Discos de Santiago

Chile

October 3, 2023

Code of conduct

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Talks

Tuesday

Introduction

3rd Oct
10:00

James Miley
Joint ALMA Observatory

Evidence for a recently ejected planet in the circumbinary disk of DG CrA

3rd Oct
10:15

Rob Van Holstein

Multiple star systems are challenging environments for the formation of planets.Tidal interactions between a binary star and its planet-forming disk can truncate the disk and induce cavities, spirals, and warps in the disk. Furthermore, forming planets can be ejected from the system through dynamic interactions with the binary star, potentially explaining the observed population of free-floating planets and part of the directly imaged wide-orbit giant planets. As part of the DESTINYS large program with SPHERE at the VLT, we observed the young, near by binary system DG CrA. We spatially resolve both stellar components and detect an extended circumbinary disk with complex substructures in near-infrared, (polarized) scattered light. Most strikingly, the observations reveal a radial, tail-like feature that starts at the inner disk region and extends outward beyond the outer edge of the circumbinary disk. From hydrodynamic models, we find that this unique feature is most likely caused by the recent ejection of a planet. We have an accepted JWST-NIRCam program to detect this planet near the outer end of the tail feature. The DG CrA system has the potential to become a benchmark for the study of star-planet-disk interactions and the formation and ejection of planets around binary stars.

3rd Oct
10:30

Early Planet Formation in Embedded Disks (eDisk): A first look at the Class 0 prostostar GSS30 IRS3

Alejandro Santamaría Miranda

In recent years, the focus of research efforts to better understand planet formation has been on Class II sources, identifying approximately one hundred substructures. The origins of these substructures, however, remain a topic of debate. Planet formation is the leading theory among the different mechanisms proposed to explain the formation of these substructures. To investigate whether these substructures are the result of planet formation, it is necessary to study the earlier evolutionary stages of protoplanetary disks, specifically Class 0/I disks, which have not been studied in detail. We present observations of the Class 0 protostar GSS30 IRS3, conducted using ALMA Band 6 (1.3 mm) at a spatial resolution of 8 au. Observation targeted continuum and several molecular lines (^{12}CO, ^{13}CO, C^{18}O, c-C_3H_2), which were all detected. We noted a disk asymmetry while no apparent substructures such as gaps or spirals were observed. A fit in the visibility plane suggests that the asymmetry may be a sharp substructure. The ^{12}CO traces the mass loss from the protostar disk, revealing three different mass loss components. Using the rotation curve analysis of the C^{18}O isotopologue, which mainly traces the Keplerian disk, we derived a dynamical mass of 0.27 ± 0.01 $M_\odot$. A warp is detected in the C^{18}O emission line, which may indicate the presence of a companion of stellar or substellar nature.

3rd Oct
10:45

Estimation of structural parameters of protoplanetary disks from visibilities using deep learning

Kevin Diaz

Currently, one of the ways to study the morphology and physical properties of protoplanetary disks is by estimating their structural parameters using the Markov Chain MonteCarlo (MCMC) method, where it seeks to find the parameters that best fit the object under study by means of the residual of the observed visibilities with simulated visibilities, which takes time foreach disk and is not very applicable to a population of larger disks. For this, the use of convolutional neural networks (CNN) is proposed to estimate these parameters.

Multi-wavelength observations of transition disks

3rd Oct
11:30

Anibal Sierra

The origin of large cavities in transitional disk is still a mysterious. Large cavities can be created by dust migration, photo-evaporation, planets, or dead-zones. Understanding its origin is fundamental to know how, when and where planet form in protoplanetary disks. In this talk I will present multi-wavelength millimeter observations of six transition disks (CQTau,DMTau, LkCa15, RXJ1615, SR24S, and UXTau), where ALMA and VLA continuum emission visibilities have been analyzed, and where we look for observational signatures (as dust traps)that can help us to disentangle what is the origin of the cavity in these disks.

Substructures in Transition Disks in Taurus SFR

3rd Oct
11:45

Marie Madeleine Rodriguez S

Transition disks are a well-suited class of disks to witness the signatures of planet formation and evolution, particularly when observed at few-au resolution. At low-resolution, they appear as a single wide ring around a dust-depleted cavity. This ring indicates that mm-sized dust is trapped in the outer disk, but it is impossible to establish their complexity and the presence of substructure inside the cavity when transition disks are are barely resolved. Thus, the prevalence and properties of transition disk substructures, and of the potential planetary systems shaping them, is yet unknown. In the Taurus Star Forming Region (1-3 Myr) using ALMA data at 230 GHz and 12CO J = 2-1 spectral line emission we characterize substructures at few-au (40mas) and constrain the type of planet(s) that shape the cavity in transition disks with planet-disk interaction models of the transitional disks around low mass pre-main sequence stars UX Tau, LkHa 330, CIDA 9, MHO6 and IP Tau.

Multi-wavelength study of the transitional disk MP Mus

3rd Oct
12:00

Aurora Aguayo

Knowing the disks' structure and evolution is crucial to understanding planet formation. Some protoplanetary disks show structures like gaps or inner cavities as an effect of their ongoing evolution. The presence of these gaps can indicate that a planet has been formed in the disk, but other explanations remain possible like photoevaporation, dead zones, or disk opacity-induced asymmetries at determined wavelengths (Birnstiel et al. 2015). Therefore, to constrain models of planet formation it is crucial to constrain the evolution of their protoplanetary disk for which both high angular and spectral resolution are required. The interest in MPMus relies on being one of the two gas-rich disks around a single star within 100 pc. In addition, previous observations have shown discontinuity at scatter light but a smooth disk at millimeter wavelengths, which could be consistent with disk opacity due to

dust evolution. In this work, we present observations at 0.9 submm (Band 7) of the transitional disk MP Mus (PDS 66) taken with ALMA and compare this result with previous ALMA observations at longer wavelengths (e.g.,Ribas et al. 2022) and with the structure shown in scattered light (e.g., Avenhaus et al. 2015).Moreover, the analyses of CO line observations may indicate an early stage of planet formation in this object.

3rd Oct
12:15

High contrast imaging at multiple wavelengths: a deep search of young planetary companions

Sebastián Jorquera

In the past three decades since the first detection of a planetary-mass object outside the Solar System, a multitude of this systems have been discovered and studied, revealing a great diversity of architectures and properties. Although multiple factors and mechanisms have been proposed to explain this multiplicity of configurations, the physical properties of the planet at early stages of their life and of the environment where they are formed play a crucial role on their subsequent evolution and their final architecture . Obtaining empirical constraints on the properties of forming planets are then crucial to understand how both planets and circumstellar disks evolve and influence each other. This talk will be focused on an ongoing high-contrast imaging campaign focused on the detection and characterisation of these young protoplanets in a sample of multiple protoplanetary disks, using observations at multiple wavelengths with different instruments and techniques. With this approach, we aim to constrain different properties of these systems to better understand their formation processes, the interaction with the circumstellar disks, and their subsequent future evolution.

3rd Oct
14:00

Not as high as you might think: atomic carbon distribution in HD 163296

Francisco Urbina

In protoplanetary discs, atomic carbon is expected to originate from the photodissociation region at the disc surface where CO is dissociated by UV photons coming from the stellar, or external interstellar, radiation field. Even though atomic carbon has been detected in several protoplanetary discs, there is a lack of spatially resolved observations of it. By using archive ALMA band 8 observations towards HD 163296, we obtain both the radial and vertical structure of the [CI] line emission at 492 GHz and perform the first direct comparison of this tracer with the optically thick line emission CO J=2-1. We found that these tracers are collocated radially but not vertically, where CO emission is, on average, located at higher altitudes, as is also the case for other tracers in the same disc. Therefore, the optically thick CO emission line appears to trace the highest altitudes, despite the expected formation mechanism of [CI] in the disc. This could be due to efficient mixing of the upper layers

of the disc, or UV photons penetrating deeper than we expected, providing us with fundamental information about the dynamics and geometry of the photodissociation region.

Investigating the origin of CO gas in debris disks using HST and ALMA observations

3rd Oct
14:15

Aoife Brennan

The origin of CO gas in debris disks has been debated since its initial detection. The gas could be a remnant of the protoplanetary disk (primordial) or have a secondary exocometary origin. In this presentation, I will present both HST and ALMA observations that aim to investigate the origin of CO gas in debris disks. The HST observations focus on two debris disks, HD110058 and HD131488. We fitted several electronic transitions of CI and CO rovibronic bands to derive column densities and temperatures for each system, revealing high CO column densities (3-4 orders of magnitude higher than beta Pictoris), and low CI/CO ratios in both. Using a secondary gas model, we simulated the radial evolution of the gas in the debris disk assuming a secondary gas origin. We find that the current secondary release model cannot simultaneously reproduce the CO and CI HST-derived column densities, as it predicts larger CI/CO ratios than observed. I will also present ALMA observations of the 12CO J=3-2 and 13CO J=3-2 emission lines in the debris disk around HD121617. This project aims to determine the gas origin by comparing the excitation and kinetic temperature. For example, if the excitation and kinetic temperature are equal the gas is in LTE, implying an H2-rich scenario (primordial origin). Conversely, in a non-LTE scenario, multi-line analysis can reveal the density of the gas, and constrain or set an upper limit to the amount of H2 present, ruling out a primordial origin.

Observing disks in CI and CO in band 10

3rd Oct
14:30

Bill Dent

The nearby bright protoplanetary disks HD100546 has been imaged in band 10 withALMA. Although technically more difficult than lower frequencies, the lines are brighter, and inprinciple trace hotter gas in the disk. Overall the structure appears similar, although the disk in atomic carbon appears thinner than in molecular gas.

3rd Oct
14:45

Estudio de condritos carbonáceos y su relación con la nebulosa solar temprana

Samanta Arana

El estudio de inclusiones vítreas, cóndrulos y matriz en 3 condritas carbonáceas con espectroscopía Raman y Microsonda electrónica, revelan procesos de formación decóndrulos y temperaturas de alteración en asteroides. Los resultados de esta investigaci'on evidencian procesos de calor repetitivos en la nebulosa solar temprana, zonación de Fe en cristales de olivino y características químicas de la nebulosa solar a través de las composiciones de inclusiones vítreas ricas en Aluminio, pobres en Aluminio y ricas en Calcio hospedadas en cristales de olivino de olivinos tipo I y II.

3rd Oct
15:30

Embedded disks: how to disentangle them?

Elizabeth Artur de la Villarmois

Protoplanetary disks are commonly associated to Class II sources, where planet-sare expected to form in the cold midplane and most of the envelope material has alreadydissipated. A more challenging picture is provided by more embedded and younger Class 0/Isources, where the disk component is difficult to dissentangle form the inner-envelopecomponent, and outflowing material is still releasing angular momentunm from the system. In this talk, I will introduce a survey of 50 Class 0/I sources that are part of the Perseus ALMA Chemical Survey (PEACHES), present their dust properties, and compare them to more evolved Class II disks. In addition, I will focus on simple sulfur-bearing species and show that some S-molecules could be good disk tracers, helping to disentangle the disk from the envelope component in these very young sources.

3rd Oct
15:45

Distribution of H2CO in Protoplanetary Disk HD163296

Claudio Hernandez-Vera

Protoplanetary disks are the birthplace of planetary systems. As part of thei rmaterial is expected to be incorporated into new planets, resolving the spatial distribution of complex organic molecules (COMs) is crucial in estimating the potential habitability of other worlds. Unfortunately, a significant portion of the organic inventory is thought to be locked on thes urface of dust grains, like O-bearing COMs that are barely detected in the gas-phase of disks.Other smaller but bright tracers like formaldehyde (H2CO) can be used in this case. H2CO is a small organic molecule considered a precursor of COMs on the icy surfaces of dust grains, butgas-phase reactions can also efficiently form it. Since the specific contribution of each mechanism is poorly constrained, determining the dominant formation pathway of H2CO is crucial for setting up its potential as a tracer of the cold reservoir in protoplanetary disks. In this context,we present seven H2CO lines observed with ALMA toward the bright protoplanetary diskHD163296. Thanks to the combination of multiple

transitions, angular resolution (0.6"), and proximity of the source (∼101 pc), we were able to resolve the excitation conditions of H2CO as a function of disk radius. Additionally, we put constraints on the height of H2CO emission to get clues about its formation. We expect to apply the same procedures in the DECO ALMA large program sample of 80 protoplanetary disks to obtain representative statistics of H2CO formation.

The 14N/15N Isotopic Ratio in Protoplanetary Disk V4046 Sgr

3rd Oct
16:00

Luna Marin

Molecular isotope ratios are essential to investigate the origin of the Solar System, as it is unclear if the organic molecules present in different Solar System bodies are inherited from the protosolar nebula or if these molecules are formed from chemical processing during the protoplanetary disk phase. One way to approach this problem is by characterizing isotopic compositions of N-bearing molecules. In particular, 14N/15N ratio is commonly used to trace the origin of Solar System bodies, by assessing the thermal history of Solar System volatiles using nitrogen fractionation. We present ALMA spatially resolved observations of HCN and its main isotopologs H13CN and HC15N J = 4-3 lines at 0.2" angular resolution toward protoplanetary disk V4046 Sgr. The bright HCN isotopologs emission in V4046 Sgr allows us to obtain the radial profiles and trace the 14N/15N ratio profile across the disk. Adopting a typical12C/13C ratio of 70, we find an increasing 14N/15N ratio of 70-220 across the disk, consistent with values observed in rocky planets, comets and meteorites. The increasing 14N/15N profile across the disk indicates that nitrogen chemistry is altered by in-situ chemical fractionation in th edisk and selective photodissociation is the dominant pathway to fractionate HCN in the inner part of the disk.

Wednesday

4th Oct
10:00

The AGE-PRO ALMA Survey: A glimpse into the evolution of gas in protoplanetary disks

Carolina Agurto

The fundamental question of how the gas and solids in protoplanetary disks evolve with time remains unanswered. However, the ongoing ALMA Large Program AGE-PRO ("ALMA survey of Gas Evolution in PROtoplanetary disks") was designed to answer this question for the gas component. AGE-PRO will trace the evolution of gas disk mass and size throughout the lifetime of disks, using a well-defined sample of 30 disks between 0.1 and 10 million years old. By studying a large sample of disks at different ages, AGE-PRO will be able to identify the key factors that drive the evolution of gas disks, and to better understand how these disks ultimately give rise to planets. Here I present the analysis on the Upper Scorpius, the oldest region in our sample. We have imaged gas and continuum emission, and generated disk-integrated line fluxes and radial intensity profiles for all lines and for the continuum, in all 10 disks selected. Additionally, we have analyzed the young Ophiuchus star forming region to examine the nature of the gas rotation with CO isotopologues. We are deriving rotational profiles from the PV diagrams and the size of Keplerian disks for Class I/FS sources.

4th Oct
10:15

Lines analysis in the Ophiuchus molecular cloud: Gas in the ODISEA survey

Camilo González Ruilova

The characterization of the molecular gas, around young stellar objects (YSOs) and protoplanetary disks, it is very important for the understanding in the stars evolution and planetary formation at early stages. The ODISEA survey corresponds to the largest sample of low YSOs in the Ophiuchus molecular cloud, with 300 targets from class I to III. Here we present the line analysis at 150 au angular resolution for all the mentioned objects, including extended emission, and rotating gaseous disks. Showing the morphology, the mass and size estimation, and correlation for the gas related to the central source. This research represents one of the largest samples, for the demographic statistics of gas, associated with YSOs in the same molecular cloud.

Multi-frequency analysis of protoplanetary discs in the Ophiuchus star-forming region

4th Oct
10:30

Prachi Chavan

Protoplanetary discs serve as crucial reservoirs for the formation of small bodies and planets. According to the core accretion theory, initial formation stages involve the growth of interstellar dust grains into larger pebbles of sub-millimeter and millimeter sizes. Observations at such wavelengths provide vital insights into these early processes. Constraining the dust properties of planet-forming discs is fundamental to understanding how dust growth may be favored or accelerated therein. The analysis of multi-frequency data, which after 10 years of ALMA operations is now for large samples, is a powerful approach to investigating disk properties.As part of the ODISEA project (Ophiuchus DIsk Survey Employing ALMA), we are combining new Band-4 (140 GHz) observations with existing archival data in Band-3 (100 GHz), Band-6 (230GHz), and Band-7 (350 GHz) to constrain dust properties in dozens of disks. We will estimate radial profiles for the temperature, surf ace density, optical depths, and maximum grain sizes to test grain growth and radial drift in dust evolution models. Our results will contribute essential benchmark information for interpreting disk demographic studies at different wavelengths and improving our understanding of planet formation.

Connecting Disk Rings and Gaps with Exoplanets Demographics

4th Oct
10:45

Gijs Mulders

Annular gaps and rings are common features in high-angular resolution surveys of protoplanetary disks. Sculpting of the dust radial distribution by unseen giant planets is a likely explanation for these structures, but begs the questions whether enough planets are available to explain all observed structures. By comparing the incidence of disk structures to the frequency of exoplanets, we can get a better handle on what unseen planets may be hiding in these disks. In this talk, I will present the results of a large statistical study of ALMA resolved disks at intermediate spatial resolution. Taking into account selection biases and stellar mass dependencies of the population, we find that most structures in the outer disk can be attributed to (ice) giant exoplanets with masses between those of Neptune and Saturn. We also predict that smaller planets should cause a high incidence of sub-structures in the inner disk and around lower-mass stars — which is yet to be probed with sensitive high-angular resolution observations.

4th Oct
11:30

The interferometric view of episodic accretions disks of FUor sources

Aaron Labdon

EPisodic accretion can solve several long-standing issues with star formation theory,from the YSO luminosity problem to how stars accrete their final mass. However, it introduces many additional problems for planet formation within protoplanetary disks. In this talk, I will discuss the view of optical interferometry on the inner disks of FU Orionis objects and explore the thermal and physical structure of the inner disks. I will explore viscous heating and boundary layer accretion scenarios in addition to the searches for causes of accretion outbursts. Finally, I will discuss the potential impacts of violent accretion outbursts on the ability of disks to form planets.

4th Oct
11:45

Spirals and Clumps around an FU Ori Star: Signs of Planet Formation via Gravitational Instability?

Philipp Weber

The formation of giant planets has traditionally been divided into two pathways:core accretion and gravitational instability. However, in recent years, gravitational instability has become less favored, primarily due to the scarcity of observations of fragmented protoplanetary disks around young stars and low occurrence rate of massive planets on very wide orbits. In this study, we present a SPHERE/IRDIS polarized light observation of the young outbursting object V960 Mon. The image reveals a vast structure of intricately shaped scattered light with several spiral arms. This finding motivated a re-analysis of archival ALMA 1.3 mm data acquired just two years after the onset of the outburst of V960 Mon. In these data, we discover several clumps of continuum emission aligned along a spiral arm that coincides with the scattered light structure.We interpret the localized emission as fragments formed from a spiral arm under gravitational collapse. Estimating the m ass of solids within these clumps to be of several Earth masses, we suggest this observation to be the first evidence of gravitational instability occurring on planetary scales. In this talk I will discuss the significance of this finding for planet formation and its potential connection with the outbursting state of V960 Mon.

A systematic survey of radio flaring variability in young stellar objects

4th Oct
12:00

Jaime Vargas

Low-mass young stars are known to be highly variable and magnetically active.Their intense magnetic fields are responsible for high-energy processes in their immediate vicinity as revealed through X-ray and radio observations. Radio variability in protostars at cm- and mm-wavelengths is associated with non thermal (gyro-)synchrotron emission from magnetospheric activity. Here I will present a radio variability study for an unprecedented sample of Young StellarObjects (YSOs) at cm- and mm-wavelengths at high spatio-temporal resolution with the VLA,ALMA, and the VLBA. I first describe our systematic search for intense centimeter radio flares towards the Orion Nebula Cluster (ONC) using the VLA followed by the first systematic search for mm-variability in YSOs using ALMA. This later study sets the first systematic constraints on the occurrence of such events in a large YSO sample, finding a wide range of mm-variability on timescales of minutes to days, including a strong mm-flare from a YSO at 8-second time resolution. Finally, I present a multi-epoch VLBA survey of non thermal emission from YSOs towards the ONC. This dataset provides a more efficient method for the assessment of non thermal radio variability at high time resolution compared to methods required for other interferometric datasets (e.g., VLA and ALMA) towards complex regions. This dataset will provide the largest sample of VLBA light curves of protostars at high time resolution from seconds to years.

Rotation analysis of young and old clusters

4th Oct
12:15

Douglas Rodriguez Alves
Joint ALMA Observatory

TBD

External irradiation as the main heat source in the ring of ISO-Oph2

4th Oct
14:00

Simón Cassasus

The thermal balance of the outer disk in protoplanetary disks, where the bulk of the mass is stored, includes heating from the interstellar radiation field. Its relevance depends on the UV luminosity of nearby stars and on the presence of very small grains, or PAHs. But external heating is often neglected in radiative transfer models. Here we present a measurement for the contribution of external irradiation to the thermodynamics of disks. The morphology of the Band6ALMA continuum in ISO-Oph 2, is strikingly suggestive of edge-on external irradiation by HD147889 (B2V,B3V). New multi-frequency observations in ALMA Band4 and Band9 are consistent with azimuthal variations in dust temperature. The hypothesis of external

irradiation as the main heating source of the mm-sized dust in ISO-Oph 2 makes a prediction for abundant stochastically heated VSGs or PAHs. This case-study in ISO-Oph 2, with external irradiation at an angle that is favourable for its identification, suggests that the thermodynamics in the outer disks of T-Tauri stars may be dominated by external irradiation at any illumination angle.

4th Oct
14:15

A deep learning approach to complete the uv-plane of ALMA interferometric observations

Sebastián Pérez

Radio interferometers like ALMA capture visibilities in the Fourier space (uv-plane)and need image synthesis to recover actual images of the sky. The finite number of antennas spread over large areas, limited integration times, and various other factors imply that visibilities are often unevenly or poorly sampled, compromising the fidelity of image reconstructions. On the other hand, AI-powered algorithms have been successful at aiding image reconstruction and processing in varied applications such as MRI imaging. Here we present the development and training of a deep learning model that allows the estimation of missing data points in gridded and subsampled uv-planes, predicting visibilities in a complete and regular grid. A completed uv-plane allows the recovery of sky images with a simple inverse Fourier transform. We train a U-net used in MRI with thousands of Fourier planes from simulated data from hydrodynamical simulations of planet-disk interactions to accomplish this. We then simulate visibilities with different parameters using the ALMA simobserve tool. The trained models could completely reconstruct the subsampled planes, both for simulated data and for actual astronomical data from ALMA, obtaining images comparable to those obtained by methods such as CLEAN but in a fraction of a second. Our preliminary results demonstrate the benefits and limitations of our approach and the necessity of more realistic training datasets.

4th Oct
14:30

Protoplanet Express, a Video Game Based on Hydrodynamical Simulations

Jorge Cuadra

High-resolution observations obtained during the last decade show that protoplanetary discs can be very complex objects. Rather than uniform discs, we see that they have large cavities, spiral arms, rings, gaps, and asymmetries. To understand these features,astrophysicists many times have to develop numerical simulations, in which planets or unseen stellar companions are added to reproduce the observed morphologies. While the spectacular observed images are popular in mainstream media, the simulation side is rarely known by the general public. We have created "Protoplanet express", a video game in which the user visits different known protoplanetary discs, which are rendered in 3D from actual hydrodynamical simulations. The user will encounter in the models the same features observed with ALMA and

other telescopes, and their goal will be to find the reason for each of them. For example, the user completes a level once they find the planet causing an observable gap in the disc. In this presentation I will show excerpts from the game, discuss its development, release and public reception.

Posters

Measuring the radius of protoplanetary disks at different ages

Camila Pulgares

The evolution of the dust and gas components of protoplanetary disks has not been completely understand. The AGE-PRO ALMA Large program was designed to study how the gas evolves with time, for this, a survey of 30 disks of 0.1-10 Myr from three star-forming regions (Lupus, Ophiuchus, and Upper Scorpius) was selected. Recent ALMA observations in bands 3 and 5 of the dust continuum emission of these 30 disks will help us to understand the dust component evolution. Here, we present preliminary results for the measurement of the radius of these disks.

Searching for young planets in protoplanetary disks with VLT/SPHERE

Catalina Vargas

High spatial resolution ALMA observations have revealed a variety of features inprotoplanetary disk such as rings, gaps, arcs, spirals, shadows, warps, etc. We search for acompanion with SPHERE for disks from the DSHARP sample by applying ADI, SDI and RDI. Theseyoung systems characterized by ALMA are rich in substructures, which are closely related toplanetary formation. The star-hopping technique in observations with SPHERE poses a uniqueopportunity to resolve the disk in systems with multiple rings/gaps, and to directly imageplanetary perturber(s) in young forming planetary systems.

Introducing AGE-PRO: the ALMA survey of Gas Evolution in PROtoplanetary disks

Laura Pérez

Gas is the dominant mass constituent of protoplanetary disks. Its structure and evolution profoundly impact every major step of planet formation: planetesimal formation, accretion of planetary atmospheres, and migration of planets. Yet, we do not have a basic understanding of how the gas disk evolves and what mechanism drives the global evolution. The "ALMA survey of Gas Evolution in PROtoplanetary disks", AGE-PRO, is the first ALMA Large Program to constrain the evolution of the mass and size of gas disks at three evolutionary phases: the embedded disk phase, the middle-age, and the end of the disk lifetime. The main goal of AGE-PRO is two-fold: to provide a key legacy dataset to test current main theories of disk evolution and planet formation, and to compare model predictions of disk evolution with mass and size measurements of disks at different ages. In this poster we will present the recently acquired observations of the AGE-PRO sample of 30 disks between 0.1-10 Myr old, and we will discuss some preliminary results of the survey.

Velocity stratification in the MAPS protoplanetary disks

Abigail Rodriguez

The vertical stratification in azimuthal velocity in protoplanetary disks is an open question, and could stem, for example, from hydrostatic lift, Keplerian shear, MHD effects in the surface, or disk-planet interactions. In this work we study the kinematics of the five disks of the Large ALMA Program, MAPS -Molecules with ALMA at Planet-forming Scales-, using different isotopologues of carbon monoxide (12CO, 13CO and C18O in the transition J = 2-1). We report on systematic velocity stratifications in all MAPS disks, in the sense that, on average, layers closer to the midplane rotate 3

Radio-continuum decrements associated to shadowing from the central warp in transition disc DoAr44

Carla Arce Tord

Warps have often been used to explain disc properties, but well characterised examples are important due to their role in disc evolution. Scattered light images of discs with central gaps have revealed sharp warps, such that the outer rings are shadowed by tilted inner discs. The near-IR intensity drops along the ring around TTauri star DoAr44 have been interpreted in terms of a central warp. We report new ALMA observations of DoAr44 in the continuum at 230 GHz and 350 GHz (at ∼10 au), along with a new epoch of SPHERE/IRDIS differential polarised imaging taken during excellent weather conditions. The ALMA observations resolve the ring and confirm the decrements proposed from deconvolution of coarse 336 GHz data. The scattered light image constrains the dips, which correspond to a misaligned inner disc with a relative inclination ζ = 21.4 +6.7-8.3 deg. The SPHERE intensity profile shows a morphological change compared to a previous epoch that may be interpreted as a variable orientation of the inner disc, from ζ ∼30 deg to ζ ∼20 deg. The intensity dips probably correspond to temperature decrements, as their mm-spectral index, α^{230GHz}_{350GHz} ∼2.0 ± 0.1, is indicative of optically thick emission. The azimuth of the two temperature decrements are leading clockwise relative to the IR-dips, by η = 14.95 deg and η = 7.92 deg. For a retrograde disc, such shifts are expected from a thermal lag and imply gas surface densities of Σ_g = 117 ± 10 g/cm^2 and Σ_g = 48 ± 10 g/cm^2. A lopsided disc, with contrast ratio fr=2.4 ± 0.5, is also consistent with the large continuum crescent.

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