Igniting stars, crafting planets: The multiscale journey of star and planet formation

Monday, July 13, 2026 - Wednesday, July 15, 2026

Tarragona

Program

Table of contents

Monday, July 13, 2026

Molecular clouds and stellar clusters: Formation and evolution of stellar cradles (Jul 13, 2026, 3:00 PM - 5:00 PM)

[2] The sites of star formation: deciphering the structure and evolution of molecular clouds and stellar clusters (3:00 PM, 25 minutes)

Presenter: GROSSSCHDEL, Josefa

Stars do not form in isolation - they are part of stellar clusters, which are themselves often part of larger stellar associations (OB associations) of families of clusters. These stellar populations are born within molecular clouds, the coldest and densest parts of the interstellar medium in galaxies. A key aspect of modern star formation research is our growing ability to map the molecular gas and the star-forming regions in three dimensions within our home galaxy, the Milky Way. Thanks to the astrometric and photometric data from the Gaia space mission, combined with complementary data (radio, submillimeter, stellar spectra, radial velocities), we can now reconstruct the three-dimensional architecture of the solar neighborhood with unprecedented detail. I will highlight recent results from 3D dust maps and open cluster catalogues that reveal the spatial distribution and kinematic structure of nearby star-forming regions, offering new insights into how molecular clouds are organized within the Milky Way's spiral structure. I will further talk about the early evolution of stellar systems that emerge from the molecular clouds and the formation, expansion, and eventual dispersal of young stellar clusters and OB associations. I will discuss the role of stellar feedback (winds, radiation, supernova explosions), and how such feedback might shape the parent cloud and influence the efficiency and timescale of star formation, which could ultimately govern the bound or unbound nature of the resulting stellar population. With this talk I will set the stage of this symposium by establishing the large-scale context of the star formation process.

[3] VOLS: a radio census of the young stellar population in Orion (3:25 PM, 15 minutes)

Presenter: DIAZ-MARQUEZ, Elena

The early stages of star formation involve a balance between accretion and ejection of material during gravitational collapse. Understanding this interplay is crucial for determining the final properties of stars and their planetary systems. Orion A, the closest star-forming complex, hosts a wide range of environments containing protostars and young stellar objects of different masses and evolutionary stages, making it an ideal laboratory for studying the radio emission from young stars throughout their evolution. The VLA Orion A Large Survey (VOLS) is focused on imaging the Orion A complex in the continuum C-band (~6 cm) and Ku-band (~2 cm), as well as in a selected set of spectral lines, and is the first radio survey to cover a wide area of Orion A with subarcsecond resolution. In this talk, I will present the first results at 6 cm based on 26 observation epochs: a systematic characterization of the detected radio sources, their spatial distribution, variability analysis, and emission nature across different evolutionary stages using counterparts at different wavelengths. Together, these results provide a comprehensive radio census of the young stellar population in Orion A.

[4] The VLA Orion A Large Survey: A New Window into the Evolution of Irradiated Disks (3:40 PM, 15 minutes)

Presenters: BLONK, Julia, BUSQUET, Gemma

We present multi-epoch 6 GHz radio continuum observations of approximately 100 known proplyds in the Orion Nebula Cluster (ONC) obtained with the Karl G. Jansky Very Large Array as part of the VLA Orion A Large Survey (VOLS). VOLS is the first radio survey to cover a large area of Orion A at subarcsecond resolution, improving sensitivity by a factor of 20 over previous surveys. Protoplanetary disks undergoing external photoevaporation in the ONC provide the nearest laboratory for studying how strong external irradiation alters disc evolution, mass-loss rates and the conditions for planet formation. While freefree emission from ionized envelopes has previously been shown to trace photoevaporative mass loss, the stability of these winds over time and how variability relates to disk structure and environment have yet to be investigated. We use spectral index maps at 6 GHz to distinguish thermal free–free emission from potential non-thermal components, and estimate and compare photoevaporative massloss with projected distance from the massive star Theta1 Ori C. The radio properties are placed in context with dust masses from ALMA and disc morphology from JWST to explore connections between variability, environment and physical structure. This study provides new constraints on the stability of photoevaporative flows in the ONC and improves our understanding of how externally irradiated environments influence protoplanetary disk evolution and the early stages of planet formation.

[5] Radio Continuum and Recombination Lines in Orion Proplyds (3:55 PM, 15 minutes)

Presenter: MUNTE-PEREZ, Alex

The Orion Nebula Cluster hosts more than 200 protoplanetary disks (proplyds) identified at optical, infrared and radio wavelengths, exposed to the intense ultraviolet radiation from nearby massive stars. These objects provide a unique laboratory to investigate externally photoevaporated disks and the impact of massive stars on planet-forming environments. Recent ALMA observations have enabled the first detection of millimeter hydrogen radio recombination lines (RRLs) toward 16 proplyds, opening a new diagnostic window to constrain the physical conditions and kinematics of their ionized gas. In this work, we expand the characterization of ionized gas in proplyds by combining centimeter radio continuum observations with radio recombination line measurements obtained from VLA C-band data from the VLA Orion A Large Survey (VOLS) project. The continuum emission traces free-free radiation from the ionized photoevaporative envelopes, allowing us to measure flux densities and spectral index of the emission. In this work, we focus on the analysis of the RRLs which provides constraints on the electron temperature, density, and gas dynamics within the ionized flows. By comparing RRLs observed at different wavelengths we also evaluate the role of non-LTE effects and pressure broadening in shaping the line profiles. These observations provide new constraints on the structure and physical conditions of ionized proplyd envelopes, improving our understanding of disk photoevaporation, massloss rates, and the evolution of protoplanetary disks in massive star-forming regions.

[6] Disk dust mass evolution in the Scorpius–Centaurus OB association (4:10 PM, 15 minutes)

Presenters: JARA, Nil, MIRET-ROIG, Nuria

Understanding how protoplanetary disks deplete their solid reservoirs is a central question in planet formation, since disk evolution sets the timescale over which planets can assemble. Constraining this process requires large homogeneous samples of disks with reliable stellar ages. We revisit the disk dust mass evolution in the Scorpius–Centaurus (Sco–Cen) OB association, the nearest OB association, and an ideal laboratory for studying disk evolution. Sco–Cen contains multiple coeval stellar subgroups spanning ages from newborn stars to ~20 Myr that can now be robustly identified with Gaia DR3 astrometry. We combine this Gaia-based membership and age catalogue with a homogeneous compilation of ALMA dust masses, obtaining a sample of 425 sources across 17 subgroups. We find a continuous decrease in disk dust mass with subgroup age for populations between 3 and 10 Myr. Older subgroups have insufficient ALMA coverage (<3%) to be included in the analysis. This trend is consistent with the progressive depletion of mmsized dust reservoirs reported in previous studies. The key advance of this work is that the Gaia-based census resolves multiple substructures that were previously treated as a single population, enabling a finer temporal sampling of disk evolution across the association. We also recover the known dependence of disk dust mass on stellar mass when comparing populations. These results highlight the importance of homogeneous and unbiased mm/sub-mm surveys, together with precise stellar demographics, for constraining disk dispersal and planet formation timescales in OB associations.

[7] Comparing photometric classifiers for YSOs: traditional schemes vs. Machine Learning (4:25 PM, 15 minutes)

Presenter: NESPOLI, Elisa

In this work we evaluate the performance of several techniques for identifying young stellar objects (YSOs) using photometric data from the WISE and 2MASS surveys. We apply the color–based classification scheme proposed by Koenig & Leisawitz (2014) and compare it with multiple Machine Learning approaches, including K-Nearest Neighbours, Support Vector Classifier, Gradient Boosting, and in particular Random Forest, which is the main focus of our analysis. All classification methods are trained and tested on a sample of 688 155 sources previously labeled as YSO or non-YSO based on the Konkoly Optical YSO Catalogue (Marton et al. 2023). We also perform a comparative analysis across several star-forming regions, including Upper Scorpius, Ophiuchus, Taurus, and Orion, highlighting regional differences in classification performance and YSO demographics.

[8] The substellar population of the most massive young clusters in the Milky Way with JWST (4:40 PM, 15 minutes)

Presenter: ALMENDROS-ABAD, Victor

Understanding the formation and evolution of young stars and clusters requires exploring a wide range of environments, from low-density star-forming regions to the most massive stellar nurseries in the Milky Way. As part of the EWOCS (Extended Westerlund 1 and 2 Open Clusters Survey) project, we have used the unprecedented sensitivity of JWST/NIRCam to study, for the first time, the substellar populations of two of the most massive young clusters in the Milky Way: Westerlund 1 and Westerlund 2. With total stellar masses exceeding 30,000 Msun, these clusters provide a unique laboratory to investigate how extreme environments influence the formation of the lowest-mass objects. Theoretical models predict that high stellar densities and strong feedback from massive OB stars may affect brown dwarf formation efficiency, but this has remained largely untested in massive young clusters. In this talk, I will present new JWST/NIRCam results for both clusters. In Westerlund 2, we identify and characterize a large population of brown dwarf candidates reaching into the planetary-mass regime, with indications of a lower disk fraction and reduced substellar demographics compared to nearby low-mass star-forming regions. In Westerlund 1, we statistically derive the first measurement of the (sub)stellar initial mass function down to ~0.05 Msun, revealing an unexpectedly shallow slope, indicating one of the most bottomlight populations of low-mass objects observed in a young cluster. Together, these results provide the first systematic constraints on brown dwarf demographics in the most massive Galactic clusters, suggesting that extreme environments may suppress the formation of the lowest-mass objects. This work offers new insights into the environmental dependence of the initial mass function and establishes key benchmarks for future JWST studies of young clusters across the Milky Way.

[9] Perspectivas topológicas y geométricas en la distribución espacial de objetos jóvenes en regiones de formación estelar (4:55 PM, 2 minutes)

Presenter: GONZALEZ GARCIA, Marta

La distribución de objetos jóvenes en regiones de formación estelar es compleja, ya que muestra estructuras a múltiples escalas espaciales asociadas a distintos procesos físicos. Las técnicas de análisis topológico de datos, y en especial los diagramas de persistencia, integran eficazmente la información multiescala y describen de forma natural diversos tipos de estructuras relevantes para la formación estelar, que van desde subgrupos densos a burbujas o huecos. En este trabajo se aplican diagramas de persistencia y técnicas de análisis clásico fractal para caracterizar la estructura espacial de objetos jóvenes en regiones tanto simuladas como reales. Se evalúan varios indicadores geométricos y topológicos, e identifican las combinaciones más efectivas para escribir estos entornos, demostrando el potencial del análisis topológico de datos para la extracción de huecos y estructuras densas.

[10] Probing the Physical Evolution and Feedback in the G14.225–0.506 Hub-Filament System with SMA (4:57 PM, 2 minutes)

Presenter: ANGUERA-GONZALEZ, Alexia

The transition from cold, dense gas to high-mass protostars involves complex physical processes that occur at various scales. In this contribution, we present new Submillimeter Array (SMA) 1.3 mm continuum and molecular line observations of the G14.225–0.506 hub–filament system, designed to characterize the physical evolution and fragmentation of its protostellar cores. At the angular resolution of our SMA data, we identify a clear differentiation in the fragmentation properties of the two main hubs: two massive cores in the northern hub (G14.2-N) and four in the southern hub (G14.2-S). Our SMA 1.3 mm continuum maps reveal that despite the lower fragmentation level, G14.2-N hosts a significantly more evolved and chemically rich hot core. Furthermore, the SMA molecular line survey allows us to detect and map active outflows through a broad range of tracers (including CH?OH, CS, SiO, SO, H?CO, and CO). We show that while molecular emission is closely associated with the strongest continuum peaks, in several regions it is dominated by outflowing gas, highlighting the role of internal feedback in shaping the dense gas. These results, obtained with the SMA, provide a high-resolution view of the evolutionary sequence within the cloud, moving from the younger southern hub to the more evolved and feedback-dominated northern hub.

Tuesday, July 14, 2026

Star formation: From darkness to light (Jul 14, 2026, 4:00 PM - 6:30 PM)

[11] Collapse of Dense Cores, Accretion Disks, and Jets: From Low- to High-Mass Protostars (4:00 PM, 25 minutes)

Presenter: FEDRIANI, Ruben

TBD

[12] Bowshocks driven by the molecular jet of SVS 13 protostar (4:25 PM, 15 minutes)

Presenter: BLAZQUEZ-CALERO, Guillermo

We present high-angular and high-spectral resolution ALMA CO observations of the molecular jet driven by the outbursting protostar SVS 13. Thanks to the high sensitivity of these data, we are able to resolve faint shell-like structures connected to jet knots at their apex. The morphology and kinematics of these shells are in excellent agreement with predictions from an analytical bowshock model. This strongly supports the interpretation that jet knots provide a fossil record of ejection variability, further reinforced by the temporal coincidence of the most recent knot with the documented optical/IR photometric outburst of SVS 13 around 1990. These findings imply that accretion outbursts should be accompanied by changes in ejection speed, since variations in jet mass flux alone would not produce the observed internal shocks nor the observed bowshocks.

[13] Probing the innermost scales of a massive protostellar jet (4:40 PM, 15 minutes)

Presenter: MASQUE, Josep Maria

IRAS18162-2048 is a massive protostar located at a distance of 1.4 kpc that powers the largest and fastest protostellar jet known in the Galaxy. It has been the target of numerous studies as it constitutes a prime example for investigating the presence of disks and jets associated with high mass protostars. In this contribution I will present the results extracted from deep sub- arsecond observations towards the heart of IRAS18162-2048 carried out with the Very Large Array. I will explore the properties of the jet down to disk-scales in order to investigate its ejection mechanism. Ultimately, this will shed light on the mass-loss processes that massive stars undergo during their earliest satges of formation.

[14] Disentangling the role of nonlinear terms in δ Scuti oscillations (4:55 PM, 2 minutes)

Presenter: RODRIGUEZ SANCHEZ, Miriam

? Scuti stars are variable stars with a complex power spectra in which numerous radial and nonradial modes are excited. Nonlinear contributions to the oscillations have generally not been taken into account, and most studies have remained within the linear regime due to the complexity involved. However, some approximations to nonlinear codes have been developed, mainly focused on RR Lyrae stars and Cepheids. Complete nonlinear codes have been developed for white dwarfs (Brickhill 1991; Wu 2001), but their physics cannot be directly applied to these stars. In this work, we investigate the role of nonlinear contributions by analysing the nonlinear oscillation equations derived from the fundamental hydrodynamic equations expanded to second order in perturbations in terms of the displacement vector. This approach follows the framework presented in Unno et al. (1989) and Aerts et al. (2010), considering no rotation, no magnetic fields, no viscosity, adiabaticity, and no turbulent convection. The expansion introduces numerous cross terms that prevent us from getting a direct numerical solution. To address this problem, we quantify the relative importance of the nonlinear terms. This was done considering the simplest case of radial modes and a snapshot in time at which nonlinear terms have their maximum contribution. We compute the nonlinear terms using stellar models and the eigenfunctions of the linear adiabatic oscillation equations. The results show that some nonlinear terms can locally reach magnitudes comparable to the linear contributions of the continuity, momentum, and energy equations, not only in the outer convective zone but also in deeper regions of the star. These results suggest that nonlinear terms have a non-negligible role in the internal dynamics of ? Scuti oscillations and must be taken into account in the development of nonlinear pulsation codes.

[15] The formation of massive stars: An approach to model the accretion boundary layer using CLOUDY (4:57 PM, 2 minutes)

Presenter: MONTESINOS, Benjamin

The accretion processes in forming massive stars -more specifically those with M > 8 solar masses- are thought to be governed by the presence of a boundary layer close to the stellar surface and fed by the protoplanetary disk. This contrasts with the magnetospheric accretion mechanism that operates in T Tauri stars (see the contribution by Lucía Fullana in this symposium). Modelling such a boundary layer still presents many unresolved problems. One of them concerns the presence of emission lines superimposed on the continuum responsible for the excess flux at wavelengths blueward of the Balmer limit, as well as the mechanisms involved—e.g. the roles of viscosity and the velocity gradient within the boundary layer when gas in Keplerian rotation in the disk encounters the rapid stellar rotation. In this contribution, we present the first attempts to use the well-known code CLOUDY to model the structure and emission of a boundary layer surrounding the equatorial region of forming massive young stellar objects.

[16] Hydrogen recombination line masers: tracing disks, winds and jets in massive young stars (5:30 PM, 15 minutes)

Presenter: MARTINEZ-HENARES, Antonio

Jets and winds are the result of the conservation of angular momentum in forming stars. How these components are launched and how they impact the gas within the innermost regions of these objects remains vastly unknown, specially in the case of the rare and distant massive stars. MWC 349A is a massive star that presents a circumstellar disk which rotates following a Keplerian law, and an ionized wind that is launched from the disk surface. In the last years, ALMA observations of the strong maser emission of hydrogen radio recombination lines (RRLs) obtained toward this system have provided a detailed picture of its ionized environment with an accuracy down to a few AU scales. The analysis of unresolved RRL emission with our 3D non-LTE radiative transfer model MORELI has unveiled a high velocity ionized jet launched from a rotating disk and engulfed within the wind, consistent with magneto-hydrodynamical (MHD) wind models. This result has been subsequently confirmed by additional ALMA observations of the H26? maser in the most extended configuration of the array with a resolution of 0.02”, which resolves the RRL emission for the first time. The resolved emission delineates the disk and the MHD wind and jet, and the model constrains their mass loss, energy and rotation. Our results show the huge potential of RRL masers as powerful probes of the innermost ionized regions and of the high-velocity jets from massive stars. In addition, we present predictions of RRL emission at the frequencies covered by the upcoming SKA telescope. These observations will allow us to characterise the ionized material from the outermost parts of the disk and recover the full 3D structure of the wind, providing stringent constraints to its launching mechanism and its impact on the lifetimes of disks around massive stars.

[17] How massive stars grow? Deriving mass accretion rates of massive young stellar objects (5:45 PM, 15 minutes)

Presenter: FULLANA GARCIA, Lucia

Although massive stars (>8M_sun) are rare, they play a key role in the chemical and dynamical evolution of galaxies through their radiation, stellar winds, and supernova explosions. However, the physical mechanisms that govern their formation remain poorly understood. Unlike low-mass stars, whose growth is well described by the magnetospheric accretion scenario by which material is channeled along magnetic field lines onto the stellar surface, massive young stellar objects (MYSOs) cannot sustain this sun process because their magnetic fields are weak or even absent. In addition, observational studies of MYSOs are particularly challenging, as they remain deeply embedded in their natal envelopes during most of their early evolution. These facts have prevented direct measurements of mass accretion rates in the high-mass regime. In this talk I will describe my current work on a sample of MYSOS that, for reasons not yet understood, are observable at optical wavelengths. Their spectra show clear signatures of ongoing accretion, such as continuum excess and numerous emission lines. Using these diagnostics, we are deriving mass accretion rates within a non-magnetic accretion framework. Furthermore, we will establish empirical relations between the accretion and emission line luminosities that will allow the community to easily infer mass accretion rates of wide samples of MYSOs. Our results will provide the first solid constraints on the accretion of massive stars.

[18] Radial differential rotation leading to dipole collapse in pre-main-sequence stars (6:00 PM, 15 minutes)

Presenter: GUSEVA, Anna

Despite significant progress in observing stellar magnetic fields, the physical processes that determine their strength and structure - likely shaped by their formation history - remain poorly understood. During the pre-main-sequence (PMS) phase, a star’s inner layers contract, gradually forming a radiative core, while its convective envelope slows due to magnetic interactions with the accretion disk and winds. This creates internal differential rotation, which can disrupt the dynamo processes generating strong dipolar fields observed in protostars. Such disruption could explain the diverse magnetic properties observed in main-sequence stars. In this talk, I’ll share our recent work on the stability of dipolar magnetic fields inherited from the protostellar phase, focusing on how large-scale radial differential rotation, driven by stellar contraction and interactions with the surrounding medium, affects them. To this aim, we developed 3D convective dynamo simulations of rotating spherical shells, where we imposed differential rotation between the inner and outer boundaries, and density and gravity profiles close to those in PMS low-mass stars, based on predictions from the 1D stellar evolution code Cesam2k20. Our results show that radial differential rotation can indeed trigger dipole collapse, leading to weaker, oscillatory magnetic fields, when it becomes stronger than the vigor of convection. We derived a collapse criterion from our 3D dynamo simulations and applied it to 1D PMS stellar evolution models, qualitatively reproducing the observed trends in the magnetic topology of low-mass stars when assuming efficient angular momentum transport in stellar radiative cores. This suggests a strong connection between stellar magnetic properties and PMS angular momentum evolution.

[19] A new population of Gamma-Loud Protostars (6:15 PM, 15 minutes)

Presenter: MENDEZ-GALLEGO, Javier

Massive young stellar objects (YSOs) are active engines driving powerful outflows. Theoretical models predict that a fraction of the accreted material is ejected in the form of highly collimated, fast jets and outflows. The injection of mechanical energy by these jets into the interstellar medium (ISM) produces strong shocks that can accelerate non-thermal particles and trigger feedback processes that regulate star formation. In this talk, we present the first detected population of protostellar jets emitting gamma rays as a byproduct of efficient cosmic-ray (CR) acceleration. The characteristics observed among the sample of Gamma-Loud Protostars allow us to probe the energetic feedback injected by protostellar jets into the ISM and strongly favor a hadronic scenario, in which high-energy gamma rays (up to ~TeV energies) are produced through interactions of accelerated protons. We conclude that protostellar jets constitute a previously unrecognized population of Galactic CR accelerators, that jet power is closely related to the bolometric luminosity of the driving YSO, where the CR production scales with the mechanical power of the jet.

Protoplanetary disks: Setting the seeds of planets (Jul 14, 2026, 6:30 PM - 7:30 PM)

[20] Dust evolution in protoplanetary disks: from grains to pebbles and planets (6:30 PM, 25 minutes)

Presenter: RIBAS, Alvaro

Understanding how protoplanetary disks deplete their solid reservoirs is a central question in planet formation, since disk evolution sets the timescale over which planets can assemble. Constraining this process requires large homogeneous samples of disks with reliable stellar ages. We revisit the disk dust mass evolution in the Scorpius–Centaurus (Sco–Cen) OB association, the nearest OB association, and an ideal laboratory for studying disk evolution. Sco–Cen contains multiple coeval stellar subgroups spanning ages from newborn stars to ~20 Myr that can now be robustly identified with Gaia DR3 astrometry. We combine this Gaia-based membership and age catalogue with a homogeneous compilation of ALMA dust masses, obtaining a sample of 425 sources across 17 subgroups. We find a continuous decrease in disk dust mass with subgroup age for populations between 3 and 10 Myr. Older subgroups have insufficient ALMA coverage (<3%) to be included in the analysis. This trend is consistent with the progressive depletion of mmsized dust reservoirs reported in previous studies. The key advance of this work is that the Gaia-based census resolves multiple substructures that were previously treated as a single population, enabling a finer temporal sampling of disk evolution across the association. We also recover the known dependence of disk dust mass on stellar mass when comparing populations. These results highlight the importance of homogeneous and unbiased mm/sub-mm surveys, together with precise stellar demographics, for constraining disk dispersal and planet formation timescales in OB associations.

[21] (Sub-)Millimeter Scattering by Porous Dust Particles in Protoplanetary Disks (6:55 PM, 15 minutes)

Presenter: VARGAS PELAEZ, Gonzalo

Interpreting (sub-)millimeter observations of protoplanetary disks requires robust constraints on dust growth, yet the maximum grain size inferred from polarization often differ from those derived from continuum spectral slopes. This contribution presents numerical light-scattering calculations to assess whether particle porosity and morphology can help alleviate this discrepancy. Two dust populations are considered: consolidated porous particles computed with the discrete dipole approximation and highly porous fractal aggregates computed with the multiple-sphere T-matrix method. For both populations, scattering matrix elements, cross-sections, and effective albedo are derived for a powerlaw size distribution at ten wavelengths between 0.87 and 10 mm, adopting the DSHARP composition. We find that increasing porosity enhances forward scattering, raises the linear polarization fraction near 90°, and extends efficient polarized self-scattering to larger maximum particle sizes compare with compact spheres. Porosity also lowers the absorption mass opacity, implying larger inferred disk masses than those derived from models assuming compact spherical particles. The opacity tables and scattering-matrix elements are available in a public repository for use in models of protoplanetary disk. Future work will extend the catalog toward larger sizes and additional compositions, while a neural network approach is explored to expand the catalog from the numerical simulation data.

[22] Deep learning on mid-resolution spectra unveils stellar characterization of young, accreting systems (7:10 PM, 15 minutes)

Presenter: GKIMISI, Katia

Circumstellar disk evolution and planet formation are closely linked to accretion processes and to the environments where young stars form. In this work, we combine observational and methodological advances to quantify how clustered environments and early protostellar phases regulate accretion and, ultimately, the planet-forming potential of disks. First, we studied external photoevaporation in the young massive cluster Trumpler 14 within the Carina Nebula Complex. Multiple O-type stars in this region produce strong farultraviolet (FUV) radiation, which can heat disk surfaces and drive thermal winds that remove gas from the outer regions of disks around nearby low-mass stars. This process may reduce disk mass and lifetime, alter the gas-to-dust ratio, and truncate disks to a few tens of AU, potentially limiting planet formation. To investigate these effects, a new methodology was developed using archival integral-field spectroscopy from VLT/MUSE. Stellar spectra were extracted from the MUSE data and analyzed using a Conditional Invertible Neural Network (cINN) to infer stellar parameters such as effective temperature, surface gravity, extinction, and optical veiling. Combined with J-band photometry, these measurements provide stellar luminosities, ages, and masses, enabling further analysis of how strong FUV irradiation affects disk indicators such as veiling and near-infrared excess. In the second part, we extend the cINN framework to embedded Class I protostars, this time using near-infrared (NIR) spectra. Because these objects are strongly obscured and veiled, conventional diagnostics are uncertain. Our method models NIR emission as the combination of stellar photospheric light, accretion-heated disk emission, and accretion shocks. A grid of synthetic spectra is created to train the cINN, and the model is then validated on observed JHK spectra. The goal of this study is to derive stellar accretion properties from these objects and gain insight into the initial stages of star/disk formation and evolution.

[23] Determinación de los parámetros de tránsitos exoplanetarios usando técnicas de Machine Learning. (7:25 PM, 2 minutes)

Presenter: HERRAIZ ESCALE, Charan

El Telescopio Espacial Kepler de la NASA (2009-2018) marcó el comienzo de lo que podríamos llamar la era “moderna” de la caza de planetas. Kepler estaba esperando captar pequeñas caídas en la cantidad de luz proveniente de estrellas individuales a lo largo de un cierto periodo de tiempo (curva de luz), causadas por planetas que cruzan frente a ellas. Esto se llama "método de tránsito". Una vez detectado, el tamaño orbital del planeta se puede calcular a partir del período (cuánto tiempo tarda el planeta en dar una vuelta alrededor de la estrella) y la masa de la estrella. Una estimación estadística basada en datos del Telescopio Kepler reveló que hay más planetas que estrellas en nuestra galaxia. Eso significa que hay más de un billón de planetas sólo en nuestra galaxia, muchos de ellos del tamaño de la Tierra. Debido al gran número de estrellas en nuestra galaxia y la cantidad de datos que estamos tomando usando telescopios espaciales a la caza de exoplanetas, necesitamos desarrollar nuevas técnicas de análisis de las curvas de luz de las estrellas para confirmar la presencia de un planeta y caracterizar sus propiedades. En este trabajo se propone crear modelos de tránsitos planetarios y entrenar algoritmos de machine learning para detectar y caracterizar exoplanetas a partir de curvas de luz del telescopio espacial TESS (Transiting Exoplanet Survey Satellite) de la NASA, lanzado en 2018 y diseñado para descubrir miles de exoplanetas alrededor de 200,000 estrellas brillantes cerca del Sol. Con esta contribución se pretende presentar los avances más recientes de este trabajo.

[24] Tracing massive star formation through chemical complexity (7:27 PM, 2 minutes)

Presenter: TASA-CHAVELI, Aitana

Massive star-forming regions host a wide range of physical processes that shape the early stages of stellar and planetary system formation. Studying these environments provides key insights into how stars form and evolve under conditions similar to those in which the Sun is thought to be born. In particular, protostellar disks represent a crucial stage in which physical conditions regulate the chemical composition of material that may eventually be incorporated into planetary systems. In this study, we present high-angularresolution (0.16") ALMA observations of the massive star-forming region G351.77-0.54. This region hosts one of the few massive disks detected in the metallic salt NaCl, and it is the only one in which we have identified CaS so far. Moreover, several massive protostellar disks are found within this cluster, characterized by different luminosities and temperatures. This diversity allows a comprehensive study of complex organic chemistry and its potential dependence on physical parameters across a broad dynamic range. Since all these massive disks arise from the same parent molecular cloud, this region provides an ideal laboratory to study the evolution of chemical complexity during massive star formation. In particular, we compare a broad inventory of COMs across five protostellar disks to explore possible correlations between these organic species with protostellar parameters. Altogether, this study highlights the influence of extreme environments on the fate of molecules and the build-up of chemical complexity.

Wednesday, July 15, 2026

Protoplanetary disks: Setting the seeds of planets (Jul 15, 2026, 4:00 PM - 5:00 PM)

[25] Lithium study of the early evolution of intermediate-mass stars with protoplanetary disks (4:00 PM, 15 minutes)

Presenter: MENDIGUTIA, Ignacio

I will present our recent work (Mendigutía et al. A&A, submitted) on the surface lithium (Li) content of young intermediate-mass stars surrounded by protoplanetary disks, which constitutes the most complete Li analysis and dataset for “Intermediate-mass T Tauri” and “Herbig” stars to date. The Li content is a direct probe of stellar mixing and empirically constrains the transition from convective to radiative interiors that models predict during the pre-main-sequence evolution of such stars. We find stronger lithium depletion than expected. I will describe the connections between this result and how inner disk material is accreted onto the stellar surface, the mechanisms regulating the stellar rotation, and the possible presence of forming planets.

[26] Hints of Disk Substructure in the First Brown Dwarf with a Dynamical Mass Constraint (4:15 PM, 15 minutes)

Presenter: SANTAMARIA MIRANDA, Alejandro

We present high-resolution ALMA observations of the Class II brown dwarf 2MASS J04442713+2512164 (2M0444), one of the brightest and best-studied BD disks. Our 0.89 mm continuum and 12CO (3–2) line data reach a spatial resolution of 0.046 arcsec (~6.4 au), enabling the first dynamical mass measurement in the substellar regime from ALMA data. We constrain the central mass to 0.043–0.092 Msun, confirming the object as a brown dwarf, and reveal a gas-to-dust disk size ratio >6, indicating efficient radial drift. Despite the expected loss of large grains due to drift, we detect tentative evidence for substructure in the dust continuum: a gap and ring pair at ~14–16 au, consistent with the presence of a dust trap. Visibility fitting with frank and galario supports this scenario. If caused by an embedded planet, the gap would be consistent with a low-mass (0.3–7.7 M_earth) rocky planet formed via core accretion. These results challenge current models of disk evolution and planet formation in the very low-mass regime. Our study opens a new window into the early evolution of brown dwarf disks and emphasizes the importance earth of high angular resolution to characterize their architecture.

[27] Planet-disc interaction models across wavelengths (4:30 PM, 15 minutes)

Presenter: TOCI, Claudia

Protoplanetary discs are the birthplace of planets and the site in which they accrete and evolve. It is then fundamental to characterize their evolution to fully understand the emerging exoplanetary population. Substructures in protoplanetary discs – such as rings, gaps, spirals – are routinely detected within discs using all the available tracers and represent key tracers of ongoing interactions in the disc’s material. These features show a strong wavelength dependent morphology, reflecting the different coupling levels between the different dust grain sizes and the gas dynamics. Among many explanations, embedded protoplanets interacting with the parental material is a compelling one. My work combines high-resolution 3D hydrodynamic, radiative transfer and telescope pipelines coupling to explore planet-induced structures, identifying observables to infer and confirm or reject the presence of massive protoplanets in discs. I will describe results from the modelling of single, bright sources (e.g., HD169142, PDS70), and will underline the information we can obtain by comparing multi-wavelengths observations with results from the hydrodynamical models. In particular, I will focus on how simulations can support observational campaigns with several instruments (VLT, ALMA) and I will present the results developed within the JEDIEX collaboration to generate synthetic MICADO/MORFEO observations of substructures in protoplanetary discs. These models will be key to identifying targets where hidden substructures could be revealed and to exploring less-studied objects.

[28] Searching for radio signatures of Star–Planet Interactions in T Tauri systems (4:45 PM, 15 minutes)

Presenter: ALIAS SAURA, Archer

Star-planet interaction (SPI) signatures in young stellar systems offer a unique window into the magnetic environment of planetary systems. In this work, we present a systematic search for SPI-related radio emission in a sample of ~7,000 T Tauri stars. By crossmatching these targets with the LOFAR Two-metre Sky Survey (LoTSS, 144 MHz) and the VLA Sky Survey (VLASS, 2–4 GHz), we investigate the prevalence of intense nonthermal, circularly polarized and coherent radio signatures. Our analysis reveals a population of candidate radio counterparts with multi-frequency detections. At low frequencies (144 MHz), the emission is consistent with coherent processes such as Electron-Cyclotron Maser (ECM), potentially driven by star-planet magnetic coupling. At GHz frequencies, we leverage multi-epoch VLASS observations to characterize variability, distinguishing between steady stellar emission and transient SPI events. Complementary infrared data from 2MASS and WISE allow us to correlate these radio detections with the evolutionary stage of the circumstellar environment. These findings provide the first large-scale statistical view of radio emission in T Tauri systems, identifying a priority set of candidates for high-resolution follow-up. Future full- Stokes observations and spectral index monitoring will be key to confirming the SPI origin of this emission, establishing radio astronomy as a powerful tool to probe the magnetospheres of young exoplanets.