FOF 2025 - PROGRAM

MONDAY 7 April

8:30 - 9:20 – *REGISTRATION AND APERTURE*

9:20 - 10:00 – *Omar López-Cruz. The Ultramassive Black Hole in the cD Galaxy Holm 15A: The Cosmic Blender*

Our new study of the cD galaxy Holm 15A, the BCG in Abell 85, has successfully recovered our previously reported large cusp radius of over 4 kpcs, validating our earlier findings. By combining Subaru imaging with IFU spectroscopy from VLT+MUSE and GTC+MEGARA, we have measured a flat metallicity gradient covering the core region. We propose that large core and the flat metallicity gradient are produced by the core scouring mechanism due to the merging of two or three SMHBs.

10:00 - 10:20 – *Federico Stasyszyn. Simulating Galactic Magnetohydrodynamics: The Role of Magnetic Fields in Galaxy Evolution*

The origin of cosmic magnetic fields in the Universe remains an open question in astrophysics. Cosmological magnetohydrodynamics (MHD) simulations have been proven to be an effective tool for understanding the cosmic structure formation process and the magnetic field evolution, which we can infer from observations. We present results from a novel set of cosmological simulations aimed at studying different magnetogenesis scenarios. Our set of runs have been obtained using the MHD version of the smoothed particle hydrodynamics code SWIFT and explores different mass resolutions, seeding mechanisms and astrophysical models. We focus on different astrophysical processes responsible for enhancing magnetic fields and confirm previous results obtained with structure formation models. Therefore, with these simulations, we can study the distribution of magnetic fields inside the different cosmic structures embedded within the cosmic web. In particular, we observe differences in the alignment between the spin of galaxies and their magnetic fields between two different magnetogenesis models.

10:20 - 11:00 – *COFFEE BREAK*

11:00 - 11:40 – *Maria Celeste Artale. High-Redshift Protoclusters Through the Lens of Cosmological Simulations*

Galaxy clusters are massive virialized structures in the universe, containing hundreds to thousands of galaxies mainly with passive evolving stellar populations. Most of their star formation activity occurs at high redshift ($z \gtrsim 2$), making the study of protoclusters—unvirialized progenitors of massive clusters—crucial for understanding their galaxy evolution. Observations tend to identify protoclusters through different star-forming galaxy populations such as Lyman-alpha emitters (LAEs), Lyman-break galaxies, and submillimeter galaxies (SMGs), among others. In this talk, I will discuss the role of LAEs as tracers of protocluster regions through cosmological simulations, and their physical properties and evolution during cosmic noon ($z \approx 2$-4). Our research stands in the context of the ongoing ODIN survey, the largest field program for LAEs, examining structures at redshifts of 2.4, 3.1, and 4.5. In the second part of my talk, I will discuss the role of the SMG population as tracers of protocluster and the challenges in modeling them in cosmological simulations. Using FLAMINGO simulation, our findings indicate that SMGs contribute up to 27% of the cosmic star formation rate density at $z \approx 2.6$. Upcoming surveys, such as the ToITEC Ultra Deep Survey, which will map regions overlapping with ODIN survey will provide important insights into the connections between these galaxy populations and with protocluster regions.

11:40 - 12:00 – *Facundo Rodríguez. Evolution of the central galaxy alignment with the environment*

Observations indicate that red central galaxies are closely aligned with their group galaxies and the large-scale environment. This alignment has been confirmed through simulations, revealing the alignment of stars forming these galaxies with the dark matter in their halos. Our study builds on these findings by examining the evolution of central galaxy alignment with their environment and the alignment between stellar and dark matter components. This work aims to describe the evolution of bright central galaxy alignment over time and understand the processes leading to the current observed alignment. Using merger trees from simulations, we tracked the alignment evolution of a central galaxy sample at z=0, which was consistent with previous observations. We utilized the anisotropic correlation function to study the alignment with the environment. We analyzed the probability distribution of angles between the axes of the shape tensor for stellar and dark matter components. We describe the evolution of alignment in bright central galaxies, highlighting differences between red and blue galaxies. Our findings show that the alignment of dark matter halos differs from that of the stellar material within them. The assembly process and mergers have influenced the evolution of this alignment.

12:00 - 12:20 – *Dante Paz. Nothing but Voids: Digging for Fossil Clues in Cosmic Emptiness*
In this talk, we examine the statistical properties of voids across a range of cosmological simulations. Our analysis focuses on how void shapes and their abundance vary with key cosmological parameters, including matter density, σ8, hubble parameter among others, within the ΛCDM framework. Beyond standard cosmology, we extend our study to modified gravity scenarios, specifically the chameleon-screened Hu-Sawicki f(R)f(R) model and the normal-branch Dvali-Gabadadze-Porrati (nDGP) model, assessing their impact on void statistics. We evaluate the potential of void-based observables in constraining cosmological parameters through redshift surveys. This approach provides new perspectives on the relationship between void properties and fundamental physics, offering potential signatures of deviations from General Relativity.

12:20 - 12:40 – *Agustín Rodríguez-Medrano. Lagrangian bias model for cosmic voids*
Cosmic voids are among the large-scale structures that hold the most cosmological information for exploration through cosmic tests. However, the relationship between galaxies and mass is a fundamental factor that must be modeled without any possible bias to fully exploit these environments for cosmology. In this work, we explore the Lagrangian perturbative bias expansion to describe biased tracers within the context of cosmic voids, aiming to study the precision of these models in characterizing void features.

12:40 - 14:30 – *LUNCH*

14:30 - 14:50 – *Valeria Cristiani. What do the stellar disks and spheroids know about the galaxy that hosts them?*
Galaxy formation is inherently linked to the diverse evolutionary paths of disk and spheroidal systems, which are the fundamental stellar components of galaxies. In order to get some light on the relation between these systems and the galaxy where they are located, we analyze some properties of the disk and spheroid populations, identified by dynamical decomposition from a sample of thousands of galaxies from the IllustrisTNG simulations, and taking into account the spheroidal mass fraction of the galaxy to which they belong. We find that disks with similar stellar mass and found in galaxies with smaller spheroid mass fraction: are smaller, have a lower Sérsic index, have formed more recently, and have lower ex-situ stellar mass, than those found in galaxies with greater spheroid mass fraction. This would indicate that a disk in a less massive galaxy has formed more recently mainly through in-situ star formation, whereas in a more massive galaxy the disk forms earlier and acquires a significant mass fraction from mergers. In contrast, for spheroids the same properties seem to be independent of the spheroid mass fraction of the galaxy to which they belong.

14:50 - 15:10 – *Bruno Celiz. Accreted mass and stellar haloes in isolated galaxies from TNG50*
We study the accreted mass and stellar haloes of ~5000 isolated galaxies with virial masses log(M_200/M_sun) > 10.3 from the hydrodynamic cosmological simulation TNG50-1. We find a strong correlation between the mass fraction of these components and virial mass, particularly in the dwarf regime, while the correlation with stellar mass is weaker. Ex-situ stars comprise 60-100% of the stellar halo mass, representing less than 1% of the total stellar mass of the galaxy. At a fixed virial mass, the median age and characteristic size of the accreted component decrease with increasing accreted mass. Stacked surface density profiles demonstrate that the accreted component is well-described by a Sérsic profile, with the Sérsic index correlating with the excess accreted mass at a given virial mass. Galaxies below the median accreted mass exhibit n = 2.0±0.5, while those above the median are better fit by n = 3.5±0.5, with a mild increase at higher masses. These results provide predictions for stellar halo properties in galaxies less massive than the Milky Way, enabling comparison with observations. Our findings suggest that analysing the oldest stars in galactic outskirts offers valuable insights into galaxy assembly history across a broad mass range.

15:10 - 15:30 – *Nelson Padilla. Galactic conformity and Assembly bias*
We explore the connection between galactic conformity (the tendency of nearby galaxies to have similar properties) and assembly bias (the phenomenon where galaxies with different properties but similar halo masses have different clustering behaviors). When clipping the sample by removing clusters of galaxies and their surroundings, conformity is strongly reduced. Is this also the case for assembly bias? Our findings shed light on the relationship between these two concepts and how they impact our understanding of galaxy evolution.

15:30 - 16:10 – *COFFEE BREAK*

16:10 - 16:30 – *Mariano Dominguez Romero. Deep K-Correct: Estimating K-Corrections and Absolute Magnitudes from Galaxy Images*

The estimation of K-corrections and absolute magnitudes are essential in extragalactic astronomy for comparing galaxy properties across different redshifts. The state-of-the-art methods rely on deterministic template-fitting techniques: Blanton's KCorrect, which estimates K-corrections and absolute magnitudes from photometry and redshift, and FastSpecFit, which refines these estimates by incorporating spectroscopic data. However, spectroscopy is expensive and often unavailable for large galaxy surveys. We introduce Deep K-Correct, a novel approach that leverages the latent space of the astronomical foundation model AstroCLIP to estimate K-corrections and absolute magnitudes directly from galaxy images. Unlike traditional methods, Deep K-Correct eliminates the need for photometric or spectroscopic measurements, utilizing the rich representations learned from millions of galaxies. We explored both zero-shot learning (using K-Nearest Neighbors) and few-shot learning (training neural network layers on top of the embeddings). Our results show that Deep K-Correct matches and marginally surpasses the accuracy of KCorrect in predicting K-corrections while requiring only images and redshift as input. We discuss the tunning of the method for the upcoming LSST images and the computation of other physical properties for stars and galaxies using Foundational Models.

16:30 - 16:50 – *Rodrigo Rodriguez. CART Current Status and Digital Backend Development*

The goal of this project is to develop an SDR spectrometer using AMD Xilinx RFSoC4x2 boards as hardware and open-source CASPER software. Initially, it will operate in the S and X bands at the new China-Argentina Radio Telescope (CART) in Barreal, San Juan, Argentina. This initiative aims to encourage collaboration with universities worldwide and contribute to the growth of the CASPER community.

This work presents the latest updates on the development of the digital backend and the current status of CART.

TUESDAY 8 April

9:00 - 9:40 – *Jailson Alcaniz. Dynamical dark energy in light of current observational data: an overview*.

Recent measurements of Baryon Acoustic Oscillations from the Dark Energy Spectroscopic Survey (DESI), in conjunction with observations from the cosmic microwave background and Type Ia supernovae, challenge the standard Λ-Cold Dark Matter (ΛCDM) paradigm. These results suggest a potential evolution in the dark energy equation of state, w(z), as inferred from analyses employing parametric models. In this talk, I review aspects of these results, as well as their broader implications for our understanding of cosmic acceleration and the nature of dark energy.

9:40 - 10:00 – *Juana Rapoport. Secondary Biases and Their Dependence on Omega Matter*

Cosmological simulations show that, for dark matter halos of equal mass, the level of clustering with neighboring structures increases or decreases when a secondary property is considered. This effect is known as "secondary bias." Since halos correspond to peaks in a density field that evolves according to a cosmological model, the existence of secondary biases implies that mass alone is insufficient to characterize the evolution of this field. In this study, we explore the relationship between cosmology and the observed distribution of halos with equal mass but differing secondary properties (spin, shape, alignment, and concentration). To this end, we present preliminary results on the measurement of secondary biases in 17 cosmological simulations with a variable ΩM.

10:00 - 10:20 – *Santiago Collazo. Direct detection of fermionic sub-MeV dark matter using Xenon based detectors*

Recent astrophysical analysis on Galactic scales about the distribution of dark matter provide strong hints on its nature. The evidence span from relativistic image in SgrA*, to stelar orbits at mili parsec scales, all the way to the Milky Way rotation curve and stellar streams up to ~ 100 kpc. This predictions suggest that fermionic dark matter of sub-MeV mass can act as a proper candidate. Supposing that the dark matter candidate is a right-handed neutrino with a mass between 100 keV and 200 keV, and considering an effective electromagnetic channel of a more general four-fermion interaction, we study the ionization events rate induced by this candidate on electrons bounded to Xenon atoms. We also include the ionization form factor which characterizes the quantum mechanic physics of the atom, improving a previous model applied to the same scenario. In addition, we have computed exclusion regions ruling out different right-handed neutrino candidates and the coupling constant involved in the interaction with the bounded electron.

10:20 - 11:00 – *COFFEE BREAK*

11:00 - 11:40 – *Tomás Verdugo. Strong Gravitational Lensing: A Key Tool for Cosmology*

Strong Gravitational lensing is a key and powerful astrophysical tool for cosmology, providing a robust framework to study the dark sector of the Universe. On one hand, it serves as an effective method to directly probe mass distributions, encompassing both visible and dark matter. On the other hand, it offers a unique opportunity to test and constrain different cosmological models, solidifying its role as a dual cornerstone of modern cosmology. In this talk, we will review the cosmological applications of strong gravitational lensing and discuss the latest advancements in exploring the dark sector of the Universe.

11:40 - 12:00 – *Martín Makler. Preparing for Strong Lensing Science with Rubin and Beyond*

Galaxy-galaxy Strong Lensing (SL) systems provide useful probes of the mass distribution in the lens, allows one to investigate high redshift objects and to set constraints on cosmological models. In addition, these systems enable tests of modifications of general relativity. The upcoming Vera Rubin Telescope Legacy Survey of Space and Time is expected to uncover on the order of 10,000 strong lenses, tremendously increasing the sample of systems for the above mentioned applications. In addition, it will enable the systematic discovery of strongly lensed transients and variable sources, including supernovae and quasars, which yield precise determinations of the Hubble parameter. Rubin could even discover the first multi-messenger lensing event. As a preparation for this survey, we have created the "Last Stand Before Rubin" (LaStBeRu): a compilation of SL systems, cross matched with photometric and spectroscopic surveys, and generated a database of their images in the current wide-field surveys, yielding thousands of candidate systems. This provides the largest database of ground based images of SL systems with value added information, such as lens and source redshifts, lens velocity dispersions, when available. In this presentation we discuss some analyses that are being carried out by our group with this dataset, including: i) use of the archival information to constrain modified gravity models, ii) classification and tagging of the systems in various categories of lenses and sources, iii) semi-automated lens modeling of selected systems, yielding the largest homogeneous sample of SL models, iv) follow-up spectroscopic observations of selected systems, v) predictions for time-delays of multiple images, creating a look-up table for lensed transients. These results contribute to the state-of-the-art of the field and prepare for the upcoming Rubin data.

12:00 - 12:20 – *Karen Nowogrodzki. Microlensing with LSST: simulation, classification, and follow-up observations from CASLEO*

Among the transient events that LSST will observe is microlensing, a phenomenon where a massive object passes along the line of sight between an observer and a light source, bending the light and causing the image to brighten. The main objective of this work is to assess the detection and characterization of microlensing events and constrain the properties of the lensing objects, using data from the LSST at the Vera C. Rubin Observatory. The ongoing research encompasses three interconnected projects that will help us prepare for LSST data: 1) a microlensing event classifier using MicroLIA to assess the detection of such events with the ELAsTiCC dataset (simulated LSST-like light curves), 2) a pipeline for inserting and extracting light curves in LSST simulations (DP0), enabling the evaluation of light curve reconstruction and the constraint of parameters, and 3) follow-up observations with the HSH telescope at CASLEO to contribute to the global characterization of microlensing events, in collaboration with the OMEGA international network. This project aims to both develop the end-to-end microlensing process, from target selection to light curve assembly and fitting, and to prepare for real-time follow-up of microlensing events detected by the LSST. The extracted light curves from DP0 will be used to train and refine MicroLIA's classifier while also providing hands-on experience with the Rubin pipeline. Meanwhile, ongoing HSH observations of microlensing events will help optimize the workflow for following up on LSST-detected events.

12:20 - 12:40 – *Ana Esteban Gutiérrez. The Einstein Cross: A Deep Dive into an Iconic Gravitational Lens*

The Einstein Cross gravitational lens system is famous for being an ideal microlensing laboratory, offering exceptional opportunities to track and measure changes in the imprints of the quasar variability due to its high frequency of microlensing events from numerous caustic crossings of compact objects (typically stars). Its lens galaxy, unusually located at a very low redshift ($z_l \sim 0.03$), along with the source quasar ($z_s \sim 1.69$), provides a unique configuration. This proximity, added to the fact that the four macro-images are formed in the bulge of its spiral lens galaxy, allows us to observe microlensing-induced light curve variations over shorter time scales compared to other lens systems. In case these flux magnification changes are significant enough (i.e., high magnification events), they could offer a wealth of crucial information about the innermost regions of the quasar's SMBH or the mass distribution within galaxies, as well as estimations of the peculiar velocities of galaxies, which are strongly correlated with the frequency of these caustic crossing events. Thus, in this contribution, my aim is to show why this extraordinary system has drawn significant attention since its discovery in 1985 and explore the huge potential it still holds.

12:40 - 14:30 – *LUNCH*

14:30 - 15:10 – *Claudia Scóccola. In search of primordial B-modes: challenges and advances in cosmic microwave background polarization*

The standard cosmological model, based on General Relativity and particle physics, describes the evolution of the Universe from its initial moments to the present day. The Cosmic Microwave Background (CMB) is one of the observational pillars of this theoretical framework. In recent decades, increasingly precise measurements have allowed us to place tighter constraints on the parameters of the cosmological model, giving rise to what we now call ”precision cosmology". However, fundamental challenges remain, such as understanding the nature of dark matter and dark energy, or determining the initial conditions of the Universe in greater detail. In particular, the polarization of the CMB contains a subtle signal from primordial gravitational waves, generated during inflation, a brief period of exponentially accelerated expansion of the Universe. These gravitational waves would leave a characteristic pattern in the polarization, known as B-modes. Detecting these modes remains a challenge due to their intrinsic weakness and contamination from polarized radiation in our galaxy. This talk reviews the current state of the field, exploring observational challenges, advancements in instrumentation and data analysis, and future prospects for detecting primordial B-modes.

15:10 - 15:30 – *María Belén Costanza. Neural network developing for Wiener filter process applied to CMB polarization maps and power spectrum computation.*
In this talk I will present the neural network developed to simulate the Wiener Filter (WF) for polarization Cosmic Microwave Background (CMB) maps, used to reduce the inhomogeneous noise present in those maps and reconstruct the B-mode signal, with an additional procedure for the E-to-B leakage problem. We present the performance of this neural network, written in Tensorflow 2, comparing the results with the traditional method that uses conjugate gradient (CG). Furthermore, we estimate the power spectrum of an unknown signal and study the accuracy on different scales of interest.

15:30 - 16:10 – *COFFEE BREAK*

16:10 - 16:50 – *Hermano Velten. A critical view of modified gravity cosmologies beyond the LCDM model*
In this talk, we discuss the viability of cosmological background expansions different from the standard flat ΛCDM model, with special attention to f(R,T) modified gravity scenarios where T is the trace of the energy-momentum tensor and the unimodular gravity.

16:50 - 17:30 – *Rodrigo de Sousa Gonçalves. Cosmic Homogeneity: A New Probe*
In this presentation we discuss the cosmic homogeneity scale as a new cosmological probe. We review the last decade of the Large Scale Structure investigations on this topic, from the theoretical approach by using fractals to the newest catalogues. We also discuss the difference between a 3D approach and a 2D approach, by specifying what are the radial and angular scale, in order to measure the homogeneity scale from these two approaches. Due to the lack of cosmological model dependence on the 2D approach we show that is possible to use it as a new probe in Cosmology, as well as to find observational results and constraints on cosmological parameters. We also forecast the constraining power of future cosmic homogeneity data, via Monte Carlo simulations, and we obtain competitive constraints on matter density parameters and the Hubble constant from the joint analysis with current SN and BAO measurements.

WEDNESDAY 9 April

9:00 - 9:40 – *Jhon Yana Galarza. New insights into the Star-Planet Connection through Precision Spectroscopy*
The discovery of nearly 5,800 exoplanets has revealed an astonishing diversity in planetary systems, emphasizing the complex processes behind planet formation. A key question remains: how are stars and planets chemically connected? One clue comes from the Sun, which seems depleted in refractory elements compared to solar twins—suggesting that these missing elements may be locked in the terrestrial planets of our Solar System. Lithium depletion has also been linked to exoplanet formation; however, this remains debated since lithium can also be enhanced when a star engulfs its planets. By analyzing a carefully selected sample of planet-hosting stars, we found that the Sun is chemically typical among solar analogs, challenging the idea that it is unusually depleted in refractory elements. Additionally, we identified significant enhancements in elements such as C, Ca, Co, Cu, Ni, Na, and S in planet-hosting stars—particularly at low metallicities—suggesting a potential role in exoplanet formation. Furthermore, we found no evidence of extra lithium depletion in host stars compared to single stars. These results help refine our understanding of how stars and planets are connected, offering new insights into the chemistry of planetary systems.

9:40 - 10:00 – *Emiliano Jofré. The TESS/MAROON-X survey for transiting planets around thick-disk stars*

It is well known that stars from different galactic populations (thin-disk, thick-disk, and halo) differ not only in their kinematics but also in their chemical composition. Specifically, thick-disk stars typically have lower metallicities and higher values of alpha-element abundances than their thin-disk counterparts. Thus, it is expected that stars from different galactic populations host planets with different overall composition and structure. In particular, small-sized or low-mass planets orbiting thick-disk stars would tend to be less dense than those of similar size/mass around thin-disk objects. So far, only a few tens of transiting planets have been detected around thick-disk stars that are currently in the solar neighborhood. In this context, in 2021 we started a program to detect and characterize transiting planets to increase the number of well-characterized transiting exoplanets with precise mass measurements around thick-disk stars that can provide important observational constraints for planet formation theory and comparative planetology. Based on TESS photometry and Gemini/MAROON-X high-precision radial velocities, here, we present the first results of our survey, including the detection and characterization of a super-Neptune transiting a K-dwarf star chemo-kinematically identified as a member of the transition between the thin and thick Galactic disk populations.

10:00 - 10:20 – *Romina Petrucci. Characterizing flares in ultra-cool dwarfs and their impact on potentially habitable planets*

Ultra-cool dwarfs (UCDs) are objects with effective temperatures below 3000 K, including fully convective very low-mass stars and brown dwarfs. They are particularly interesting because it is easier and more likely to detect Earth-like planets in their habitable zone than around stars of any other spectral type. However, a key aspect to assess whether planets orbiting UCDs would be able to promote the emergence of life on their surfaces is to characterize the host's magnetic activity.

With this in mind, in this contribution, we present the characterization of the photometric variability of 208 ultra-cool dwarfs with spectral types between M4 and L4 using 20-s and 2-min cadence data from the TESS space mission. We computed the rotation period of 87 UCDs and detected 778 flares in 103 of them. The analysis of these data allows us to conclude that the correlations among the measured flare characteristics, namely the slope of the cumulative flare frequency distribution, flare amplitude, duration, and energy, are consistent with those measured for dwarf stars of earlier spectral types. Our findings indicate that UCD flares are similar to those produced by FGK and earlier M dwarfs. According to traditional understanding, magnetic fields in stars with partially convective envelopes are seated at the tachocline, which fully convective UCDs do not have. In this context, our results suggest that the physical mechanism that produces flares might be similar in these very differently structured dwarfs.

Additionally, flares are thought to initiate abiogenesis in terrestrial planets. We explore this possibility and find that the UV energy emitted during flaring events in the UCDs of our sample is not enough to drive prebiotic chemistry on any terrestrial planet orbiting them.

10:20 - 11:00 – *COFFEE BREAK*

11:00 - 11:40 – *Javier Minniti. Pulsating variable stars in the near-infrared trace the hidden regions of the Milky Way disk*

We are currently experiencing an era where distances are precisely being measured for about one billion stars in our Galaxy by the Gaia mission. However, the Milky Way innermost regions, and those lying beyond them, at the far side disk, have remained largely unexplored. The difficulty to unveil these regions mainly arises from our location in the disk mid-plane and the large distances involved. Pulsating variable stars have the key feature that individual distance, age, and reddening can be estimated based on their pulsational properties, and can therefore help us to improve this situation. Classical Cepheids are ideal tracers of the disk properties. They are young, luminous, and - relatively - easy identifiable standard candles. Their location at the Milky Way disk complicates their identification, mainly due to the substantial reddening they are subject to. This is particularly true when studying them at the far side of the Galactic disk, but it can be surpassed with the use of infrared (IR) photometry. We will show how the use of additional observable properties aids in the near-IR light-curve based classification process, providing a pure sample of Cepheids. In parallel, Mira variables, which are well studied and bright standard candles, offer an excellent opportunity to trace intermediate and old populations in these complex regions. We will present our current knowledge on the properties of the far side of the Galactic disk using these excellent tracers.

11:40 - 12:00 – *Martina Tapia-Reina. Ages of LMC Star Clusters with GMOS Integrated Spectroscopy: Systematic Comparison of Available Tools*

We present the first systematic analysis comparing the ages, reddening and radial velocities of star clusters using two widely used tools: STARLIGHT and Analyzer of Spectra for Age Determination (A.S.A.D). Both tools utilize the full integrated spectrum fitting technique. We find that there is a good agreement between the parameters derived by the two tools despite the fact that they use different approaches in calculating these parameters. We also confirm that both tools provide consistent results with the literature parameters obtained from resolved photometry. We note that for optimal age and reddening estimates, observed integrated spectra should have S/N $ > $ 10 when using A.S.A.D and should be fitted by less than 5 single stellar populations (SSPs) when using STARLIGHT. We also show that the deviation of the radial velocity estimates between the two tools depends on the S/N of the observed integrated spectrum and demonstrate that when varying the metallicity, the age estimates of STARLIGHT are not affected significantly while the results of A.S.A.D are generally underestimated. As more observational data become available through modern instruments, the strengths and limitations of each available automated tool need to be taken in consideration when interpreting their results.

***12:00 - 12:20 –** Tali Palma. A new catalog of binary and grouped open clusters*

Identifying binary and multiple open cluster systems is crucial for understanding their formation, evolution and dynamics in the Milky Way. In a new catalog, open clusters that form gravitationally bound pairs or groups were detected and different types of interactions were distinguished. Based on a previous catalog of 7167 clusters, tidal factors were used to estimate tidal forces and only close neighbours within 50 pc were considered. A total of 2170 star clusters within 617 paired systems and 261 groups (with three or more members) were identified. Classification was based on proper motion distributions, cluster ages, and colour-magnitude diagrams. This new method provides an improved approach to identifying star clusters that share the same spatial volume and experience notable tidal interactions. Preliminary statistical analyses of structure, distribution and mass segregation will be presented.

***12:20 - 12:40 –** Mariana Orellana. Light curve modeling of unusual supernovae*

Supernovae are some of the brightest events in the universe. We are interested into the kind that are the explosions of very massive stars. At the current rate of discovery and good quality follow-up, the community has established sets of characteristic light curves of the main supernova types. As one might expect, outliers from the general populations emerge. The study of that peculiar cases thus becomes relevant, they call for unorthodox proposals outside the comfort zone of the parameter spaces. One recent case is given by the bolometric evolution of the supernova SN2022jli as published by Chen et al. (2024). We aim to understand the sources that could be responsible for modifying the light curve to have a double peaked shape with prolonged timescales and a fast drastic brightness drop at around 270 d. In this talk I'll summarize the modeling steps we have performed for this supernova, and place it in context with some previous studies done by our group.

***12:40 - 14:30 –** LUNCH*

***14:30 - 15:10 –** Carlos Saffe. Giant-giant pairs: a high-quality test for the chemical tagging*

The most important assumption of chemical tagging is that members of birth clusters should have a homogeneous chemical composition. However, studies of main-sequence binary systems showed that small abundance differences between the components could also exist. Several scenarios have attempted to explain the origin of the differences, such as planet formation, planet engulfment and atomic diffusion. However, none of the models fully explains the observed differences. In particular, giant stars are significantly less sensitive to the effects of diffusion and engulfment than main-sequence stars, thanks to their massive convective envelopes. We then propose to study a sample of giant-giant pairs, a novel approach to explore the origin of the slight differences observed. The giant-giant pairs were carefully selected from a recent Gaia EDR3 binary sample with very similar components, which will allow us to achieve the highest possible precision through a line-by-line differential study. In this way, giant-giant pairs can emerge as a high-quality test for the chemical tagging, also providing a tool to disentangle the origin of the small differences observed.

***15:10 - 15:50 –** Gustavo Bruzual. Stellar population synthesis models including binary stars*

I will review the role of interacting massive binary stars on the spectrophotometric properties of stellar populations as a function of age and metallicity predicted by synthesis models. The most relevant differences with respect to single star models occur in the ultraviolet, including the number of H and He ionizing photons. This spectral range is now observable with JWST in distant galaxies and the use of appropriate models is fundamental for the correct interpretation of these observations.

***15:50 - 16:30 –** COFFEE BREAK + Poster Session*

***20:00 - 21:00 –** PUBLIC TALK – Martín Makler: 'bla bla bla'*

THURSDAY 10 April

***9:00 - 9:40 –** Sergio Parón. Interstellar Medium, Star Formation, and Astrochemistry*

To study star formation we need to understand the interstellar medium (ISM), its dynamics and its structure along the different spatial scales. In particular, there are some issues about the formation of high-mass stars that remain unknown. However, nowadays thanks to the most modern telescopes and instruments, we are able to observe and analyze the physical and chemical processes involved in the birth of such stars, shedding light on the open questions. In this talk, I will introduce the interstellar medium, and discuss the interesting structures distributed at different spatial scales related to the collapse of gas that gives rise to the star formation processes. I will show that the observational study of star formation is a research that must be conducted in a multispectral way, focusing on the multi-spatial scale. Additionally, some points regarding astrochemistry will be introduced as tools that help us in the above mentioned studies.

9:40 - 10:00 – *Rafael Pignata. N-Dimensional Diagrams: A Modern Approach to Planetary Nebula Morphology (PhD)*
The morphology of Planetary Nebulae (PNs) is extremely diverse and complex, ranging from simple spheres to intricate bipolar structures, with the presence of shells, rings, jets, filaments, among others. Having tools that enable the identification and characterization of these various components based on their physical properties is crucial to reducing subjectivity in their interpretation. In this seminar, I will discuss how, by using integral field spectroscopy data and clustering methods, we are updating and developing N-dimensional diagnostic diagrams to more accurately identify the different morphological components of PNs.

10:00 - 10:40 – *Denise R. Gonçalves. CO – ALMA constraints for the coldest material in low-ionization jets of PNe*
Our knowledge of planetary nebulae (PNe) is primarily based on their large-scale ionized components. However, PNe also host low-ionization structures (LISs), frequently appearing as small-scale, highly collimated pairs. Although the presence, origin, and implications of these structures remain unclear, their origin seems to be closely connected with the launching and propagation of the jetlike outflows (Rechy-García et al. 2022) that shape the transition from the asymptotic giant branch to the PN phase. A particularly puzzling aspect is that, despite being prominent in low-ionization lines ([NII], [OII], [SII]) –and contrary to theoretical predictions (e.g., Balick et al. 2020, as a recent example)– the measured electron density of LISs is lower than in the surrounding large-scale nebular components (Gonçalves et al. 2009; Mari et al. 2023). This fact suggests that a significant amount of neutral and molecular gas may be hidden within LIS pairs. Our group's observational campaign to uncover this hidden component through near-IR H2 emission has yielded positive results in every PNe studied so far (Akras et al. 2017, 2020; Mari et al. 2025, in prep.). Currently, we directed our observational efforts toward the detection of CO –the second most abundant molecule– using millimeter single-dishes and interferometers. In this contribution, the focus are prominent LISs where molecular H, as well as atomic C and O have already been observed. Here we present preliminary results from our single-dish and ALMA observations, alongside photo-dissociation models that allow robust interpretation of the data (Gonçalves et al. 2025, in prep.).

10:40 - 11:20 – *COFFEE BREAK*

11:20 - 12:00 – *Luis Gutiérrez Soto. Unveiling the Hidden Population of H-alpha Excess Sources in the Southern Sky: A Synergy of S-PLUS Photometry and Machine Learning*
We present a novel method to identify and classify Hα-excess compact sources in the Southern Hemisphere using the 12-band photometry of the S-PLUS survey (7 narrow- and 5 broad-band filters). By employing color-color diagnostics, we isolate approximately 7,000 Hα candidates, including emission-line stars, young stellar objects, cataclysmic variables (CVs), planetary nebulae, QSOs, and compact galaxies with redshifted emission lines, as well as transients, X-ray binaries, and peculiar objects. Combining S-PLUS colors with advanced clustering techniques (UMAP+HDBSCAN) and infrared data, we are able to distinguish between distinct classes within our Hα source list. A Random Forest model, trained on the HDBSCAN results, highlights the key color features that differentiate the various classes of Hα-excess sources, providing a robust framework for future studies, such as follow-up spectroscopy.

12:00 - 12:20 – *Rodrigo Cabral Fontes. A first estimation of the IMF in Orion OB1b from 0.05 Msun to 8 Msun using public surveys*
The initial mass function (IMF) is a fundamental result of the star formation process and a crucial quantity in nearly all areas of astrophysics. The nearby (~400 pc) Orion star-forming complex includes stars and brown dwarfs spanning wide ranges of mass and age (~1-10 Myr). Slightly evolved populations like 25 Ori (Orion OB1a), σ Ori (Orion OB1b), and Collinder 69 (λ Ori) have relatively low extinctions, making them ideal for accurate IMF determinations in the low-mass regime. In this work, we present the IMF determination of kinematically distinct stellar populations within Orion OB1b in the mass range $0.05 < M/Msun < 8$. The groups were selected by employing astrometric and photometric data from Gaia DR3, while masses and ages were determined using stellar structure and evolution models from the literature. We corrected for the contamination by field stars and main observational biases using spectroscopically confirmed members as a control sample. We recovered the distance and age multi-modality towards OB1b reported in literature, which could suggest separate origins for the different groups. The resulting IMFs were fitted to a lognormal function in the subsolar range, a tapered power-law in the whole mass range, and a segmented power-law. The obtained parameters are consistent with findings for λ Ori, σ Ori, and 25 Ori, supporting the scenario of a common underlying IMF for most of Orion's populations.

12:20 - 13:00 – *Marcelo Miller Bertolami. The Planetary Nebulae Luminosity Function: Why does it work?*
The [OIII] λ5007 Planetary Nebulae Luminosity Function (PNLF) has been a reliable and precise extragalactic distance indicator, effective up to ~20 Mpc, for over 30 years. This method has been successfully applied to both elliptical and spiral galaxies. Given its applicability to both old and young stellar populations, the PNLF is arguably one of the best tools for examining systematic differences between Population I and Population II distance measurement techniques.
Theoretically, however, the PNLF method should not work as well as it does, since the luminosities of the brightest planetary nebulae (PNe) are expected to be highly sensitive to the age of their host stellar population. Yet, the method remains remarkably robust, consistently yielding galaxy distances with ~10% precision across all Hubble types.
In this talk, I will review the PNLF, its applications, and past and ongoing efforts to improve our understanding of the physical processes that shape the luminosity function and the brightest PNe.

20:00 - 00:00 – *SOCIAL DINNER*

FRIDAY 10 April

9:40 - 10:20 – *Alice Zurlo. Direct imaging of exoplanets and moons*
In this presentation, I will give a brief review of some of the latest results in the fields of high-contrast imaging and planet formation. Recently, two circumplanetary disks have been discovered: around the young protoplanet PDS 70 c and the ultra-wide companion SR 12 c. These breakthrough discoveries give hope in finding exosatellites around young companions. I will present the first results of a team effort to look for satellites and circumplanetary disks around the known companions of high-contrast imaging. Studying the vicinity of young exoplanets can shed light on the mechanisms of planet formation.

10:20 - 10:40 – *Carolina Villarreal D'Angelo. The faith of a giant planet atmosphere around a white dwarf*
In this talk, I will explore the response of a giant planet's atmosphere to the incoming XUV radiation from a white dwarf, focusing on the WD J0914+1914 system. An exoplanet has been inferred in this system through spectroscopic observations of a gaseous disc around the star, which may be the result of material loss from the planet's atmosphere. I will present the results from hydrodynamical simulations to assess the evidence for the existence of the proposed planet.

10:40 - 11:00 – *Emmanuel Gianuzzi. Formation and Evolution of Narrow Rings around Asteroids*
The stellar occultation method has enabled the detection of narrow rings around Centaur asteroids, such as (10199) Chariklo, and trans-Neptunian objects, such as (136108) Haumea and (50000) Quaoar. These discoveries have sparked interest in the formation and evolution of such systems.
This study examines the formation and confinement of these rings, emphasizing their proximity to the 3:1 spin-orbit resonance (between the asteroid rotation and a mean motion of a ring particle). Through numerical simulations, we investigate the dynamical evolution of a particle disk orbiting an asteroid with a non-axisymmetric potential (i.e., a non-spherical body) whose rotation period varies over time. This potential is introduced by incorporating a fixed mass anomaly (a surface bulge) on the asteroid. The evolution of the disk particles under this potential reveals that, depending on the variation in the rotation period, the mass of the anomaly, and the mass of the disk, a narrow ring can be captured in the 3:1 resonance.
While these preliminary results are promising, further work is required to account for the nature of the asteroid's spin evolution and the effects of different friction and dispersion models on the disk particles.

11:00 - 11:40 – *COFFEE BREAK*

11:40 - 12:20 – *Mario Sucerquia - Extreme Exomoons: Unlocking the secrets of ringed and volcanic satellites*
Since the advent of space telescopes such as Kepler and TESS, the discovery of exomoons has been anticipated to follow the plethora of exoplanet detections. Despite more than a decade of observations, exomoons remain elusive, with only a few candidates, such as those around Kepler-1625b and Kepler-1708b, proposed. Their physical and orbital properties challenge current theories of satellite formation and dynamics, leaving their existence under debate. This talk explores the state of exomoons and exoring science, intertwining their orbital dynamics and observational characteristics to unravel the key processes shaping their evolution. We investigate phenomena such as tidal detachment leading to the formation of "ploonets" (moons transitioning into independent planets), the existence of "cronomoons" — moons with rings that could be mistaken for giant satellites — and the potential for exo-Io analogs in highly dynamic environments. A notable case is WASP-49b, which orbits its host star every 2.8 days,

offering a unique testbed to study orbital stability, tidal interactions, and atmospheric signatures linked to volcanic activity. Furthermore, the search for circumplanetary rings and their potential association with massive moons provides critical insights into the mechanisms shaping these exotic systems. By combining theoretical models and observational strategies, this talk aims to bridge the gaps in our understanding of exomoons and their role in the broader context of planetary system evolution.

12:20 - 12:40 – *Matías Cerioni. Tides that Stretch Resonant Chains*

Resonant chains, consisting of consecutive two- and three-body mean-motion resonances between adjacent planets, are a frequent result in the formation of low-mass planetary systems (individual masses below ~20 Earth masses).
If the system is compact, tidal effects will cause the planets to fall inwards and increase their relative separations, opening up the chain. The magnitude of this 'tidal separation' will mainly depend on the age of the system, as well as planetary radii, and the capacity of the planets to dissipate internal energy. As of today, multiple planetary systems show signs of having suffered this type of departure from resonance as a result of tides (i.e Kepler-80, K2-138).
In this presentation, we show how observed tidal separations can be used to constrain system parameters, by focusing on the YZ Cet system. Finally, we discuss possible limitations of the method, and how the results are affected by the longitude of the resonant chain.

12:40 - 13:00 – *Carolina Charalambous. Breaking cold Jupiter resonance chains with stellar flybys*

Planetary migration models predict multiple planets captured into a chain of mean-motion resonances during the disk phase. Over a dozen systems have been observed in these configurations, nearly all close-in planets, with a lack of resonant chains for planets with orbital periods larger than ~300 days. Dynamical studies often overlook the fact that stars do not evolve in isolation. In this work, we explore the possibility that the absence of giant planets in wide-period resonant chains may be due to post-formation disruption caused by stellar flybys. For planets in the 2:1-2:1 and 3:2-3:2 resonant chains, we evaluate the long-term stability after varying parameters such as the planet masses, as well as the inclination, pericentric distance, and mass of the flyby star. The encounter occurs within the secular regime, mainly perturbing eccentricities and inclinations. Our integrations show that the 2:1-2:1 resonant chain is significantly more resilient to a stellar flyby than for the 3:2-3:2 configuration. The nature of the instability is different in both scenarios, the 2:1-2:1 becomes unstable quickly, soon after a penetrative close encounter. Instead, planets in the 3:2-3:2 chain become unstable in long timescales due to more distant flybys that only provide small perturbations for the system to chaotically dissolve. If an encounter occurs between a star hosting planets and a passing star, Jupiter-mass systems with 3 planets in a 3:2-3:2 resonant chain or more compact initial configurations are likely to be disrupted.

13:00 - 14:50 – *LUNCH*

14:50 - 15:30 – *Maria Valeria Sieyra. Characterising solar eruptions through data-constrained MHD simulations*

Solar eruptions are ubiquitous in the sun and are one of the leading actors of space weather. Motivated by what drives eruptive processes and to better understand the coupling between active region magnetic topology and thermodynamical variables, we develop a numerical framework for modelling ARs evolution. We consider different extrapolation techniques based on an HMI magnetogram. Here, I will present the results of an eruption that occurred in NOAA AR 12241 on December 18, 2014 using a non force free extrapolation. We find that a flux rope self-consistently develops and rises. With the aid of an algorithm that identifies and tracks this structure, we study the dynamics of the magnetic flux rope and determine the kinematical properties. We also reproduce synthetic EUV emissions from different points of view that can be directly compared with observations. With the aim of identifying particle acceleration sites and to predict the location and shape of non-thermal emission, we also add test particles to the model. This work takes us a step closer to understanding the processes involved during the eruption.

15:30 - 15:50 – *Dion Donné. 2.5D MHD Simulation of an Eruption Prominence with Stochastic Heating*

Solar prominences are still not understood and even less how they erupt into a coronal mass ejection (CME). Recently, literature has shown that stochastic heating plays a crucial role in realistically simulating solar prominences, retrieving their fibril structure as well as counterstreaming flows. Yet, up to now stochastic heating has not been carried out in the context of an erupting prominence. Here, we elaborate on our findings by performing a high resolution 2.5D MHD simulation of an erupting prominence with stochastic heating and outline its effects on the morphology and dynamics of an erupting prominence.

15:50 - 16:30 – *COFFEE BREAK*

16:30 - 16:50 – *Mariana Cécere. Impact of Helmet Streamers on the Eruption Dynamics of Magnetic Flux Ropes*

Solar eruptions are critical for space weather predictions, and understanding the mechanisms behind these events is key to assessing their geoeffectiveness. Helmet streamers (HSs), present in both solar minimum and maximum activity periods, play a significant role in the eruption process. These structures include a low-energy current sheet where coronal mass ejections (CMEs) tend to deflect, and a closed magnetic field region that often confines eruptions. This study investigates how the presence of HSs influences the eruptiveness of magnetic flux ropes (MFRs) using 2.5D MHD simulations. Our findings highlight that null point reconnection is crucial for determining whether an MFR will erupt, depending on the initial magnetic configuration. We identify a critical ratio of magnetic fluxes that determines the success of the eruption. When the strapping flux above the MFR is less than two-thirds of its own poloidal flux, an eruption is more likely. This work establishes key parameters for predicting CME behavior based on MFR and HS configurations.

16:50 - 17:10 – *Ernesto Zurbriggen. Numerical MHD modelling of Supra-Arcade Downflows*

Supra-Arcade Downflows (SADs) are infrequent, wiggly, and low-emission structures observed to descend through the bright coronal plasma resembling the motions of tadpoles. SADs have always been detected after long-term erupting solar flares in EUV and soft X-ray wavelengths. Based on their physical characteristics, SADs have been interpreted as low-density bubbles and are related with fast magnetic reconnection processes. Despite the fact that several models of SADs have been proposed, the SAD origin and dynamics are not completely understood yet. Therefore, the triggering mechanism of SADs remains a topic open to further discussion.

In this talk, I will present our last numerical MHD scenario of SADs, where we assess whether spontaneous magnetic-reconnection outflows produced in a current sheet are able to drive descending, low-emission structures compatible with SADs in accordance with the retracting flux tube model.