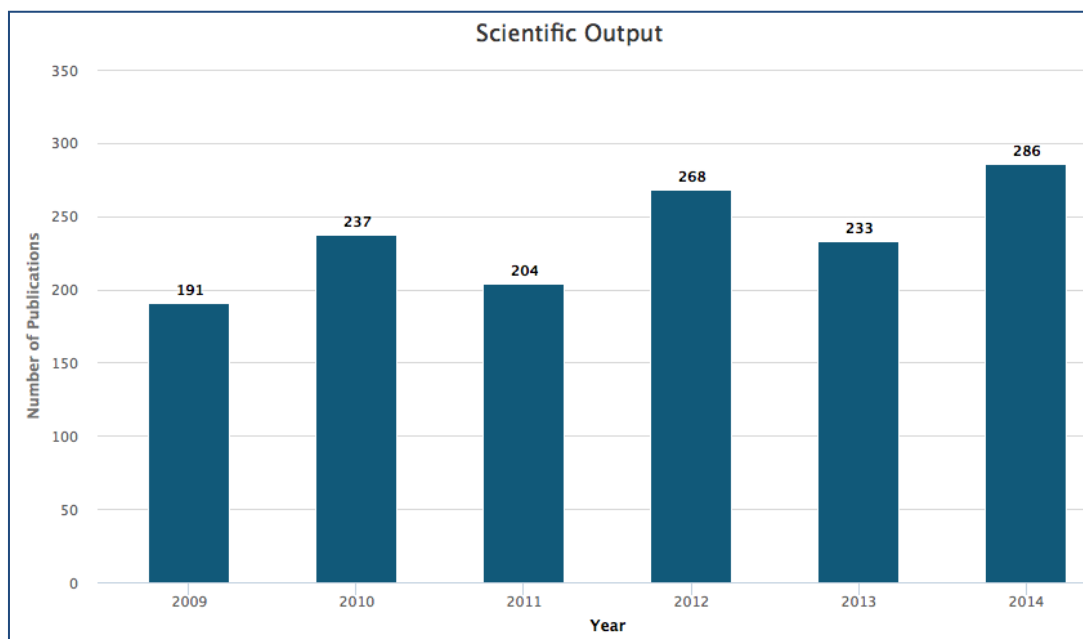
Project Management: M. Balaguer, J.M. Castro, A. López, B. Molina, J. Rodríguez.

Software: A. García, J.M. Gómez, C. Husillos, J.M. Ibáñez, I. Morales, R. Morales Muñoz, M. Passas, C. Pastor, V. Terrón.

SCI PUBLICATIONS

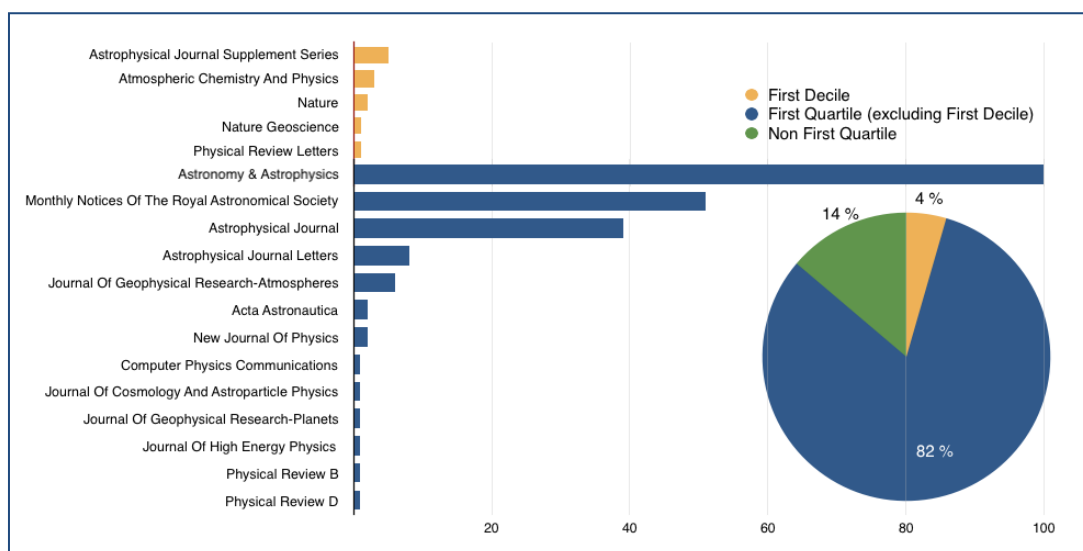
The research activity carried out at the IAA-CSIC during 2014 can be measured by the number of publications in scientific journals that report new results, new pieces of science. This year, this activity has resulted in 286 papers published in journals of the Science Citation Index (SCI), i.e., international journals recognized by their quality and impact.

The complete list of the IAA-CSIC publications in 2014 is given in the Annex at the end of this report. The evolution of the number of SCI publications in the last 6 years is shown in the figure below. The number of publications shows an increasing trend with time. The IAA-CSIC publications in 2014 exceeds the average of the previous 5 years by 25%.

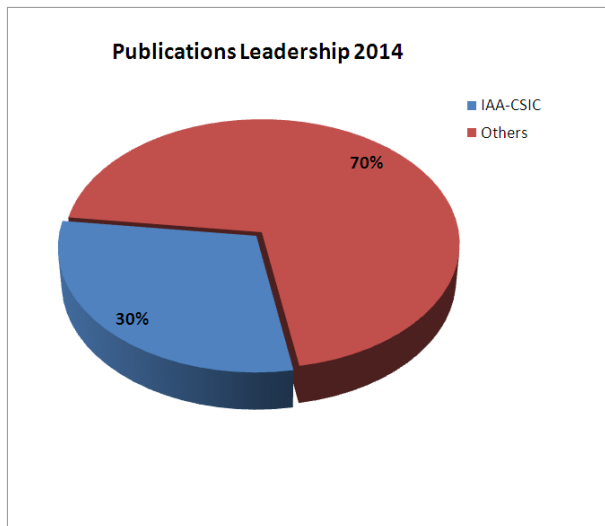


The publications of the IAA-CSIC are mostly distributed in high impact journals. About 86% of our publications are made in journals of the first quartile (top 25% journals). Among these publications, 4% are made in the first decile (top 10% journals). Most of the IAA-CSIC scientific results are published in Astronomy & Astrophysics, the main European astronomical journal.

A significant fraction of these results are published in Monthly Notices of the Royal Astronomical Society and Astrophysical Journal, the most important British and American astronomical journals. It must be noticed that Icarus, one of the most important journals for planetary sciences was not included in the first quartile in 2014.

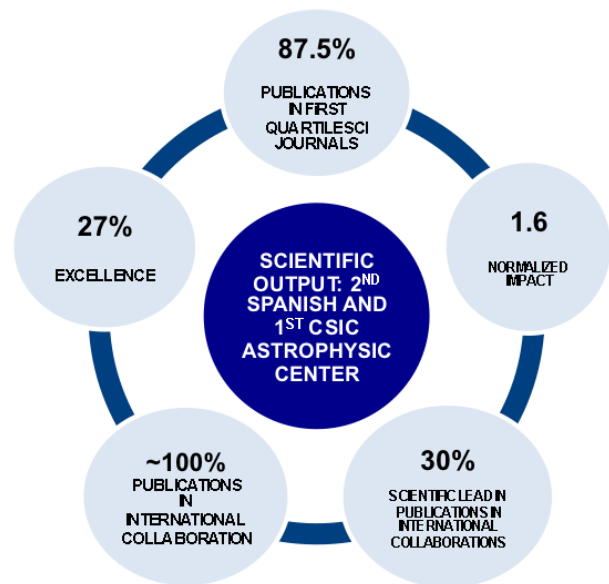


Other aspects of the scientific research of the IAA and its quantitative results are the leadership and internationalization of these publications. A significant fraction of the 2014 IAA SCI publications is led by its scientists. The figure below shows that 30% of the IAA publications have an IAA first author. This is consistent with the leadership of the IAA in the last 5 years.



Furthermore, almost 100% of the IAA publications include authors from international institutions, probing the extraordinary level of internationalization of the IAA research.

According to the SCIMAGO SIR-2014, the scientific output of the IAA in the period 2008-2012 ranks the second position among Spanish centers devoted to Astrophysical research. Among the centers of CSIC, the IAA scientific output occupies the 7th position.



EDUCATION

PHD THESES

"Nuevos Métodos Observacionales de Estrellas Post-AGB y Nebulosas Planetarias"

Author: Mónica Wendolyn Blanco Cárdenas
Supervisors: Luis Felipe Miranda Palacios, Martín A. Guerrero Roncel
Universidad de Granada Jan 24, 2014

"Estudio de Nebulosas Planetarias con Emisión Difusa en Rayos X"

Author: Nieves Ruiz Fernández
Supervisors: Martín A. Guerrero Roncel
Universidad de Granada Mar 21, 2014

"Percepción de las Radiaciones Hawking y Unruh por Distintos Observadores: Aplicaciones de la Función de Temperatura Efectiva"

Author: Luis Cortés Barbado
Supervisors: Carlos Barceló Serón, Luis Javier Garay Elizondo
Universidad de Granada Apr 04, 2014

"Accurate Photometry and Photometric Redshifts for Cosmological Surveys"

Author: Alberto Molino Benito
Supervisors: Narciso Benítez Lozano
Universidad de Granada Apr 11, 2014

"Inconsistencias en el análisis armónico de series temporales de estrellas pulsantes observadas desde satélite"

Author: Javier Pascual Granado
Supervisors: Rafael Garrido Haba
Universidad de Granada Apr 30, 2014

"Experimental and theoretical study of scattering matrix of martian dust analogous."

Author: Dominika Dabrowska
Supervisors: Olga Muñoz Gómez, Fernando Moreno Danvila
Universidad de Granada Sep 25, 2014

"Monte Carlo Models of the dust environment of a sample of comets from the Oort Cloud to the outer Main Asteroid Belt"

Author: Francisco José Pozuelos
Supervisors: Fernando Moreno Danvila
Universidad de Granada Oct 24, 2014

"X-ray Emission from Hot Bubbles in Nebulae around Evolved Stars"

Author: Jesús Alberto Toalá Sanz
Supervisors: Martín A Guerrero Roncel, Jane Arthur
Universidad de Granada Oct 24, 2014

"Estudio de las regiones más internas en jets relativistas: campo magnético y estructura del jet en el quásar NRAO 150"

Author: Sol Natalia Molina
Supervisors: José Luis Gómez Fernández, Juan Iván Agudo Rodríguez
Universidad de Granada Oct 27, 2014

"A multiwavelength and multiscale study of luminous and ultraluminous infrared galaxies in the local universe"

Author: Rubén Herrero Illana
Supervisors: Miguel Ángel Pérez Torres, Antxon Alberdi Odriozola
Universidad de Granada Oct 31, 2014

"Study of Gamma-Ray Bursts with Robotic Telescopes"

Author: Martin Jelinek
Supervisors: Alberto J. Castro Tirado
Universidad de Granada Nov 28, 2014

TEACHING

Master and PhD Programs

Title: *Radioastronomía e Interferometría*
Authors: **José Francisco Gómez Rivero, Antonio Maria Alberdi Odriozola, Guillem Josep Anglada Pons**
Program: Física y Matemáticas – FISYMAT
University: Universidad de Granada
Hours: 60
Date: October 6, 2014

Other Programs

Title: *Introducción al Sol y al Sistema Solar*
Authors: **José Carlos del Toro Iniesta**
Program: El Universo: desde el Big Bang a la vida
Organizer: Universidad de Granada
Hours: 36
Date: May 15, 2014

Title: *Iniciación a Python*
Authors: **Victor Francisco Terrón Salas, César Husillos Rodríguez**
Hours: 20
Program: Curso del Gabinete de Formación de la Agencia Estatal Consejo Superior de Investigaciones Científicas
Organizer: Instituto de Astrofísica de Andalucía
Place: Granada, Spain
Date: April 21, 2014

INTERNATIONAL

SEMINARS

Dr. Isabel Pérez Martín (UGR)

Title: "Bar parameter evolution over the last 7 Gyr "

Date: Jan 16, 2014

Dr. Anibal García Hernández (Instituto de Astrofísica de Canarias, IAC)

Title: "Nucleosynthesis and molecular processes in evolved stars"

Date: Jan 23, 2014

Dr. Gemma Busquet (IAA)

Title: "The CHESS survey of the protostellar shock L1157-B1"

Date: Jan 30, 2014

Lic. Joel Sánchez Bermúdez (IAA)

Title: "The bricks of the Very Large Telescope Interferometer"

Date: Feb 06, 2014

Prof. E. Pérez (IAA)

Title: "A powerful new method to measure the atmospheric water vapour column."

Date: Feb 13, 2014

Dr. Isabel Márquez Pérez (IAA)

Title: "The AGN nature of LINER nuclear sources"

Date: Feb 20, 2014

J. Masegosa (IAA)

Title: "La Asociación de Mujeres Investigadoras y Tecnólogas (AMIT)"

Date: Mar 06, 2014

Dr. Paola Marziani (Università di Padova)

Title: "Quasars and their emission lines as cosmological probes"

Date: Mar 13, 2014

Juan Antonio Fernández Ontiveros (Max Planck Institut for Radioastronomy)

Title: "The Nature of the IR Emission in Low-Luminosity AGN at Parsec Scales"

Date: Mar 20, 2014

Jesús A. Toalá (IAA)

Title: "New findings on the X-ray emission from Wolf-Rayet nebulae"

Date: Mar 27, 2014

Dr. Rene Duffard (IAA)

Title: "A ring system detected around the Centaur (10199) Chariklo"

Date: Apr 03, 2014

Francisco Manuel Bayo Muñoz and Juan José Guijarro Jiménez (IAA)

Title: "The IAA Cloud Service"

Date: Apr 08, 2014

Dr. Pau Amaro Seoane (Max Planck Institute for Gravitational Physics - Albert Einstein Institute)

Title: "Sculpting the Galactic Centre: Astrophysics and fundamental physics with photons and gravitational waves"

Date: Apr 10, 2014

Javier Pascual Granado (IAA)

Title: "Inconsistences in the harmonic analysis of time series"

Date: Apr 24, 2014

Dr. Xuan Fang (IAA)

Title: "Deep spectroscopy of planetary nebulae"

Date: May 15, 2014

Rafael Parra (IAA)

Title: "IAA Computing Service"

Date: May 29, 2014

Dr. Pheneas Nkundabakura (National University of Rwanda)

Title: "Status of Astronomy in East Africa"

Date: Jun 05, 2014

Dr. Thomas von Clarmann (Karlsruhe Institute for Technology)

Title: "Remote sensing: survival strategies in the jungle of averaging kernels and covariance matrices"

Date: Jun 24, 2014

Dr. Christian Hummel (European Southern Observatory, ESO)

Title: "The brief lives of massive stars as witnessed by interferometry"

Date: Jun 26, 2014

Dr. Miguel Ángel Pérez Torres (IAA)

Title: ""What is the progenitor system of the nearby Type Ia SN 2014J?""

Date: Jul 03, 2014

Dr. Gregorio José Molina Cuberos (Universidad de Murcia)

Title: "Metamateriales Quirales, el Plan B para la Refracción Negativa"

Date: Sep 24, 2014

Dr. Antonio de Ugarte Postigo (IAA)

Title: "OCTOCAM: Proposal for a multichannel imager and spectrograph with high-time-resolution capabilities for the 8.1m Gemini telescopes"

Date: Oct 15, 2014

Dr. Rainer Schödel (IAA)

Title: "The Fingerprint of a Galactic Nucleus: A Multi-Wavelength, High-Angular Resolution, Near Infrared Study of the Centre of the Milky Way"

Date: Oct 16, 2014

María Rioja and Richard Dodson (International Centre for Radio Astronomy Research, ICRAR)

Title: "High Frequency Astrometry and Pulsar Studies with the Korean VLBI Network"

Date: Oct 22, 2014

Rubén López-Coto (Institut de Física d'Altes Energies - IFAE)

Title: "The non-thermal universe at the highest energies: TeV gamma-ray astronomy with the MAGIC telescope"

Date: Oct 30, 2014

Dr. Hui Dong (IAA)

Title: "Unveiling the Massive Stars in the Galactic Centre "

Date: Nov 13, 2014

Francesco Costagliola (IAA)

Title: "An ALMA view on the compact obscured nuclei of luminous IR galaxies"

Date: Nov 20, 2014

Francesco Belfiore (Cavendish Laboratory)

Title: "First results from SDSS IV - MaNGA"

Date: Nov 24, 2014

S. B. Pandey (Aryabhata Research Institute of Observational Sciences, ARIES)

Title: "Energetic transients as a part of time domain astronomy in TMT era"

Date: Nov 27, 2014

Dr. Alberto J. Castro Tirado (IAA)

Title: "GLORIA: Global Robotic Intelligent Array for e-science"

Date: Dec 04, 2014

Mirian Fernández Lorenzo (IAA)

Title: "Structural properties of isolated galaxies"

Date: Dec 11, 2014

VISITING SCIENTISTS

Francisco Abellán

Universitat de València
31/03/2014 - 09/04/2014

Juan Iván Agudo Rodríguez

Joint Institute for VLBI in Europe (JIVE)
27/06/2014 - 11/07/2014

Pau Amaro Seoane

Max Planck Institute for Gravitational Physics - Albert
Einstein Institute
08/04/2014 - 11/04/2014

Jane Arthur

Universidad Nacional Autónoma de México
19/10/2014 - 26/10/2014

Jose Ignacio Añez López

Universidad de Granada
15/12/2014 - 15/01/2015

Mónica Wendolyn Blanco Cárdenas

Universidad Nacional Autónoma de México
20/01/2014 - 17/02/2014

Gabriele Bruni

Max Planck Institut for Radioastronomy
17/11/2014 - 21/11/2014

Valentín Bujarrabal

Observatorio Astronómico Nacional
29/01/2014 - 30/01/2014

Tristan Cantat

Osservatorio Astronomico di Padova
22/04/2014 - 21/05/2014

Nathália Cibirka

Universidad de São Paulo
14/02/2014 - 11/03/2014

Richard Dobson

International Centre for Radio Astronomy Research
(ICRAR)
20/10/2014 - 24/10/2014

Eduardo Duarte Lacerda

Universidade Federal de Santa Catarina
17/09/2014 - 01/09/2015

Florence Durret

Institut d'Astrophysique de Paris
17/03/2014 - 22/03/2014

Yufeng Fan

Yunnan Astronomical Observatory
16/12/2014 - 19/12/2014

Yufeng Fan

Yunnan Astronomical Observatory
22/11/2014 - 29/11/2014

Andrew Fenney

Mullard Space Science Laboratory
23/06/2014 - 27/06/2014

Juan Antonio Fernández Ontiveros

Max Planck Institut for Radioastronomy
07/04/2014 - 11/04/2014

Juan Antonio Fernández Ontiveros

Max Planck Institut for Radioastronomy
17/03/2014 - 28/03/2014

Domingo Aníbal García Hernández

Instituto de Astrofísica de Canarias (IAC)
23/01/2014 - 24/01/2014

Carlos García Meca

Universidad Politécnica de Valencia
01/09/2014 - 31/08/2015

Eduard García Ribera

Parc Astronomic del Montsec
20/01/2014 - 24/01/2014

Josep Miquel Girart

Institut de Ciències de l'Espai - CSIC
25/03/2014 - 27/03/2014

Omaira González Martín

Instituto de Astrofísica de Andalucía - CSIC
09/03/2014 - 21/03/2014

Christos Haldoupis

University of Crete
24/01/2014 - 31/01/2014

Thomas Hoder

University of Brno
01/12/2014 - 05/12/2014

Petr Janout

Technical University of Prague
27/01/2014 - 07/03/2014

Antoine Mahoro

National University of Rwanda
28/05/2014 - 10/06/2014

Elena Manjavacas

Max Planck Institut for Astronomy
15/12/2014 - 19/12/2014

María Ángeles Martínez Carballo

Universidad Zaragoza
16/11/2014 - 21/11/2014

María Ángeles Martínez Carballo

Universidad Zaragoza
22/06/2014 - 27/06/2014

Paola Marziani

Osservatorio Astronomico di Padova
21/06/2014 - 02/07/2014

Paola Marziani

Osservatorio Astronomico di Padova
04/03/2014 - 19/03/2014

Katherina Meraner

Max Planck Institut for Meteorology
27/10/2014 - 05/12/2014

Francisco Javier Moreno González

Universidad de Sevilla
01/07/2014 - 29/07/2014

Pheneas Nkundabakura

National University of Rwanda
28/05/2014 - 10/06/2014

Shasbi B. Pandey

Aryabhata Research Institute of Observational
Sciences (ARIES)
25/11/2014 - 01/12/2014

Gerardo Ramos Larios

Universidad de Guadalajara
21/07/2014 - 27/07/2014

Angels Riera

Universitat de Barcelona
23/01/2014 - 24/01/2014

María José Rioja

International Centre for Radio Astronomy Research
(ICRAR)
20/10/2014 - 24/10/2014

Ricardo Rizzo

Centro de Astrobiología - CSIC
06/08/2014 - 07/08/2014

Milan Simek

Institute of Plasma Physics of Czech Academy of
Science in Prague
01/12/2014 - 05/12/2014

Josep María Solanes

Universitat de Barcelona
03/06/2014 - 06/06/2014

Craig Stark

University of Saint Andrews
21/04/2014 - 25/04/2014

Gabriele Stiller

Karlsruhe Institute for Technology
12/11/2014 - 18/11/2014

Gabriele Stiller

Karlsruhe Institute for Technology
23/06/2014 - 27/06/2014

Amelia Stutz

Max Planck Institut for Astronomy
18/02/2014 - 20/02/2014

Ivan Synlavskiy

Observatorio Astronómico de Kiev
02/10/2014 - 10/10/2014

Lucero Uscanga Aguilera

National Observatory of Athens
02/06/2014 - 07/06/2014
05/08/2014 - 07/08/2014
13/08/2014 - 13/08/2014

Thomas von Clarmann

Karlsruhe Institute for Technology
12/11/2014 - 18/11/2014

Thomas von Clarmann

Karlsruhe Institute for Technology
23/06/2014 - 27/06/2014

WORKSHOPS AND MEETINGS



Spanish SKA Day

National Meeting

Granada, Spain

Oct 23 - 23, 2014

IAA members of the Scientific Organizing Committee:

L. Verdes-Montenegro Atalaya, A. Alberdi Odriozola

IAA members of the Local Organizing Committee:

J. Garrido Sánchez, E. García Gómez-Caro, J. Blasco

Herrera, S. Anton, N. Ramírez Olivencia

http://riastronomia.es/opencms/opencms/Workshops/R_20140729.html



Workshop for the WSO Working Group and Spanish UV Astronomy

National Meeting

Granada, Spain

Jun 30 - Jul 01, 2014

IAA members of the Scientific Organizing Committee:

M. Guerrero Roncel, J. Maíz Apellániz

IAA members of the Local Organizing Committee:

X. Fang, A. Márquez Lugo

<http://spanishuvastronomy.iaa.es/>

STAFF

RESEARCHERS

Permanent Staff

Alberdi Odriozola, Antxon
Aldaya Valverde, Víctor
Alfaro Navarro, Emilio Javier
Anglada i Pons, Guillem Josep
Barceló Serón, Carlos
Bellot Rubio, Luis Ramón
Benítez Lozano, Narciso
Castro Tirado, Alberto Javier
Cerviño Saavedra, Miguel
Claret dos Santos, Antonio
del Olmo Orozco, Ascensión
del Toro Iniesta, José Carlos
Delgado Sánchez, Antonio Jesús
Fernández Hernández, Matilde
Funke, Bernd
Garrido Haba, Rafael
Gómez Fernández, José Luis
Gómez Rivero, José Francisco
González Delgado, Rosa María
Gordillo Vázquez, Francisco José
Gorosabel Urkia, Javier
Guerrero Roncel, Martín
Gutiérrez Buenestado, Pedro José
Iglesias Páramo, Jorge
Lara López, Luisa María
López de Coca Castañer, Pilar
López González, María José
López Jiménez, Antonio Carlos
López Moreno, José Juan
López Puertas, Manuel
López Valverde, Miguel Angel
Maíz Apellániz, Jesús
Márquez Pérez, Isabel
Martín Ruiz Susana
Masegosa Gallego, Josefa
Miranda Palacios, Luis Felipe
Moles Villamate, Mariano Jesús
Moreno Danvila, Fernando
Muñoz Gómez, Olga
Olivares Martín, José Ignacio
Osorio Gutiérrez, Mayra Carolina
Ortiz Moreno, José Luis
Perea Duarte, Jaime David

Pérez Jiménez Enrique
Pérez Montero, Enrique
Pérez Torres, Miguel Angel
Prada Martínez, Francisco
Rodríguez Gómez, Julio Federico
Rodríguez Martínez, Eloy
Ruedas Sánchez, José
Verdes-Montenegro Atalaya, Lourdes
Vílchez Medina, José Manuel

Emeriti

Costa Boronat, Víctor
Rolland Quintanilla, Angel

ERC Consolidator Grant

Schödel, Rainer

Ramón y Cajal Members

de Ugarte Postigo, Antonio
Duffard, René Damián
García Comas, Maia Leire
Luque Estepa, Alejandro
Peñarrubia Garrido, Jorge
Sánchez Sánchez, Sebastián Francisco
Thöne, Christina

Juan de la Cierva Members

Binbin, Zhang
Oates, Samantha Rachel

JAE-Doc Fellows

González Galindo, Francisco
Povic, Mirjana
Rodriguez López, Cristina Teresa
Santander Vela, Juan de Dios

Postdoc Fellows

Amado González, Pedro José
Anton, Sonia
Blasco Herrera, Javier
Busquet Rico, Gemma
Cortés Barbado, Luis
Costado Dios, María Teresa
Costagliola, Francesco
Díaz Fraile, Darío
Díaz Rodríguez, Ana Karla
Dong, Hui
Fang, Xuan
Fernández Lorenzo, Mirian
Fernández Martín, Alba
García Benito, Rubén

Gardini, Angela
Garrido Sánchez, Julian
Guirado Rodriguez, Daniel
Herrero Illana, Rubén
Jeong, Soomin
Jiménez Teja, Yolanda
Kehrig, Carolina
Martínez Carballo, María Ángeles
Mendoza Pérez, María Ángeles
Peralta Calvillo, Javier
Santos Sanz, Pablo
Stock, Joachim
Suárez Yanes, Juan Carlos
Venegas Ortiz, Juan
Villaverde Aparicio, Marcos

PhD Students

Carballo Rubio, Raúl
Casadio, Carolina
Cortijo Ferrero, Clara
Casal López, Estefania
Dabrowska, Dominika
Escobar Cerezo, Jesús
Esteban Pozuelo, Sara
Favole, Ginevra
Fernández Valenzuela, Estela del Mar
Galindo Salgado, Pablo
Gallego Calvente, Aurelia Teresa
Gilli, Gabriella
Gosic, Milan
Hernández García, Lorena
Herrero Illana, Rubén
Hu, Youdong
Jurado Navarro, Ángel Aythami
López Fernández, Rafael
Macías Quevedo, Enrique
Modroño Berdiñas, Zaira
Molina, Sol Natalia
Molino Benito, Alberto
Nogueras Lara, Francisco
Ocando Barrios, Sandra Marina,
Parra Rojas, Francisco Carlos,
Pozuelos Romero, Francisco José
Ramírez Moreta, Pablo,
Ramírez Olivencia, Naim
Sampedro Hernández, Laura María
Sánchez Bermúdez, Joel
Sánchez Menguiano, Laura
Sánchez Ramírez, Rubén
Sánchez Requerey, Iker
Schoenell, William
Tello Salas, Juan Carlos
Toalá Sanz, Jesús Alberto

Invited Researchers

Alvarez Candal, Alvaro Augusto (Consejo Nacional de
Desarrollo Científico y Tecnológico, Brasil)
Márquez Lugo, Ramón Alejandro (CONACYT, Mexico)
Rodríguez Martínez, Mónica Ivette (CONACYT, Mexico)
Sulentic, Jack (Junta de Andalucía, Spain)

ENGINEERS AND TECHNICIANS

Abril Martí, Miguel
Aceituno Castro, Francisco José
Álvarez García, Daniel
Aparicio del Moral, Beatriz
Azzaro, Marco
Balaguer Jiménez, María
Becerril Jarque, Santiago
Benítez Yáñez, Alicia Desirée
Bustamante Díaz, Isabel
Candini, Gian Paolo
Cárdenas Vázquez, María Concepción
Casanova Escurín Víctor Manuel
Castro Marín, José María
Cobos Carrascosa, Juan Pedro
Costillo Iziarra, Luis Pedro
Cunniffe, Ronan
de la Rosa Álvarez, José Luis
España Navarro, Joaquín José
García Segura, Antonio Jesús
Girela Rejón, Fernando Javier
Gómez López, Juan Manuel
Ferro Rodríguez, Irene María
Herranz de la Revilla, Miguel
Husillos Rodríguez, César
Ibáñez Mengual, José Miguel
Jerónimo Zafra, José María
Jiménez Ortega, Jaime
Labrousse, Pierre
Lara Gil, Oscar
López Jiménez, Antonio Carlos
Magán Madinabeitia, Héctor
Martínez Navajas, Ignacio
Mirabet Puig, Eduard
Mirasol Junco, Jose Alberto
Molina Farrugia, Berta
Morales Durán, Isaac
Morales Muñoz, Rafael
Morales Palomino, Nicolás Francisco
Passas Varo, María

Pastor Morales, María del Carmen
Pérez Medialdea, David
Pérez Silvente, Tomás
Ramón Ballesta, Alejandro
Ramos Más, José Luis,
Robles Muñoz, Nicolás Francisco,
Rodón Ortiz, José Ramón
Rodríguez Gómez, Julio Federico
Rodrigo Campos, Julio,
Ruiz Bueno, José Antonio
Ruiz del Mazo, José Enrique
Terrón Salas, Víctor Francisco
Sánchez Carrasco, Miguel Andrés
Sánchez del Río, Justo
Sánchez Expósito, Susana
Sanz Mesa, María del Rosario
Sota Ballano, Alfredo
Terrón Salas, Víctor Francisco

SERVICES AND ADMINISTRATION

Administration Services

Bordons Mesonero, Fernando
Cortés Guerrero, María Ángeles
de Castro Díaz, Rosa Irene
Gómez Finnet, Susana Alicia
Heredia Maldonado, María José
Herrera Jiménez, Eva María
Madrid Gómez, Carmen Elisa
Molina Guerrero, Josefa
Rodríguez Hernández, Adrián
Tapia Ruiz, Francisco José
Torrededía Rodrigo, Cristina

Computer Center

Bayo Muñoz, Francisco Manuel
Cantero Rus, Benigno
Guijarro Jiménez, Juan José
Parra Garófano, Rafael

General Services

Molero Delgado, José Francisco
Molina Rodrigo, Antonio
Navarro Ayala, Francisco
Quiles Gutiérrez, Antonio Manuel
Rendón Martos, Francisco

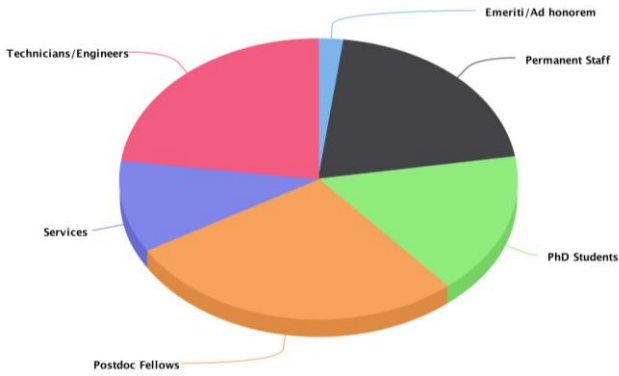
Library

Arco Sarmiento, María Ángeles
Romero Vílchez, María Carmen

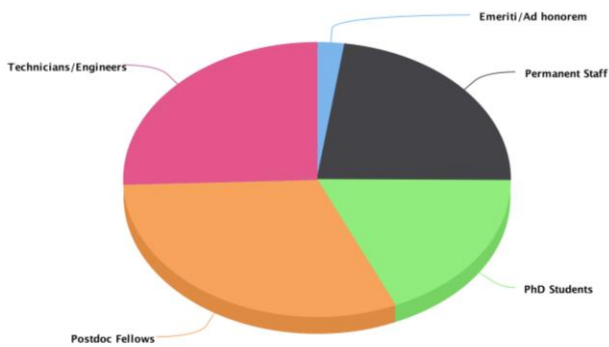
Outreach and Communication Unit

García Gómez-Caro, Emilio José
López de la Calle, Silbia

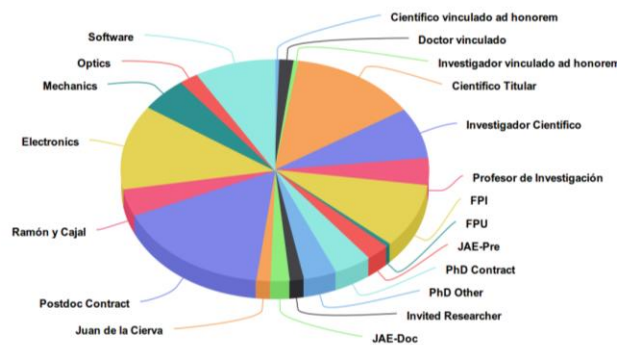
The 2014 IAA staff is distributed among the following general groups. The staff is dominated by scientists, with a non negligible fraction of technicians and engineers.



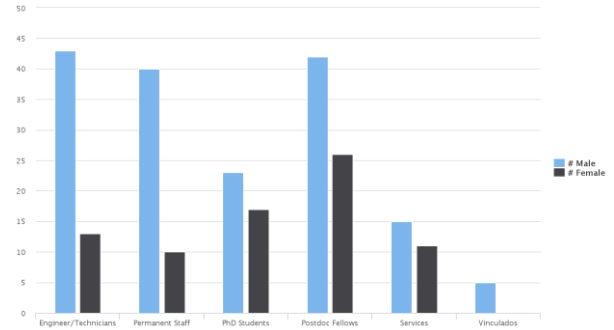
The scientific and technical personnel can be arranged among these overall categories.



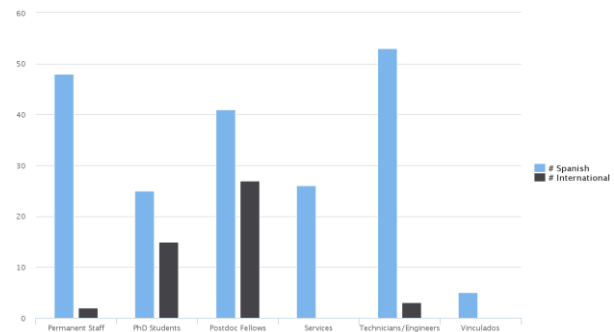
These can be disaggregated into the different technician, engineer, and scientific groups.



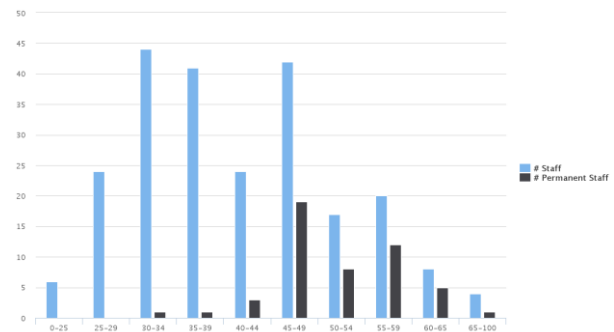
The gender and nationality distribution of the different groups are shown next. The fraction of women is closer to parity among the PhD students and post-doctoral fellows.



This is also the case for international staff, whose fraction is larger among PhD students and post-doctoral fellows.



Finally, the distribution of all the IAA staff and those that occupy permanent positions by age reveals the aging of the last group.



These figures are indicative of the active actions undertaken by IAA to attract international young talent and incorporate women to the scientific career.

PUBLIC OUTREACH

PROJECTS HELD DURING 2014

The activities of the IAA-CSIC **Communication, Education and Public Outreach Unit** cover almost all existing formats to communicate science.

- Popular Science Journal IAA: *Información y Actualidad Astronómica*. Issued once every four months, it is devoted to high school and university students, as well as general public interested in astronomy (www-revista.iaa.es). Issues in 2014: 42, 43, 44.

- *El Radioscopio*, a weekly popular science radio program in collaboration with Canal Sur Radio and broadcasted by Radio Andalucía Información. <http://radioscopio.iaa.es>

- *Lucas Lara* popular talks. These conferences began in 1995. We celebrate nine talks every year. <http://www-divulgacion.iaa.es/ciclo-lucas-lara>

- *¿Eres de óptico o de radio?* Summer weekend astronomical and tourist event that includes a visit to the IAA-CSIC Observatory of Sierra Nevada (OSN) and to the IRAM 30-meter radioantenna in Sierra Nevada (Granada). <http://www.iaa.es/visitas-OSN-IRAM>

- *The European Researchers' Night* takes place every year all over Europe and beyond the last Friday of September. The IAA-CSIC took part in the event in Granada on Friday 26 "moving" its research to the center of the city. <http://www.iaa.es/NocheIAA2014>

- *PIIISA Project* (Proyecto de Iniciación a la Investigación de Innovación en Secundaria). A multidisciplinary project designed to allow high school students work with scientists. The IAA-CSIC is the founder of the project. <http://www.piiisa.es>

- *Rosetta Mission* and ISON special issues. Websites devoted to the 2014 cometary hits: the approach to the Sun of the ISON comet, nicknamed "comet of the century" <http://ison.iaa.es>, and the encounter of the *Rosetta Mission* with comet 67P <http://rosetta.iaa.es>.

- Square Kilometre Array (SKA) telescope Communication. The IAA-CSIC **Communication, Education and Public Outreach Unit** is in charge of the Spanish SKA minisite. <http://spain.skatelescope.org/>

- Educational activities. The IAA-CSIC attends two student groups every month, and this year we have started the project *Misiones Pedagógicas 2.0* to take astronomical outreach to small towns.

- *Los orígenes* popular talks. Developed in collaboration with the Ateneo de Granada cultural association. <http://ateneodegranada.com/?cat=40>

ACTIVITIES OF THE COMMUNICATION, EDUCATION AND PUBLIC OUTREACH UNIT



- *Deconstruyendo la luz* video project. Eleven short pieces about IAA-CSIC research projects and a long documentary about light in astronomy.

<http://luz.iaa.es/>

- Social Networks. Twitter and facebook profiles managing.

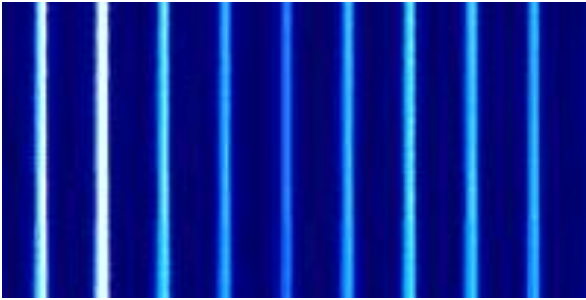
<https://twitter.com/iaauc>

<https://www.facebook.com/iaa.comunicacion>

PRESS RELEASES

IAA SCIENTIFIC HIGHLIGHTS DISTRIBUTED TO THE MEDIA IN 2014.

A whole year of news ...



A UNIVERSAL COMB

December 10, 2014

Optical frequency combs allow accurate astronomical spectroscopic observations.



OSIRIS FOLLOWS THE STEPS OF PHILAE

November 18, 2014

The images taken with the OSIRIS cameras show the awesome trip of the Philae module after touching the surface of the comet 67P.



IAA-CSIC IS CO-MANAGING AN INSTRUMENT THAT WILL ORBIT AROUND THE SUN

November 11, 2014

The ESA mission *Solar Orbiter* will travel around the Sun to study both solar physics and the Sun's influence on the interplanetary medium, using instruments of local measurement as well as remote surveyal.



THE GLORIA PROJECT MAKES AVAILABLE 13 ROBOTIC TELESCOPES IN THREE CONTINENTS TO INTERNET USERS

November 10, 2014

GLORIA, which uses copyleft licenses for the free distribution of its contents and materials, is supported by the Ciziten Science program of the European Union.



CONFIRMED THE EXISTENCE OF A GROUP OF "QUIET" QUASARS

October 29, 2014

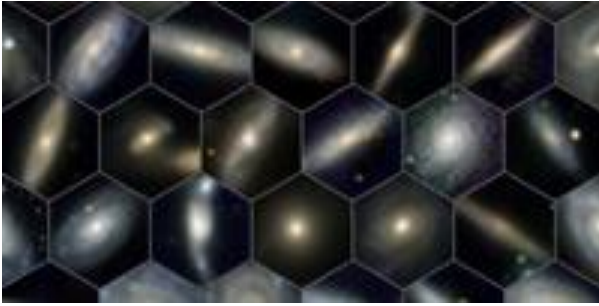
Apart from very distant, ultraluminous quasars - evolving rapidly and associated with galaxy mergers-, there is likely another population of quasars that evolves slowly.



FRONTIER SCIENCE AND ENGINEERING MEET IN THE SPANISH SKA DAY

October 22, 2014

Scientists and engineers from technology groups and Spanish companies come together for the first time at a meeting on the SKA project, which will place special emphasis on Spanish participation.



AN UNPRECEDENTED VIEW OF 200 GALAXIES OF THE LOCAL UNIVERSE

September 30, 2014

The second data release of the international project CALIFA - a survey of galaxies carried out at Calar Alto observatory - will take place today.



TYPE IA SUPERNOVAE STEM FROM THE EXPLOSION OF WHITE DWARFS COUPLED WITH TWIN STARS

August 20, 2014

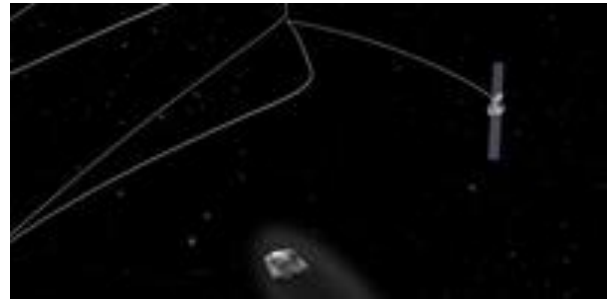
A study discards the possibility that type Ia supernovae stem from explosions of white dwarfs nourished by normal stars. Were these conclusions to become generalized, type Ia supernovae might no longer serve as "standard candles" to measure astronomical distances.



NEW FIREBALL DETECTION STATION AT CALAR ALTO OBSERVATORY

September 4, 2014

Calar Alto Observatory has a fireball detection station composed by five high sensitivity CCD cameras.



ROSETTA MISSION IN ORBIT AROUND COMET 67P

August 6, 2014

The complex orbit insertion maneuver took place today, when the spacecraft was about a hundred kilometers of the comet.



SIGNS OF THE FORMATION OF A PLANETARY SYSTEM AROUND THE STAR HD169142

September 4, 2014

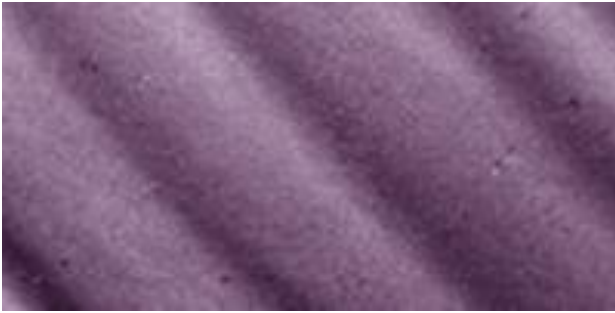
The young star HD 169142 displays a disk of gas and dust with two annular gaps possibly due to the formation of planets.



THE UNEXPECTED SHAPE OF THE NUCLEUS OF THE COMET 67P

July 17, 2014

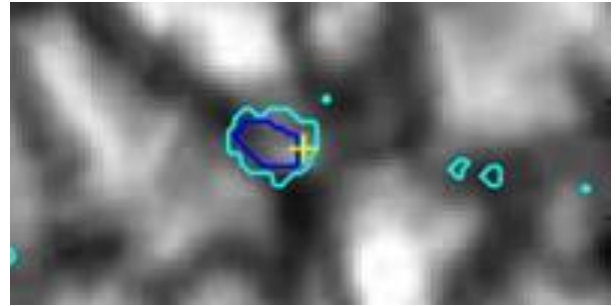
Comet 67P/Churyumov-Gerasimenko, destination of the ESA Rosetta mission, unexpectedly consists of two parts.



THE ATMOSPHERIC WAVES OF VENUS, KEY TO UNDERSTANDING THE SUPERROTATION OF ITS ATMOSPHERE, HAVE BEEN DECIPHERED

July 9, 2014

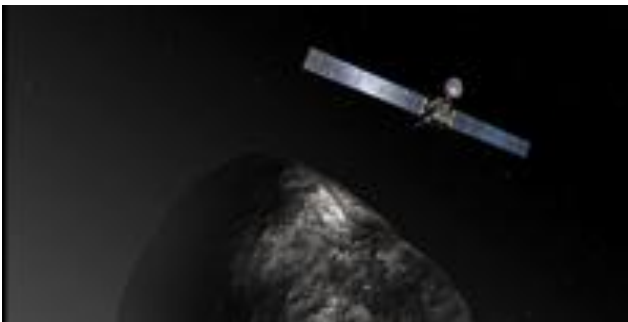
Venus' atmosphere rotates up to sixty times faster than its surface, a phenomenon known as superrotation whose origin has yet to be satisfactorily explained



IMAX, A SPANISH INSTRUMENT, REVEALS HOW MAGNETIC STRUCTURES IN THE SUN ARE BORN AND EVOLVE

July 2, 2014

IMaX, aboard the SUNRISE mission –a telescope that observed the sun from a stratospheric balloon over the Arctic- has observed the formation and evolution of a magnetic flux tube on the solar surface



ROSETTA'S COMET TAKES SHAPE

July 3, 2014

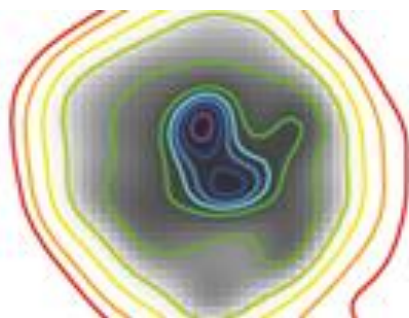
In current images obtained by OSIRIS, the Rosetta's scientific imaging system, the nucleus of 67P/Churyumov-Gerasimenko covers only four pixels.



ANCIENT WORLDS AROUND A "FOREIGN" STAR

June 4, 2014

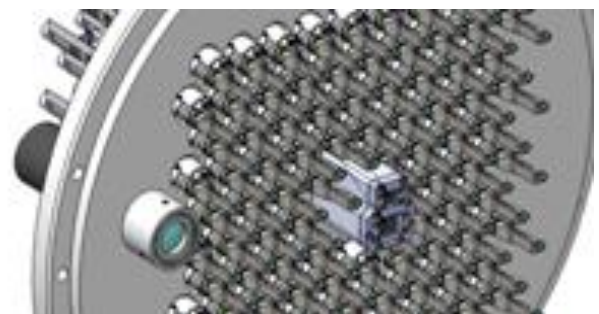
Two planets have been discovered around Kapteyn's, a star that was possibly part of a satellite galaxy absorbed by the Milky Way.



RESEARCHERS FROM THE IAA WIN THE "BEAUTY CONTEST", AN INTERNATIONAL COMPETITION TO OBTAIN OPTICAL AND INFRARED INTERFEROMETRIC IMAGES

July 3, 2014

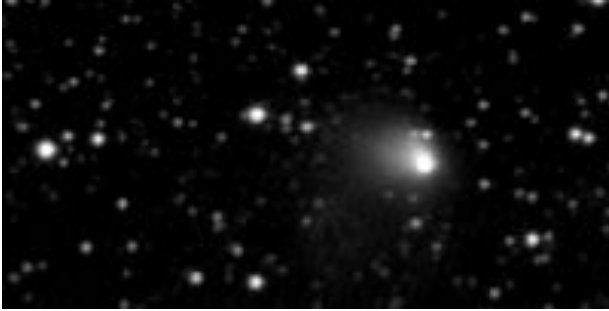
Interferometric imaging at optical and infrared wavelengths is a novel technique that has been developed during the last ten years.



THE CONTRACT FOR THE CONSTRUCTION OF MEGARA, THE NEXT OPTICAL INSTRUMENT FOR THE GRAN TELESCOPIO CANARIAS, IS SIGNED

May 21, 2014

MEGARA is the first spectrograph capable of observing the emission of the gas located in between distant galaxies.



ROSETTA'S TARGET COMET IS BECOMING ACTIVE

May 15, 2014

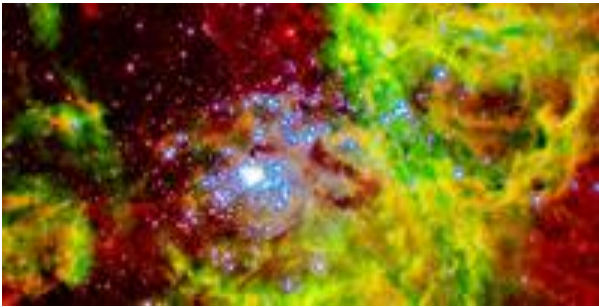
The scientific imaging system OSIRIS on board ESA's Rosetta spacecraft witnesses the awakening of the mission's target comet.



FIRST SYSTEM OF RINGS SPOTTED AROUND A BODY OF THE SOLAR SYSTEM WHICH IS NOT A PLANET

March 26, 2014

Two rings, possibly composed of water ice, surround Chariklo, an object 250 kilometer in diameter. The finding was made possible using the stellar occultation technique.



THE LAWS USED TO ASSESS HOW DUST AFFECTS THE LIGHT FROM STARS THAT REACHES US ARE BEING REWRITTEN

April 15, 2014

Laws used since 1989 to correct the extinction effects prompted errors in the characterization of stars and need revision.



GOSSS SURVEY CLEARS THE WAY FOR THE STUDY OF MASSIVE STARS

March 6, 2014

The GOSSS survey was designed to fill the gaps and overcome the heterogeneity of previous surveys, which led to systematic errors in the classification of stars



STAR-QUAKES REVEAL CONTENT OF STARS HOTTER AND MORE MASSIVE THAN THE SUN

March 1, 2014

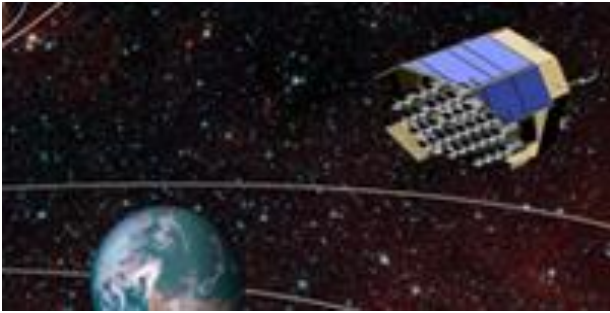
The propagation of sound waves inside stars produces oscillations on their surface. The analysis of these oscillations makes it possible to assess the internal structure and age of stars, and it has just turned out to be also effective in the detailed study of stars more massive than the Sun.



THE GREATEST IMPACT OF A ROCK AGAINST THE MOON HAS BEEN OBSERVED

February 24, 2014

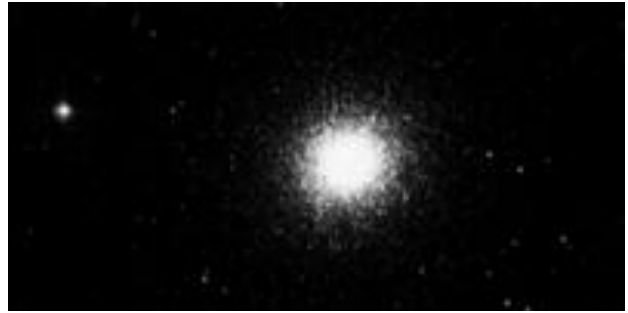
The impact was observed by researchers from the University of Huelva and IAA-CSIC and produced a glow brighter than the North Star.



SEARCHING FOR NEW WORLDS WITH PLATO

February 20, 2014

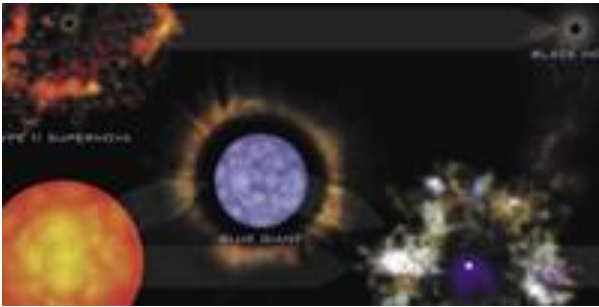
PLATO will be a space eye with 34 telescopes that will investigate one million stars. Spain participates actively in the mission.



THE GLORIA PROJECT LAUNCHES 'PERSONAL SPACE' - A FREE WEB-BASED TOOL TO EXPLORE THE COSMOS FROM YOUR LAPTOP

January 22, 2014

The 'Personal Space' web application allows you to make a direct and personal connection to the universe by linking significant events in your own life with what was above you in the sky at that moment.



STARS CARRY "MEMORIES" FROM THEIR EARLY LIFE INTO THEIR FINAL STAGE

February 11, 2014

It has been discovered that characteristics present at the start of a star's life disappear during their adult life and re-emerge during their neutron star or white dwarf phases.



IAA-CSIC WILL PARTICIPATE IN THE FOURTH PROJECT TO INTRODUCE RESEARCH AND INNOVATION INTO SECONDARY SCHOOLS IN GRANADA (PIISA 2014)

January 7, 2014

The fourth year of this initiative, launched by IAA-CSIC and aimed at introducing secondary school students to the scientific method, begins tomorrow.



OBSERVED THE CLOSEST TO EARTH SINCE 1604 TYPE IA SUPERNOVA

January 30, 2014

SN 2014J, discovered in galaxy M82, has mobilized experts from around the world. Pictures of the supernova were taken at the Estallidos Project site, coordinated by IAA, using the William Herschel telescope.

Throughout 2014, the IAA has posted more than 370 appearances in media. According to the last 2014 CSIC report of visibility, the IAA was the third most cited center of all CSIC centers.

FUNDING

The IAA obtains most of its funding through competitive Andalusian, Spanish, and European calls. Here we provide a list of all competitive funding awarded to IAA staff in 2014.

The time evolution of the IAA budget in the last years is shown in the top-right figure. The fraction of the IAA budget and new funding in 2014 by funding agency are shown next.

EUROPEAN RESEARCH COMMISSION ERC

GALACTICNUCLEUS The Fingerprint of a Galactic Nucleus: A Multi-Wavelength, High-Angular Resolution, Near-Infrared Study of the Centre of the Milky Way

Reference: I-ERC/3311 614922

PI: **Rainer Schödel**

Duration: February 1, 2014 – January 31, 2019

Amount: 1.547.657,00 €

FECYT

Cuando los astros se animan: científicos, divulgadores y diseñadores trabajando juntos

Reference: FCT-14-9021

PI: **Martín Antonio Guerrero Roncel**

Duration: September 1, 2014 – December 31, 2015

Amount: 12.000 €

MICINN

Atmospheric Space Interactions Monitor (ASIM). FM Manufacturing and Scientific Return: The IAA contribution

Reference: ESP2013-48032-C5-5-R

PI: **Francisco Gordillo Vázquez & Alejandro Luque Estepa**

Duration: January 1, 2014 – June 30, 2016

Amount: 133.100 €

Fabricación e integración de SO/PHI (Polarimetric and Helioseismic Imager for Solar Orbiter)

Reference: ESP2013-47349-C6-1-R

PI: **José Carlos del Toro Iniesta**

Duration: January 1, 2014 – December 31, 2015

Amount: 925.650 €

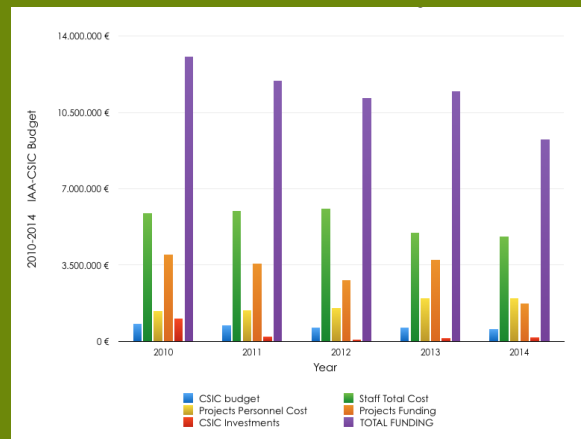
The Javalambre - Physics of the accelerated universe astrophysical survey

Reference: AYA2013-48623-C2-1-P

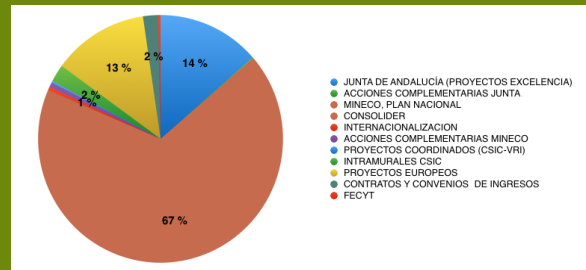
PI: **Narciso Benítez Lozano**

Duration: January 1, 2014 – December 31, 2016

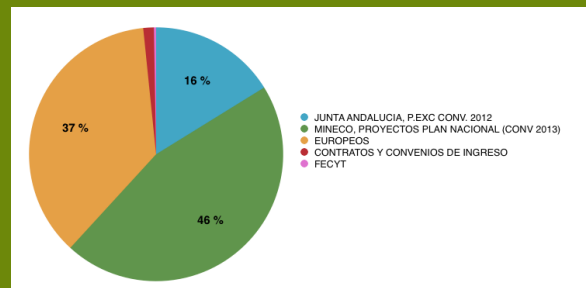
Amount: 119.790 €



Time evolution of the IAA budget in the last 5 years.



Origin of the IAA 2014 budget by funding agency.



IAA 2013 new funding by agency.

El papel de los estallidos de formación estelar en la formación y evolución de galaxias: Estallidos 5

Reference: AYA2013-47742-C4-1-P

PI: **José Manuel Vilchez Medina & Enrique Pérez Montero**

Duration: January 1, 2014 – December 31, 2016

Amount: 158.510 €

Desde las bajas a las altas tasas de acreción en núcleos activos de galaxias. Alimentación y retroalimentación

Reference: AYA2013-42227-P

PI: **Isabel Márquez Pérez & Ascensión del Olmo Orozco**

Duration: January 1, 2014 – December 31, 2016

Amount: 186.340 €

Jets Relativistas en Galaxias Activas

Reference: AYA2013-40825-P

PI: **José Luis Gómez Fernández**

Duration: January 1, 2014 – December 31, 2016

Amount: 101.640 €

Cartografiando el Cielo: Sondeos en el Óptico e infrarrojo de la Vía Láctea

Reference: AYA2013-40611-P

PI: **Emilio Alfaro Navarro**

Duration: January 1, 2014 – December 31, 2016

Amount: 304.920 €

**REGIONAL GOVERNMENT
JUNTA DE ANDALUCIA**

Objetos Transneptunianos y otros remanentes de la formación del sistema solar. Evolución del sistema solar y sistemas exoplanetarios

Reference: FQM-1776

PI: **José Luis Ortiz Moreno**

Duration: May 16, 2014 – May 15, 2018

Amount: 152.000 €

CALIFA-PopStar: Un legado andaluz universal

Reference: FQM-2828

PI: **Rosa María González Delgado**

Duration: May 16, 2014 – May 15, 2018

Amount: 59.050 €

Contribución andaluza al proyecto espacial CoRoT

Reference: TIC-2469

PI: **Rafael Garrido Haba**

Duration: May 16, 2014 – May 15, 2018

Amount: 259.745 €

La red de Telescopios de Robóticos en Andalucía como parte de una Red a escala planetaria

Reference: TIC-2839

PI: **Alberto Javier Castro Tirado**

Duration: May 16, 2014 – May 15, 2018

Amount: 213.959 €

ANNEX

SCI PUBLICATIONS

1. Abreu, J. Albert, C. Beer, J. , **Ferriz-Mas, A**, McCracken, K.G., Steinhilber, F.

"Response to: 'Critical Analysis of a Hypothesis of the Planetary Tidal Influence on Solar Activity' by S. Poluianov and I. Usoskin", *Solar Physics*, Vol. 289, p. 2343 (2014)

DOI: 10.1007/s11207-014-0473-2

2. Ackermann, M et al. (includes **Dominguez, A, Prada, F, Zandanel, F**)

"Multifrequency Studies of the peculiar Quasar 4C+21.35 during the 2010 flaring activity", *Astrophysical Journal*, Vol. 786, p. 157 (2014)

DOI: 10.1088/0004-637X/786/2/157

3. **Agudo, I**, Thum, C, **Gomez, JL**, Wiesemeyer, H, "A simultaneous 3.5 and 1.3 mm polarimetric survey of active galactic nuclei in the northern sky", *Astronomy & Astrophysics*, Vol. 566, A59 (2014)

DOI: 10.1051/0004-6361/201423366

4. Agundez, M, Biver, N, **Santos-Sanz, P**, Bockelee-Morvan, D, Moreno, R.

"Molecular observations of comets C/2012 Si (ISON) and C/2013 R1 (Lovejoy): HNC/HCN ratios and upper limits to PH₃", *Astronomy & Astrophysics*, Vol. 564, p. L2 (2014)

DOI: 10.1051/0004-6361/201423639

5. Ahn, CP et al., the SDSS Collaboration (includes **Prada, F**)

"The tenth data release of the sloan digital sky survey: first spectroscopic data from the sdss-iii apache point observatory galactic evolution experiment", *Astrophysical Journal Supplement Series*, Vol. 211, p. 17 (2014)

DOI: 10.1088/0067-0049/211/2/17

6. Alatalo, K., Appleton, P.N., Lisenfeld, U., Bitsakis, T., Guillard, P., Charmandaris, V., Cluver, M., Dopita, M.A., Freeland, E., Jarrett, T., Kewley, L.J., Ogle, P.M., Rasmussen, J., Rich, J.A., **Verdes-Montenegro, L.**, Xu, C.K., Yun, M.

"Strong far-infrared cooling lines, peculiar CO kinematics, and possible star-formation suppression in Hickson compact group 57", *Astrophysical Journal*, Vol. 795, p. 159 (2014)

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7. Aleksic, J et al., the MAGIC Collaboration (includes **Pérez-Torres, MA**)

"Discovery of TeV gamma-ray emission from the pulsar wind nebula 3C 58 by MAGIC", *Astronomy & Astrophysics*, Vol. 567, p. L8 (2014)

DOI: 10.1051/0004-6361/201424261

8. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"MAGIC observations and multifrequency properties of the flat spectrum radio quasar 3C 279 in 2011", *Astronomy & Astrophysics*, Vol. 567, p. 70 (2014)

DOI: 10.1051/0004-6361/201323036

9. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"Search for very high energy gamma-rays from the z=0.896 quasar 4C+55.17 with the MAGIC telescopes", *Monthly Notices Of The Royal Astronomical Society*, Vol. 440, p. 530 (2014)

DOI: 10.1093/mnras/stu227

10. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"Optimized dark matter searches in deep observations of Segue 1 with MAGIC", *Journal Of Cosmology And Astroparticle Physics*, Vol. , p. 008 (2014)

DOI: 10.1088/1475-7516/2014/02/008

11. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"Contemporaneous observations of the radio galaxy NGC 1275 from radio to very high energy gamma-rays", *Astronomy & Astrophysics*, Vol. 564, A5 (2014)

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12. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"MAGIC long-term study of the distant TeV blazar PKS 1424+240 in a multiwavelength context", *Astronomy & Astrophysics*, Vol. 567, A135 (2014)

DOI: 10.1051/0004-6361/201423364

13. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**)

"MAGIC gamma-ray and multi-frequency observations of flat spectrum radio quasar PKS 1510-089 in early 2012", *Astronomy & Astrophysics*, Vol. 569, A46 (2014)

DOI: 10.1051/0004-6361/201423484

14. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**) "First broadband characterization and redshift determination of the VHE blazar MAGIC J2001+439", *Astronomy & Astrophysics*, Vol. 572, A121 (2014)
DOI: 10.1051/0004-6361/201424254
15. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**) "MAGIC reveals a complex morphology within the unidentified gamma-ray source HESS J1857+026", *Astronomy & Astrophysics*, Vol. 571, A107 (2014)
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16. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**) "MAGIC upper limits on the GRB 090102 afterglow", *Monthly Notices Of The Royal Astronomical Society*, Vol. 437, p. 3103 (2014)
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17. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**) "Discovery of very high energy gamma-ray emission from the blazar 1ES 1727+502 with the MAGIC Telescopes", *Astronomy & Astrophysics*, Vol. 563, A90 (2014)
DOI: 10.1051/0004-6361/201321360
18. Aleksic, J et al., the MAGIC Collaboration (includes **Pérez-Torres, MA**) "MAGIC search for VHE gamma-ray emission from AE Aquarii in a multiwavelength context", *Astronomy & Astrophysics*, Vol. 568, 124 (2014)
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19. Aleksic, J et al., the MAGIC Collaboration (includes **Dominguez, A, Prada, F, and Zandanel, F**) "Rapid and multiband variability of the TeV bright active nucleus of the galaxy IC 310", *Astronomy & Astrophysics*, Vol. 563, A91 (2014)
DOI: 10.1051/0004-6361/201321938
20. Alfonso-Garzon, J, Montesinos, B, Moya, A, Mas-Hesse, JM, **Martin-Ruiz, S**. "OMC/INTEGRAL photometric observations of pulsating components in eclipsing binaries and characterization of DY Aqr", *Monthly Notices Of The Royal Astronomical Society*, Vol.443, p. 3022 (2014)
DOI: 10.1093/mnras/stu1386
21. **Alvarez-Candal, A, Ortiz, JL, Morales, N, Jimenez-Teja, Y, Duffard, R, Sicardy, B, Dhillon, VS,** Marsh, T, Littlefair, S, Mottola, S, Hellmich, S, Shahbaz, T. "Stellar occultation by (119951) 2002 KX14 on April 26, 2012", *Astronomy & Astrophysics*, Vol. 571, A48 (2014)
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25. **Argudo-Fernandez, M,** Verley, S, Bergond, G, **Sulentic, J,** Sabater, J, Lorenzo, MF, Espada, D, Leon, S, **Sanchez-Exposito, S, Santander-Vela, JD, Verdes-Montenegro, L.** "Effects of the environment on galaxies in the Catalogue of Isolated Galaxies: physical satellites and large scale structure", *Astronomy & Astrophysics*, Vol. 564, A94 (2014)
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29. Barcelo, C, Carballo-Rubio, R, Garay, LJ.

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Instituto de Astrofísica de Andalucía
Glorieta de la Astronomía sn
18008 Granada
www.iaa.es

