Conferencias invitadas en sesiones plenarias

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Sesión especial: Invitación a la Sociedad Mexicana de Astronomía

La Sociedad Mexicana de Astronomía ha aceptado nuestra invitación a participar en la XI Reunión Científica. Conjuntamente hemos programado dedicar una de nuestras sesiones plenarias a mostrar la relevante e histórica colaboración científica entre ambos países. Contaremos con las siguientes conferencias plenarias invitadas de científicos mejicanos y españoles, ejemplo del desarrollo actual de proyectos de investigación conjuntos entre ambos países.

Silvia Torres Peimbert (UNAM, México)
La colaboración entre España y México
Jesús González (UNAM)
A la frontera de la Instrumentación Astronómica

Martín A. Guerrero (IAA)
Multi-wavelength observations of planetary nebulae)

José Alberto López (UNAM)
FRIDA: Espectroscopia Integral de Campo e Imágenes limitadas por difracción para GTC

Resúmenes de las conferencias invitadas en sesiones plenarias

Bayesian Inference Techniques in Astronomy & Astrophysics

Andrés Asensio Ramos
Instituto de Astrofísica de Canarias

Learning from the comparison of models and observations is, in general, an ill-posed problem. The presence of noise, uncertainties and model parameter degeneracies forces us to consider the inference as a probabilistic problem. Bayesian inference gives us a robust theoretical framework to cope with such complications. I will present a description of the fundamentals, going from the basic techniques to the most advanced ones, showing applications in several fields of Astronomy & Astrophysics.

Highlights from the Multi Unit Spectroscopic Explorer (MUSE)

Roland Bacon
CRAL - Observatoire de Lyon

The Multi Unit Spectroscopic Explorer (MUSE) is a second-generation VLT panoramic integral-field spectrograph. MUSE has a field of 1×1 arcmin² sampled at 0.2×0.2 arcsec² and a simultaneous spectral range of 0.465-0.93 μm, at a resolution of R~3000. The instrument has been designed to take advantage of the VLT ground layer adaptive optics ESO facility using four laser guide stars. MUSE couples the discovery potential of a large imaging device to the measuring capabilities of a high-quality spectrograph, while taking advantage of the increased spatial resolution provided by adaptive optics. After a successful preliminary acceptance in Europe in fall 2013, MUSE has been dismounted, shipped to Chile and re-integrated in the Paranal new integration hall and finally installed on the Nasmyth platform of UT4 late January this year. During the 2 commissioning runs, millions of spectra have been obtained in order to validate the instrument and measured its achieved performance. To demonstrate its power, a number of show-case and spectacular observations have also been obtained. Preliminary results demonstrate that MUSE is likely to become a new reference in the field of integral field spectroscopy thanks to its large field of view, very high throughput, excellent image quality, good spectral resolution, wide simultaneous spectral range and state-of-the art control and data reduction software.

IRIS observations and 3D 'realistic' MHD models of the solar chromosphere

Viggo Hansteen
Institute of theoretical astrophysics, University of Oslo

The Interface Region Imaging Spectrograph (IRIS) is a NASA ``Small Explorer'' mission was launched in late June 2013 and since then has obtained spectra and images from the outer solar atmosphere at unprecedented spatial and temporal resolution. It's primary goal is to probe the photosphere-corona interface: the source region of outer atmosphere heating and dynamics, and a region that has an extremely complicated interplay between plasma, radiation and magnetic field. The scientific justification for IRIS hinges on the capabilities of 3D radiative magnetohydrodynamic models to allow the confident interpretation of observed data. In this talk we will discuss the interplay between observations and modeling illustrated with examples from recent IRIS observations.

FRIDA: Espectroscopía Integral de Campo e Imágenes limitadas por difracción para GTC
José Alberto López
UNAM (Mexico) en representación del equipo de FRIDA

FRIDA es una cámara y espectrómetro integral de campo que operará en combinación con GTCAO para explotar el límite de difracción del Gran Telescopio Canarias. FRIDA ha sido diseñado y está siendo construido como una colaboración entre instituciones de México, España y USA. En modo imagen FRIDA proveerá escalas de 0.010, 0.020 y 0.040 arcsec/píxel, correspondiendo a campos de visión de 20.48 x 20.48 arcsec and 40.96 x 40.96 arcsec, respectivamente. Un rebanador de campo monolítico con 30 rebanadas proveerá espectroscopía integral de campo con resoluciones espectrales R ~ 1000, 4,500 and 30,000. Cada rebanada se proyecta en dos pixeles en la dirección espectral. Los campos de visión correspondientes en modo IFS son 0.65 x 0.60 arcsec, 1.30 x 1.20 arcsec and 2.60 x 2.40 arcsec. FRIDA está iniciando integración de sistemas y está programado para completar ensamblar e integración de todo el instrumento hacia finales de 2015, y ser posteriormente entregado a GTC. En esta contribución presentamos un resumen de su diseño, fabricación y aplicaciones científicas potenciales

Multi-wavelength observations of planetary nebulae
Martin A. Guerrero
Instituto de Astrofísica de Andalucía

Planetary nebulae (PNe), the short-lived descendants of low- and intermediate-mass stars in their way toward white dwarfdom, are classical laboratories for nebular astrophysics and late stellar evolution. Photoionization, wind-wind interactions, dust production, chemical enrichment of the interstellar medium and other processes are routinely investigated in PNe. Observations at different wavelengths have offered a multi-faceted view of PNe, allowing us to probe cold neutral or molecular material at the outermost shells, photoionized gas in the main nebulae, and shock-heated plasma at X-ray-emitting temperatures in their interiors. In this talk I will describe how recent multi-wavelength observations of PNe keep changing our understanding of their structure, formation and evolution.

The Planck cosmological results
Enrique Martínez
Instituto de Física de Cantabria

In this review we describe the main science data products and update the cosmological results published on March 2013 by the Planck mission. Launched on May 14th 2009, it has recently provided the most precise confirmation of the standard six parameter LCDM model. It has also revised the value of some of these parameters and improved the accuracy in their determination, reaching a precision of around 1% or better. Another relevant result from Planck is the measurement with a high significance the gravitational lensing potential affecting the CMB photons. In addition, several large scale anomalies in the CMB temperature distribution detected previously in WMAP data have been confirmed. All these first cosmological results will be revised in the light of the final Planck products based on the full data set, including polarization, that are planned to be released in October this year.

Galaxy formation and evolution in compact groups of galaxies at z=0
Claudia Mendes de Oliveira
Instituto de Astronomía, USP, Brasil

The main topic of this talk is the study of galaxy formation and evolution in different environments of dense and loose groups based on the analysis of a large sample of compact groups and field galaxies observed with Fabry-Perot instruments. We have derived velocity maps, monochromatic and velocity dispersion maps for more than one hundred galaxies in compact groups to determine their evolutionary stages and these have been compared to data for galaxies in less dense environments, from the GHASP sample, for determination of the Tully-Fisher relation, search for tidal dwarf galaxy and young clusters, formed due to interactions, and to determine the mass profiles of galaxies and study of the cusp/core problem. Our main results will be discussed in this talk.

Constraints on Reionization from the Observed Cosmic Properties at High-z
Eduard Salvador-Solé

Institut de Ciències del Cosmos – Universitat de Barcelona

Reionization plays a central role in the process of galaxy formation. In this talk I review the present status of our knowledge on this elusive process and the observational techniques currently employed or in progress to try to determine it. Special attention is paid on a new, very simple approach, developed by our group, making use of all the observed properties of the Universe at very high-redshift ($z > 2$) in order to constraint its evolution and, in particular, the reionization history. A self-consistent model of galaxy formation, specifically designed to monitor the coupled evolution of galaxies and intergalactic medium (IGM) since the dark ages, is used that includes Population III stars, normal galaxies, and massive black holes (MBHs) seeded by the remnants of massive metal-free stars. The best solution we obtain yields excellent fits to all the data, namely galaxy sizes, cold gas, stellar, and MBH mass densities, star formation rate densities, ionizing emissivities, IGM temperatures and metallicities, and galaxy and MBH mass functions. The reionization implied is extended and complex, with two full HI ionization events. This double reionization is consistent with the recent limits drawn from the small-scale polarization CMB anisotropies. As a byproduct, we unveil several interesting features in the observed cosmic properties at high-z.

Comet composition and chemistry: what can we expect from Rosetta?

Rita Schulz
ESA Scientific Support Office, ESTEC, Noordwijk, The Netherlands

The composition of a comet nucleus cannot be directly determined by remote sensing observations, but is usually inferred from coma observations, assuming certain conditions in the near-nucleus environment. The development of cometary activity is undoubtedly related to most complex, yet unknown, physico-chemical processes in the surface layer of the nucleus and the inner coma. Hence, it is presently not possible to unambiguously extract the true composition of a comet nucleus from its coma composition. Key information on these processes is expected from the Rosetta mission to comet 67P/Churyumov-Gerasimenko. Rosetta monitors the evolution of the nucleus surface and the coma composition as a function of increasing and decreasing solar flux input along the comet's pre- and post-perihelion orbit. Different instrumentations are used in parallel, from multi-wavelength spectrometry to in-situ measurements of coma and nucleus composition and physical properties. This provides the opportunity to cross-correlate the values obtained by the different measurement techniques on board, and in addition link the inner coma chemistry uncovered by the space mission to the abundance of coma species observed from Earth or Earth orbit. Thus, the Rosetta target comet can serve as a reference for interpretation and modelling of the physical and chemical processes relevant for the formation of a comet's coma. If this knowledge is properly transferred to other comets, it will provide new means to distinguish whether differences between comets, observed in their comae, reflect differences of their nuclei or are related to different environmental conditions of the comets at the time of observation. This in turn has important implications to the question of how and where comets were formed in the early solar system.

X Aniversario del Observatorio Virtual Español

Enrique Solano
Centro de Astrobiología (INTA-CSIC).

El objetivo principal del Observatorio Virtual es el de proporcionar un mecanismo de acceso y análisis fácil y eficiente de la información existente en los archivos astronómicos. El Observatorio Virtual Español es un proyecto que nace en 2004 para coordinar las actividades VO a nivel nacional. El proyecto se encuentra liderado desde sus orígenes por el Centro de Astrobiología (INTA-CSIC). Las principales líneas de trabajo desarrolladas durante estos 10 años han sido las siguientes: 1) desarrollo y gestión de archivos astronómicos adaptados a los estándares del Observatorio Virtual; 2) colaboración con grupos de investigación en proyectos de ciencia-VO, 3) desarrollo de herramientas de análisis VO y minería de datos; 4) difusión de resultados: Organización de escuelas para el uso de herramientas VO, organización de redes de trabajo para la publicación de datos en VO, participación en cursos de Máster; 5) actividades educativas y de divulgación. A lo largo de esta presentación se describirán algunos de los resultados más importantes obtenidos hasta la fecha así como las líneas de trabajo futuras.

An overview of first science results with CanariCam at the GTC

Charles M. Telesco
Department of Astronomy, University of Florida

CanariCam is the facility mid-IR (8-25 microns) camera on the Gran Telescopio Canarias (GTC). With 0.08-arcsec pixels, CanariCam is diffraction-limited (0.3 arcsec at 10 microns) across a 19 x 26 arcsec field of view. The available

science modes are: 1. imaging across the full field of view; 2. slit spectroscopy with R = 100 at 10 and 20 microns; 3. imaging polarimetry at 10 microns. In addition, spectropolarimetry in the 10-micron region has just been commissioned and will soon be available. Since early 2012, CanariCam has been obtaining exciting and groundbreaking science on AGNs, YSOs, circumstellar disks and their environments, sub-stellar objects, and other astronomical sources of broad interest. After a brief description of CanariCam, I will provide an overview of CanariCam science accomplishments with special emphasis on polarimetry, a mode that is completely unique to CanariCam and holds great promise for scientific breakthroughs. I wish to acknowledge support for this research from the US National Science Foundation through grants AST-0903672 and AST-0908624.

Two important moments in the history of the Universe: last scattering surface and black body photosphere of the Universe

Rashid Sunyaev
MPIA, Garching, Germany

Last scattering surface and black body photosphere of the Universe are two very important milestones in the history of our Universe. Hydrogen recombination at redshifts $z \sim 1100 - 1300$ leads to rapid decrease of the optical depth of the Universe due to Thomson scattering. As a result the acoustic peaks in the observed CMB angular distribution are formed in the vicinity of the last scattering surface. The question remains how and at which redshifts the observed practically ideal black body spectrum of CMB was formed. Why we dream that proposed space missions like PIXIE will be able to detect traces of any significant energy release in our Universe at redshifts smaller than 2 million? Why spectral distortions can not originate behind black body photosphere or at redshifts higher that 2 million?

Cosmology: taming astrophysics to learn about fundamental physics. Some examples.

Licia Verde
ICREA & ICC UB-IEEC & ITA University of Oslo

Cosmology, is often repeated, has become a precision science, now it will have to make the transition to accurate science. To achieve this there are several challenges to overcome. I will discuss some selected examples drawn from the experience with cosmic microwave background observations and large-scale structure. In particular, cosmic microwave background observations have been the key to establish the current cosmological paradigm and in offering renewed support to the theory of inflation. Given that the energy scale of inflation is many orders of magnitude larger than any of the energies that can be reached by terrestrial experiments, the cosmos offers, in principle, a wonderful laboratory to learn about fundamental physics, if the primordial signal can be extracted in a robust and reliable way.

Closer to home, more local observations of large scale structure also offer a window into e.g. the physics of dark energy or of neutrino if complicated astrophysical processes such as star formation and galaxy formation can be tamed.

Science with ALMA

Wouter Vlemmings
Onsala Space Observatory, Sweden

ALMA has been operational for nearly three years and has already produced many stunning science results in nearly all areas of astronomy. In this talk I will present the latest status of ALMA and some of the highlights from the first observing cycles. I will in mostly, but not only, focus on Galactic astronomy and in particular the ALMA observations of the early and late stages of stellar evolution. As ALMA is still growing and will continue developing, I will end with promises of things to come.