INVITED TALKS:

M. Guainazzi (ESTEC-ESA)

"The Hot Universe with XARM and Athena"

X-ray spectroscopy is at the eve of a true revolution. Micro-calorimeter detectors with an energy resolution of a few eV over the whole energy range between a few tens and ~10 keV are planned to be flown on two approved missions: the JAXA-led XRISM ("X-ray Imaging Spectroscopy Mission"; launch due by the end of the Japanese Fiscal Year 2021) and the ESA L-class mission Athena (launch due in the early 2030s). The study of large-scale baryonic structures and of their evolution is at the core of the Athena science objectives: mapping the physical parameters of bound baryonic structures, the chemical and physical evolution of the inter-group and -cluster medium, and the location and kinematics of missing baryons in the hot phase of the intergalactic medium. These objectives will be pursued through an unprecedented combination of energy (~2.5 eV) and spatial resolution (~5" HEW), coupled to an effective area more than one order of magnitude larger than any other existing or planned X-ray mission. XRISM will constitute a juicy appetiser: building on the solid technological heritage of the "Hitomi" soft X-ray payload, XRISM aims at pioneering unprecedented high resolution X-ray spectroscopy, with four main scientific objectives: 1) Structure formation of the Universe and evolution of clusters of galaxies; 2) Circulation history of baryonic matters in the Universe; 3) Transport and circulation of energy in the Universe; 4) New science with unprecedented high resolution X-ray spectroscopy.

M.Lieu (University of Birgmingan):

“The prospects of machine learning on galaxy cluster science”

Machine learning is quickly being adopted by the astronomical community in all areas of astronomy. Never the less, machine learning field is very broad subject, from simple regression and clustering algorithms to more complex, deep learning models with millions of parameters. In this talk I will review some of the various machine learning models that have been applied to galaxy clusters so far and machine learning methods that look promising, for game-changing applications in cluster science in the near future.

J.A. López-Aguerri (IAC)

“Instrumentacion para la observación de cúmulos de galaxias”

Durante las ultimas dos décadas los avances en el conocimiento de la evolución de galaxias en cúmulos ha sido espectacular gracias al desarrollo de instrumentación apropiada para estos estudios. Sin embargo, aun hay muchas preguntas sin resolver que necesitan de nueva instrumentacion que tiene que ser desarrollada en los próximos años. En esta charla hare un repaso de los instrumentos actualmente operativos y que mejor se adaptan a las necesidades de observación en cumulos. Asi mismo hare una presentación sobre futuros telescopios y/o instrumentos que podrían ser útiles para avanzar en el estudio de los cúmulos de galaxias.

J.A. Rubiño (Instituto de Astrofísica de Canarias)

“Cosmology with the Sunyaev-Zeldovich effect”

The Sunyaev-Zeldovich effect provides a unique way to map the large-scale structure of the universe as traced by massive clusters of galaxies. In this talk I will review the latest cosmological results obtained using this methodology, with special emphasis on the results of the Planck mission. I will discuss the constraints derived from SZ cluster counts, the diffuse SZ signal and also the peculiar velocities derived with measurements of the kinematic SZ. Finally, I will describe current and future projects related to SZ measurements in which the Spanish community is involved.

J. Vilchez (IAA)

“On the influence of the environment in cluster galaxies: physical properties, star formation and metallicity”

The evolution of galaxies is affected by their environment; galaxies inhabiting the densest locations, exemplified in clusters, suffer from strong environmental effects whereas truly isolated galaxies may witness the original conditions of the formation process. The observational footprints for cluster galaxies are expected to vary depending on the location in the cluster, the stellar and gaseous galactic components, or the shape of the dark matter halo. The study of the structure, star formation history and metal content in cluster galaxies can provide useful clues to test theoretical predictions. Here we review the general characteristics of the galaxy population in clusters and the panorama of environmental mechanisms there in operation, as well as the effects on the main galaxy properties, rates of star formation, metallicity and scaling laws, in the light of current simulations of galaxy evolution.

ORAL PRESENTATIONS:

Aguado Barahona, A. (IAC)

"Optical follow-up of galaxy cluster candidates detected by Planck"

Autores: Aguado Barahona, A.

The Legacy PLANCK all-sky Sunyaev-Zeldovich (SZ) galaxy cluster catalogue PSZ2 (Planck Collaboration XXVII 2015) provides the possibility to detect galaxy clusters using the SZ effect signature in a full sky survey. However, in order to constrain cosmological parameters from this catalogue, the clusters must be characterized in their physical properties, mainly redshift and mass. I will describe our optical follow-up programme 128-MULTIPLE-16/15B (LP15), which has been developed with the aim of validating SZ Planck sources with unknown optical counterparts in the Northern Hemisphere, as well as contributing to determine the completeness and purity of the catalogue. We have performed deep optical imaging for more than 200 sources using the Isaac Newton Telescope (INT) and spectroscopy for almost 100 sources using Telescopio Nazionale Galileo (TNG) and Gran Telescopio Canarias (GTC) at Roque de los Muchachos Observatory (La Palma). We adopted robust confirmation criteria based on velocity dispersion and richness estimations. After two years of observations, we have confirmed 81 PSZ2 sources, 66 of them with new spectroscopic information. We have updated the purity of the catalogue from 76.65% originally to 86.0% after this observational programme. In addition, we study the reason for false detections and we find correlation between the number of unconfirmed sources and the galactic thermal dust emission.

Biviano, A. (INAF-Osservatorio Astronomico di Trieste)

"Old clusters in new Jeans"

Autores: A.Biviano

I will report and discuss observational results that I have recently obtained from the analysis of several spetroscopic data-sets (WINGS, OmegaWINGS, GASP, CLASH-VLT, SPT follow-up, GCLASS) covering the redshift range 0.05 to 1.0. In particular I will present results on the orbital evolution of cluster galaxies, and on the inner slope of the cluster dark matter density profiles. These results are based on relatively new techniques that solve the Jeans equation for the phase-space distribution of cluster galaxies and the velocity dispersion profile of brightest cluster galaxies.

Calvi, Rosa (IAC)

“Confirmation of two galaxy protoclusters beyond z=5 with GTC-OSIRIS” Autores: Rosa Calvi, Helmut Dannerbauer, José Miguel Rodrìguez Espinosa, Pablo Arrabal Haro, IAC and ALBA project collaborators

Galaxy clusters, the most massive gravitationally bound structures in the universe, form in regions of enhanced Dark matter and baryons density. In the last years, much attention has been focused on proto-clusters, that is on over-dense regions at high redshifts which, at some stage, evolve into current clusters. They offer a fundamental tool for investigating the formation of the first galaxies and their evolution through cosmic time and for providing informations on the cosmology-dependent evolving density fluctuation peaks, setting important constraints on the cosmological models describing the Universe. Additionally, there is an increasing evidence that the high-z active star-forming galaxies in the early universe were the main culprits for re-ionising the Universe. By conducting OSIRIS medium-band photometric observations at the Gran Telescopio Canarias (GTC) we found possible proto-clusters members, Lyman emitter or Lyman Break Galaxie signatures, in the GOODS-North field at z=5.2 and in the Subaru/XMM Newton Deep Survey field (SXDS) at z=6.5. I will present in this talk the results of the Multi-object spectroscopical follow up of a subset of Lyman emitter (LAE) candidates selected using three medium-band filters from the SHARDS program in both fields. We have securely spectroscopically confirmed the existence of two ''genuine'' proto-clusters, the one at redshift z∼6.5 is very interesting as it is close to full re-ionisation of the Universe. The spectroscopic redshifts were used to detect kinematical substructures in both overdensities and investigate whether the systems are virialized, giving also an upper limit of the dinamical mass estimates. We also explored the SFRs, EWs and Lyman alpha escape fractions of the member populations in both proto-clusters. These two works show the potential capabilities of GTC and its instrumentation in the light of new challenges in high-z observations.

Dannerbauer, H. (Instituto de Astrofísica de Canarias)

“Impact of environment on molecular gas reservoirs probed in distant cluster and field galaxies”

Autores: Helmut Dannerbauer

We know that environment has a critical impact on galaxy growth and evolution. What we do not know is when it starts to have an impact and how it does it. We are using the Australian Telescope Compact Array (ATCA) and ALMA to study the role of environment on the molecular gas content, the fuel of star formation, of distant star-forming galaxies. From our pilot study to search for low-surface brightness cold CO(1-0) molecular gas emission, I present the discovery of massive extended CO gas reservoirs in these star-forming galaxies that are located in the protocluster surrounding the radio galaxy, MRC1138-262 at z=2.2. The discovery is unexpected as gas truncation and stripping was predicted. Our results alter our view of the important topics of the development and gas phase distribution of the “proto-intracluster medium“: how ram-pressure stripping may operate in galaxy protoclusters, how the galaxies may contribute to enriching and heating the proto-intracluster medium, and how their star formation may be limited by their internal dynamics. Furthermore, I will present results of our on-going ATCA Large Program ‘CO ATCA Legacy Archive of Star-Forming Galaxies (COALAS)’ based on our successful pilot study. Our sample consists of well-covered 'field'-targets from the ALMA survey ALESS in the ECDFS and protocluster galaxies surrounding the Spiderweb. This survey

significantly extends our study of how environment impact the cold molecular gas content, gas excitation and star-formation efficiency in cluster and field galaxies in the early universe.

Díaz Rodríguez, O. (Instituto de Astrofísica de Canarias)

"Characterization of the star-formation activity in two galaxy protoclusters beyond z=2"

Autores: Oliver Díaz Rodríguez, Helmut Dannerbauer, Carlos M. Gutiérrez, Caitlin Casey.

We present near-infrared multi-object spectroscopic observations with the brand-new instrument EMIR at the 10.4m GTC (Gran Telescopio Canarias) of two galaxy protoclusters at z=2.10 and 2.47 in the COSMOS field. The latter structure is part of the largest galaxy proto-supercluster named Hyperion. A major asset of this MOS-mode is the simultaneous observations in the H and K band, thus for z=2-2.5 objects we will obtain both [OIII]+Hbeta (in H band) and Halpha+[NII] (in K band). Major goal of this GTC science verification observations is to i) confirm the membership of individual galaxies to these galaxy clusters in formation and ii) characterize their physical properties such as stellar mass, star-formation rate, Balmer decrement and the dominating ionization mechanism of the nebular gas. Adding ALMA observations enable us to derive star-formation efficiencies and gas fractions, compare it to the field and thus get a complete insight into the star-formation activity of these two growing galaxy clusters. These observations will allow us to better constrain the assembly history of galaxy clusters themselves and understand the role of environment in guiding galaxy evolution. Finally, this study will provide input to fine-tune the selection of galaxy (photo)clusters with the upcoming ESA mission Euclid.

Díaz Sánchez, A. (Universidad Politécnica de Cartagena)

"The brightest high redshift submillimeter galaxies strongly lensed by galaxy clusters"

Autores:Anastasio Díaz-Sánchez, H. Dannerbauer, S. Iglesias-Groth, and R. Rebolo

In order to find bright strong lensed submillimeter galaxies (SMGs) in the full-sky, we carried out a cross-matching between the AllWISE and Planck full-sky compact source catalogs. As reference we adopted the SEDs of the brightest SMGs, from the NIR to the submillimeter. Our aim was to identify candidates in these catalogs with strong submillimeter fluxes and strongly lensed by galaxy clusters. We report the detection of the two brightest high redshift SMGs with z=2.044 and z=2.302. The lensed sources appears to be gravitationally magnified by massive foreground galaxy clusters with z=0.44 and z=0.36. The spectroscopic follow-ups of the cluster of galaxies and the lensed galaxies are shown. One of them has X-ray emission, which had been mistaken with a nearest galaxy cluster. Both galaxies and galaxy clusters have been observed with HST. We have followed up one of them with IRAM/NOEMA and ALMA interferometers, resulting in the brightest CO(3−2) detection ever of an SMG. APEX/LABOCA observations confirm the submillimeter nature of the other galaxy and it is between the ~2000 sources with more than 4 Jy in MWA 72-321 MHz. Substructure in the lensed signal, seen in this galaxy, can be used to measure the presence of small halos in the lensing cluster and galaxies of the cluster.

Diego, J. M. (IFCA)

“Extreme magnification events behind clusters”

Autores: J.M. Diego

Extreme magnification is possible if the background object is compact. This includes stars, gravitational waves, SNe and to some extent QSOs.I discuss the possibility offered by these events to learn not only about the background object but also about the distribution of matter on very small scales in the galaxy cluster

Ferragamo, A. (IAC):

“Sunyaev-Zeldovich vs dynamical masses scaling relations using 207 galaxy clusters from optical follow-up of Planck PSZ1 sources”

Autores: Antonio Ferragamo, J. A. Rubiño Martín, R. Barrena, A. Streblyanka, A. Aguado-Barahona

The ESA's PLANCK mission scanned the microwave sky in 9 frequency bands from 30 to 857 GHz. In addition to the study of the CMB anisotropies, the satellite was especially well designed to detect galaxy clusters (GC) using the Sunyaev-Zeldovich (SZ) effect. The Planck collaboration has published two SZ catalogues: the PSZ1 (Planck Collaboration XXIX 2014) and the PSZ2 (Planck Collaboration XXVII2015). Both of them are publicly available in the ESA's Planck Legacy Archive (PLA). We have recently finished the observations of an International Time Project 2013-2015 (ITP13) and Long Term Program 2015-2017 (LP15), to perform the optical validation and characterisation of the PSZ1 catalogue. We confirmed almost 400 previously unknown clusters with 0.1

Hafez, Y. (KACST)

“New Estimation of Diffuse Radio Emission From Few Nearby Radio Galaxy Clusters at 10 GHz Using KACST Radio Telescope at 46°24´ E, 24° 54´ N"

Autores: Yaser Hafez, Thamer Alrefay, Zaki Almostafa, Fouzan Alfouzan

Major studies during the last years have been made to measure the diffuse radio emission from galaxy clusters at several range of frequencies which reveal the presence of cosmic rays and magnetic fields in the intra-cluster medium. In this talk we present a new study to measure the radio emissions from few nearby radio galaxy clusters at 10 GHz using our new KACST Radio Telescope at Al’Uyayyna (46° 24′ E, 24° 54′ N) for the first time in the region. From observations we made over 17 months, we have estimated new flux density values of accuracy better that 1.8%. The methodology of our analysis, observations, corrections and results will be presented.

Knebe, A. (UAM)

“The Three Hundred project: a large catalogue of theoretically modelled galaxy clusters for cosmological and astrophysical applications”

Autores :Knebe, Yepes, Pearce, Cui, Dave, Power, et al.

We introduce the 'The Three Hundred' project, an endeavour to model 324 large galaxy clusters with full-physics hydrodynamical re-simulations. Here we present the data set and study the differences to observations for fundamental galaxy cluster properties and scaling relations. We find that the modelled galaxy clusters are generally in reasonable agreement with observations with respect to baryonic fractions and gas scaling relations at redshift z = 0. However, there are still some (model-dependent) differences, such as central galaxies being too massive, and galaxy colours (g − r) being bluer (about 0.2 dex lower at the peak position) than in observations. The agreement in gas scaling relations down to 10^{13} M⊙/h between the simulations indicates that particulars of the sub-grid modelling of the baryonic physics only has a weak influence on these relations. We also include – where appropriate – a comparison to three semi-analytical galaxy formation models as applied to the same underlying dark-matter- only simulation. All simulations and derived data products are publicly available.

Manjón García, A. (Instituto de Física de Cantabria)

“Dark matter density profile estimation in galaxy cluster MACS J1206.2-0847 with a free-form strong lensing analysis”

Autores: Alberto Manjón García, Jose M. Diego, Diego Herranz and Daniel Lam

We have performed a free-form analysis on strong lensing data from galaxy cluster MACS J1206.2-0847 in order to estimate and constrain its inner dark matter distribution. Our non-parametric reconstruction method is able to estimate the cluster total mass distribution without using any prior information on the underlying mass provided the number of strong lensing images with known redshifts is large enough. 97 strong lensed images belonging to 27 background sources were used. No other free-form method has been applied to this cluster using so many strong lensing constraints. Several models with different configurations were considered and compared on the basis of how well were able of reproducing two arcs placed close to the brightest cluster galaxy (BCG). The stellar mass contribution of the BCG was estimated separately through a photometric analysis. After removing this baryonic contribution, a measurement of the dark matter density profile in the inner core of the cluster for the best model was obtained.

Méndez-Abreu, J. (IAC)

”The WEAVE nearby cluster survey”

The WEAVE instrument, to be mounted at the William Herschel Telescope (WHT), is now under construction and it will start operations during the first trimester of 2020. As part of the instrument development, seven large surveys will be carried out using 70% of the total observing time at the WHT. One of these major surveys is the WEAVE Cluster survey, which is aimed at understanding galaxies in clusters and the effect of environment on galaxy evolution. In this talk, I will briefly describe the first layer of this survey, called WEAVE Nearby Cluster survey. This focuses on evolution of dwarf galaxies in local clusters. Spain is a major

contributor to WEAVE and the Spanish community is encouraged to take advantage of our participation in the WEAVE instrument.

Negri, A. (IAC)

“The evolution of the luminosity function of cluster galaxies in the Cluster-EAGLE simulation”

Autores: Andrea Negri, Claudio Dalla Vecchia (IAC), Alfonso Aguerri (IAC), C-EAGLE collaboration

The galaxy luminosity function (LF) is a fundamental tool for exploring galaxy evolution over cosmic time. In the last decade observations have been able to probe the evolution of the galaxy LF with redshift, in particular showing a variation of its low-mass end with redshift. On the numerical side, there is currently no extended study of the evolution of the LF of galaxies in clusters. We employ the data of the Cluster-EAGLE project, a set of cosmological, hydrodynamical zoom simulations of 30 galaxy clusters, to study the evolution of the galaxy LF in clusters as function of redshift. We compile a catalogue of simulated galaxies’ luminosities in the SDSS bands using the E-MILES spectra database, and taking into account dust attenuation. Stacked luminosity functions show a good agreement with observations, presenting little evolution with redshift of the faint-end slope. The environment effects are strong for intermediate-luminosity galaxies. In the clusters infall region ($r > 3\ r200$), star-forming galaxies dominate in number the knee of the LF, whereas, inside the clusters ($r < r200$), the fraction of passive galaxies is larger. The relative fraction of passive and star-forming galaxies within r200 evolves with redshift, with the star-forming fraction being larger above $z\sim0.5$. On the other hand, the fraction of low-luminosity, red dwarfs dominates the faint end up to $z=2$.

Old, L. (ESA-ESAC)

“The environmental dependence of the star formation main sequence at z > 1”

Autores: L. Old, M. Balogh, G., Rudnick, A. Muzzin, McGee, van der Burg, R. F. J., S. L., Chan, J. C. C., Wilson, M., Nantais, J., Cerulo, P., Biviano, A., Altieri. B, Cooper, M. C., Demarco, R., Forrest, B., Lidman, C., Noble, A., Pintos-Castro, Forrest, B., I.,

Thanks to extensive studies at low redshift, we typically see that galaxies in higher-density environments like galaxy clusters have ceased forming stars compared to those in lower-density environments. At $z > 1$, when the Universe was eight times denser, however, the interactions between galaxies and their environment are expected to have been very different compared to that of today. We, therefore, expect the timescales of possible mechanisms driving galaxy evolution to differ. In this talk, I will present early science results from the ongoing Gemini Observations of Galaxies in Rich Early Environments (GOGREEN) survey at $z >1$. The GOGREEN survey is a multi-object spectroscopic campaign of 21 groups and clusters at $1 < z < 1.5$, targeting the evolutionary counterparts of today's groups and clusters, and is aimed at providing a first look at environmental effects on galaxy evolution at a time when galaxies were growing in a fundamentally different way from the present day. The survey utilizes the new GMOS Hamamatsu detectors on Gemini North and South to reach unprecedented stellar masses at this redshift for a homogeneously selected sample of galaxies. I will describe the

current status of GOGREEN and present new results on the environmental dependence of the star formation main sequence at this fairly unconstrained epoch.

Old, L. (ESA-ESAC)

“What can cluster galaxies can tell us about their host environments?”

Autores: L. Old, R. Wojtak, F. R. Pearce, M. E. Gray, G. A. Mamon, C. Sifón, E. Tempel, A. Biviano, H. K. C. Yee, R. de Carvalho, V. Müuller, T. Sepp, R. A. Skibba, D. Croton, S. P. Bamford, C. Power, A. von der Linden, A. Saro.

We are entering an exciting time for cluster cosmology and galaxy evolution studies with current and upcoming surveys such as Euclid, eROSITA and LSST. With the production of these wide-field surveys across a variety of wavelengths and redshift ranges, we are moving into an era where samples of 10^6 galaxy clusters will be available. These large samples enable the reduction of statistical uncertainties, however, the success of future cluster cosmology studies depends on unbiased cluster mass measurements. In the first part of this talk, I will present the results of an extensive blind study, The Galaxy Cluster Mass Reconstruction Project, which was created in order to determine how well we can measure the masses of groups and clusters using the properties of galaxies. In addition to the describing the levels of scatter and bias we can expect from commonly-used techniques, I will also present the latest results on whether the presence of significant dynamical substructure in groups and clusters impacts mass estimation, indicating where these ‘unrelaxed’ systems should be used for cosmology studies. Finally, I will address the implications of the magnitude of scatter in the recovered masses for future surveys relying on high-mass groups and cluster masses.

***Perez Martinez, J.M. (Tohoku University)*:**

“The evolution of galaxy scaling relations in clusters at 0.5”

Autores: J. M. Perez-Martinez, B. Ziegler, H. Dannerbauer, A. Böhm, M. Verdugo, A. I. Díaz, and C. Hoyos

We present a collection of cluster samples at 0.51, with star-forming galaxies’ sizes dropping by a factor ~3 in the VSR while their B-band luminosity is enhanced by roughly 2 mags in the TFR. Furthermore, our cluster samples follow parallel sequences with respect to the local AMR, displaying lower specific angular momentum mean values and a stronger redshift evolution than their field counterparts. I will discuss the connection between the interacting nature of dense environments and the simultaneous evolution of the cluster galaxies’ size, luminosity and angular momentum across cosmic time.

Pérez-Romero, J. (IFT UAM-CSIC)

“CTA Sensitivity to Dark Matter induced gamma-ray signals from Galaxy Clusters”

Autores: Rémi Adam, Moritz Hütten, Judit Pérez-Romero, Jose E. Ruiz, Miguel Á. Sánchez-Conde

Galaxy clusters have proved to be competitive targets to perform gamma-ray dark matter (DM) searches, despite the expected cosmic ray induced gamma-ray emission. I will present the ongoing effort for estimating the sensitivity of the future Cherenkov Telecope Array (CTA) to detect DM-induced gamma-ray emission from galaxy clusters. Following state-of-the-art studies of the X-ray inferred properties of clusters, we have selected a preliminary target sample constituted by 52 nearby objects. This sample includes the Perseus galaxy cluster, which has been shown to be one of the most promising ones for CTA and is part of its Key Science Program. For each cluster, we model the DM content and simulate the corresponding expected induced gamma-ray signal. Including the most recent CTA instrument response functions, we compute the expected CTA sensitivity using a likelihood maximization analysis combining spatial and spectral templates of both the cosmic-ray and DM induced gamma-rays. The final goal is to show the sensitivity of CTA to discover, for the first time, diffuse TeV gamma-rays in galaxy clusters. Even in the case of no detection, we will show that CTA can provide stringent constraints on TeV DM annihilation in galaxy clusters, competitive to other targets and DM probes.

Planelles, S. (University of Valencia)

“Generating multi-wavelength mock observations of galaxy clusters”

Autores: Susana Planelles, Vicent Quilis

I present the current status of a novel numerical approach developed to produce multi-wavelength synthetic observations of massive galaxy clusters directly obtained from cosmological simulations. The algorithm is based on a full-radiative transfer code that allows to compute the change of the intensity at any frequency along the null-geodesic of photons. In this contribution, we explore mock observations of a massive galaxy cluster developed in a full Eulerian-AMR cosmological simulation. In particular, we compare the emission from the whole IGM and from the WHIM gas component (defined as the gas with a temperature in the range 10^5-10^7 K) at three observational bands associated to thermal X-rays, thermal and kinematic Sunyaev-Zel’dovich effect, and radio emission. Our results in all three bands are in broad agreement with previous simulated and observational estimates of both gas components. Moreover, these synthetic maps could be directly compared with existing or forthcoming multi-wavelength observations.

Rodríguez del Pino, B. (CAB/INTA-CSIC)

“Environmental influence on star formation properties in the A901/2 multi-cluster system”

Autores: Rodríguez del Pino, B.

The A901/2 multi-cluster system, at redshift z~0.167, is a unique laboratory to study environmental effects in galaxy evolution due to its dynamic nature and the wide range of environments it encompasses. The OMEGA survey, obtained with the OSIRIS tuneable filter at

the GTC, has mapped the Halpha emission from the cluster galaxies with the main goal of evaluating the effects of environmental processes on their star formation properties. The results from our analysis show that cluster galaxies experience a slow transition from being actively star forming to become passive, contrary to some previous studies which suggest a rapid truncation of star formation. Moreover, we find that most of the intermediate and high mass spiral galaxies retain significant star formation activity and their spiral morphology. These results indicate that the physical mechanism responsible for suppressing star formation has to be gentle and affect mainly the gas component of the galaxies, suggesting that ram-pressure stripping or starvation are potential candidates. We have also identified a large population of galaxies experiencing significant stripping of their gas, the so-called "jellyfish galaxies". Interestingly, these galaxies show enhanced star formation activity compared with field counterparts, which could indicate that galaxies undergoing ram-pressure stripping in clusters might experience a last burst of star formation before becoming passive.

Sánchez Portal, M. (Instituto de Radioastronomía MIlimétrica (IRAM))

“GaLAxy Cluster Evolution survey (GLACE)”

Autores: Miguel Sánchez-Portal, Zeleke Beyoro Amado, Ricardo Pérez-Martínez, Mirjana Povic, Ana M. Pérez-García, Jordi Cepa and the GLACE team.

We present the results of an optical line survey in the intermediate redshift cluster Zw Cl0024+1652 at z = 0.395. We have targeted the strongest emission lines in the optical range, namely the Halpha/[NII] line complex, Hbeta and [OIII] using the tuneable filters (TF) of the OSIRIS instrument at the 10.4m GTC telescope. With this very complete of data we are tackling a comprehensive set of scientific issues, in particular the star formation (SF), AGN population and gas metallicity contents as a function of the environment as characterised by the local density. In this talk we present the analysis performed on the TF data and the results obtained so far.

Sotillo Ramos, D. (UCM)

“Galaxy And Mass Assembly (GAMA): Mass, metallicity, and SFR relationships in galaxy groups”

Autores: Diego Sotillo Ramos, Maritza Arlene Lara López, Ana María Pérez García, Ricardo Pérez Martínez

The stellar mass and metallicity are among the fundamental parameters of galaxies. An understanding of the interplay between those properties as well as their environmental dependence will give us a general picture of the physics and feedback processes ongoing in groups of galaxies. We study the relationships and environmental dependencies between the stellar mass, and gas metallicity for more than 700 galaxies in groups up to redshift 0.35 using the Galaxy And Mass Assembly (GAMA) survey.

Trujillo Cabrera, I. (IAC)

“Using the Intra Cluster light to unveil the nature of the dark matter”

Autores: Ignacio Trujillo; Mireia Montes

Both observations and theory have recently revealed that the dark matter and intracluster light (ICL) are distributed identically down to the current level of observational precision. In other words, using the ICL only, we can trace where and how the dark matter in clusters is distributed. In this contribution, I will show the prospects for using this recent discovery to understand the ultimate nature of the dark matter. In particular, I will focus on the possibility of using the ICL to explore whether the dark matter is self-interacting or not.

Valtchanov, I. (Telespazio Vega Space for ESA)

“XXL Survey: cosmology with galaxy clusters”

Autores: Valtchanov, Pierre, Altieri et al. on behalf of the XXL consortium

The XXL survey covers two 25 deg2 patches with XMM observations of ∼10 ks. We summarize the scientific results on galaxy clusters associated with the first release of the XXL data. The X-ray observations, combined with deep multi-wavelength observations, lead to solid standalone cosmological constraints and provide a wealth of information on the formation and evolution of AGN, clusters, and the X-ray background. In particular, XXL offers a unique opportunity to pinpoint the z>1 cluster density.

Vega Ferrero, J. (University of Pennsylvania)

“Constraining the cross section of dark matter with giant radial arcs in galaxy clusters”

Autores: J. Vega-Ferrero, J. M. Dana, J. M. Diego, G. Yepes, P. Hopkins, M. Meneghetti

We compare the statistics and morphology of arcs in galaxy clusters using simulations with standard cold dark matter and simulations where dark matter has a probability of interaction (parametrized by its cross section), i.e self-interacting dark matter. Through ray tracing, we produce a statistically large number of arcs around six galaxy clusters at different redshifts. Since dark matter in more likely to interact in colliding clusters than in relaxed clusters, and this probability of interaction is largest in the denser regions, we focus our analysis on radial arcs (which trace the lensing potential in the central region better than tangential arcs), in galaxy clusters which are undergoing a major merger. We find that self-interacting dark matter produces fewer radial arcs than standard cold dark matter but they are on average more magnified. We also appreciate differences in the morphology which could be used to statistically favor one model versus the other.

Vega Ferrero, J. (University of Pennsylvania)

“The Hubble constant from SN Refsdal”

Autores: J. Vega-Ferrero, J. M. Diego, V. Miranda, G. M. Bernstein

Hubble Space Telescope observations from 2015 December 11 detected the expected fifth counter-image of supernova (SN) Refsdal at $z = 1.49$. In Vega-Ferrero et al. 2018, we compared the time-delay predictions from numerous models with the measured value derived by Kelly et al. 2016 from very early data in the light curve of the SN Refsdal and find a best value for H_0 = 64^{+9}_{-11}$ km/s/Mpc (68% CL), in excellent agreement with predictions from cosmic microwave background and recent weak lensing data + baryon acoustic oscillations + Big Bang nucleosynthesis (from the DES Collaboration). This is the first constraint on H_0 derived from time delays between multiple-lensed SN images, and the first with a galaxy cluster lens, subject to systematic effects different from other time-delay H_0 estimates. Additional time-delay measurements from new multiply imaged SNe will allow derivation of competitive constraints on H_0.

POSTERS:

Grieger, B. (ESAC)

“Direct and inverse numerical modeling of the gravitational lens effect of arbitrary extended deflectors”

Autores: Björn Grieger

In the thin lens approximation, the gravitational lens effect is completely described if the deflection angle can be computed for every point in the deflector plane. Analytical expressions are available for the deflection angle of a point mass and a circular disk of homogeneous surface mass density. From the latter, the deflection angle of any circular symmetric mass distribution can be obtained by summing over rings of constant surface mass density. Here, we have derived an analytical expression for the deflection angle of a rectangular area of constant surface mass density by solving the double surface integral. With this, for any arbitrary surface mass distribution defined on a rectangular grid of cells with constant surface mass density within each cell, the total deflection angle at any point can be obtained by adding up the deflection angles of all cells. The expression for the deflection angle of a rectangular area can also be employed for inverse modeling of the surface mass distribution in the deflector plane. We simulate observations of galaxy shears (with underlying intrinsic ellipticities) and retrieve from these the surface mass distribution of a deflector defined on a grid of rectangular cells with the kriging method.

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“SMA observations of the mature galaxy cluster Cl J1449+0856 at z=2”

Autores: P. Portos, H. Dannerbauer

Based on previous APEX-LABOCA 870micron observations of the region around the galaxy cluster Cl J1449+0856 at z = 1.99, submm interferometric observations of the six brightest sources (870 micron fluxes > 10 mJy and S/N > 4) with the SMA have been carried out. The aims of these observations are to confirm the reliability of the LABOCA-selected submillimeter galaxies, to determine their accurate positions and fluxes and verify if they are physically related to the targeted galaxy cluster. To characterize the counterparts of the SMA sources we use an exquisite multi-wavelength dataset available. Here we present the results of our work and discuss its implications.