International Conference on Exoplanets and Planet Formation

Report of Abstracts

https://indico-tdli.sjtu.edu.cn/e/EPF2025

Abstract ID : **2**

Solar System Encounters with Substellar Objects

Content

The modestly eccentric and non-coplanar orbits of the giant planets pose a challenge to solar system formation theories which generally indicate that the giant planets emerged from the protoplanetary disk in nearly perfectly circular and coplanar orbits. We demonstrate that a single encounter with a 2-50 Jupiter-mass object passing through the solar system at a perihelion distance less than 20 AU can excite the giant planets' eccentricities and mutual inclinations to values comparable to those observed. If such a flyby occurs, we estimate that there is a surprisingly high chance of 1-in-100 that it produces a dynamical architecture similar to that of the solar system. The scenario of a close encounter with a substellar object offers not only a plausible alternative explanation for the origin of the secular architecture of the solar system planets but might also important in shaping exoplanetary systems with very different architectures.

Primary authors: BROWN, Garett; MALHOTRA, Renu; REIN, Hanno (University of Toronto)

Presenter: REIN, Hanno (University of Toronto)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **REIN, Hanno** on **Sunday, August 3, 2025**

Abstract ID : **3**

Direct Imaging of Protoplanet Candidates in Protoplanetary Disks Using NIX L-band Observations

Content

We present our study using the VLT/ERIS NIX imager observations at 3.8 μm to directly detect protoplanet candidates responsible for the observed kinematic signatures in protoplanetary disks. By taking advantage of the long-wavelength sensitivity of the L-band, we aim to reduce the impact of circumstellar and circumplanetary dust extinction, significantly improving our ability to resolve thermal emissions from embedded protoplanets. Our targets, identified through ALMA observations of prominent spiral structures and kinematic deviations, are ideal candidates for direct imaging. This work aims to confirm the planetary nature of these features and provides initial constraints on the luminosities of the detected planets. These observations represent a crucial step in integrating kinematic and photometric techniques to calibrate the mass-luminosity relationship of young protoplanets and enhance our understanding of planet formation processes. Our findings highlight the potential of combining ALMA and NIX data to advance the study of planetary genesis in diverse disk environments.

Primary author: CHOWBAY, SWASTIK (University of Milan)

Co-author: Dr FACCHINI, Stefano

Presenter: CHOWBAY, SWASTIK (University of Milan)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHOWBAY, SWASTIK** on **Thursday, August 7, 2025**

Abstract ID : **4**

Characterization of rocky exoplanets in habitable zones: An astrobiological approach

Content

Rocky exoplanets, defined by their predominantly silicate and metal composition, represent a fascinating frontier in contemporary astrobiology, as their study allows us to explore conditions that could sustain life forms beyond our solar system. Complementary to this, those rocky planets that orbit in the habitable zone, which refers to the region around a star where the temperature allows for the existence of liquid water on the surface, becomes an essential criterion for selecting targets in the search for life outside planet Earth.

The identification of exoplanets in the habitable zone, especially those that share characteristics with Earth, gives us a perspective on the diversity of planetary environments that could exist in the universe. Additionally, the study of these worlds allows us to explore fundamental concepts in the physics and chemistry of processes that lead to the formation of complex organic molecules. Research on the interaction between exoplanets and their host stars also provides us with information about how initial conditions in a planetary system can influence the evolution of its atmosphere and its impact on habitability. With the advancement of tools like the James Webb telescope, we will be able to detect biomarkers such as methane and oxygen, reinforcing the importance of a multidisciplinary approach in the exploration of life in the cosmos.

This work focuses on the characterization of rocky planets located in habitable zones, with the aim of finding possible candidates for future astrobiological research. For this purpose, habitable zones will be identified based on the spectral type of host stars. Subsequently, the physical and orbital properties of these confirmed exoplanets in these planetary systems will be studied. Finally, prioritization criteria will be established for those planets with the highest probability of harboring conditions conducive to life.

Primary author: VEGA CARO, Maria Valentina (Student)

Presenter: VEGA CARO, Maria Valentina (Student)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **VEGA CARO, Maria Valentina** on **Monday, August 11, 2025**

Abstract ID : **5**

Retention of Surface Water on Tidally Locked Rocky Planets in the Venus Zone around M Dwarfs

Content

Terrestrial planets within the Venus zone surrounding M-dwarf stars can retain surface ice caps on the perpetual dark side if atmospheric heat transport is inefficient, as suggested by previous global climate simulations. This condition is proposed to play a role in the potential regional habitability of these planets. However, the amount of surface ice may be limited by considering the water condensed from the steam atmosphere in a runaway greenhouse state, and the physical mechanism for triggering the condensation process is not clear. Here, we use a two-column moist radiative–convective–subsiding model to investigate the water condensation process on tidally locked planets from the runaway greenhouse state. We find that the water condensation process is characterized by two distinct equilibrium states under the same incoming stellar flux. The initiation of condensation corresponds to a warm, unstable state exhibiting positive Planck feedback, whereas the termination phase corresponds to a cold, stable state exhibiting negative Planck feedback. We further show that the surface water mass in the collapsed state decreases with the incoming stellar flux, background surface pressure, and optical thickness of noncondensable greenhouse gases, with a global equivalent depth of less than ~20 cm. Our two-column approach provides a straightforward way to understand the water evolution on Venus zone planets around M dwarfs.

Primary authors: DING, Feng (Peking University); Ms OUYANG, Yueyun (Peking University); Dr YANG, Jun (Peking University)

Presenter: DING, Feng (Peking University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DING, Feng** on **Tuesday, August 12, 2025**

Abstract ID : **6**

Atmospheric Circulation of High-Obliquity Mini-Neptunes

Content

With the operation of JWST, exoplanet observation targets have extended to low-mass planets. In multiplanetary systems, orbital-spin resonance may lead to a high obliquity for inner planets, resulting in unique atmospheric circulation patterns. To identify potential atmospheric observational signatures of such non-synchronously rotating planets, this study employs the SPARC/MITgcm to simulate the three-dimensional (3D) atmospheric circulation of the mini-Neptune K2-290 b, whose obliquity may reach about 67°. The key findings are: (1) Regardless of tidal locking, the long orbital and rotation periods result in weak horizontal temperature gradients due to weak temperature gradient (WTG) balance. (2) At high obliquity, the zonal-mean zonal wind exhibits an easterly/westerly oscillation with a period of $\sim$50 orbits (1.2 Earth years), similar to the quasi-biennial oscillation (QBO) in Earth's stratosphere. This QBO-type oscillation is induced by wave-mean-flow interaction, which involves the vertical propagation of planetary-scale waves and the wave absorption at critical layers. (3) When metallicity is increased, the circulation become stronger due to increased opacity and shallower heating. The circulation remains nearly unchanged in the presence of MnS/Na_2S cloud when synchronously rotating, while becoming slightly weaker when nonsynchronously rotating. (4) The planet-to-star flux ratio and variation between different phases are generally limited in all cases, making detection challenging.

Primary author: LAI, Yanhong

Presenter: LAI, Yanhong

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LAI, Yanhong** on **Wednesday, August 13, 2025**

Abstract ID : **7**

Escaping Outflows from Disintegrating Exoplanets: Day-side versus Night-side Escape

Content

Ultrahot disintegrating exoplanets have been detected with tails trailing behind and/or shooting ahead of them. These tails are believed to be made of dust that are formed out of the supersonic escaping flow that emanated from the permanent day side. Conserving angular momentum, this day-side escape flux would lead the planet in orbit. In order to explain the trailing tails in observation, radiation pressure, a repulsive force pushing the escape flow away from the host star, is considered to be necessary. We here investigate whether escape could be deflected to head away from the host star by the pressure gradient force. We demonstrate in an idealized framework that escape flux from the night side can occur, and sometimes, can be even stronger than the escape from the day-side. The nightside escape infers that escape flow could trail behind the planet in orbit by virtue of angular momentum conservation even without radiation pressure. We also find analytical approximations for both day-side and nightside escape fluxes, which may be applied to study planetary evolution of disintegrating planets.

Primary authors: KANG, Wanying (MIT); DING, Feng (Peking University); Prof. WORDSWORTH, Robin (MIT); Prof. SEAGER, Sara (MIT)

Presenter: KANG, Wanying (MIT)

Track Classification: Atmospheres

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **KANG, Wanying** on **Thursday, August 14, 2025**

Abstract ID : **8**

True Polar Wander of Lava Worlds

Content

As one of the most detectable types of terrestrial planets, lava worlds are highly prioritized targets for exoplanet atmosphere characterization since their atmospheres may reveal what they are made of and how. Our work examines the possibility of true polar wander (TPW) occurring on these ultrahot tidally locked planets, powered by mass redistribution from atmospheric flow between the hot permanent dayside and the cold permanent nightside. We find that lava planets within a certain mass and temperature range may undergo TPW, and this likelihood increases with star mass. As a result of TPW, the magma ocean and atmospheric compositions may be less evolved (refractory-enriched) than previously thought and may be validated by exoplanet demographic surveys.

Primary authors: KANG, Wanying (MIT); DING, Feng (Peking University); Prof. NIMMO, Francis (UCSC)

Presenter: KANG, Wanying (MIT)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KANG, Wanying** on **Thursday, August 14, 2025**

Abstract ID : **9**

On the hidden mass of dust in young protoplanetary disks

Content

Knowing the masses and sizes of protoplanetary disks is of fundamental importance for the contemporary theories of planet formation. However, their observational estimates are associated with large uncertainties, especially in the early stages of disk evolution when initial conditions for subsequent planet formation are likely be established.

We used three-dimensional hydrodynamic simulations of protoplanetary disks, complemented with radiation transfer calculations, to obtain radiation intensity images of young protoplanetary disks at different stages of dust growth. We then calculated the disk radii and masses of these mock disk images using an algorithm that is often applied
to real protoplanetary disks when observed with ALMA.

We found that this procedure underestimates the true mass of dust contained in the disk by at least a factor of several, while the true disk radius is recovered with an accuracy of up to 50%. Dust growth affects its mass estimates and an unusually low dust temperatures are required to retrieve the true dust mass if the dust grows to particle sizes of the order of mm-cm.

Primary author: VOROBYOV, Eduard (University of Vienna)

Presenter: VOROBYOV, Eduard (University of Vienna)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **VOROBYOV, Eduard** on **Thursday, August 14, 2025**

Abstract ID : **10**

A JWST Survey for Free-floating Brown Dwarfs Down to the Mass of Jupiter

Content

We present the results of a JWST survey for free-floating brown dwarfs down to the mass of Jupiter in the nearby star-forming cluster IC 348. Through this work, we have spectroscopically confirmed 11 new brown dwarfs within the cluster. The faintest new objects have mass estimates of 2 Jupiter masses, making them the least massive known brown dwarfs and providing a new constraint on the minimum mass of the IMF. There remain 19 additional promising candidates that lack spectroscopy. Ten of the confirmed brown dwarfs and one previously known member exhibit absorption in the 3.4um fundamental band of an unidentified aliphatic hydrocarbon, which was not predicted by atmospheric models and was not previously detected in atmospheres outside of the solar system. Among the brown dwarfs in IC 348 that have hydrocarbon detections, the features are stronger at fainter magnitudes, indicating that the hydrocarbon is a natural constituent of the atmospheres of the coolest newborn brown dwarfs. We propose a new spectral class "H" that is defined by the presence of the 3.4um band of the hydrocarbon. One of the new brown dwarfs at 2 Jupiter masses exhibits large excess emission from a circumstellar disk, making it the least massive known brown dwarf with a disk.

Primary author: LUHMAN, Kevin (The Pennsylvania State University)

Co-author: Dr ALVES DE OLIVEIRA, Catarina (European Space Agency)

Presenter: LUHMAN, Kevin (The Pennsylvania State University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LUHMAN, Kevin** on **Thursday, August 14, 2025**

Abstract ID : **11**

Modeling planet formation and the dependence on stellar host properties

Content

The formation and evolution of planetary systems are linked to their host stellar environment. We employ a pebble-accretion-based planet population synthesis model to explore the correlation between planetary properties and stellar mass/metallicity. Our numerical results reproduce several main aspects of exoplanetary observations. First, we find that the occurrence rate of super-Earths, ηSE, follows an inverted V-shape in relation to stellar mass: it increases with stellar mass among lower-mass dwarfs, peaks at early M dwarfs, and declines toward higher-mass GK stars. Second, super-Earths grow ubiquitously around stars with various metallicities, exhibiting a flat or weak ηSE dependence on Zå. Third, giant planets in contrast form more frequently around stars with higher mass/metallicity. Lastly, we extend a subset of simulations to 1 Gyr to investigate the long-term evolution of the systems' architecture. By converting our simulated systems into synthetic observations, we find that the eccentricities and inclinations of single-transit systems increase with stellar metallicity, while these dependencies in multiplanet systems remains relatively weak. The alignment between our results and observations provides key insights into the connection between planet populations and stellar properties.

Primary author: LIU, Beibei (Zhejiang University)

Presenter: LIU, Beibei (Zhejiang University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LIU, Beibei** on **Thursday, August 14, 2025**

Abstract ID : **12**

Early Solar System instability triggered by dispersal of the gaseous disk

Content

The Solar System ' s orbital structure is thought to have been sculpted by an episode of dynamical instability among the giant planets. However, the instability trigger and timing have not been clearly established. Hydrodynamical modeling has shown that while the Sun ' s gaseous protoplanetary disk was present the giant planets migrated into a compact orbital configuration in a chain of resonances. Here we use dynamical simulations to show that the giant planets ' instability was likely triggered by the dispersal of the gaseous disk. As the disk evaporated from the inside-out, its inner edge swept successively across and dynamically perturbed each planet ' s orbit in turn. The associated orbital shift caused a dynamical compression of the exterior part of the system, ultimately triggering instability. The final orbits of our simulated systems match those of the Solar System for a viable range of astrophysical parameters. The giant planet instability therefore took place as the gaseous disk dissipated, constrained by astronomical observations to be a few to ten million years after the birth of the Solar System. Terrestrial planet formation would not complete until after such an early giant planet instability; the growing terrestrial planets may even have been sculpted by its perturbations, explaining the small mass of Mars relative to Earth.

Primary author: LIU, Beibei (Zhejiang University)

Presenter: LIU, Beibei (Zhejiang University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LIU, Beibei** on **Friday, August 15, 2025**

Abstract ID : **13**

Direct imaging of exoplanets with Coronography

Content

The direct imaging of exoplanets represents a pivotal method for exploring planetary systems beyond our solar system. This technique faces significant challenges, primarily due to the extreme brightness contrast and small angular separation between exoplanets and their host stars. Coronagraphy has emerged as a powerful optical approach to suppress starlight and enhance the detection of faint planetary signals. This work provides an in-depth review of coronagraphic techniques, including phase masks, Lyot coronagraphs, vortex coronagraphs, and their integration with adaptive optics systems. Recent advancements in these methods are analyzed, alongside their application in state-of-the-art instruments such as the James Webb Space Telescope (JWST) and future observatories like the Extremely Large Telescope (ELT). The study also highlights the current limitations and technical challenges in advancing the field of exoplanet imaging.

Primary author: MAKHTICH, salma (Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco)

Presenter: MAKHTICH, salma (Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **MAKHTICH, salma** on **Monday, August 18, 2025**

Abstract ID : **14**

Solar terrestrial planets were born in resonance

Content

Traditionally, models have proposed that Earth and its rocky neighbors formed gradually, through a series of chaotic collisions between Mars-size bodies and planetesimals, after the Solar System's gas disk had dispersed. Recent observations of young exoplanets suggest a different story: many planets form early, while still embedded in their young gas disks. Due to orbital migration, protoplanets often end up in resonances where their orbits fall into simple, near-integer ratios. Systems like TRAPPIST-1, TOI-178, and HD110067 have their planets in resonance chains for billions of years. In this project, we demonstrate that our solar system terrestrial planets can be a broken resonance chain. The outer giant planets trigger the destabilization of the initial resonances, and the Moon-forming giant impact happened soon afterwards. The 3.05:1 period ratio between Mars and Venus is a relic of the primordial chain. Our study implies that terrestrial planets form early in the Solar Nebula, similar to many other exoplanets.

Primary author: HUANG, Shuo (Tsinghua University)

Co-authors: Prof. KOKUBO, Eiichiro (NAOJ); Prof. ORMEL, Chris (Tsinghua University); Prof. PORTEGIES ZWART, Simon (Leiden Observatory); Mr YI, Tian (Tsinghua University)

Presenter: HUANG, Shuo (Tsinghua University)

Contribution Type: Poster

Comments:

paper link: https://arxiv.org/abs/2506.04164

Status: ACCEPTED

Submitted by **HUANG, Shuo** on **Tuesday, August 19, 2025**

Abstract ID : **15**

Fragmentation-enhanced Leaking of Dust Through Planet-Induced Gaps

Content

Super-thermal gas giant planets or their progenitor cores are known to open deep gaps in protoplanetary disks, which stop large, drifting dust particles on their way to the inner disk. The possible separation of the disk into distinct reservoirs and the resulting dust depletion interior to the gap have important implications for planetesimal formation and the chemical and isotopic composition of the inner regions of protoplanetary disks. Small grains, however, can diffuse through a gap and mostly follow the gas flow. Coagulation and fragmentation determine the available mass of small grains and are thus instrumental for the study of a gap's filtration efficiency. We present two-dimensional multifluid hydrodynamic simulations of planet-disk system with dust coagulation, evolved over 45000 planetary orbits, to investigate the effects of different planetary masses, dust fragmentation velocities, and viscosities on the inner disk's dust mass budget and composition. We find that filtering can only be efficient for high planetary masses, high fragmentation velocities, and low diffusivities. Clear compositional distinctions between the inner and outer disk cannot be maintained by a 31 M⊕ planet if the fragmentation velocity is low, even if α< 5×10ˆ-4. Significant "contamination" of the inner disk by outer disk dust occurs in much less than 2×10ˆ5 years for Jupiter's core and even for more massive objects. This either places tight constraints on the physical conditions in the Solar nebula or mandates consideration of alternative explanations for the NC-CC dichotomy. Astrophysical constraints on the parameters could discriminate between these possibilities.

Primary author: PFEIL, Thomas (Flatiron Institute)

Co-authors: Prof. ARMITAGE, Phil (Flatiron Institute); Dr JIANG, Yan-Fei (Flatiron Institute)

Presenter: PFEIL, Thomas (Flatiron Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **PFEIL, Thomas** on **Tuesday, August 19, 2025**

Abstract ID : **16**

Unveiling the Heavenly River's other shores: Characterizing exoplanet atmospheres with ANDES

Content

The next frontier in exoplanet science is the characterization of planetary atmospheres, from gas giants to Earth-like worlds. The ANDES high-resolution spectrograph for the Extremely Large Telescope (ELT) is poised to become a transformative instrument in this field. Its unparalleled combination of a massive collecting area and high spectral resolution (R=100,000) from the optical to the near-infrared will enable breakthrough science across the entire exoplanet mass-radius-irradiation diagram. This presentation will explore the revolutionary capabilities of ANDES. We will demonstrate how it will conduct detailed atmospheric reconnaissance on a statistical sample of hot Jupiters, measuring wind speeds, mapping atmospheric dynamics, and constraining the C/O ratio to trace planetary origins. For the prevalent population of sub-Neptunes, ANDES will determine if they are water worlds, hydrogen-dominated, or something else entirely, directly addressing the mystery of the radius valley. Most compellingly, ANDES will pioneer the atmospheric study of terrestrial planets in the habitable zones of nearby M-dwarfs via transmission spectroscopy. Furthermore, its high-contrast, high-resolution mode will, for the first time, enable the detection of reflected light from a "golden sample" of non-transiting Earth-sized planets, searching for molecular features and constraints on surface conditions. Operating in synergy with JWST and ARIEL, ANDES will provide the high-resolution data necessary to break degeneracies in atmospheric retrievals and add crucial dimensions of dynamics and chemistry. By bridging the gap between planetary demographics and detailed physical characterization, ANDES at the ELT will fundamentally advance our understanding of planet formation, evolution, and the potential for habitability beyond our solar system.

Primary author: Prof. PALLE, Enric (Instituto de Astrofisica de Canarias)

Presenter: Prof. PALLE, Enric (Instituto de Astrofisica de Canarias)

Contribution Type: Oral Talk

Comments:

NOne

Status: ACCEPTED

Submitted by **PALLE, Enric** on **Tuesday, August 19, 2025**

Abstract ID : **17**

Patterns in Multi-Planet Systems

Content

Humanity's search for Earth analogs is enriched by the fact that Earth-like planets do not form in isolation. The interplay between Earth-like planets and their siblings is an emerging new research topic. A prevalent pattern that represents one of the most common modes of planet formation is that planets in the same system tend to have similar sizes and regular orbital spacing, like "peas-in-a-pod." However, the peas-in-a-pod pattern is not a complete description of planetary systems. In our own solar system, Jupiter, which is believed to have been instrumental to the formation of Earth and the delivery of its water, represents a clear departure from peas-in-a-pod. In this talk, I show how a decade-long survey dedicated to discovering Jupiter analogs among exoplanet systems has revealed a new pattern: Jupiter-like outer planets are most prevalent around the systems of inner transiting planets that tend to have gaps, rather than regular spacing. This result suggests that Jupiter-like planets disrupt the regular spacing of small planets. The exact mechanism of disruption—whether planets that would have been in the gaps are simply inclined or suffered collisions or ejections—is an ongoing topic of study.

Primary author: WEISS, Lauren (University of Notre Dame)

Presenter: WEISS, Lauren (University of Notre Dame)

Contribution Type: Oral Talk

Comments:

invited talk

Status: ACCEPTED

Submitted by **WEISS, Lauren** on **Sunday, August 24, 2025**

Abstract ID : **18**

Towards the Characterization of the Rocky Planet Sites in Disks

Content

The physical and chemical properties of the inner regions of protoplanetary disks, where rocky planets are located, are still largely unknown. This is changing rapidly thanks to JWST observations and infrared interferometry with ESO’s GRAVITY and MATISSE instruments. The presentation will introduce the results of the JWST/MINDS MIRI disk spectroscopy program and focus in particular on the diversity of disk properties around stars of different masses. It will also present new interferometry results showing asymmetric structures in the very inner regions of disks.

Primary author: Prof. HENNING, Thomas (Max Planck Institute for Astronomy)

Presenter: Prof. HENNING, Thomas (Max Planck Institute for Astronomy)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Sunday, August 24, 2025**

Abstract ID : **21**

Strong clumping in global streaming instability simulations with a dusty fluid

Content

Two big questions need to be answered in planet formation: How do we prevent dust from being accreted, and how can dust form planetary seeds?
For the first question, we already have a variety of theoretical mechanisms and observations, such as rings, vortices, or, in general, dust traps, that can efficiently prevent dust from migrating inwards.
To answer the second question, we need a mechanism that allows dust to clump together until gravitational collapse becomes relevant and additional material can be collected.
One promising candidate is Streaming Instability, which is usually studied using Lagrangian particles in local shearing box simulations.
This time, I will present axisymmetric global patch simulations of this instability, in which dust is modelled as a pressureless fluid with a Stokes number of 0.01.
Strong clumping sets in once the total dust-to-gas mass ratio is large enough. We investigate the maximum density in these clumps over 160 orbits and compare it to the Hill density to determine if the clumps become gravitationally unstable. In addition, we try to estimate the optical depth of these clumps to see which ALMA band is most suitable for observations.

Primary author: OSTERTAG, Dominik (Max-Planck-Institute for Astronomy Heidelberg)

Co-author: Dr FLOCK, Mario (Max-Planck-Institute for Astronomy Heidelberg)

Presenter: OSTERTAG, Dominik (Max-Planck-Institute for Astronomy Heidelberg)

Contribution Type: Poster

Comments:

In case I am not selected for an oral talk, I am happy to present my work as a poster. I will attach the .pdf of my poster below

Status: ACCEPTED

Submitted by **OSTERTAG, Dominik** on **Monday, August 25, 2025**

Abstract ID : **22**

Orbits and Masses for 156 Companions from Combined Astrometry and Radial Velocities, and A Validation of Gaia Non-Single Star Solutions

Content

We combine absolute astrometry from Hipparcos and Gaia with archival radial velocities from the Keck/HIRES and ESO/HARPS spectrographs, as well as relative astrometry (when available), to derive masses and orbits for 156 companions around main-sequence stars, including 111 stellar companions, 12 brown dwarfs, and 33 planets. Although this sample is not compiled for occurrence-rate statistics due to systematic biases in non-uniform target selection and varied observing strategies, we nonetheless clearly detect the Brown Dwarf desert in the distribution of companion masses (as well as in mass ratio), out to separations of more than 10 AU. This work also enables a validation of Gaia DR3 non-single-star solutions by predicting Gaia's measured Right Ascension and Declination acceleration terms. For stars with Gaia astrometric acceleration solutions, we find qualitative agreement with Gaia DR3 results. Our predicted accelerations agree with the Gaia DR3 values overall, showing a median offset of 1.85 sigma, with a tail extending to about 10 sigma. These residuals suggest modestly underestimated uncertainties, broadly consistent with previous results for parallaxes and proper motions. Three of our systems have full Gaia orbital fits; however, their true orbital periods are long and all three Gaia solutions are spurious. Gaia DR4 will provide individual astrometric measurements and enable more detailed and extensive investigations of accelerating and orbital fits.

Primary author: AN, Qier (Johns Hopkins University)

Co-authors: Dr BRANDT, Timothy D. (Space Telescope Science Institute); Dr BRANDT, G. Mirek; Mr VENNER, Alexander (University of Southern Queensland)

Presenter: AN, Qier (Johns Hopkins University)

Contribution Type: Poster

Comments:

Preferred: oral. If an oral slot isn't available, I'm happy to present this work as a poster.

Status: ACCEPTED

Submitted by **AN, Qier** on **Tuesday, August 26, 2025**

Abstract ID : **23**

Magnetospheric Accretion of Young Stars and Formation of Close-in Planets

Content

Most discovered exoplanets orbit within 1 au of their host stars. In this region, circumstellar disks around young stars are strongly shaped by stellar magnetic fields, which govern both disk structure and accretion dynamics. I will first review recent observational and theoretical advances in characterizing the inner disk. I will then present our global 3D magnetohydrodynamical simulations of magnetospheric accretion and planetary migration to explore how planets form and evolve in such environments. We find that Earth-mass planets migrate very slowly and often stall near the inner edge of the disk "dead zone," effectively halting their inward drift. In contrast, giant planets may be trapped near the magnetospheric truncation radius, where disk–magnetosphere interactions dominate. These mechanisms may already be imprinted in the demographics of close-in exoplanets. Together, our results suggest that magnetospheric accretion and dead-zone physics play a fundamental role in shaping planetary system architectures.

Primary author: ZHU, Zhaohuan (University of Nevada Las Vegas)

Presenter: ZHU, Zhaohuan (University of Nevada Las Vegas)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHU, Zhaohuan** on **Tuesday, August 26, 2025**

Abstract ID : **24**

Exoplanet Classification using Vision Transformer

Content

The classification of exoplanets remains a major challenge in astronomy, demanding extensive computational and observational resources. Traditional approaches often require considerable time, effort, and cost, underscoring the need for advanced machine learning methods to improve classification efficiency. In this work, we present a novel framework that converts raw light curve data from NASA's Kepler mission into Gramian Angular Fields (GAFs) and Recurrence Plots (RPs) using the Gramian Angular Difference Field and RP techniques. These transformed representations are then used as inputs to a Vision Transformer (ViT) model, which excels at capturing complex temporal dependencies. Model performance is evaluated using recall, precision, and F1-score metrics under a five-fold cross-validation scheme, ensuring robust assessment and reduced evaluation bias. Our results show that RPs outperform GAFs, with the ViT achieving a recall of 89.46% and a precision of 85.09%, demonstrating strong capability in accurately detecting exoplanetary transits. While undersampling techniques were employed to mitigate class imbalance, the resulting reduction in dataset size remains a limitation. Overall, this study highlights the use of transformer-based architectures in advancing automated exoplanet classification, and emphasizes the need for future research to optimize model design for improved performance and generalization.

Primary author: Ms CHOUDHARY, Anupma (IIT(ISM) Dhanbad)

Co-authors: Prof. KUSHVAH, B. S. (IIT(ISM) Dhanbad); Mr BANDARI, Sohith (IIT(ISM) Dhanbad); Dr CHOWBAY, Swastik (Universitá degli Studi di Milano)

Presenter: Ms CHOUDHARY, Anupma (IIT(ISM) Dhanbad)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHOUDHARY, Anupma** on **Thursday, August 28, 2025**

Abstract ID : **25**

Towards Precise Constraints on Atmospheric Evolution for 50 Sub-Neptunes

Content

Sub-Neptunes are the most common short-period ($P < 100$ d) planets in the galaxy, but their evolutionary histories remain a major mystery for the field. Demographic evidence alone cannot currently distinguish the roles of photoevaporation, core-powered mass loss, and gas-poor formation in sculpting the distribution of sub-Neptune sizes and masses. Observations of atmospheric escape processes in action can help clarify the physical mechanisms responsible for sub-Neptune evolution. We have recently formed the WINERED Helium Consortium to help advance the field towards a better understanding of these processes. Using the Magellan/WINERED instrument, members of our consortium are making precise measurements of metastable helium, a tracer of atmospheric escape that can help diagnose physical conditions in the upper atmospheres of exoplanets. By measuring metastable helium absorption to at least 0.2% precision in a sample of 50 sub-Neptunes, we disentangling the roles of photoevaporation and core-powered mass loss in a statistical sample of small planets, all while delivering a sample of planets with known low-Z atmospheres that are suitable for targeted JWST followup. By the start of ICEPF, this effort will be more than halfway complete. We will present some of the first results from this extensive observational campaign, including a high-SNR detection of helium in a planet only three times the mass of the Earth−the lowest-mass planet to have its atmosphere robustly detected from the ground to date.

Primary author: VISSAPRAGADA, Shreyas (Carnegie Observatories)

Presenter: VISSAPRAGADA, Shreyas (Carnegie Observatories)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **VISSAPRAGADA, Shreyas** on **Friday, August 29, 2025**

Abstract ID : **26**

Magma ocean worlds as constraints on exoplanet geophysics and atmospheric formation

Content

I will present an overview and recent highlight results of how rocky exoplanets are informative of the process of atmospheric formation on terrestrials worlds –an evolutionary stage that is not observable anymore in the present-day Solar System. In particular, transiting exoplanets orbit typically on orbits which receive strong stellar irradiation. This drives their internal temperatures into regimes where parts or the entirety of the planetary mantle is molten magma instead of solid rock. In these magma ocean regimes atmospheric volatiles rapidly cycle between the interior and atmosphere of a planet because C-H-N-S-P compounds efficiently dissolve into magma. This hot evolutionary stage therefore presents a critical gap in our understanding of how the initial conditions of planetary systems transition into atmospheric chemistry and determine long-term climate states. I will review our current understanding of the phase state and atmosphere-interior coupling of rocky super-Earths and volatile-rich sub-Neptunes and then detail some aspects about how the study of lava exoplanets starts to present constraints on the initial chemical composition of rocky exoplanets, and what we can learn from these about the early evolution of the terrestrial planets in our Solar System. With an emphasis on the observable super-Earth and sub-Neptune population, I will discuss recent novel theoretical and observational works that shed light on the internal phase state and evolutionary scenarios, with a particular focus on (i) H-C-N-S distribution between planetary interiors and atmospheres, and (ii) atmospheric tracers for mantle phase state, composition, and atmospheric thickness. Contrasting with the dominant current view in the community, I will show that there is –as of yet –no sufficient evidence for concluding on the absence of substantial volatile enrichment on any rocky exoplanet. Instead, hot exoplanets deviate from this trend, suggesting that magma ocean exoplanets can hold onto their atmopsheres for Gyr timescales.

Primary author: LICHTENBERG, Tim (University of Groningen)

Presenter: LICHTENBERG, Tim (University of Groningen)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LICHTENBERG, Tim** on **Friday, August 29, 2025**

Abstract ID : **27**

Constraining the formation history of giant planets

Content

With the ever growing detailed characterization of giant exoplanets, the question of how, when, and where these planets formed becomes even more pressing. The formation of these planets happens in the core-accretion scenario, where first a planetary core forms before gas accretion can commence. The formation of the core was long thought to happen via the accretion of planetesimals, even though this theory has problems to form giant planets outside of a view AU (e.g. Johansen & Bitsch 2019). In contrast, in the pebble accretion scenario, planets can accrete mm-cm sized pebbles that drift inwards, resulting in an acceleration of their growth, allowing planets to form in the outer disc regions (e.g. Savvidou & Bitsch 2023). However, the atmospheric measurements of planets open up the pathway to understand where these planets form, as the disc's composition changes as a function of temperature, so as function of orbital distance to the host star. Unfortunately, this picture is complicated by the success of the pebble accretion scenario itself: as the pebbles drift inwards, they evaporate at ice lines and thus enrich the disc with evaporating volatile ices. In time this enrichment decreases, as the volatile rich gas is accreted inwards. Consequently, the disc's composition changes in time, complicating our understanding of planet formation (e.g. Schneider & Bitsch 2021a). From a modeling perspective, the disc evolution requires several model parameters (e.g. disc mass, disc radius, viscosity), while planet formation itself also requires parameters that need to be varied (e.g. initial position). Considering that planetary atmospheric measurements mostly report the planetary C/O ratio, we face the problem that the models harbor more unknowns than constraints.

In this talk, I will review the relevant processes for planet formation via pebble accretion and point to solutions to break the degeneracy between models and constraints that allow us to pinpoint the formation location of planets (Guzman Franco et al., submitted).

Primary author: BITSCH, Bertram (University College Cork)

Presenter: BITSCH, Bertram (University College Cork)

Contribution Type: Oral Talk

Comments:

Invited Talk

Status: ACCEPTED

Submitted by **BITSCH, Bertram** on **Friday, August 29, 2025**

Abstract ID : **28**

How to interpret secondary eclipses of tidally-locked rocky exoplanets

Content

The James Webb Space Telescope has started to probe short-period rocky exoplanets for signs of atmospheres. So far, the most successful method has been to infer the presence/absence of an atmosphere using infrared secondary eclipses. The underlying idea is that a tidally-locked exoplanet with no atmosphere should have a hot dayside and deep eclipse, while a planet with thick atmosphere should have a relatively cool dayside and shallow eclipse. Importantly, the majority of eclipses measured so far (N>10) are compatible with hot daysides, and thus no atmospheres.

However, how should one interpret these data more quantitatively and what about cases like TRAPPIST-1c, which appears to be slightly colder than the no-atmosphere null hypothesis? Here we revisit atmospheric heat redistribution on tidally-locked rocky exoplanets using a new 3D GCM with sophisticated correlated-k radiative transfer. We compare our results to a popular theoretical scaling proposed by Koll (2022). Overall, our results are compatible with the interpretation that most rocky exoplanets observed so far do not have thick CO_2-rich atmospheres, but point to possible exceptions for atmospheres with more exotic compositions, such as H_2O. The hunt for exo-atmospheres is thus far from over, and more of everything is needed: theory, models, and JWST data.

Primary author: KOLL, Daniel (Peking University)

Co-author: ZHAN, Ruizhi (Peking University)

Presenter: KOLL, Daniel (Peking University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **KOLL, Daniel** on **Monday, September 1, 2025**

Abstract ID : **29**

Detecting Lava Oceans on Hot Exoplanets Using the Glint Effect

Content

Theory and models predict that extremely hot rocky exoplanets (T>850 K) could be covered with lava oceans. However, direct observational evidence of lava oceans remains elusive. Here we show that phase curves can be used to distinguish between planets with smooth, molten surfaces (lava-ocean) versus rough, solid surfaces (Moon- or Mercury-like). To do so, we argue that lava oceans should be smooth enough to exhbit specular reflection, which gives rise to an ocean "glint". We develop both numerical and analytical models which solve for the reflected and emitted light of a surface with specular versus Lambertian reflection. We show that the phase curve of a specular surface is much flatter than the well-known sinusoidal shape of a Lambert surface, and causes the phase curve amplitude to be noticeably smaller than its secondary eclipse depth. Incorporating Fresnel's law, we predict that two peaks will appear near transit for low-albedo surfaces. Our results suggest that phase curve variations caused by the glint effect can be used to detect smooth, molten surfaces such as lava oceans. This detection method holds promise for characterization of hot rocky exoplanets with thin atmospheres using JWST.

Primary authors: Mr LI, Haolin (Department of Atmospheric and Oceanic Sciences, School of Physics, Peking University); KOLL, Daniel (Peking University)

Presenter: Mr LI, Haolin (Department of Atmospheric and Oceanic Sciences, School of Physics, Peking University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **Mr LI, Haolin** on **Friday, September 5, 2025**

Abstract ID : **30**

Reinterpreting the JWST Observations of 55 Cancri e with a Non-Grey General Circulation Model

Content

The ultra-short-period super Earth 55 Cancri e is an extraordinary target for exoplanet observation. Recent observations indicated a secondary atmosphere rich in CO or CO2 (Hu et al. 2024). Some other observations found temporal variability of the eclipse depths. However, the interpretations of the observations predominantly relied on 1D models with non-self-consistent heat redistribution or oversimplified 3D models with unrealistic radiative transfer. Few 3D models with realistic radiative transfer have been applied to 55 Cancri e due to the extremely high temperatures. Here we perform non-grey cloud-free GCM simulations using the custom correlated-k coefficients developed from the ExoMol database. With self-consistent heat redistribution, our simulations rule out the pure CO and CO2-poor (< 10-1 CO2 by volume mixing ratio) atmospheres that were part of the best-fit scenarios in Hu et al. We also find pure H2O atmospheres of 0.01-10 bar and CO2-rich atmospheres of 1-100 bar fit the observations equally well. However, none of the 1D or 3D models provides a better fit than an idealized blackbody model with a heat redistribution factor of ˜0.3. Therefore, the best fit atmospheric compositions largely rest on the heat redistribution rather than spectroscopic features. Our simulations also indicate the variability driven by large-scale atmospheric dynamics is significantly weaker than observed. Overall, our work highlights that confirming the composition of the atmosphere of 55 Cancri e requires further observations and systematic comparisons with 3D models.

Primary author: ZHAN, RUIZHI (Peking University)

Co-author: KOLL, Daniel (Peking University)

Presenter: ZHAN, RUIZHI (Peking University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHAN, RUIZHI** on **Sunday, September 7, 2025**

Abstract ID : **31**

Infall Induced Spiral Arms and Kinematic Perturbations in Protoplanetary Disks

Content

Spatially resolved observations of protoplanetary discs have revealed a multitude of substructures. From gaps and cavities, to spiral arms and perturbed kinematics, these observations are highly suggestive of companion-disc interactions from planetary to stellar mass objects. However other mechanisms, such as the gravitational instability (GI) or late-stage infall, may explain some of these structures. Using hydrodynamical simulations and radiative transfer to produce mock observations, I have found that infall induced perturbations in the disk kinematics can mimic those formed by other mechanisms. In particular, infall induced perturbations lead to radial flows that converge on to spiral arms, a signature once thought to be a hallmark of GI induced spirals. This may fundamentally alter present interpretations of disk kinematics in systems such as AB Aur, and in the exoALMA sample.

Primary author: CALCINO, Josh (Tsinghua University)

Co-authors: ORMEL, Chris (Tsinghua University); Prof. PRICE, Daniel J. (Monash University)

Presenter: CALCINO, Josh (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CALCINO, Josh** on **Tuesday, September 9, 2025**

Abstract ID : **32**

Convective inhibition leads to different climate regimes on hycean planets

Content

Hycean planets are exoplanets characterized by water oceans and H_2-rich atmospheres. These planets are high-priority targets for biosignature searches, because of their abundant surface liquid water combined with easy-to-characterize H_2-rich atmospheres. One of the most unusual climate features of hycean planets is convective inhibition. In H_2-rich atmospheres, the molecular weight difference between H_2O and H_2 can suppress moist convection and dramatically alter the planet's temperature structure. So far, convective inhibition has been largely studied for gas giants in the solar system, its effect on hycean planets, however, is still poorly understood. This work develops pen-and-paper theory to analyze the effects of moist convective inhibition on hycean planets. The theory is tested and verified against a 1D radiative-convective model. We show that hycean planets near the onset of convective inhibition exhibit either bistability or oscillations, due to the heat and moisture trapped in the inhibition layers. Meanwhile, the inhibition layer and surface climate of hot hycean planets exhibit multi-stability due to the lack of constraints on the water cycle inside the inhibition layer. The water cycle inside the inhibition layer is influenced by numerous processes that are challenging to resolve in 1D models, including turbulent diffusion, convective overshoot and large-scale horizontal shear. Our results highlight that hycean planets have unexpectedly rich climate dynamics. Meanwhile, previous claims about hycean planets based on 1D models should be treated with caution until confirmed with self-consistent 3D models; this includes the claim that K2-18b might be habitable and the proposal to infer H_2O oceans on sub-Neptunes using JWST measurements of chemical species such as NH_3.

Primary authors: DING, Feng (Peking University); GAO, Yichen (Peking University); KOLL, Daniel (Peking University)

Presenter: GAO, Yichen (Peking University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GAO, Yichen** on **Wednesday, September 10, 2025**

Abstract ID : **33**

Resolving the Formation Puzzles of K2-19 Planets through a Decade of Transit Photometry

Content

K2-19 hosts a pair of Neptunian planets deep inside the 3:2 resonance.
Previous results by Petigura et al. (2020) showed that (a) these two planets have high orbital eccentricities of 0.2, which are inconsistent with the formation scenario of convergent disk migration; (b) K2-19 b has a hydrogen-helium envelope mass fraction of 44 percent, presenting a challenge to the core-accretion theory. Here we present new results with a photodynamical analysis of 10 years of transit data. While we confirm the previous mass measurements of two planets, we obtained results with smaller orbital eccentricities and envelope mass fraction, which have good agreements with models of convergent disk migration and core-accretion formation mechanism. Therefore, the puzzles of planetary formation of K2-19 have been resolved by our transit analysis. Systems such as K2-19 remain to be important testbeds for theories of planet formation.

Primary author: JIANG, Ing-Guey (National Tsing Hua University)

Co-authors: Dr ALMENARA, Jose (Observatoire de Geneve, Switzerland); Prof. MARDLING, Rosemary (Monash University, Australia); Prof. LELEU, A. (Observatoire de Geneve, Switzerland); DIAZ, R.F.; BONFILS, X.; YEH, Li-Chin (National Tsing Hua University); Prof. YANG, Ming; Prof. STASSUN, Keivan; Dr A-THANO, Napaporn; Dr EDWARDS, Billy; BOUCHY, F.; BOURRIER, V.; DELINE, A.; EHRENREICH, D.; FONTANET, E.; FORVEILLE, T.; JENKINS, J. M.; KWOK, L. K. W.; LENDL, M.; PSARIDI, A.; UDRY, S.; VENTURINI, J.; WINN, J.

Presenter: JIANG, Ing-Guey (National Tsing Hua University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **JIANG, Ing-Guey** on **Wednesday, September 10, 2025**

Abstract ID : **34**

Characterizing Near-Resonance Multi-Planet Systems through Transit Timing Variations

Content

It is not well understood why many exoplanets are near but not trapped in resonances with their neighbors. To figure out a comprehensive picture, it is important to characterize more near-resonance multi-planet systems. In order to improve the mass measurement and parameter determination of two sub-Neptunes, K2-266 d and K2-266 e, we present new transit observations obtained with CHaracterising ExOPlanets Satellite (CHEOPS) and Transiting Exoplanet Survey Satellite (TESS), increasing the baseline of transit data from a few epochs to 165 epochs for K2-266 d, and to 121 epochs for K2-266 e. It is found that the masses of K2-266 d and K2-266 e are 6.01 ± 0.43 Earth Mass and 7.70 ± 0.58 Earth Mass, respectively. With these updated values and one order of magnitude better precision, we confirm the planets to belong to the population of planets that has been determined to be volatile-rich. The results of dynamical simulations, showing that the system is stable, the orbits are not chaotic, and that these two planets are close to but not in 4:3 mean motion resonance. Moreover, the results of several other interesting systems investigated through the transit timing analysis will be summarized.

Primary author: YEH, Li-Chin (National Tsing Hua University)

Co-authors: JIANG, Ing-Guey (National Tsing Hua University); Dr EDWARDS, Billy; Prof. YANG, Ming; Prof. STASSUN, Keivan; Dr A-THANO, Napaporn; Prof. MARDLING, Rosemary (Monash University, Australia); Dr ALMENARA, Jose (Observatoire de Geneve, Switzerland); Dr KORTH, Judith (Observatoire de Geneve, Switzerland); Prof. LELEU, Adrien (Observatoire de Geneve, Switzerland)

Presenter: YEH, Li-Chin (National Tsing Hua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YEH, Li-Chin** on **Thursday, September 11, 2025**

Abstract ID : **35**

On the formation of water oceans in rocky exoplanets with hydrogen atmospheres

Content

It has been suggested that some rocky exoplanets could form substantial water inventories through oxidation reactions between their primordial hydrogen-rich atmospheres and underlying magma oceans. Here we investigate this hypothesis using a coupled atmosphere–magma ocean model. We find that large-scale water formation is unlikely for two reasons. First, any water formed from oxidation reactions in the magma ocean would quickly outgas because of the water-poor atmosphere above. Second, the top boundary layer of the magma ocean becomes stable against convection because the oxidation reactions produce metallic iron, which sinks to the core. This iron loss makes the top boundary layer significantly more buoyant than the rest of the magma, thus becoming stable against mixing. Our results suggest that hydrogen dissolution is unlikely to play a major role in the formation of oceans in rocky exoplanets.

Primary author: MODIRROUSTA-GALIAN, Darius (TDLI/SJTU)

Co-author: Prof. KORENAGA, Jun (Yale University)

Presenter: MODIRROUSTA-GALIAN, Darius (TDLI/SJTU)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **MODIRROUSTA-GALIAN, Darius** on **Thursday, September 11, 2025**

Abstract ID : **36**

Fascinating Transit Timing Variations of Hot Jupiters: Evidence of Planet Migration

Content

Transit timing variations (TTVs) of hot Jupiters can reveal signatures of multiple physical processes, including apsidal precession, the Romer effect, and notably, planetary migration. Hot Jupiters are believed to form at significant distances from their host stars and later migrate inward, a scenario that can be directly supported by TTV measurements. Detecting TTVs requires a long observational baseline and high precision in determining transit midpoints. Leveraging the full-sky coverage and continuous monitoring capabilities of TESS, we have launched a campaign to monitor the long-term TTVs of known hot Jupiters. As part of this effort, we have reported TTV detections for WASP-161b, K2-237b, and XO-3b, augmenting our observations with additional data from approved proposals using CHEOPS and ground-based telescopes. Our analysis suggests that a period decay model best explains the TTVs of WASP-161b. However, the inferred tidal quality factor is remarkably low, comparable to that of rocky planets in the Solar System, despite WASP-161b being a gas giant. This rapid orbital decay likely indicates an exceptionally efficient transfer of orbital energy into the planet ' s or host star ' s interior, or it may be driven by alternative mechanisms, such as magnetic interactions. For K2-237b, we detected a period decay, with additional evidence suggesting the presence of a circumstellar disk. Infrared excess was observed at a significance level of 1.5σ in the WISE W1 and W2 bands, and at 2σ in the W3 and W4 bands, based on spectral energy distribution fitting. To further investigate the physical origins of the period decay, we are developing a star-planet interaction model that considers both magnetic and tidal interactions simultaneously. For magnetic interactions, the package incorporates the magnetic topology of the host star and the orbital characteristics of the planet. For the tidal interaction, the package includes empirical equations for both equilibrium and dynamic tides.

Primary author: YANG, Fan (CEA Paris-Saclay)

Presenter: YANG, Fan (CEA Paris-Saclay)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Fan** on **Friday, September 12, 2025**

Abstract ID : **37**

Magnetic field and tide of star and planet

Content

I will discuss some recent projects: (1) the scaling laws of stellar convection dynamo and binary tidal dynamo; (2) tidal wave resonance with orbital motion; (3) ohmic dissipation on dynamical tide; (4) global analysis of disk gravitational instability. In (1) we interpret the observational field-rotation scaling law of convection dynamo in a single star and predict the field-orbit scaling law of tidal dynamo in close binary stars. In (2) we find that the wave-orbit resonance facilitates orbital evolution and tidal dissipation even increases with planet-satellite distance. In (3) we find that ohmic dissipation greatly contributes to tidal evolution when orbital frequency faster than twice primary's rotation frequency. In (4) we find the transitional mode for disk substructure at cooling beta ˜ 1.

Primary author: Prof. WEI, Xing (Beijing Normal University)

Presenter: Prof. WEI, Xing (Beijing Normal University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WEI, Xing** on **Friday, September 12, 2025**

Abstract ID : **38**

Formation and Presence of Molecular and Crystalline Structures in the NGC 6357 Region

Content

Understanding star and planet formation in extreme environments is crucial for uncovering the origins of our solar system. While most knowledge comes from nearby, isolated regions such as Taurus and Lupus, over half of all stars and planetary systems form in environments exposed to strong far-ultraviolet (FUV) radiation, emitted by massive OB stars, with energies below the Lyman limit (E <13.6 eV).

NGC 6357—a young (˜1–1.6 Myr), massive star-forming complex located 1690 pc away and hosting over 20 O-type stars—provides a unique opportunity to study the effects of FUV radiation on protoplanetary disks. This is the focus of the XUE (eXtreme UV Environments) collaboration.

Here, we present results from XUE2, a disk in the Pismis 24 cluster, based on spectra from JWST/MIRI and VLT/FORS2, complemented by photometric data. We first characterized the central star through spectrophotometric fitting, a fundamental step since protoplanetary disks are shaped by their host stars.

To evaluate the potential for rocky planet formation, we conducted a molecular and mineralogical analysis of the disk. We confirmed the presence of CO and tentatively detected CH_3^+, both key molecules for organic chemistry. Additionally, we identified silicates such as enstatite and forsterite—molecules and minerals also observed in disks exposed to lower irradiation levels.

These findings offer new insights into the composition of inner disk regions under strong FUV irradiation, helping to constrain the formation conditions of rocky planets in massive clusters—an essential contribution to understanding the origins of the diverse exoplanets observed today.

Primary author: LEMUS NEMOCÓN, María Alejandra (Observatorio Astronómico Nacional - Universidad Nacional de Colombia)

Co-authors: Prof. HIGUERA GARZÓN, Mario Armando (Observatorio Astronómico Nacional - Universidad Nacional de Colombia); Dr RAMÍREZ-TANNUS, María Claudia (Max-Planck-Institut für Astronomie)

Presenter: LEMUS NEMOCÓN, María Alejandra (Observatorio Astronómico Nacional - Universidad Nacional de Colombia)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LEMUS NEMOCÓN, María Alejandra** on **Friday, September 12, 2025**

Abstract ID : **39**

Outward Migration of a Gas-Accreting Planet: A Semi-Analytical Formula

Content

Type II orbital migration is a key process to regulate the mass and semimajor axis distribution of exoplanetary giant planets. The conventional formula of type II migration generally predicts too rapid inward migration to reconcile with the observed pile-up of gas giant beyond 1 au. Analyzing the recent high-resolution hydrodynamical simulations by Y-P. Li et al. (2024) and J-P. Pan (2025) that show robust outward migration of a gas-accreting planet, we here clarify the condition for the outward migration to occur and derive a general semi-analytical formula that can be applied for broad range of planet mass and disk conditions. The striking outward migration is caused by azimuthal asymmetry in horseshoe flow in the protoplanetary disk that is produced by the planetary gas accretion, while the conventional inward migration model is based on radial asymmetry in the torques from the disk. We found that the azimuthal asymmetry dominates and the migration is outward, when the gap depth defined by the surface density reduction factor of 1/(1+K') is in the range of 0.03 < K' < 50. Using simple models with the new formula, we demonstrate that the outward migration plays an important role in shaping the mass and semimajor axis distribution of gas giants. The concurrent dependence of planets' accretion rate and migration direction on their masses and disk properties potentially reproduces the observed pile-up of exoplanetary gas giants beyond 1 au, although more detailed planet population synthesis calculations are needed in the future.

Primary author: IDA, Shigeru (Science Tokyo)

Co-authors: LI, Yaping; Mr PAN, Jun-Peng (Shanghai Astronomical Observatory); Dr CHEN, Yi-Xian (Princeton); Prof. LIN, Douglas N. C. (UC Santa Cruz)

Presenter: IDA, Shigeru (Science Tokyo)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **IDA, Shigeru** on **Friday, September 12, 2025**

Abstract ID : **40**

Novel Atmospheric Dynamics Shape the Inner Edge of the Habitable Zone around White Dwarfs

Content

White dwarfs offer a unique opportunity to search nearby stellar systems for signs of life, but the habitable zone around these stars is still poorly understood. Since white dwarfs are compact stars with low luminosity, any planets in their habitable zone should be tidally locked, like planets around M dwarfs. Unlike planets around M dwarfs, however, habitable white dwarf planets have to rotate very rapidly, with orbital periods ranging from hours to several days. Here we use the ExoCAM global climate model to investigate the inner edge of the habitable zone around white dwarfs. Our simulations show habitable planets with ultrashort orbital periods (P ˜ 1 day) enter a "bat rotation" regime, which differs from typical atmospheric circulation regimes around M dwarfs. Bat rotators feature mean equatorial subrotation and a displacement of the surface's hottest regions from the equator toward the midlatitudes. We qualitatively explain the onset of bat rotation using shallow water theory. The resulting circulation shifts increase the dayside cloud cover and decrease the stratospheric water vapor, expanding the white dwarf habitable zone by ~50% compared to estimates based on 1D models. The James Webb Space Telescope should be able to quickly characterize bat rotators around nearby white dwarfs thanks to their distinct thermal phase curves. Our work underlines that tidally locked planets on ultrashort orbits may exhibit unique atmospheric dynamics, and guides future habitability studies of white dwarf systems.

Primary author: ZHAN, RUIZHI (Peking University)

Co-authors: DING, Feng (Peking University); KOLL, Daniel (Peking University)

Presenter: ZHAN, RUIZHI (Peking University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHAN, RUIZHI** on **Saturday, September 13, 2025**

Abstract ID : **41**

Resonance Capture and Stability Analysis for Planet Pairs under Type I Disk Migration

Content

We present a theoretical framework for investigating a two-planet system undergoing convergent type I migration in a protoplanetary disk. Our study identifies the conditions for resonant capture and subsequent dynamical stability. By deriving analytical criteria for general j: j − 1 first-order mean-motion resonances (MMRs) applicable to planet pairs with arbitrary mass ratios, we validate these predictions through N-body simulations. The key results are demonstrated in τm-τm/τe plots, where τm and τe are the timescales of the angular momentum and eccentricity damping, respectively. Specifically, we determine which combinations of orbital damping timescales allow for capture into resonance, showing that too fast migration or too strong eccentricity damping inhibit successful capture. After capture, the subsequent evolution can be classified into three regimes: stable trap, overstable trap and escape. Importantly, resonant capture always remains stable when the inner planet significantly outweighs the outer one. In contrast, when the mass of the inner planet is lower than or comparable to that of the outer planet, the system transitions from the stable to overstable trap, and eventually escapes the resonance, as the relative strength of eccentricity damping to migration (τm/τe) decreases.

Primary authors: LIU, Beibei (Zhejiang University); 林, 灵鸿 (浙江大学)

Presenter: 林, 灵鸿 (浙江大学)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **林, 灵鸿** on **Sunday, September 14, 2025**

Abstract ID : **42**

Open-Source Tidal Modeling with GYRE-tides: Lessons from WASP-12 System

Content

We present GYRE-tides, an open-source framework for computing non-adiabatic tidal responses in realistic stellar models. WASP-12b, a hot Jupiter on a 1.1-day orbit around an F-type subgiant, provides a benchmark case: its observed orbital decay rate of 3.2 Myr offers a stringent test of tidal theory. Using GYRE-tides with MESA stellar models, we confirm that radiative and convective damping reproduce previous semi-analytic and adiabatic estimates but remain insufficient to match the observed inspiral rate. GYRE-tides can also quantify wave nonlinearity, underscoring the need to explore nonlinear damping, while validating the code as a reliable community tool. Looking ahead, upcoming surveys (e.g., the Roman Space Telescope Galactic Bulge Time Domain Survey) will discover tens of thousands of short-period planets, making open-source, physics-driven tools like GYRE-tides essential for connecting observed decay rates to the microphysics of stellar interiors.

Primary author: SUN, Meng (National Astronomical Observatories of China)

Co-authors: Dr TOWNSEND, R. H. D (University of Wisconsin-Madison); XIA, Hongbo (Northwestern University)

Presenter: SUN, Meng (National Astronomical Observatories of China)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SUN, Meng** on **Monday, September 15, 2025**

Abstract ID : **43**

A Multi-Step Iterative Retrieval of WASP-39b with JWST and Consistency with Chemical Equilibrium and Cloud Formation

Content

As one of the first exoplanets extensively characterised by the James Webb Space Telescope (JWST), WASP-39 b has quickly become a cornerstone for atmospheric studies. Multiple transit spectra obtained with NIRISS, NIRCam, NIRSpec (G395H and PRISM), and MIRI provide an unprecedented dataset for probing its atmosphere.

Our analysis suggests that the molecular and atomic species identified in retrieval models—including H_2O, CO_2, Na, K, and silicate gases and clouds—are consistent with an atmosphere in chemical equilibrium. We employ an iterative retrieval framework that cross-validates observational inferences with equilibrium chemistry and cloud formation, offering a coherent explanation for the observed spectra.

While we advocate for acquiring more extensive data, potentially at higher spectral resolutions in particular wavelengths, to validate our findings regarding WASP-39 b, our work highlights a refined retrieval methodology. This strategy incorporates a rigorous three-step process that strategically employs ab initio chemistry models alongside blind retrievals, which are used iteratively to uncover physically robust optimal solutions, enriching our understanding of the chemistry and dynamics of exoplanetary atmospheres.

Primary author: MA, Sushuang (King's College London)

Co-authors: Dr AL-REFAIE, Ahmed Faris (University College London); Dr CECCHI-PESTELLINI, Cesare (INAF); Dr SABA, Arianna (University College London); Dr TENNYSON, Jonathan (University College London); TINETTI, Giovanna (King's College London); Dr YURCHENKO, Sergei N. (University College London)

Presenter: MA, Sushuang (King's College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **MA, Sushuang** on **Monday, September 15, 2025**

Abstract ID : **44**

Non-Uniform Water Distribution in Jupiter's Mid-Latitudes: Influence of Precipitation and Planetary Rotation

Content

Jupiter is known for its colorful and dynamic appearance. However, its beauty poses a challenge for measuring its composition, as the optimal location for determining metallicity in Jupiter is largely unknown. Recently, Juno found that non-uniform features may extend to the layers well beneath clouds. Here, we examine water distribution in Jupiter's mid-latitudes. High-resolution simulations reveal a non-uniform distribution of water in Jupiter's weather layer. Precipitation establishes a large-scale depletion of water vapor tens of kilometers beneath water clouds. Turbulent large-scale eddies, such as baroclinic instabilities, and waves, lead to a latitudinal dependency of water vapor within the depleted levels. We show that the water vapor abundance has a correlation with potential vorticity, a measurable quantity that directly relates to the rotation of the planet. Our study highlights the significance of precipitation and large-scale dynamics in accurately measuring the bulk composition of condensable volatiles on giant planets. We suggest that future giant planet and ice giant missions may verify our theory and advance our knowledge of planetary atmospheric dynamics for metallicity measurements.

Primary author: GE, Huazhi (California Institute of Technology)

Co-authors: Dr CHEN, Sihe (California Institute of Technology); Prof. INGERSOLL, Andrew P. (California Institute of Technology); Prof. LI, Cheng (University of Michigan); Prof. ZHANG, Xi (University of California, Santa Cruz)

Presenter: GE, Huazhi (California Institute of Technology)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GE, Huazhi** on **Monday, September 15, 2025**

Abstract ID : **45**

Water vapor emission at the warm cavity wall of the HD 100546 disk as revealed by ALMA

Content

Water has long been of primary interest in astronomy, as it is fundamental for the onset of life on Earth and plays a key role in planet formation. The location of the water snowline, where water ice sublimates into vapor, is a favorable location for planetesimal formation, promoting dust coagulation. The water sublimation front also regulates the chemical composition of planet-forming material, often traced via the carbon-to-oxygen (C/O) ratio, which strongly influences the composition of planetary cores and atmospheres.
While water in protoplanetary disks has been predominantly observed at infrared wavelengths, the powerful capabilities of ALMA now offer an unprecedented opportunity to map the spatial distribution of water vapor at millimeter wavelengths.
I will present new ALMA observations of water vapor in the disk of HD 100546, showing a peak of the emission at the warm cavity wall of the transition disk. These breakthrough observations pave the way for a deeper understanding of the water budget and distribution in the birthplace of planets. Furthermore, they show the potential of mm observations with ALMA to directly reveal the water snowline in the favorable conditions offered by warm cavities of transition disks.

Primary author: RAMPINELLI, Luna (Università degli Studi di Milano)

Presenter: RAMPINELLI, Luna (Università degli Studi di Milano)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **RAMPINELLI, Luna** on **Tuesday, September 16, 2025**

Abstract ID : **46**

Circumbinary planets from radial velocities: results and sample comparisons

Content

Circumbinary systems are an important testing ground for planet formation theories as the dynamically complex influence of the binary makes planet formation and survival more difficult. Obtaining a larger sample of such planets, accurately characterised, is therefore vital to further our understanding. Using radial velocities, the BEBOP survey has achieved sensitivity down to Saturn mass planets across a wide range of orbital periods for many targets and has a number of planet detections and candidates. In this talk I will motivate the study of circumbinary planets, present historical results (e.g. from Kepler) and recent results from BEBOP, and I will compare the population of circumbinary planets arising from radial velocities to those from Kepler and those orbiting single stars.

Primary author: BAYCROFT, Thomas (T.D. Lee Institute)

Presenter: BAYCROFT, Thomas (T.D. Lee Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **BAYCROFT, Thomas** on **Wednesday, September 17, 2025**

Abstract ID : **47**

2M1510 a young quadruple brown dwarf system with a complex architecture

Content

2M1510 is a remarkable system consisting only of brown dwarfs, no hydrogen burning star in sight. At a young age of ≈ 45 Myr it is an important benchmark for brown dwarf atmosphere and evolution models since the inner pair of brown dwarfs is eclipsing, meaning that precise constraints on masses and radii can be obtained. I will present results showcasing the unique architecture of this already remarkable system: 2M1510 consists of a hierarchical triple brown dwarf with the eclipsing binary and a distant companion, all three of these have the same mass ($\approx 30\,\mathrm{M_{Jup}}$), and a fourth brown dwarf with half the mass of the others that orbits the inner eclipsing binary on an orbit that is both very eccentric and polar (inclined at $90°$ relative to the inner binary). This system and its architecture is important for understanding planet, brown dwarf and star formation and linking them all together.

Primary author: BAYCROFT, Thomas (T.D. Lee Institute)

Presenter: BAYCROFT, Thomas (T.D. Lee Institute)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BAYCROFT, Thomas** on **Wednesday, September 17, 2025**

Abstract ID : **48**

Hybrid accretion of rocky planets imprinted in volatile depletion

Content

Volatile elements –critical for planetary evolution and habitability –are systematically depleted in rocky planets relative to their host stars across planetary systems. The origin of this universal feature has remained unresolved, with two leading theories –traditionally prolonged collisional growth versus rapid pebble accretion –often treated as competing models. Here, we use geochemical constraints from Earth and Mars to test a new model of devolatilization during pebble accretion, coupled with a population of early-formed planetesimals, to evaluate the viability of a hybrid formation scenario within a Bayesian inference framework. Our analysis quantifies, for the first time in a probabilistic framework, the relative contributions of devolatilized pebbles and early-formed, volatile-depleted planetesimals to the growth of terrestrial planets. We find that the bulk silicate Earth is best described by at least ˜75% derived from two protoplanets formed via pebble accretion (and devolatilization), with up to ˜25% from planetesimals compositionally similar to Vesta. In contrast, bulk silicate Mars is most consistent with 27 ± 5% derived from pebble accretion and 73 ± 5% from Vesta-like planetesimals. These results provide statistical evidence that rocky planets do not form through a single dominant process, but rather via a hybrid pathway that combines rapid pebble accretion with prolonged collisional assembly. This reconciles long-standing competing theories of terrestrial planet formation, while also establishing a probabilistic methodology to test in further accretion models against geochemical, meteoritic, and astrophysical data. Together, our findings offer a unified explanation for volatile depletion in Earth and Mars and provide new insights into the compositional diversity of rocky worlds within and beyond the Solar System.

Primary authors: WANG, Haiyang (University of Copenhagen); JOHANSEN, Anders (University of Copenhagen)

Presenter: WANG, Haiyang (University of Copenhagen)

Contribution Type: Oral Talk

Comments:

Invited.

Status: ACCEPTED

Submitted by **WANG, Haiyang** on **Wednesday, September 17, 2025**

Abstract ID : **49**

Age Dependence of the Occurrence and Architecture of Ultra-Short-Period Planet Systems

Content

Ultra-short-period (USP) planets, with orbital periods shorter than one day, represent a unique class of exoplanets whose origin remains puzzling. Determining their age distribution and temporal evolution is vital for uncovering their formation and evolutionary pathways. Using a sample of over a thousand short-period planets around Sun-like stars and kinematic methods from the Planets Across Space and Time (PAST) project, we find that the host stars of USP planets are relatively older than other short planets. Subsequently, we find that the occurrence of USP planets increases with time. Furthermore, we uncover evidence indicating that USP planetary system architectures evolve on Gyr timescales, as evidenced by the period distribution, orbital spacing, and transiting planet multiplicity. Our findings suggest most USP planets originated via inward migration driven by tidal dissipation over Gyr timescales. This work reveals the age-dependence of USP planet systems' occurrence and architecture, providing new constraints for future studies to further distinguish between different formation mechanisms of USP planets.

Primary author: TU, Peiwei (Nanjing University)

Co-authors: Prof. XIE, Jiwei (Nanjing University); Prof. CHEN, Dichang (Sun Yat-sen University); Prof. ZHOU, Jilin (Nanjing University)

Presenter: TU, Peiwei (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TU, Peiwei** on **Friday, September 19, 2025**

Abstract ID : **50**

Turbulent infall onto class 0 disks as cause of CAI brief condensation episode in the solar system

Content

Calcium-aluminum-rich inclusions (CAIs) in carbonaceous chondritic meteorites are the oldest relics in the solar system. Notably, their radiogenic age feature a brief (100 kyr) condensation episode. In contrast, the reservoirs of the short-lived isotopes in CAIs, presumably supernovae or asymptotic giant stars, pollutes star-forming regions in giant molecular cloud complexes (GMC) over much longer (Myr) duration. Through a series of numerical simulations, we show here the possibility that, within an extended region (2~3 AU), nearly all "pre-solar" CAI-loaded grains in the infall clouds were sublimated and re-condensed during the early (⊠ 10^5 yr) infall and formation of class-0 disks. We adopt a set of initial conditions from a previous hydrodynamic simulation of the collapse of GMC and the formation of young stellar clusters. We analyze the evolution of the disk ’ s thermal distribution and dynamical structure resulting from the interaction between circumstellar disks and infalling gas. Our follow-up simulations, with much higher resolution, show significant and rapid changes in the disk orientation and morphology due to the dynamic infall of external streamers. Warps and global spiral density waves commonly appear. They lead to intense dissipation which heats the gas to sufficiently high temperature to sublimate prior-generation CAIs. This solid-to-gas phase transition is followed by subsequent cooling and re-condensation. The CAI contained in the meteorites today could be the relics of the last episode of major infall onto class 0 disks.

Primary author: ZHENG, Jiachen (Beijing Normal University)

Co-authors: WEI, Xing (Beijing Normal University); Prof. DENG, Hongping (Shanghai Astronomical Observatory); Dr XU, Wenrui (Center for Computational Astrophysics); LIN, Douglas N. C. (UC Santa Cruz)

Presenter: ZHENG, Jiachen (Beijing Normal University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHENG, Jiachen** on **Sunday, September 21, 2025**

Abstract ID : **51**

Free-floating Planets Produced by Planet-Planet Scatterings: Ejection Velocity and Survival Rate of Their Moons

Content

The discovery of numerous free-floating planets (FFPs) has intensified interest in their origins and dynamical histories. A leading formation mechanism is planet-planet scatterings in unstable multi-planetary systems, which can naturally lead to planetary ejections. If these planets originally host moons, it remains an open question whether such satellites can remain gravitationally bound to FFPs after ejection. In this work, we investigate both the ejection velocity of FFPs produced by planet-planet scatterings and the survival rate of their potential moons; we estimate the latter by determining the statistics of the minimum planet-planet distance prior to planet ejection, and comparing it to the initial orbital radius of the moon relative to its host planet. Using the circular restricted three-body framework, we derive an analytical boundary for the ejection velocity based on Jacobi energy conservation, which agrees with the results of integrations. We also identify a minimum planetary mass required for successful ejection. For two-planet systems with finite planetary masses, we use simulations and analytical arguments to determine how the ejection velocity scales with the planetary mass and initial semi-major axis. Extending our analysis to three-planet systems yields similar results, reinforcing the robustness of our conclusions. These findings offer insights into the property of FFPs and inform future efforts to search for exomoons around them.

Primary authors: HUANG, Xiumin (上海交通大学李政道研究所); LAI, Dong (TDLI)

Presenter: HUANG, Xiumin (上海交通大学李政道研究所)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **黄, 秀敏** on **Sunday, September 21, 2025**

Abstract ID : **52**

Circumplanetary Disk Models and Infrared Spectral Features

Content

Circumplanetary disks (CPDs) are key environments for both satellite formation and mass accretion onto young planets. Their infrared spectral features provide essential diagnostics of dust composition, disk structure, and evolutionary stage. In this work, we present a comparative study of infrared spectral signatures associated with different types of CPD models. By combining recent observational data with dedicated spectral fitting, we highlight the distinct behaviors of silicate features and continuum excesses across various disk configurations. Particular attention is given to the mid-infrared regime, where differences between dusty and dust-depleted outer regions become most pronounced. We further discuss how current and upcoming infrared facilities can constrain the radial distribution of dust in CPDs, offering new perspectives on the detectability and characterization of these disks at larger radii. This work underscores the importance of infrared spectroscopy in linking theoretical models with observations and in guiding future searches for CPDs around young planetary-mass companions.

Primary author: SUN, Xilei (Sun Yat-Sen University)

Co-authors: Prof. DONG, Ruobing (Peking University); LIU, Shangfei (Sun Yat-sen University)

Presenter: SUN, Xilei (Sun Yat-Sen University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SUN, Xilei** on **Monday, September 22, 2025**

Abstract ID : **53**

Probing Planet-forming Dust with Polarimetry: HD100453 and Beyond

Content

Dust in protoplanetary disks plays a central role in how planets form. Its size, structure, and composition control how solids grow, move, and interact with companions in the disk. Polarimetric imaging is a particularly powerful way to study the dust properties, because it traces scattered light of dust floating on the disk surface at different wavelengths. By carefully calibrating and analysing the data, we can recover reliable measurements of how much light the disk reflects and polarizes, and use this information to infer the grain size, porosity, and composition.

In this talk, I will present our latest multi-wavelength study of the HD 100453 disk using VLT/SPHERE. HD 100453 is a prototypical companion-disk interaction system hosting a spiralled disk and a sub-stellar companion. We systematically measured its polarised disk reflectivity, total reflectivity, and degree of polarisation from visible to near infrared wavelengths and interpreted the results with radiative transfer models. We find that compact, sub-micron aggregates dominate the disk ring, while the spiral arms contain more porous grains, and the optically thin cavity requires very small grains. These spatial differences provide new evidence of dust filtration and localized grain evolution likely shaped by disk-companion interactions.
I will also briefly compare with other disks we have studied (e.g., RX J1604, HD 142527, HD 169142), highlighting common trends and differences in dust properties. Together, these results show how dust properties vary within and among disks, and how polarimetric imaging contributes to our broader picture of planet formation.

Primary author: MA, Jie (Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France)

Co-authors: Prof. DOMINIK, Carsten (University of Amsterdam); Dr DUCHÊNE, Gaspard (Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France); Prof. GINSKI, Christian (University of Galway); Dr MÉNARD, François (Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France); Prof. SCHMID, Hans Martin (ETH Zurich); Dr TAZAKI, Ryo (The University of Tokyo)

Presenter: MA, Jie (Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **MA, Jie** on **Monday, September 22, 2025**

Abstract ID : **54**

Modeling the vertical velocity gradient to disentangle stellar activity from exoplanet signal

Content

Extremely precise radial velocity (EPRV) measurements are critical for discovering habitable planets and estimating their masses. Modern EPRV instruments have achieved cm/s stability, however, that hasn't translated to the discovery of earth-like planets around sun-like stars. Below a few m/s, the Doppler shift of spectral lines due to stellar activity will start dominating planetary signals. A planetary radial velocity signal should be consistent across all the heights, while a stellar activity-induced photospheric velocity, could be different at different heights of the stellar atmosphere. Based on this idea, we developed a method to disentangle stellar activity signals and planetary signals in radial velocity data. In our model, we treat the rising and falling lanes of granulation separately. We first calculate the 'granulation contrast', and then determine the velocity profile of both raising and falling lanes. Using Korg, a julia package for spectral synthesis, we solve the radiative transfer equation with an atmospheric model after Doppler shifting each photospheric layer by a vertical velocity profile model. To test our model, we fit this synthetic spectrum with multi epochs of disk-averaged solar spectra observed with NEID. The stellar activity parameters of our model are the coefficients of the velocity gradient polynomial. In this talk, I will present our model and its effectiveness in disentanglling planetary signals from stellar activity signals.

Primary author: REJI, Varghese (Tata Institute of Fundamental Research, Mumbai)

Co-authors: Ms KV, Asha Lakshmi (Tata Institute of Fundamental Research, Mumbai); Dr NINAN, Joe (Tata Institute of Fundamental Research, Mumbai); TEAM, NEID (NEID)

Presenter: REJI, Varghese (Tata Institute of Fundamental Research, Mumbai)

Contribution Type: Poster

Comments:

Talk/Poster

Status: ACCEPTED

Submitted by **REJI, Varghese** on **Tuesday, September 23, 2025**

Abstract ID : **55**

Convection in protoplanetary disks: friend or foe?

Content

Hydrodynamic instabilities likely operate in protoplanetary disks. One candidate, convective overstability (COS) or radial convection, can develop in particular disk regions. The ensuing turbulence and flow structures are expected to affect planet formation. We present high-resolution simulations of the COS using local Boussinesq shearing box and global compressible cylindrical models with and without embedded dust grains. Under axisymmetry, we show that the COS generates zonal flows that trap dust; however, unsteady flows and dust feedback effects can limit dust concentrations. Global 3D simulations reveal that COS induces outward mass transport and large-scale vortex formation that significantly modifies the disk structure. Furthermore, these COS-produced vortices efficiently concentrate dust, particularly for larger grains at solar and supersolar metallicities. These findings highlight the COS' s role in shaping disk structures and dust distributions, offering insights into observed dust rings and asymmetries in protoplanetary disks, with implications for planet formation processes.

Primary author: LIN, Min-Kai (ASIAA)

Co-author: Dr LEHMANN, Marius (Iowa State University)

Presenter: LIN, Min-Kai (ASIAA)

Contribution Type: Oral Talk

Comments:

If an oral presentation is not accepted, I will apply for a poster instead.

Status: ACCEPTED

Submitted by **LIN, Min-Kai** on **Wednesday, September 24, 2025**

Abstract ID : **57**

A Galactic Exoplanet Census with the Roman Space Telescope

Content

NASA' s Nancy Grace Roman Space Telescope —launching in late 2026 —will open up unprecedented discovery space in the infrared universe. Combining Hubble-like sensitivity and resolution with a field of view 100 times larger and a sky-mapping speed 1,000 times faster, Roman will conduct panoramic, high-resolution surveys that will transform our understanding of dark energy, exoplanetary systems, galactic structure, the solar system, and star formation —all while producing an enormous data set that will be analyzed for decades to come. One of Roman' s Core Community Surveys is the Roman Galactic Bulge Time Domain Survey (RGBTDS), an ambitious program that will monitor 1.7 square degrees toward the crowded Galactic center with unprecedented precision and cadence. Over 440 days across six observing seasons, Roman will repeatedly image the same stars every 12 minutes, enabling the detection of planetary systems by using microlensing to reveal thousands of cold planets and elusive free-floating worlds, and transits to discover tens of thousands of hot and warm planets, including Earth-sized and larger worlds orbiting their stars. Together, these observations will deliver the first comprehensive galactic census of exoplanets —spanning all major stellar populations and probing planets with radii or masses above ˜2× Earth' s at all separations, from hot Jupiters to icy wanderers beyond the snow line. I will highlight Roman' s revolutionary capabilities, preview its expected scientific yield, and describe the efforts of the Roman Galactic Exoplanet Survey Project Infrastructure Team (RGES-PIT), which is developing the framework, tools, and strategies to maximize the scientific return from the RGBTDS.

Primary author: GAUDI, Scott (The Ohio State University)

Presenter: GAUDI, Scott (The Ohio State University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **GAUDI, Scott** on **Wednesday, September 24, 2025**

Abstract ID : **58**

Formation of rocky planets, super-Earths and sub-Neptunes via pebble accretion

Content

Planets form from protoplanetary discs of gas and dust that orbit around young stars. I will present models of planet formation via pebble accretion that include the accretion of rock, water and gas. I will focus particularly on the formation of rocky planets, super-Earths and sub-Neptunes. I will demonstrate that the accretion of gas onto rocky cores that reach pebble isolation mass leads to a natural radius valley between super-Earths and sub-Neptunes. I will also discuss the formation of rocky planets and how such planets can accrete significant amounts of water from ice-covered pebbles.

Primary author: Prof. JOHANSEN, Anders (Globe Institute, University of Copenhagen)

Presenter: Prof. JOHANSEN, Anders (Globe Institute, University of Copenhagen)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **JOHANSEN, Anders** on **Wednesday, September 24, 2025**

Abstract ID : **59**

The high-resolution radial structure of debris disks in the ARKS ALMA program

Content

Debris disks in the outer planetary system are analogues of the Solar System’s Kuiper belt, consisting primarily of planetesimals and the dust and gas that they create via frequent collisions. These belts are both the successors to protoplanetary disks and a component of the mature planetary system with which they continue to interact, allowing for the formation and evolutionary process of the planetary system to imprint structures on the debris disk. The ALMA survey to Resolve exoKuiper belt Substructures (ARKS) was recently completed and is currently the only ALMA large program targeting debris disks. These observations have resolved two dozen debris disks at unprecedented resolution, allowing for substructures to be searched for and linked to the architecture and evolutionary history of planetary systems. This talk will focus on what we have learned from the radial structures seen in these observations, including comparisons between the structure of debris disks and protoplanetary disks to better understand their connection and any correlations between stellar and disk properties. The radial substructures in the sample will also be discussed in the context of dynamical interactions with planets and collisional evolution intrinsic to the disk, leading to constraints that we can place on the planetary systems across the sample.

Primary author: HAN, Yinuo (Caltech)

Co-author: ARKS COLLABORATION

Presenter: HAN, Yinuo (Caltech)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **HAN, Yinuo** on **Wednesday, September 24, 2025**

Abstract ID : **60**

A New Perspective: Interior Structures as Constraints for Terrestrial Planet Formation in the Solar System

Content

The planets of the Solar System serve as critical benchmarks for testing planet formation theories. However, multiple coexisting models attempt to explain the formation of the four terrestrial planets, making it difficult to distinguish between them. We propose that the abnormal interior structures of Mercury and Earth can impose critical constraints on their accretion histories and ultimately on Solar System formation processes. Specifically, we demonstrate that Mercury's elevated iron fraction may have originated from a series of close encounters with proto-Venus, which partially stripped its mantle. Furthermore, we reveal that the Moon-forming giant impact could produce either a stratified or homogeneous mantle in early Earth, depending on impact parameters intrinsically linked to the Solar System's dynamical history. These two critical events, therefore, provide invaluable insights for evaluating the validity of terrestrial planet formation models.

Primary author: Prof. DENG, Hongping (Chinese Academy of Science)

Presenter: Prof. DENG, Hongping (Chinese Academy of Science)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DENG, Hongping** on **Friday, September 26, 2025**

Abstract ID : **61**

Dust Polarization in Protoplanetary Disks: A Probe of Grain Growth and Kinematics

Content

Spatially resolved continuum polarization in protoplanetary disks at (sub)millimeter and centimeter wavelengths was first detected with the SMA, CARMA, and VLA, and has since been transformed by ALMA. Early interpretations attributed the observed polarization to direct thermal emission from magnetically aligned grains—a long-sought tracer of magnetic fields expected to play a central role in disk dynamics and evolution. However, alternative mechanisms, particularly scattering by large grains, have since been proposed. In this talk, I will first discuss scattering-induced polarization as a probe of grain growth in disks. I will then present evidence for the coexistence of polarized thermal emission from toroidally aligned prolate (TOP) grains alongside scattering by the same grains. Finally, I will outline a plausible physical mechanism for toroidal grain alignment, in which gas aerodynamic drag acting on grains in Keplerian motion naturally orients them —analogous to the way a badminton birdie aligns with its flight path through the air.

Primary author: Prof. LI, Zhi-Yun (University of Virginia Main Campus)

Presenter: Prof. LI, Zhi-Yun (University of Virginia Main Campus)

Contribution Type: Oral Talk

Comments:

Invited contribution

Status: ACCEPTED

Submitted by **LI, Zhi-Yun** on **Friday, September 26, 2025**

Abstract ID : **62**

Dust Clumping In Turbulent and Windy Protoplanetary Disks: Planetesimal Formation Under Realistic Gas Dynamics

Content

Dust concentration in protoplanetary disks (PPDs) represents the first step toward planetesimal formation, a critical yet poorly understood stage in the bottom-up picture of planet formation. The Streaming Instability (SI) is widely regarded as a robust mechanism for initiating planetesimal formation, but its efficiency is strongly shaped by the surrounding gas dynamics. Meanwhile, disk accretion in PPDs is primarily governed by magnetohydrodynamic (MHD) disk winds, while non-ideal MHD effects can enable additional hydrodynamic instabilities. To investigate dust–gas interactions under realistic disk conditions, we perform extensive two-dimensional global simulations that incorporate non-ideal MHD effects. Our results show that SI can persist in accretion flows driven by MHD disk winds and turbulence induced by the vertical shear instability. Furthermore, accretion flows mediated by MHD disk winds substantially reduce the gas surface density, thereby increasing the dust-to-gas surface density ratio. This enhanced ratio strengthens SI-induced dust clumping and promotes subsequent planetesimal formation.

Primary author: HUANG, Pinghui (Purple Mountain Observatory)

Co-author: Prof. BAI, Xue-Ning (Tsinghua University)

Presenter: HUANG, Pinghui (Purple Mountain Observatory)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HUANG, Pinghui** on **Saturday, September 27, 2025**

Abstract ID : **63**

Concurrent Accretion and Migration of Giant Planets in their Natal Disks

Content

Migration commonly occurs during the epoch of planet formation. For emerging gas giant planets, it proceeds concurrently with their growth through the accretion of gas from the protoplanetary disks. In classical theories of planetary migration, both Type I and Type II processes result in fast inward migration, which is hard to align with the architecture of the planetary systems. Recent works found that the accretion plays an important role in the dynamical evolution of the planet. In this work, we conducted systematic, high-resolution 3D hydrodynamic numerical simulations to investigate the migration of accreting planets. The effect of different planet masses, disk parameters are systematically explored. Our findings show that planetary accretion can weaken the inward tendency, or even reverse it to outward across a broad range of parameter space. We will also discuss the observational implications of our simulation results for planetary evolution.

Primary author: PAN, Jun-Peng (Shanghai Astronomical Observatory)

Co-authors: LI, Yaping; CHEN, Yi-Xian (Princeton); IDA, Shigeru (Science Tokyo); LIN, Douglas N. C. (UC Santa Cruz)

Presenter: PAN, Jun-Peng (Shanghai Astronomical Observatory)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **PAN, Jun-Peng** on **Sunday, September 28, 2025**

Abstract ID : **64**

Toward the boundary of giant planet and binary star formation

Content

With mass ratios bridging planetary systems and stellar binaries, giant planets around M dwarfs as well as brown dwarf systems are cases that serve as unique test cases for formation theories. In this talk, I will first present our statistical studies on the occurrence rate and metallicity dependence of M-dwarf giant planets, revealing that their formation history is likely similar to that of FGK counterparts. I will then compare the eccentricity distributions of long-period giant planets, brown dwarfs, and low-mass stars. It turns out that (1) brown dwarfs and giant planets may form via different pathways at wide orbits but undergo analogous migration processes, and (2) low-mass stars behave similarly to massive stellar binaries. Finally, I will discuss future prospects, with a focus on the potential of Gaia astrometry.

Primary authors: Prof. BURGASSER, Adam (UCSD); Dr CADIEUX, Charles (Université de Montréal); Dr COLLINS, Karen (CfA); Dr GAN, Tianjun (Westlake University); Prof. HUANG, Chelsea (University of Southern Queensland); Prof. IDA, Shigeru (Institute of Science Tokyo); Prof. MAO, Shude (Westlake University); Dr SHPORER, Avi (MIT); Prof. THEISSEN, Christopher (UCSD); Prof. WANG, Sharon (Tsinghua University); Prof. WANG, Songhu (Indiana University)

Presenter: Dr GAN, Tianjun (Westlake University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GAN, Tianjun** on **Monday, September 29, 2025**

Abstract ID : **65**

Protoplanetary disk substructures across different environments

Content

At the time of the 2017 Shanghai Exoplanets and Planet Formation conference, ALMA had only recently begun imaging protoplanetary disks at high angular resolution. These high-resolution observations revealed that many disks harbored diverse substructures such as rings, spirals, and asymmetries, which have been hypothesized to result from a number of processes, such as planet-disk interactions or gravitational instabilities. These early studies, however, focused primarily on massive, nearby, and relatively isolated disks. I will present recent ALMA observations exploring the extent to which substructure development is influenced by the disk environment. These include the detection of substructures in compact, externally irradiated disks in the Sigma Orionis cluster and spiral structures in disks thought to be undergoing late infall. These new observations highlight the richness and variety of disk substructures across different environmental contexts.

Primary author: HUANG, Jane (Columbia University)

Presenter: HUANG, Jane (Columbia University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **HUANG, Jane** on **Monday, September 29, 2025**

Abstract ID : **66**

Evolution of dust in a protoplanetary disc driven by stellar flybys: implications for the streaming instability

Content

Stellar flybys are a common dynamical process in young stellar clusters and can significantly reshape protoplanetary discs. However, their impact on dust dynamics remains poorly understood, particularly in the weakly coupled regime (St≫1). We present three-dimensional hydrodynamical simulations of parabolic stellar flybys—both coplanar and inclined—interacting with a gaseous and dusty protoplanetary disc. Gas and dust spirals differ in morphology and position, with their offset enhancing dust accumulation measured through the linear growth of the streaming instability. Flybys with mass equal to the central star (1 $M_{\odot}$) truncate the disc, producing tightly wound, ring-like spirals that promote dust coagulation. Moreover, a sub-stellar-mass flyby (0.1 $M_{\odot}$) suppresses dust concentration below the critical clumping threshold after periastron and maintains this suppression over time, indicating long-lasting inhibition of dust clumping. An equal-mass flyby raises growth rates well above the threshold, suggesting that such encounters may foster conditions favourable for dust clumping. Flyby-induced spirals play a central role in shaping dust evolution, leading to distinct spatial and temporal behaviours in weakly coupled discs. These findings offer new perspectives on the morphological imprint of dynamical encounters in dusty disc environments.

Primary author: SU, Wei-Shan (Institute of Astronomy and Astrophysics, Academia Sinica,)

Co-author: SMALLWOOD, Jeremy (University of Oklahoma)

Presenter: SU, Wei-Shan (Institute of Astronomy and Astrophysics, Academia Sinica,)

Contribution Type: Poster

Comments:

If the oral presentation is not accepted, I would like to be considered for a poster presentation.

Status: ACCEPTED

Submitted by **SU, Wei-Shan** on **Monday, September 29, 2025**

Abstract ID : **67**

Environmental Interactions of Protoplanetary Disks: Early-Stage Planetesimal Formation and Late Infall

Content

Planets form in protoplanetary disks (PPDs) through a multi-scale process where micron-sized dust grows to pebbles and forms planetesimals. These planetesimals act as seeds to subsequent core and envelope accretion, eventually resulting in full-grown planets. From a theoretical standpoint, modeling of these processes is often performed under the assumption of an isolated disk. However, observational constraints on the dust-mass budget of PPDs, as well as the detection of substructures already in Class I disks, indicate that planet formation might start early during the Class 0/I stage. Here, the PPD is still embedded in its natal environment and subject to significant environmental interactions. Based on results from 3D non-ideal MHD core-collapse simulations, I investigated whether planetesimals can already form at this stage, where turbulence is high but more material is available. Depending on the physical conditions, I find that ˜100 earth masses of planetesimals may form, which have a high water content.

But environmental interactions are not limited to the early disk stages: Observations indicate ubiquitous inflow of material in the form of streamers onto PPDs in the Taurus and other star forming regions. Such interactions have considerable implications for planet formation during the Class II stage of PPDs, because they supply fresh material and impact disk dynamics. First, I investigated how such "late infall" could be the reason for the planet-disk misalignment in IRAS 04125+2902 using 3D hydrodynamical simulations, suggesting that the present-day disk may be the second generation. Furthermore, I considered which observational streamer signatures can arise under which environmental conditions, showing that turbulent Bondi-Hoyle-Lyttleton accretion processes can cause a variety of morphologies. Finally, these streamers can cause observable spiral structures, warps and accretion bursts of new material, highlighting the importance of including the effects of late infall in planet formation models.

Primary author: HÜHN, León-Alexander (Heidelberg University)

Presenter: HÜHN, León-Alexander (Heidelberg University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HÜHN, León-Alexander** on **Monday, September 29, 2025**

Abstract ID : **68**

Shadow Variability in Disks: A Multi-Epoch Sample Study with VLT/SPHERE Scattered-Light Imaging

Content

We present a study of shadow variability in protoplanetary disks using multi-epoch near-infrared imaging using VLT/SPHERE. Our sample consists of 35 disks observed over the past decade, with 2–6 epochs per target. We find that shadows are common and show variability on timescales ranging from days to years. We characterize the morphology, evolution, and statistics of these shadows, and investigate their connections to stellar and disk properties.

Shadow variability provides a unique probe of physical processes in the otherwise unresolved inner disk on AU scales. These processes include inner-disk precession driven by magnetic fields, companions, or infall, as well as localized puffing-up of the inner rim due to temperature variations. Our results reveal that the inner disk region hosts diverse dynamical processes that can influence both planet formation and the evolution of the outer disk. I will also discuss the broader implications of this study for the formation of terrestrial planets in inner disks.

Primary author: DONG, Ruobing (Peking University)

Presenter: DONG, Ruobing (Peking University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DONG, Ruobing** on **Wednesday, October 1, 2025**

Abstract ID : **69**

Migration Traps in Windy Disks: A New Key to Exoplanet Demographics

Content

The orbital migration of young planets is one of the key processes shaping the architecture of planetary systems. In the classical picture, disk-driven migration is often rapid and directed inward, in apparent tension with the observed diversity of exoplanet orbital distributions. In this work, we demonstrate that magnetically driven disk winds fundamentally alter this paradigm. Using high-resolution hydrodynamic simulations with a wind-driven accretion prescription, we uncover a characteristic two-turn migration behaviour: low-mass planets experience an initial transition from inward to outward migration as wind transport reshapes the horseshoe region, followed by a second reversal back to inward migration when the wind becomes sufficiently strong to linearize the corotation torque. This mechanism defines a finite zone in protoplanetary disks where planets can be stalled or migrate outward.

The existence of such “migration traps” provides a natural explanation for the retention and long-term survival of planets at tens of astronomical units, consistent with ALMA’s growing census of wide-orbit substructures. Moreover, the predicted dependence on disk accretion rate and magnetic field strength directly links planet migration to stellar environment and disk evolution, offering a bridge between planet formation theory and exoplanet population statistics. These results imply that wind-regulated migration can be a decisive factor in setting the demographics of planetary systems, shaping where giant planets grow, how resonant chains form and break, and ultimately why planetary architectures around other stars display such remarkable diversity.

Primary author: WU, Yinhao (East Asian Core Observatories Association)

Co-author: Mr CHEN, Yi-Xian (Princeton University)

Presenter: WU, Yinhao (East Asian Core Observatories Association)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WU, Yinhao** on **Wednesday, October 1, 2025**

Abstract ID : **70**

Encounters between Circumstellar Disks: Formation of Free-floating Planetary Mass Objects and Brown-dwarf Binaries

Content

The origin of planetary mass objects (PMOs) wandering in young star clusters remains enigmatic, especially when they come in pairs. They could represent the lowest-mass object formed via molecular cloud collapse or high-mass planets ejected from their host stars. However, neither theory fully accounts for their abundance and multiplicity. Here, we show via hydrodynamic simulations that free-floating PMOs have a unique formation channel via the fragmentation of tidal bridges between encountering circumstellar disks. This process can be highly productive in dense clusters like Trapezium forming metal-poor PMOs with disks. Free-floating multiple PMOs also naturally emerge when neighboring PMOs are caught by their mutual gravity. PMOs may thus form a distinct population that is fundamentally different from stars and planets. Moreover, we find that close brown-dwarf binaries bound to host stars can form during encounters.

Primary author: FU, Zhihao (Max Planck Institute for Astronomy)

Presenter: FU, Zhihao (Max Planck Institute for Astronomy)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **FU, Zhihao** on **Wednesday, October 1, 2025**

Abstract ID : **71**

Efficient tidal dissipation via stellar magnetic fields

Content

Tidal dissipation rates have been directly measured in several exoplanetary systems, providing important constraints on modeling of planetary and stellar physics. One such intriguing system is WASP-12, in which the orbit of hot Jupiter WASP-12b is observed to have a very fast tidal inspiral time around a main-sequence F star. Because the star has a convective core, nonlinear wave breaking is not thought to be an efficient tidal dissipation mechanism. In this talk, we describe a new tidal dissipation mechanism: conversion of internal gravity waves into magnetic waves, which subsequently damp via Ohmic diffusion. We predict this to be an efficient source of tidal dissipation for objects orbiting stars with convective cores near the end of the main sequence. This is because these stars develop strong chemical composition gradients near their radiative-convective interface which enable the internal gravity waves to convert to magnetic waves. This mechanism could play an important role in understanding the orbital evolution of hot Jupiters orbiting early-time stars.

Primary authors: Dr DUGUID, Craig (Durham); LECOANET, Daniel (Northwestern University)

Co-authors: Prof. BARKER, Adrian (University of Leeds); Dr DE VRIES, Nils (University of Exeter)

Presenter: LECOANET, Daniel (Northwestern University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LECOANET, Daniel** on **Wednesday, October 1, 2025**

Abstract ID : **72**

Phase-resolved atmospheric dynamics and first detection of hydrogen emission in an ultra-hot Jupiter

Content

Ultra-hot Jupiters with extreme stellar irradiation and day-to-night temperature contrasts provide unique laboratories for studying global circulation, climates, and atmospheric escape in exoplanets. Using high-resolution spectroscopy, we can directly probe the atmospheric dynamics by measuring the Doppler shift of planetary signals due to rotation and winds. Here, we carried out a pilot study on high-resolution phase curve of the hottest exoplanet, KELT-9 b, obtained with the optical spectrometer Keck Planet Finder (KPF). We resolved the planetary emission in pre-quadrature phases (phi=0.1-0.25) under high spectral resolution for the first time. With the phase-resolved emission profile, we retrieve the thermal structure and wind pattern in this ultra-hot planet, which unambiguously displays supersonic day-to-night winds above 10 km/s. Further comparison to 3D circulation models reveals a weak atmospheric drag and efficient heat recirculation, as also supported by photometric phase curves from space. Additionally, our observations led to the first detection of hydrogen emission (H-alpha) in hot Jupiters. The H-alpha emission from KELT-9 b shows an intriguing double-peaked line shape, providing unique constraints on the thermal structure and mass loss process in its upper atmosphere. This opens a new window to atmospheric dynamics and escape of close-in exoplanets.

Primary author: ZHANG, Yapeng (California Institute of Technology)

Co-authors: WARDENIER, Joost (Universite de Montreal); KOMACEK, Thaddeus (University of Oxford); HOUSEHOLDER, Aaron (Massachusetts Institute of Technology); HUANG, Chenliang (Shanghai Astronomical Observatory); KESSELI, Aurora (IPAC, Caltech); DAI, Fei (University of Hawaii); HOWARD, Andrew (California Institute of Technology); INGLIS, Julie (California Institute of Technology); KNUTSON, Heather (California Institute of Technology); MAWET, Dimitri (California Institute of Technology); PINO, Lorenzo (INAF); WALLACK, Nicole (Carnegie Institution for Science); XUAN, Jerry (California Institute of Technology)

Presenter: ZHANG, Yapeng (California Institute of Technology)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHANG, Yapeng** on **Wednesday, October 1, 2025**

Abstract ID : **73**

A VLT/MUSE Survey for Accreting Planets in 75 Protoplanetary Disks

Content

Using the Multi Unit Spectroscopic Explorer (MUSE) instrument on the VLT, Haffert et al. detected accretion signals in Hα emission from two protoplanets in the PDS 70 protoplanetary disk. Those planets are still forming in disks, and they hold the key to our understanding of planet formation. Inspired by this, a total of 21 MUSE programs to search for accreting protoplanets have been carried out in the past 7 years, targeting 75 protoplanetary disk systems.

We process this large sample to search for additional protoplanet candidates in disks. Specifically, more than 30 objects in this sample (e.g., HD 163296, HD 169142, IM Lup, GW Lup, J1604, and TW Hya) have been proposed to host giant planets at specific locations, inferred from NIR and mm disk morphology and gas kinematics that are well explained by planet-disk interaction models. We search for Hα counterparts at the corresponding planet locations, and by doing so, provide updates on the status of these candidates. In addition, using state-of-the-art high-contrast imaging technique, we estimate the flux detection limit for each target, and compare these limits to the fluxes of PDS 70 b and c, to assess whether PDS 70 b- and c-like planets are common. Our research traces actively accreting and still-forming planets, which helps us to better understand planet formation.

Primary author: LI, Zhuhai (Department of Astronomy, School of Physics, Peking University, Beijing 100871, China)

Presenter: LI, Zhuhai (Department of Astronomy, School of Physics, Peking University, Beijing 100871, China)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LI, Zhuhai** on **Thursday, October 2, 2025**

Abstract ID : **74**

Chemical Imprints of Planet Formation in the Atmospheres of Solar Twins/Analogs

Content

The Sun's chemical composition is anomalously depleted in refractory elements compared to solar twins, a pattern potentially tied to the formation of its planetary system. To investigate this link, we conducted a high-precision, line-by-line differential analysis of 23 elements in 100 solar-type, planet-hosting stars using Magellan/Keck spectra. We find that the Sun is consistently refractory-poor, irrespective of stellar planet population. All stars hosting giant planets show a negative correlation between abundance and condensation temperature, yet the Sun remains the most depleted. Interestingly, stars with only small planets show a tentative trend toward even greater refractory element depletion, closer to that of the Sun. Future work will need to figure out whether it's the formation of gas giants, small rocky planets, or none that caused the Sun to be missing these materials, and calculate exactly how much of an effect it had.

Primary author: Dr SUN, Qinghui

Presenter: Dr SUN, Qinghui

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **SUN, Qinghui** on **Thursday, October 2, 2025**

Abstract ID : **75**

An efficient spectral Poisson solver for the NIRVANA-III code: the shearing-box case with vertical vacuum boundary conditions

Content

Self-gravity (SG) is crucial in various astrophysical processes, including molecular cloud collapse, FU Orionis outbursts, protoplanetary disc accretion (with potential fragmentation), and gravito-turbulent dynamos (He & Ricotti 2023; Vorobyov & Basu 2006; Baehr & Zhu 2021). Numerical computation of SG requires solving the Poisson equation. On uniform Cartesian grids, iterative multigrid methods are standard, as demonstrated by Ziegler (2005) in the finite-volume MHD code NIRVANA-III. Nonetheless, this requires precise evaluation of the SG potential at domain boundaries, often necessitating a multipole expansion. A more suitable method is the screening, or James, method (James 1977; Gressel & Ziegler 2024), which enables computing the exact potential at the domain boundaries.

Spectral methods offer an alternative approach by solving the Poisson equation in Fourier space with high accuracy and efficiency −with an optimal numerical complexity of $N \log(N)$. However, they impose periodicity in all three directions, creating unrealistic domain repetitions and requiring the source term's volume integral to vanish (Binney & Tremaine 2008; Mandal et al. 2023). It is therefore desirable to develop a method that not only ensures spectral accuracy and efficiency, but also captures "free-space" boundary conditions. The Vico-Greengard-Ferrando (VGF) method (Vico et al. 2016), widely used in plasma physics and condensed matter but overlooked in astrophysics, achieves this by modifying the Green' s function to account for the unbound potential outside the domain. Most importantly, under the VGF formalism the Green's function in Fourier space has a an analytical form and is regularized at the singularity, making it suitable for FFT methods. Yet, this method has not been adapted to the shearing box approximation, where two dimensions are periodic and one enforces free-space boundaries.

In this poster, we present a new spectral method for the Poisson equation intended for the Cartesian geometry (Rendon Restrepo & Gressel *in prep.*). We demonstrate its convergence and performance in a reference implementation using pencil decomposition (via the P3DFFT library; Pekurovsky 2012) within the finite-volume code NIRVANA-III. Finally, we show how this solver enables studies of gravito-turbulent dynamos.

Primary author: RENDON RESTREPO, Steven (Leibniz-Institut für Astrophysik Potsdam (AIP))

Co-author: Dr GRESSEL, Oliver (Leibniz-Institut für Astrophysik Potsdam (AIP))

Presenter: RENDON RESTREPO, Steven (Leibniz-Institut für Astrophysik Potsdam (AIP))

Contribution Type: Poster

Status: ACCEPTED

Submitted by **RENDON RESTREPO, Steven** on **Thursday, October 2, 2025**

Abstract ID : **76**

Gravito-turbulent disc stratification and the impact of the exact 2D self-gravity prescription on gravitational instability

Content

In Class 0 and I as well as in the outskirts of Class II circumstellar discs, the self-gravity of gas is expected to be significant, which certainly impacts the disc vertical hydrostatic equilibrium. Notably, the contribution of dust, whose measured mass is still uncertain (Ansdell et al. 2016; Manara et al. 2016), could also play a role in this equilibrium.
In the first part of my talk, I aim to formulate and approximately solve the equations governing the hydrostatic equilibrium of a self-gravitating disc composed of gas and dust. Particularly, I provide a fully consistent treatment of turbulence and gravity that almost symmetrically affects gas and dust. From an observational perspective, I investigate whether disc masses can be indirectly measured through gas layering and dust settling, and how our results may influence dynamical signatures Rendon Restrepo et al. 2025a.

The Gravitational Instability (GI) is a dominant theory that explains angular momentum transport in young protoplanetary disks. Additionally, it is a key theory in planet formation, describing how a disk can fragment into clumps for efficient cooling (Kratter & Lodato 2016; Lin & Kratter 2016). Most simulations characterizing GI have relied on a thin-disc (2D) approximation, employing either a zero or a finite smoothing length prescription for the gravitational potential. However, a finite smoothing length suppresses the Newtonian nature of gravity Rendon Restrepo & Barge 2023, potentially inhibiting gravitational collapse, and does not respect Newton's third law (Baruteau & Masset 2008). Conversely, a vanishing smoothing length, or solving a 2D Poisson equation, artificially amplifies gravity.

In the second part of my talk, I will introduce an analytically derived, exact 2D self-gravity prescription designed for use in 2D simulations. This prescription eliminates the need for smoothing length approximations Rendon Restrepo et al. 2025b. Specifically, I will demonstrate how it resolves the inherent issues of a Plummer potential, particularly the short-range suppression of Newtonian gravity. I will conclude my talk by demonstrating the implications of this work for the GI paradigm of planet formation, supported by 2D global simulations with the FARGO-CPT code (Rometsch et al. 2024, Rendon Restrepo *in prep.*). In particular, I will show how this approach may resolve the long-debated "convergence issue" in GI simulations with 2D grid-based codes.

Primary author: RENDON RESTREPO, Steven (Leibniz-Institut für Astrophysik Potsdam (AIP))

Co-authors: Dr GRESSEL, Oliver (Leibniz-Institut für Astrophysik Potsdam (AIP)); Dr ZIEGLER, Udo (Leibniz-Institut für Astrophysik Potsdam (AIP))

Presenter: RENDON RESTREPO, Steven (Leibniz-Institut für Astrophysik Potsdam (AIP))

Contribution Type: Poster

Status: ACCEPTED

Submitted by **RENDON RESTREPO, Steven** on **Thursday, October 2, 2025**

Abstract ID : **77**

Extending dynamical mass measurements: GI as the origin of dust spirals?

Content

In recent years, the outstanding capabilities of ALMA paved the way to a detailed analysis of the gas kinematical pattern in protoplanetary disks, leading to new discoveries about disk structure, planet-disk interaction and planet formation. Measuring disk masses is a crucial step to understand how much material is available for planet formation and to help discriminate different evolutionary scenarios. Yet, traditional methods rely on many uncertain assumptions on dust or line properties, and often fail in providing reliable measurements, making the determination of disk masses a very challenging task. However, gas kinematics can be efficiently leveraged to measure disk masses: by disentangling the imprint of the disk self-gravity onto the gas velocity field, disks can be "dynamically" weighed without any dependency on the chosen tracer or dust properties. The gas rotation curve is the observable quantity to fit with an accurate model that takes into account all the contributions to the gas rotation velocity: stellar gravity, disk self-gravity, pressure gradients and vertical thermal stratification. For our purpose, knowing the 2D (R,z) thermal structure is fundamental: the vertical thermal stratification leaves clear imprints in the rotation curves, with statistically significant differences between lines originating in the upper layers and the ones near the disk midplane. As different emission lines probe physical properties at different heights across the disk vertical extent, we can constrain the 2D thermal structure by leveraging the disk molecular stratification. We discuss how, by combining the disk thermal structure, molecular stratification and gas kinematics, the dynamical method bears the potential to a further step into the characterization of planet-forming disks masses.

Primary author: PEZZOTTA, Viviana (University of Milan)

Co-authors: FACCHINI, Stefano; Prof. LODATO, Giuseppe (University of Milan)

Presenter: PEZZOTTA, Viviana (University of Milan)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **PEZZOTTA, Viviana** on **Thursday, October 2, 2025**

Abstract ID : **78**

Vision Transformers as a Robust Alternative for Identifying Planetary Candidates in Solar EPRV Data

Content

Extreme precision radial velocity (EPRV) surveys usually require extensive observational baselines to confirm planetary candidates, making them resource-intensive. Traditionally, periodograms are used to identify promising signals before further observational investment, but their effectiveness is often limited for low-amplitude signals due to stellar activity. We introduce a machine-learning (ML) framework that extracts planetary signals from spectroscopic time-series data. Injection-recovery tests on randomly selected 100-observation subsets from NEID solar data (2020–2022 period) show that for low-amplitude systems (<1 m/s), our model improves planetary candidate identification by a factor of two compared to the traditional Lomb-Scargle periodogram. This highlights the potential of ML as a robust alternative for identifying planetary candidate signals in EPRV surveys.

Our ML model is based on Vision Transformer (ViT) architecture that intakes a reduced representation of the solar spectrum observations and predicts the period and semi-amplitude of a planetary signal candidate. In this talk, I will present our model framework, data preprocessing, and the final results in comparison to the traditional Lomb-Scargle periodogram.

Primary author: GAVANKAR, Anoop (Tata Institute of Fundamental Research, Mumbai)

Co-authors: Dr HANASOGE, Shravan (Tata Institute of Fundamental Research, Mumbai); Mr MITTAL, Tanish (Birla Institute of Technology, Pilani); NINAN, Joe (Tata Institute of Fundamental Research, Mumbai)

Presenter: GAVANKAR, Anoop (Tata Institute of Fundamental Research, Mumbai)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GAVANKAR, Anoop** on **Thursday, October 2, 2025**

Abstract ID : **79**

A retrograde planet in a tight binary star system with a white dwarf

Content

Close-in companion stars are expected to adversely influence the formation and orbital stability of circumstellar (S-type) planets by tidally truncating protoplanetary discs, impeding mutual accretion of planetesimals, and narrowing dynamically stable regions. This explains the observed dearth of S-type planets in tight binary star systems. ν Octantis, whose stellar components have a mean separation of 2.6 AU, has long been suspected of hosting a circum-primary planet in a retrograde and exceptionally wide orbit that resides midway between the stars. Strong theoretical grounds against its formation and the absence of observational precedents, however, have challenged the reality of the planet. Our study presents new radial velocity measurements that consolidate the planet hypothesis. Stable fits to all radial velocity data require the planetary orbit to be retrograde and practically coplanar. We also report the critical discovery from adaptive optics imaging that the companion star is a white dwarf. Our exploration of credible primordial binary orbital settings shows that the minimum separation between the stars was 1.3 AU initially, which overlaps the current planetary orbit and makes any scenarios in which the circum-primary planetary orbit formed coevally with the young stars hardly conceivable. The retrograde planet must have originated from a circumbinary orbit or a second-generation protoplanetary disc, showing the role of binary stellar evolution in the formation and evolution of planetary systems.

Primary author: Mr CHENG, Ho Wan (The University of Hong Kong, Hong Kong)

Co-authors: Dr TRIFONOV, Trifon (Zentrum für Astronomie der Universität Heidelberg, Germany & Sofia University, Bulgaria); Prof. LEE, Man Hoi (The University of Hong Kong, Hong Kong); Dr CANTALLOUBE, Faustine (Université Grenoble Alpes, France); Dr REFFERT, Sabine (Zentrum für Astronomie der Universität Heidelberg, Germany); Dr RAMM, David (University of Canterbury, New Zealand); Prof. QUIRRENBACH, Andreas (Zentrum für Astronomie der Universität Heidelberg, Germany)

Presenter: Mr CHENG, Ho Wan (The University of Hong Kong, Hong Kong)

Contribution Type: Poster

Comments:

This work was recently published in Nature. https://doi.org/10.1038/s41586-025-09006-x

Status: ACCEPTED

Submitted by **CHENG, Ho Wan** on **Friday, October 3, 2025**

Abstract ID : **80**

Laplace surface of eccentric orbits around Kerr black hole

Content

We study the Laplace surface of eccentric orbits around a Kerr black hole with a companion star. The frame-dragging (Lense–Thirring effect) balances the stellar tidal effect. By applying secular theory we find some interesting results: (i) equilibrium solutions exist only in a narrow range of orbital inclinations of test particle, belonging to two distinct branches; (ii) a new scaling law of r_M emerges in addition to the classical Laplace radius r_L; (iii) stability is more common when stellar obliquity is around 90 degrees.

Primary authors: 全, 浩男 (北京师范大学); Prof. 魏, 星 (北京师范大学)

Presenter: 全, 浩男 (北京师范大学)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **全, 浩男** on **Friday, October 3, 2025**

Abstract ID : **81**

The Fate of Hydrogen and Helium: from rocky planetesimals to Earth- and Neptune-like worlds

Content

Hydrogen (H), helium (He), silicates, and iron are the fundamental building blocks of planets and their atmospheres, yet the chemical interactions between them remain poorly understood. The fate of H and He within planetary interiors may dictate the volatile inventories, atmospheric redox states, and the interpretation of key observational diagnostics.

Here, we systematically investigate the partitioning of hydrogen and helium between a molten silicate mantle and liquid iron core, using first-principles calculations based on Density Functional Theory (DFT) across conditions relevant to Earth- to Neptune-like planets. We then develop a coupled global chemical equilibrium-interior structure model to assess the implications of these findings on the distribution of volatiles across the planet. Our calculations reveal a striking divergence: hydrogen becomes strongly siderophilic, preferentially sequestering into iron-rich cores, whereas helium remains largely excluded from the metal and instead partitions into silicates and the overlying atmosphere.

These results provide new insights into the chemical architectures of rocky planets and sub-Neptunes. For terrestrial planets, H-rich cores and He-rich mantles offer a natural mechanism for generating reducing secondary atmospheres, with direct consequences for prebiotic chemistry. For sub-Neptunes, the resulting H/He ratio in the envelope is predicted to scale sensitively with planet mass, leading to less inflated cores, smaller H_2/He reservoirs, and atmospheres enriched in CHNOPS-bearing molecules compared to past models. Crucially, we identify the He 1083 nm absorption line as a sensitive, population-level observational probe, offering a direct spectroscopic signature of the efficiency of atmosphere-interior volatile exchange.

Together, these findings underscore the profound importance of interior-atmosphere interaction on the composition and evolution of planets and their atmospheres, and provide testable predictions for ongoing and future observations with JWST and the upcoming Habitable Worlds Observatory.

Primary author: GUPTA, Akash (Princeton University)

Co-authors: Dr LUO, Haiyang (Princeton University); Prof. DENG, Jie (Princeton University); Prof. BURROWS, Adam (Princeton University)

Presenter: GUPTA, Akash (Princeton University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **GUPTA, Akash** on **Saturday, October 4, 2025**

Abstract ID : **83**

Shadow Induced Warps in Protoplanetary Disks

Content

Shadows are commonly observed in protoplanetary disks in near-infrared and (sub)millimeter images, often cast by misaligned inner disks or other obscuring material. While recent studies show that shadows can alter disk dynamics, only the case symmetric across the midplane (e.g., from a polar-aligned inner disk) has been studied. Here we study shadows cast by an inner disk with a 30° mutual inclination using 3D radiation-hydrodynamical simulations. The 30° inclined shadow leads to a much stronger accretion compared with the polar case, reaching $\alpha \sim 1$, because the disk is squeezed twice in one azimuth, leading to shocks and strong radial flows near the midplane. The outer disk develops a warp: the inner disk region tilts toward the shadow, while the outer, exponentially tapered disk tilts and twists in a different direction, inclined $\sim 32°$ relative to the inner region. Locally isothermal simulations with a prescribed temperature structure reproduce the effect, confirming that it is thermally driven. Fourier-Hermite analysis shows that it is the m=1, n=1 temperature perturbation that drives the warp by launching bending waves, with the tilting response of the disk approximately proportional to the modal amplitude. This mode always exists unless the shadow is coplanar or polar. The m=1,n=1 mode peaks at $\sim$15° mutual inclination, and contributes substantially across 3° to 30°. We discuss testable predictions for current and future ALMA and NIR observations.

Primary author: ZHANG, Shangjia (Columbia University)

Co-authors: Dr FAIRBAIRN, Callum (Insitute for Advanced Study); ZHU, Zhaohuan (University of Nevada Las Vegas)

Presenter: ZHANG, Shangjia (Columbia University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHANG, Shangjia** on **Saturday, October 4, 2025**

Abstract ID : **84**

JWST observations of the cornerstone temperate sub-Neptune K2-18 b

Content

Earth-temperature, sub-Neptune-sized exoplanets are now within reach for detailed atmospheric characterization with JWST, with K2-18 b being one of the first to receive repeated observations. Initial observations revealed an H2-dominated atmosphere rich in CH4 with moderate evidence for CO2. We have conducted additional JWST observations to capture new transmission spectra of the planet using NIRSpec's G235H and G395H grisms. The resulting high-precision transmission spectrum robustly detects both CH4 and CO2, precisely measuring their abundances and firmly establishing the planet's water-rich nature. The planet could have either a thick envelope with >10% H2O by volume or a thin atmosphere above a liquid-water ocean. The spectrum reveals no detectable H2O, NH3, or CO. The absence of atmospheric water vapor suggests an efficient cold trap, while the nondetections of NH3 and CO support the scenario of a small H2-rich atmosphere overlying a liquid reservoir. However, alternative models that include these gases can also reproduce the spectrum within uncertainties and offsets, highlighting the need for deeper observations. This unprecedented dataset offers critical insights into K2-18 b's internal structure and informs an updated roadmap for characterizing temperate sub-Neptunes, advancing our understanding of their atmospheric properties and potential habitability.

Primary author: HU, Renyu (The Pennsylvania State University)

Presenter: HU, Renyu (The Pennsylvania State University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **HU, Renyu** on **Sunday, October 5, 2025**

Abstract ID : **85**

Are Alkali Metals depleted in Jupiter?

Content

As an archetypal planet, Jupiter is critical to understanding the formation of the solar system and exoplanetary systems. Jupiter's bulk elemental abundances constrain its interior structure and formation history. Recent Juno mission observations revealed significant alkali metal depletion (0.001×–0.1× solar) in Jupiter, contrasting sharply with supersolar carbon, nitrogen, and noble gases measured by Galileo. This depletion cannot be explained solely by shallow NaCl and KCl condensation. I will present an alternative explanation assuming solar abundance alkali metals, including deep-atmosphere mineral cloud formation and their interactions with alkali metals and electrons. I will discuss methods to differentiate this interpretation from bulk depletion scenarios and highlight key chemical processes requiring laboratory investigation.

Primary author: ZHANG, Xi (University of California Santa Cruz)

Presenter: ZHANG, Xi (University of California Santa Cruz)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHANG, Xi** on **Sunday, October 5, 2025**

Abstract ID : **86**

PAST. VIII: Kinematic Characterization and Identification of Radial Velocity Variables for the LAMOST-Gaia-TESS Stars

Content

The Transiting Exoplanet Survey Satellite (TESS) has discovered over 6700 nearby exoplanets candidates using the transit method through its all-sky survey. Characterizing the kinematic properties and identifying variable stars for the TESS stellar sample is crucial for revealing the correlations between the properties of planetary systems and the properties of stars (e.g., Galactic components, age, chemistry, dynamics, radiation). Based on data from TESS, Gaia DR3, and LAMOST DR10, we present a catalog of kinematic properties (i.e., Galactic positions, velocities, orbits, Galactic components, and kinematic age) as well as other basic stellar parameters for $\sim 660,000$ TESS stars. Our analysis of the kinematic catalog reveals that stars belonging to different Galactic components (i.e., thin disk, thick disk, halo and 12 streams in the disk) display distinctive kinematic and chemical properties. We also find that hot planets with period less then 10 days in the TESS sample favor thin disk stars compared to thick disk stars, consistent with previous studies. Furthermore, using the LAMOST multiple-epoch observations, we identify 41,445 stars exhibiting significant radial velocity variations, among which 7,846 are classified as binary stars. By fitting the radial velocity curves, we further derive orbital parameters (e.g., mass ratio, orbital period and eccentricity) for 297 binaries. The observed decreasing orbital eccentricity with shorting period reveals evidence of tidal circularization. The catalogs constructed in this work have laid a solid foundation for future work on the formation and evolution of stellar and planetary systems in different Galactic environments.

Primary author: WU, Di (Nanjing University)

Co-authors: CHEN, Dichang (Sun Yat-sen University); XIE, Jiwei (Nanjing University); ZHOU, Jilin (Nanjing University); WANG, Haifeng (Universita degli Studi di Padova); ZONG, Weikai (Beijing Normal University); DONG, Subo; XIANG, Maosheng (National Astronomical Observatories, Chinese Academy of Science); LUO, Ali (National Astronomical Observatories, Chinese Academy of Science)

Presenter: WU, Di (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WU, Di** on **Sunday, October 5, 2025**

Abstract ID : **87**

Probing Magnetic Fields in Protoplanetary Disks with Near-IR Polarimetry

Content

Magnetic fields are crucial drivers of protoplanetary disk evolution, but direct detection within disks remains challenging. I will present a method to probe the magnetic field in disk atmospheres using near-IR polarimetry. Unlike scattering by spherical grains, magnetically aligned non-spherical grains produce a unique polarization signature, notably a non-zero azimuthal Stokes parameter Uϕ. A key insight is that the symmetry of the Uϕ map can distinguish magnetic fields from other effects like multiple scattering; magnetic alignment produces asymmetric patterns, while multiple scattering yields strictly anti-symmetric ones. I will show how this principle can being applied to interpret observations from instruments like VLT/SPHERE, highlighting several promising systems that show polarization signatures from potentially magnetic fields. Furthermore, I will introduce our ongoing development of a novel Monte Carlo radiative transfer code, which uses neural networks to efficiently simulate scattering by aligned grains. This powerful tool will ultimately enable self-consistent modeling of the interplay between magnetic fields and multiple scattering from near-IR to ALMA wavelengths, providing a new window into the physics of planet formation.

Primary authors: Prof. LI, Zhi-Yun (University of Virginia); YANG, Haifeng (Zhejiang University); Ms ZHANG, Zhiqi (Zhejiang University)

Presenter: YANG, Haifeng (Zhejiang University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YANG, Haifeng** on **Sunday, October 5, 2025**

Abstract ID : **88**

Population Level Differences Between Wide-Separation Giant Planets and Brown Dwarfs

Content

It has been long theorized that giant planets are distinct from brown dwarfs, with the former generally thought to form bottom-up through core accretion while latter thought to form top-down through gravitational instability. A comparative study of these two types of objects gives us an opportunity to understand how these processes differ and provide new insights into the mechanisms at play. I will present on two population studies of 30-50 directly imaged companions that orbit stars beyond 3 AU. In the first study, we used new high-resolution spectrographs to measure their spin speeds and show for the first time that giant planets spin faster than brown dwarfs. This difference in spin speeds likely points to different degrees of angular momentum regulation early on while these objects are still accreting material. In the second study, we use the 10-100x more precise astrometry enabled by long-baseline optical interferometry to greatly refine the orbital eccentricities for this same population of objects. We confirm previous studies that giant planets have lower eccentricities than brown dwarf companions. Furthermore, for the first time, we robustly measure the shapes of the eccentricity distributions for substellar objects beyond 3 au. We find that wide-separation giant planets have an eccentricity distribution consistent with that of close-in giant planets < 1 au. On the other hand, we find that brown dwarf companions have a broad eccentricity distribution similar to binary stars, but with a possible peak at smaller eccentricities than stellar binaries. I will discuss the implications of these results on our understanding of giant planet and brown dwarf formation.

Primary author: WANG, Jason (Northwestern University)

Co-authors: Dr HSU, Dino (Northwestern University); Mr ROBERTS, Jonathan (Northwestern University); TEAM, ExoGRAVITY; TEAM, KPIC

Presenter: WANG, Jason (Northwestern University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WANG, Jason** on **Sunday, October 5, 2025**

Abstract ID : **89**

3I/ATLAS: The Third Interstellar Interloper

Content

In recent years, we have discovered the first three interstellar objects that originated from outside of the solar system. In this talk, I will review what we have learned from the known interstellar objects to-date, highlighting key physical and orbital attributes that are difficult to reconcile with previous models of planetesimal behavior. I will review the recent discovery and characterization of the third interstellar object, 3I/ATLAS, and discuss its properties with respect to the interstellar object population. I will emphasize the implications of interstellar object observations for exoplanetary science. The Rubin Observatory Legacy Survey of Space and Time (LSST) is poised to further transform our understanding of interstellar objects. I will end this talk by discussing the current limitations of ground-based discoveries, the feasibility of future discoveries, and the possibility of a future interception mission.

Primary author: SELIGMAN, Darryl (Michigan State University)

Presenter: SELIGMAN, Darryl (Michigan State University)

Contribution Type: Oral Talk

Comments:

Invited talk

Status: ACCEPTED

Submitted by **SELIGMAN, Darryl** on **Sunday, October 5, 2025**

Abstract ID : **90**

The Atmospheres of Young Planets Orbiting Active Stars with JWST

Content

Mature sub-Neptune-sized exoplanets with H/He atmospheres are common yet remain enigmatic due to their predominantly cloudy, featureless near-infrared spectra. On the contrary, the young (< 300 Myr) counterparts to these systems exhibit clear and extended atmospheres, making them ideal targets for atmospheric characterization. For this reason young planets are exquisite targets for transmission spectroscopy; however, their stellar hosts are highly active making the interpretation of atmospheric observations challenging. Regardless, observational constraints of young systems provide crucial insights into our understanding of exoplanet formation and evolution. In this talk, I will present several benchmark studies of young planets and their host stars with NASA's JWST. I will present early results from the KRONOS JWST program designed to understand the evolution of sub-Neptunes around Sun-like stars, highlighting the associated challenges and opportunities. By studying both planets and their stars together, we will provide an interdisciplinary and comprehensive view of planet formation, early evolution, and the interaction between early exoplanets and stellar.

Primary authors: FEINSTEIN, Adina (Michigan State University); Prof. WELBANKS, Luis (Arizona State University)

Presenter: FEINSTEIN, Adina (Michigan State University)

Contribution Type: Oral Talk

Comments:

Invited talk - Excited to attend!

Status: ACCEPTED

Submitted by **FEINSTEIN, Adina** on **Sunday, October 5, 2025**

Abstract ID : **91**

Detection of four cold Jupiters through combined analyses of radial velocity and astrometry data

Content

Cold Jupiters play a crucial role in planet formation and the dynamical evolution. Since their initial discovery around 47 UMa, cold Jupiters have attracted significant interest, yet their formation mechanisms remain uncertain, underscoring the critical need to expand the known population.

In this work, RV data are combined with Gaia astrometry using Hipparcos–Gaia proper motion anomalies over a 25-year baseline. By jointly modeling both datasets with the MCMC framework, we constrain planetary masses, orbital inclinations, and full three-dimensional orbital architectures. This reduces RV-related degeneracies and improves mass determinations. Four cold Jupiters are reported: HD 68475 b and HD 100508 b are each the first confirmed planet in their system, with orbital periods of 7832^{+463}_{-323} d and 5681 ± 42 d, and dynamical masses of $5.16^{+0.53}_{-0.47}\,M_{\rm Jup}$ and $1.2^{+0.30}_{-0.18}\,M_{\rm Jup}$, respectively. In known multi-planet systems, HD 48265 c has a period of 10418^{+2400}_{-1400} d and a mass of $3.71^{+0.68}_{-0.43}\,M_{\rm Jup}$, while HD 114386 c orbits in $444.00^{+0.93}_{-0.88}$ d with a minimum mass of $0.37^{+0.03}_{-0.03}\,M_{\rm Jup}$.

The two planets in the HD 48265 system may exhibit a significant mutual inclination, making it a target for testing the von-Zeipel–Kozai–Lidov mechanism. HD 68475 b is a promising candidate for future direct imaging with ELT/METIS. We identified a Jupiter analog with the longest known orbital period, implying that a substantial population of cold Jupiters likely awaits discovery by Gaia. Overall, this work expands the sample of dynamically characterized cold Jupiters and underscores the power of combining radial velocity and astrometry for advancing exoplanet demographics.

Primary authors: WU, Yiyun (TDLI); FENG, Fabo (TDLI); Mr XIAO, Guang-yao (TDLI); Dr BULTER, R.Paul (Earth and Planets Laboratory, Carnegie Institution for Science,)

Presenter: WU, Yiyun (TDLI)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Comments:

The poster would be submitted later

Status: ACCEPTED

Submitted by **WU, Yiyun** on **Monday, October 6, 2025**

Abstract ID : **92**

Collision Simulations of Compressed Icy Aggregates: Bouncing Thresholds and Growth Limits in Protoplanetary Disks

Content

Planet formation starts with the coagulation of sub-micron dust grains into aggregates in protoplanetary disks. Previous models predict that icy aggregates remain highly porous (filling factor $\ll 0.01$) and grow over centimeter sizes (Suyama et al., 2008). In contrast, recent polarimetric observations reveal maximum sizes of only 0.1–1 mm with compact structures (filling factor > 0.1) (e.g., Zhang et al., 2023; Ueda et al., 2024). These observations suggest the existence of compression processes and growth barriers.
We investigate bouncing, a collisional outcome at relatively low velocities (Güttler et al., 2010). Experiments show that compact SiO_2 aggregates begin to bounce at certain velocities and critical velocities decrease with aggregate mass (Weidling et al., 2012; Kothe et al., 2013). Yet the bouncing conditions for icy aggregates remain unclear (Shimaki & Arakawa, 2012; Arakawa et al., 2023).
Unlike previous simulations, we generate compact aggregates by compressing fluffy aggregates mimicking the natural process through which compact aggregates form. As a result, the velocity threshold for bouncing depends on the aggregate mass for all tested filling factors, in qualitative agreement with previous experiments. Comparing these results with turbulent collision velocities (Dominik & Dullemond, 2024), we estimate that growth halts at 0.1–1 mm, matching disk observations. This highlights the importance of bouncing collision in controlling dust evolution and the pathway to planetesimals.

Primary author: HARUTO, Oshiro (Institute of Science Tokyo)

Co-authors: Dr TATSUUMA, Misako (RIKEN iTHEMS / NIT Tokyo college); Prof. OKUZUMI, Satoshi (Institute of Science Tokyo); Prof. TANAKA, Hidekazu (Tohoku University)

Presenter: HARUTO, Oshiro (Institute of Science Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HARUTO, Oshiro** on **Monday, October 6, 2025**

Abstract ID : **93**

Limb Asymmetry as a Diagnostic of Photochemical Haze in Hot-Jupiters: Key Implications for JWST Interpretations

Content

Observations of limb asymmetry in exoplanetary atmospheres provide strong constraints on atmospheric dynamical and chemical processes. Photochemical hazes, for example, are expected to form on the day side and settle on the night side, creating measurable differences in transmission spectra across the eastern and western limbs. Recent observations from the state-of-the-art JWST have indeed revealed such observable differences between the two limbs (e.g., WASP-39b), further highlighting the urgency of investigating these asymmetries to better understand the underlying physical and chemical processes causing them.

We present results from 3D simulations of photochemical haze in the atmospheres of hot-Jupiters, focusing on three representative haze types: Titan-, water-world- and soot-like haze. We find that the tidally-locked nature of hot-Jupiters leads to confinement of haze particles around the nightside gyres. This creates a strong opacity source over the western limb, which raises the photosphere and creates a larger transit depth compared to the eastern limb. This asymmetry is unlikely to be spectrally degenerate with stellar activity, cloud opacity or disequilibrium chemistry, and therefore may serve as a strong diagnostic of photochemical haze in exoplanetary atmospheres. Additionally, shortwave heating from haze generates a thermal inversion and drastically alters the abundance of chemical species between the two limbs. We compare our results with JWST NIRSpec/PRISM mode observations of WASP-39b, and find that neglecting the radiative heating of haze could lead to misinterpretations of JWST observations. These results highlight the importance of accounting for photochemical haze when interpreting observed limb asymmetries in exoplanetary atmospheres.

Primary author: MAK, Mei Ting (University of Oxford)

Co-authors: Prof. MAYNE, Nathan (University of Exeter); Dr SERGEEV, Denis (University of Bristol); Dr KOMACEK, Thaddeus (University of Oxford); Dr ZAMYATINA, Maria (University of Exeter); Dr STEINRUECK, Maria (University of Chicago); Dr MANNERS, James (Met Office); Prof. SING, David (Johns Hopkins University); Dr HEBRARD, Eric (University of Exeter); Dr KOHARY, Krisztian (University of Exeter)

Presenter: MAK, Mei Ting (University of Oxford)

Contribution Type: Poster

Comments:

I would be happy to present my works as poster if I am not selected for an oral talk. Thank you!

Status: ACCEPTED

Submitted by **MAK, Mei Ting** on **Monday, October 6, 2025**

Abstract ID : **94**

Global Hall-magnetohydrodynamic simulations of transition disks

Content

Transition disks (TDs) are a type of protoplanetary disk characterized by a central dust and gas cavity. The processes behind how these cavities are formed and maintained, along with their observed high accretion rates of 10^{-8}-$10^{-7} M_{\odot}/yr$, continue to be subjects of active research. This work aims to investigate how the inclusion of the Hall effect (HE) alongside Ohmic resistivity (OR) and ambipolar diffusion (AD) affects the structure of the TD. Of key interest is the dynamical evolution of the cavity and whether it can indeed produce transonic accretion, as predicted by theoretical models in order to account for the observed high accretion rates despite the inner disk's low density. We present our results of 2D axisymmetric global radiation magnetohydrodynamic (MHD) simulations of TDs for which all three non ideal MHD effects are accounted. We used the nirvana fluid code and initialized our model with a disk cavity reaching up to $R = 8au$ with a density contrast of 10^5. We performed three runs, one with only OR and AD, and one for each of the two configurations that arise when additionally including the HE, that is, with the field aligned (anti-aligned) with respect to the rotation axis. For all three runs, our models maintain an intact inner cavity and an outer standard disk. MHD winds are launched both from the cavity and from the disk. Notably, when the HE is included, ring-like structures develop within the cavity. We moreover obtain accretion rates of 3-8 $\times$ $10^{-8} M_{\odot}/yr$, comparable to typical values seen in full disks. Importantly, we clearly observe (tran)sonic accretion ($v_{acc} > c_s$) in the cavity. Additionally, outward magnetic flux transport occurs in all three runs.

Primary author: SARAFIDOU, Eleftheria (Queen Mary University London)

Co-authors: Prof. ERCOLANO, Barbara (University Observatory, Faculty of Physics, Ludwig-- Maximilians-Universität München); Dr GRESSEL, Oliver (Leibniz Institute for Astrophysics Potsdam)

Presenter: SARAFIDOU, Eleftheria (Queen Mary University London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SARAFIDOU, Eleftheria** on **Monday, October 6, 2025**

Abstract ID : **95**

Global Hall-magnetohydrodynamic simulations of transition disks

Content

Transition disks (TDs) are a type of protoplanetary disk characterized by a central dust and gas cavity. The processes behind how these cavities are formed and maintained, along with their observed high accretion rates of 10^{-8}-$10^{-7} M_{\odot}/yr$, continue to be subjects of active research. This work aims to investigate how the inclusion of the Hall effect (HE) alongside Ohmic resistivity (OR) and ambipolar diffusion (AD) affects the structure of the TD. Of key interest is the dynamical evolution of the cavity and whether it can indeed produce transonic accretion, as predicted by theoretical models in order to account for the observed high accretion rates despite the inner disk's low density. We present our results of 2D axisymmetric global radiation magnetohydrodynamic (MHD) simulations of TDs for which all three non ideal MHD effects are accounted. We used the nirvana fluid code and initialized our model with a disk cavity reaching up to $R = 8au$ with a density contrast of 10^5. We performed three runs, one with only OR and AD, and one for each of the two configurations that arise when additionally including the HE, that is, with the field aligned (anti-aligned) with respect to the rotation axis. For all three runs, our models maintain an intact inner cavity and an outer standard disk. MHD winds are launched both from the cavity and from the disk. Notably, when the HE is included, ring-like structures develop within the cavity. We moreover obtain accretion rates of 3-8 $\times$ $10^{-8} M_{\odot}/yr$, comparable to typical values seen in full disks. Importantly, we clearly observe (tran)sonic accretion ($v_{acc} > c_s$) in the cavity. Additionally, outward magnetic flux transport occurs in all three runs.

Primary author: SARAFIDOU, Eleftheria (Queen Mary University London)

Co-authors: Prof. ERCOLANO, Barbara (University Observatory, Faculty of Physics, Ludwig--Maximilians-Universität München); Dr GRESSEL, Oliver (Leibniz Institute for Astrophysics Potsdam)

Presenter: SARAFIDOU, Eleftheria (Queen Mary University London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SARAFIDOU, Eleftheria** on **Monday, October 6, 2025**

Abstract ID : **96**

Multi-planet system formation under stellar cluster environments

Content

Most stars form in dense stellar clusters, so it is important to study how these cluster environments influence disc evolution, planet formation and the final planetary system. The UV radiation emitted by massive stars causes external photoevaporation of discs, depleting planet-forming materials with thermal winds. Studies showed that early stage disc evolution and planet formation via pebble accretion are sensitive to the external photo-evaporation. However, so far most studies used simplified models consisting of only one planet per system. In reality, planetary systems form in protoplanetary discs with multitudes of planetary embryos/cores which dynamically evolve as a result of planet-planet interactions between each other and planet-disc interactions. These effects can not be captured by modelling of an isolated planetary embryo, and can affect pebble accretion rates onto the planetary embryos/cores, complicating the way in which external photo-evaporation affects the planet growth potential. I will present my research on studying how the formation of multiple planetary systems via pebble accretion is affected by external photo-evaporation in a stellar cluster environment, and how the FUV radiation sculpts the planetary architectures and planetary demographics.

Primary author: QIAO, Lin (Queen Mary University of London)

Presenter: QIAO, Lin (Queen Mary University of London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **QIAO, Lin** on **Monday, October 6, 2025**

Abstract ID : **97**

Environmental Interactions of Protoplanetary Disks: Early-Stage Planetesimal Formation and Late Infall

Content

Planets form in protoplanetary disks (PPDs) through a multi-scale process where micron-sized dust grows to pebbles and forms planetesimals. These planetesimals act as seeds to subsequent core and envelope accretion, eventually resulting in full-grown planets. From a theoretical standpoint, modeling of these processes is often performed under the assumption of an isolated disk. However, observational constraints on the dust-mass budget of PPDs, as well as the detection of substructures already in Class I disks, indicate that planet formation might start early during the Class 0/I stage. Here, the PPD is still embedded in its natal environment and subject to significant environmental interactions. Based on results from 3D non-ideal MHD core-collapse simulations, I investigated whether planetesimals can already form at this stage, where turbulence is high but more material is available. Depending on the physical conditions, I find that ~100 earth masses of planetesimals may form, which have a high water content.

But environmental interactions are not limited to the early disk stages: Observations indicate ubiquitous inflow of material in the form of streamers onto PPDs in the Taurus and other star forming regions. Such interactions have considerable implications for planet formation during the Class II stage of PPDs, because they supply fresh material and impact disk dynamics. First, I investigated how such "late infall" could be the reason for the planet-disk misalignment in IRAS 04125+2902 using 3D hydrodynamical simulations, suggesting that the present-day disk may be the second generation. Furthermore, I considered which observational streamer signatures can arise under which environmental conditions, showing that turbulent Bondi-Hoyle-Lyttleton accretion processes can cause a variety of morphologies. Finally, these streamers can cause observable spiral structures, warps and accretion bursts of new material, highlighting the importance of including the effects of late infall in planet formation models.

Primary author: HÜHN, León-Alexander (Heidelberg University)

Presenter: HÜHN, León-Alexander (Heidelberg University)

Contribution Type: Poster

Comments:

This talk is about selected results from the PhD Thesis.

Status: ACCEPTED

Submitted by **HÜHN, León-Alexander** on **Monday, October 6, 2025**

Abstract ID : **98**

Planetary Statistical Studies with LAMOST

Content

The year 2025 marks a milestone in the history of exoplanet research—thirty years after the discovery of 51 Peg b, the first exoplanet found orbiting a Sun-like star. Over the past three decades, more than 6,000 exoplanets have been confirmed, with thousands more candidates awaiting validation. The catalog of known exoplanets has expanded dramatically, extending from the solar neighborhood (within 100–200 parsecs) out to several thousand parsecs across the Milky Way, signaling the dawn of a Galactic-scale exoplanet census. A central question now drives the field: How do the properties of planetary systems vary with Galactic location and stellar age? Addressing this will provide crucial insights into the formation and evolution of diverse exoplanet populations in different Galactic environments.

Meanwhile, the Large Sky Area Multi- Object Fiber Spectroscopic Telescope (LAMOST) has accumulated extensive spectroscopic data on Milky Way stars over the past decade, offering a valuable resource for statistical exoplanet studies aimed at this very question. In this presentation, I will discuss how LAMOST contributes to planetary statistics through recent work investigating the age dependence of various planet types. By combining data from LAMOST, Gaia, and Kepler, we uncover evidence of their long-term evolution.

Primary author: XIE, Ji-Wei (Nanjing University)

Presenter: XIE, Ji-Wei (Nanjing University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **XIE, Ji-Wei** on **Monday, October 6, 2025**

Abstract ID : **99**

the small grain hypothesis – emission model for the HD 169142 disk

Content

The size of dominant dust grains in proto-planetary disks determines both the thermal dynamics of the disk, as well as the formation pathway for planetesimals. This information, however, is hard to come by, as it is degenerate with a multitude of other effects (disk temperature, disk sub-structure, grain composition, etc.).

The disk of HD 169142 has been imaged at high-resolution in multiple ALMA/VLA bands. Its radiation is also dominated by a single bright ring. So it is likely our best shot at success. I will present our modelling efforts and explain why we believe that the dust grains have not grown much beyond 100 micron.

Primary author: WU, Yanqin (University of Toronto)

Co-author: QIAN, Yansong (University of Toronto)

Presenter: WU, Yanqin (University of Toronto)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WU, Yanqin** on **Monday, October 6, 2025**

Abstract ID : **100**

Rogue worlds in the era of Roman

Content

The Roman Space Telescope's Galactic Bulge Time Domain Survey will provide a new window into the demographics of free-floating planets, planets unbound to any star. The mass and velocity distributions of this population hold key insights into their formation mechanisms and the growth of planetary systems in a short-lived period of early dynamical instability that is otherwise difficult to probe observationally. In this talk, I will show the results of simulation-based predictions for the Galactic free-floating planet mass function and connect these results to particular features in the mass function that Roman will be able to observe.

Primary author: DEROCCO, William (University of Maryland, College Park)

Presenter: DEROCCO, William (University of Maryland, College Park)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DEROCCO, William** on **Monday, October 6, 2025**

Abstract ID : **101**

Revisiting planet–debris disk interactions: The dynamical role of disk gravity

Content

While the number of exoplanets has surged in recent decades, the exploration of the outer regions of planetary systems has lagged behind, primarily due to observational limitations. Debris disks – exoplanetary analogues of the Solar System ' s asteroid and Kuiper belts –offer a valuable, indirect probe of these regions. Ubiquitous around main-sequence stars, such disks preserve signatures of past and ongoing dynamical processes, including interactions with planets, and can reveal the presence of otherwise undetectable companions. Most studies of planet—debris disk interactions, however, rely on simplified models that represent the disk as a swarm of massless planetesimals, in contrast to observations indicating that debris disks may contain several Earth masses of material. In this talk, I review the theoretical framework of planet—debris disk interactions and present new results that incorporate the previously neglected effects of disk self-gravity. I show that even moderate amounts of planetesimals can substantially affect the disk ' s radial and vertical structure –producing features such as gaps, warps, and spirals –while also modulating the overall level of dynamical stirring. Remarkably, these effects arise even when the disk is less massive than the perturbing planet, challenging common assumptions. These results demonstrate the limitations of massless-disk models and underscore the importance of including disk gravity in future studies. I will also discuss implications for current and ongoing observations, particularly with JWST, in constraining the presence and properties of yet-unseen planetary companions.

Primary author: SEFILIAN, Antranik (University of Arizona)

Presenter: SEFILIAN, Antranik (University of Arizona)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **SEFILIAN, Antranik** on **Monday, October 6, 2025**

Abstract ID : **102**

Friends not foes: How Jupiters shape the lives of small planets

Content

The connection between outer gas giants and inner super-Earths reflects their formation and evolutionary history. Past work exploring this link has suggested a tentative positive correlation between these two populations, but these studies were limited by small sample sizes and in some cases sample biases. In this talk I will highlight my recent collaborations with Eve Lee where we take a new look at this super-Earth/gas giant connection. With a sample of 184 super-Earth hosts (largest to date), we show that there is a statistically significant positive correlation between super-Earths and outer gas giants around metal-rich FGK stars, and that this correlation disappears for metal-poor hosts. We next consider how this connection evolves across stellar mass, finding that the positive correlation between super-Earths and Jupiters is nonexistent for M-dwarfs, emerges in metal-rich K-dwarfs, and strengthens with increasing stellar mass. These findings reflect the critical role that disk solid budget plays in shaping architectures of planetary systems. Finally, I will preview our current efforts to understand the active role gas giants play in shaping small planet lives by focusing on the dependence of small planet properties on the presence of an outer gas giant.

Primary authors: BRYAN, Marta; LEE, Eve (UC San Diego)

Presenter: BRYAN, Marta

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **BRYAN, Marta** on **Monday, October 6, 2025**

Abstract ID : **103**

Planetary Systems in Wide Binaries Probed by Polluted White Dwarfs

Content

How does the presence of a stellar companion affect the evolution of a planetary system compared to those around single stars? In this study, we use polluted white dwarfs as tracers of long-lived planetary systems. Using data from the Dark Energy Spectroscopic Instrument (DESI), we find that white dwarfs in wide binaries are less likely to host planetary systems than their single-star counterparts. This suggests that a binary companion can play a central role in shaping the fate of planetary systems beyond the main-sequence stage. We also examine potential links between the metallicity of the primary star and the likelihood of hosting a planetary system.

Primary author: XU, Siyi (Gemini Observatory/NSF NOIRLab)

Presenter: XU, Siyi (Gemini Observatory/NSF NOIRLab)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **XU, Siyi** on **Tuesday, October 7, 2025**

Abstract ID : **105**

Linking Core-Induction Effects to Atmospheric Escape in Rocky Exoplanets

Content

In the Solar System, the conducting cores of rocky planets vary substantially in relative size—from approximately 80% of the planetary radius on Mercury to about 20% on the Moon—with Earth' s core occupying an intermediate value of roughly half the planetary radius. Exoplanet observations likewise reveal a broad diversity in core sizes, encompassing both super-Earths and super-Mercuries. The size of a planet' s conducting core may strongly influence the extent of non-thermal, stellar wind–driven atmospheric ion escape. In particular, induction effects within large conducting cores can generate additional magnetic fields that help shield planetary atmospheres from extreme stellar wind and magnetic activity, which are especially prevalent around M-dwarf and young Sun-like stars. Using a multi-species magnetohydrodynamic (MHD) model, we investigate atmospheric ion escape from rocky planets possessing Venus-like (CO_2-dominated) atmospheres. Our results indicate that, due to core induction effects alone, the total atmospheric ion escape rate decreases by several factors for planets with the largest conducting cores (≈80% of planetary radius) relative to those with the smallest cores (≈20% of planetary radius). This disparity becomes even more pronounced when gravitational effects are treated self-consistently. These findings suggest that conducting core size plays a key role in atmospheric retention and may inform future searches for habitable worlds with the James Webb Space Telescope and, subsequently, the Habitable Worlds Observatory.

Primary author: Prof. DONG, Chuanfei (Boston University)

Co-authors: Dr CHEN, Yuxi (University of Michigan, Ann Arbor); Ms CHIN, Laura (Boston University)

Presenter: Prof. DONG, Chuanfei (Boston University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DONG, Chuanfei** on **Tuesday, October 7, 2025**

Abstract ID : **106**

Understanding the Biases of 1D Atmospheric Retrievals based on 3D General Circulation Models for Brown Dwarfs and Isolated Extrasolar Giant Planets

Content

The atmospheres of brown dwarfs and exoplanets are inherently three-dimensional (3D). Fundamental parameters, compositions and chemistry of the atmospheres are often derived from spectra via the retrieval technique based on one-dimensional (1D) atmospheric models, and the results may suffer from systematic biases due to the 1D interpretation.

We aim to systematically explore the biases introduced when 1D retrieval models are employed to explain spectra that are generated from an inherent 3D atmosphere produced by the general circulation models and to examine improvements by adding physical factors such as multi-dimensional temperature or cloud structures. Preliminary results show that simple 1D cloud-free models often produce overestimated molecular abundances of certain species and incorrect P-T gradients to compensate for 3D cloudy spectral differences.

In future work, we will apply more complex retrieval models to explore how the inferred parameters change and what new insights can be obtained.

Primary authors: TAN, Xianyu; LI, zhengduo (TDLI)

Presenter: LI, zhengduo (TDLI)

Track Classification: Atmospheres

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LI, zhengduo** on **Tuesday, October 7, 2025**

Abstract ID : **107**

Oligarchic growth of protoplanets in an expanding planetesimal ring

Content

In the standard planet formation scenario, it has been assumed that planetesimals form throughout the protoplanetary disk and are distributed smoothly in the radial direction, except near the snowline. Recently, however, simulations of gas and dust evolution have shown that planetesimals form only in radially limited locations, such as gas pressure bumps and snowlines, and are concentrated in ring-like regions. In Kambara & Kokubo (2025), we have investigated the evolution of a planetesimal ring and found that protoplanets undergo oligarchic growth while the ring expands. The mass and orbital separation of the protoplanets in the ring can be predicted using the oligarchic growth model, taking into account the surface density after ring expansion. The final ring width and the mass of protoplanets weakly depend on the initial ring width. When we fix the initial ring width, the protoplanets become heavier, and the ring expands faster in a more massive ring.
However, dependence on the semimajor axis is yet to be investigated. When the planetesimal surface density is constant, the isolation mass of protoplanets is $\propto a^3\Sigma^{3/2}$, where a is the semimajor axis and Σ is the solid surface density. We perform a series of {\em N}-body simulations changing the distance from the central star. Even when we change the distance from the star, protoplanets undergo oligarchic growth while the ring expands. In contrast to the isolation mass without planetesimal diffusion, the mass of the most massive protoplanet does not depend strongly on its semimajor axis. This may be explained by relatively inefficient diffusion in the close-in region, which allows protoplanets to grow before the surface density decreases due to planetesimal diffusion.

Primary author: KAMBARA, Yuki (The University of Tokyo)

Co-author: KOKUBO, Eiichiro (NAOJ)

Presenter: KAMBARA, Yuki (The University of Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KAMBARA, Yuki** on **Tuesday, October 7, 2025**

Abstract ID : **108**

Equilibrated, Not Accreted: The Fate of Water in Super-Earths and Sub-Neptunes

Content

Recent claims of biosignature gases in sub-Neptune atmospheres have reignited interest in water-rich sub-Neptunes with surface oceans—so-called Hycean planets. These planets are typically assumed to form beyond the snow line and to retain large global water inventories (>10 wt%). However, such scenarios neglect chemical equilibration between molten interiors and primordial envelopes.

We compute global chemical equilibrium states for a synthetic population of young super-Earths and sub-Neptunes with magma oceans, drawn from a planetary population synthesis model. Although many planets initially accrete 5–30 wt% water, interior–atmosphere interactions destroy most of it, reducing the final global water mass fractions to <1.5 wt%. None of the planets reach the water content threshold proposed for Hycean worlds.

Furthermore, we find that water-dominated atmospheres arise only on planets that formed inside the snow line and accreted little ice. These carbon- and hydrogen-poor systems develop thin envelopes dominated by endogenic water. By contrast, planets that formed beyond the snow line accrete more volatiles, but interior–atmosphere equilibration partitions hydrogen into the interior and drives production of H2 gas, leaving only small atmospheric water mass fractions.

Furthermore, all of our water-dominated envelopes reside within the one-phase H2–H2O regime, where hydrogen and water are fully miscible. This precludes the formation of distinct water layers, undermining another key assumption of the Hycean scenario.

Our results challenge the classical link between volatile ice accretion and water-rich atmospheres. Instead, they demonstrate that interior–atmosphere equilibration, not ice-accretion, is the primary control on water inventories in young super-Earths and sub-Neptunes.

Primary author: WERLEN, Aaron (Ludwig Maximilian University of Munich)

Co-authors: Prof. DORN, Caroline (ETH Zurich); Dr BURN, Remo (Observatoire de la Cote d'Azur); Prof. SCHLICHTING, Hilke (University of California, Los Angeles); Dr GRIMM, Simon (ETH Zurich & University of Zurich); Prof. YOUNG, Edward (University of California, Los Angeles)

Presenter: WERLEN, Aaron (Ludwig Maximilian University of Munich)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WERLEN, Aaron** on **Tuesday, October 7, 2025**

Abstract ID : **109**

The Cooling Efficiency of Lyα Photons in the Upper Atmospheres of Hot Jupiters

Content

Mass-loss rate, energy budget, and thermal structure are key unknowns in the upper atmospheres of hot Jupiters. Lyman continuum stellar radiation is generally regarded as the dominant energy source that drives hydrodynamic escape and heats the gas. Near the temperature peak of the atmosphere, EUV heating is balanced by radiative cooling through Lyα emission. Consequently, atmospheric escape models predict a maximum temperature of ~10^4 K that is only weakly sensitive to the incident stellar flux. These models routinely assume that every Lyα photon generated in the atmosphere can eventually escape, an approximation that has never been tested against the extreme Lyα optical depths of hydrogen dominated envelopes. Here, we present Monte Carlo simulations that follow the resonant scattering of Lyα photons in the upper atmospheres of representative hot Jupiters. We find that the "instant escape" limit is accurate within the temperature-peak region and beyond for typical hot Jupiters, but breaks down at deeper, denser layers, where collisional de-excitation noticeably reduces the cooling efficiency. For ultra hot giants such as KELT-9b, whose Balmer continuum radiation makes a significant contribution to atmospheric heating, the Lyα escape fraction drops well below unity near the temperature peak. Consequently, assuming 100% Lyα cooling efficiency leads to an overestimated net cooling rate. Our results provide the first quantitative correction factors that can be folded into existing hydrodynamic escape models.

Primary author: HUANG, Chenliang (Shanghai Astronomical Observatory)

Presenter: HUANG, Chenliang (Shanghai Astronomical Observatory)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HUANG, Chenliang** on **Tuesday, October 7, 2025**

Abstract ID : **110**

Modelling and Seeking Atmospheres of Hot Terrestrial Planets

Content

The Hot Rocks Survey is a large programme with the James Webb Space Telescope designed to investigate nine irradiated terrestrial exoplanets orbiting nearby M dwarfs in search of atmospheres (GO 3037). Our goal is to detect atmospheric signatures or constrain the nature of the planets' rocky surfaces. I will present the latest results from the Hot Rocks Survey, which place strong limits on the abundance of CO_2 in these worlds—where a robust detection of an atmosphere has not yet been achieved.

To interpret the observations, we employ models spanning different levels of complexity. Our main strategy is to apply simple, physically motivated approaches to data that remain only weakly constraining. In parallel, we are developing 3D planetary climate models that act as virtual laboratories for exploring the physical and chemical complexity of these extreme environments. I will introduce the OASIS model, a comprehensive 3D framework built from the ground up to capture the fundamental processes governing planetary atmospheres—fluid dynamics, radiative transfer, moist physics, and cloud formation.

OASIS is designed as a universal climate model, capable of interpreting data from both solar system planets and exoplanets. I will discuss the challenges in building such a model and present the key physical modules that compose OASIS. I will show that the model successfully reproduces the environment of computationally demanding cases such as Venus. With its hierarchical flexibility, OASIS offers a powerful tool for guiding the interpretation of current observations and shaping future observations towards a deeper understanding of planetary climates across the universe.

Primary author: MENDONCA, Joao Manuel (University of Southampton)

Presenter: MENDONCA, Joao Manuel (University of Southampton)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **MENDONCA, Joao Manuel** on **Tuesday, October 7, 2025**

Abstract ID : **111**

Bouncing 100 miron Grains Keep Protoplanetary Disks Bright

Content

Protoplanetary disks display the so-called size-luminosity relation, where their mm-wavelength fluxes scale linearly with their emitting areas. This suggests that these disks are optically thick in mm-band, an interpretation further supported by their near-black-body spectral indexes. Such properties are well established in very young star-forming regions like Lupus (1-3 Myrs), but, as I will show in the talk, they also persist in the much older Upper Scorpius region (5-11 Myrs).

This raises a fundamental question: how can disks shine brightly for so long, when grain growth and subsequent radial drift should have quickly depleted their solid reservoir? We suggest that the "bouncing barrier" provides the answer. This mechanism stalls grain growth at a near-universal size of ~100 micron, and these grains can keep the disks bright. I will also discuss the implications of this proposal for planet formation.

Primary author: QIAN, Yansong (University of Toronto)

Co-author: WU, Yanqin (University of Toronto)

Presenter: QIAN, Yansong (University of Toronto)

Contribution Type: Oral Talk

Comments:

Paper available at https://arxiv.org/abs/2507.06298

Status: ACCEPTED

Submitted by **QIAN, Yansong** on **Tuesday, October 7, 2025**

Abstract ID : **113**

A New Obliquity Kraft Break at ˜6500 K

Content

Recent studies suggest that spin–orbit misalignments are not universal across planetary architectures and may be distinctive to hot-Jupiter-like systems produced by high-e migration. I will argue that nearly all existing obliquity measurements for planets beyond hot Jupiters sample hosts cooler than our newly revised Kraft break, Teff˜6500 K, substantially hotter than the often-quoted 6100K, a bias traceable to the inclusion of binaries/multiples. Because hot Jupiters around cool stars are predominantly aligned, obliquities of non-hot-Jupiter planets around similar cool hosts offer limited leverage to test whether hot stars are primordially more misaligned or whether large tilts are specific to high-e delivery. I will also highlight the strongest evidence we recently found for the high-e origin and subsequent tidal evolution of stellar obliquity.

Primary authors: ONG, Joel; WANG, Songhu (Indiana University); WANG, Xian-Yu

Presenter: WANG, Songhu (Indiana University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WANG, Songhu** on **Tuesday, October 7, 2025**

Abstract ID : **114**

Planet–Planet Scattering Explains the Origin of Warm Jupiters

Content

The origin of warm Jupiters—giant planets with orbital periods of several tens of days—remains debated. They may be proto–hot Jupiters undergoing migration, the inward extension of the cold Jupiter population shaped by formation and migration processes, or a distinct class of gas giants. Using seven years of TESS observations and extensive ground-based follow-up, we present a well-characterized catalog of warm Jupiters that reveals a strong positive mass–eccentricity correlation. We show that this trend arises naturally from planet–planet scattering: lower-mass warm Jupiters are more likely to collide, while higher-mass ones tend to eject companions. This mechanism implies that warm Jupiters form in compact, multiplanet systems prone to dynamical instability. It also explains their low stellar obliquities and high companion occurrence rates. The same mass–eccentricity relation observed among cold Jupiters suggests that both populations share common dynamical origins. Moreover, because scattering can excite sufficiently high eccentricities among some warm and cold Jupiters, the same mechanism may also produce progenitors of hot Jupiters, pointing toward a unified dynamical framework for all giant planets.

Primary author: DONG, Jiayin (University of Illinois Urbana-Champaign)

Co-authors: Dr GUPTA, Arvind (National Optical-Infrared Astronomy Research Laboratory); KOKUBO, Eiichiro (NAOJ); LEE, Eve (UC San Diego); Prof. MURRAY-CLAY, Ruth (University of California, Santa Cruz)

Presenter: DONG, Jiayin (University of Illinois Urbana-Champaign)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DONG, Jiayin** on **Tuesday, October 7, 2025**

Abstract ID : **115**

Time-Resolved Observations of Directly Imaged Exoplanets: A New Perspective in Probing Planet Formation

Content

Time-resolved observations of directly imaged planets offer a powerful yet underexploited approach to understanding planet formation and evolution. These observations probe three critical aspects of planetary systems: time-variable accretion signatures in actively forming protoplanets, rotational properties that constrain angular momentum evolution, and dynamical processes in planetary atmospheres.

This talk will present results from pilot monitoring programs that demonstrate the strengths of direct monitoring observations of exoplanets across multiple science cases. I will discuss monitoring of emission line variability and accretion activity in protoplanets. These observations reveal highly dynamic mass growth processes and probe the interaction between planets and their natal disks. I will present measurements of rotational periods and phase-resolved atmospheric mapping in planets across multiple evolutionary stages. These analyses constrain early angular momentum evolution in planetary systems. Time-resolved spectroscopy refines atmospheric characterization and strengthens connections between atmospheric properties and formation pathways. The demonstrated performance establishes a clear path toward systematic high-contrast monitoring surveys that offer a new perspective in probing how planets form and evolve.

Primary author: ZHOU, Yifan (University of Virginia)

Presenter: ZHOU, Yifan (University of Virginia)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHOU, Yifan** on **Tuesday, October 7, 2025**

Abstract ID : **116**

How a Close-in Planet Protects its White Dwarf Host from Pollution

Content

Approximately 25–50\% of white dwarfs (WDs) exhibit metal absorption lines in their photospheres, which are attributed to accretion from their remnant planetary systems. Although white dwarfs with detected planetary systems are more likely to show photospheric pollution, two notable exceptions—WD J0914+1914 and WD 1856+534—host close-in giant planets yet exhibit no detectable photospheric metal pollution. Previous studies have proposed that massive, close-in planets can block inward transport of small particles driven by radiative forces (e.g., Poynting–Robertson drag and the Yarkovsky effect). However, it remains unclear whether the close-in planet can similarly prevent delivery of larger bodies via dynamical interactions. We aim to quantify the protective influence of close-in planets on white-dwarf pollution by asteroids approaching on near-parabolic orbits, and to explore the planetary masses and orbital separations required to provide effective protection. We perform ensembles of short-term N-body integrations, sampling a range of planet masses and orbital separations and initializing asteroids on highly eccentric orbits with periapses near the WD Roche radius, in order to measure scattering, capture, and ejection outcomes and quantify the planet' s shielding efficiency. For WD1856+534b-like configurations ($a_p = 0.02$ AU), giant planets with masses greater than 0.5 Jupiter masses are sufficient to clear over 80\% of highly eccentric small-body contaminants. The effectiveness of the protective effect diminishes with decreasing planetary mass and increasing semi-major axis. These findings help explain why some white dwarfs that host close-in giant planets do not show the photospheric metal pollution commonly observed in other systems.

Primary authors: XIE, Ji-Wei (Nanjing University); 张, 欣悦 (南京大学)

Co-authors: CHEN, Dichang (Sun Yat-sen University); ZHOU, Jilin (Nanjing University)

Presenter: 张, 欣悦 (南京大学)

Track Classification: Dynamical evolution

Contribution Type: Poster

Status: ACCEPTED

Submitted by **张, 欣悦** on **Tuesday, October 7, 2025**

Abstract ID : **117**

Grain Growth in Different Disk Substructures: A Multi-Wavelength ALMA Study of HD 143006

Content

High-resolution observations have revealed a variety of substructures in protoplanetary disks, with rings being the most common and crescent-shaped asymmetries often interpreted as dust traps. These asymmetric features are thought to facilitate grain growth by concentrating dust, yet direct comparisons of dust properties between rings and asymmetric substructures remain limited. To address this, we investigate the HD 143006 system, which exhibits three prominent rings and one asymmetric crescent-like structure.

We analyze ALMA Band 3, 6, and 7 continuum images and perform spatially resolved SED fitting to constrain dust properties across the different substructures. Our results show that the asymmetric structure exhibits higher surface density and temperature compared to the rings. However, we do not find evidence for significantly larger maximum grain sizes in the asymmetric feature. Additionally, we detect a distinct morphological difference in the innermost ring at Band 3 relative to shorter wavelengths, which may indicate the presence of free-free emission from a jet or outflow.

These findings suggest that while dust trapping enhances local density and heating, it does not necessarily imply more advanced grain growth compared to rings. Our study highlights the importance of multi-wavelength analysis in disentangling the physical conditions within diverse disk substructures.

Primary author: YANG, Yi

Presenter: YANG, Yi

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Yi** on **Tuesday, October 7, 2025**

Abstract ID : **118**

Interpretable Deep Transfer Learning for Protoplanetary Disk Classification in Polarimetric Imaging

Content

High-contrast polarimetric imaging has enabled direct studies of protoplanetary disks, but the growing number of targets calls for efficient, automated classification methods. We present a pilot study applying deep learning to Polarimetric Differential Imaging (PDI) data from the public POLARIS archive (VLT/SPHERE IRDIS). Using a transfer learning approach with a ResNet18 backbone adapted for 1-channel FITS input, our model distinguishes disks from reference images with ˜80–90% validation accuracy despite the small dataset size (96 images). Explainability techniques like Grad-CAM confirm that the network attends to disk regions in successful cases, while misclassifications reveal sensitivity to residual speckles and background noise. These results demonstrate the feasibility of machine learning–based classification of disks, while highlighting the need for larger datasets, improved preprocessing, and integration of domain knowledge. This work outlines a framework for scaling ML approaches to upcoming high-contrast imaging surveys with VLT, Subaru, and JWST.

Primary author: YANG, Yi

Presenter: YANG, Yi

Track Classification: Disks

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Yi** on **Wednesday, October 8, 2025**

Abstract ID : **119**

Lava tides on short period exoplanets

Content

Orbiting at just a few stellar radii, short-period rocky exoplanets are subject to extreme irradiation and tidal forcing. When substellar temperatures exceed silicate liquidus values, the surface and upper mantle transition into a magma ocean. Traditional models of tidal dissipation in such oceans treat them as weakly viscous solids, neglecting the fluid dynamics that emerge once the melt fraction passes a critical threshold, forcing a solid-to-liquid rheological transition. In this talk, we explore the thermodynamic consequences of fluid lava tides in both global and dayside-confined magma oceans, showing that tidal dissipation can rival, and often exceed stellar heating. Motivated by phase-curve and eclipse observations of lava worlds, we examine: (i) the amplitude and timescale of tidally driven surface thermal variability; (ii) how fluid driven tidal power restructures the planet ' s interior; and (iii) the conditions under which lava tides extend the magma ocean onto the nightside, diminishing the day-night thermal contrast.

Primary author: FARHAT, Mohammad (University of California, Berkeley)

Co-author: CHIANG, Eugene (University of California, Berkeley)

Presenter: FARHAT, Mohammad (University of California, Berkeley)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **FARHAT, Mohammad** on **Wednesday, October 8, 2025**

Abstract ID : **120**

Building machine learning model to predict planet formation in the giant impact stage

Content

In the final stage of terrestrial planet formation, protoplanets grow through a series of collisional mergers. This stage is known as the giant impact stage and has been studied using N-body simulations (e.g., Kokubo et al., 2006). Recently, research has emerged with the aim of reducing computational costs by replacing N-body simulations with machine learning models during the giant impact stage. In a previous study, the final state of planetary systems could be predicted in a time four orders of magnitude shorter than that required for N-body simulations (Lammers et al., 2024).

However, this study used N-body simulations of only three-protoplanet
systems as training data, which limits their ability to accurately predict the evolution of systems with four or more protoplanets due to the limited number of protoplanets. As a result, the current accuracy of the models for predicting colliding protoplanet pairs remains around 60%, which is insufficient to investigate the properties of planetary systems formed through the giant impact stage.

In this study, we aim to develop a new machine learning model that predicts the orbital and mass evolution of planets using N-body simulation results. We construct two machine learning models to achieve this goal. The first model predicts the order of collisions between protoplanets, and the second model predicts the semimajor axis after a collision. Since the results of N-body simulations can be represented as merger trees, which are similar to dendrograms in graph theory, we employ graph neural networks (GNNs) to learn the order of collisions between protoplanets from the simulation results. A GNN is a type of neural network that is suited for graph-structured data. The second model predicts the semimajor axis of protoplanets after a collision. This model utilizes a random forest regressor, a traditional machine learning model that employs decision trees, achieving a mean absolute error of 0.0737. When we predict the orbital and mass evolution of a protoplanetary system, we first predict the collision pair of the system using the first model. Then, we predict the semimajor axis after the collision using the second model.

In the presentation, we will introduce the details of our models and compare their predictions with the results of N-body simulations.

Primary author: ISHIDA, Yuichiro (The University of Tokyo)

Co-author: KOKUBO, Eiichiro (National Astronomical Observatory of Japan)

Presenter: ISHIDA, Yuichiro (The University of Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ISHIDA, Yuichiro** on **Wednesday, October 8, 2025**

Abstract ID : **121**

Segmented-Polynomial-fitting Least Squares (SPLS): An optimized algorithm to find Earth twins

Content

Detecting Earth twins remains challenging because their shallow, long-period transits are difficult to distinguish from background noise. Motivated by the challenge, we developed Segmented-Polynomial-fitting Least Squares (SPLS), a new algorithm that simultaneously fits planetary transits and background trends using a segmented double polynomial model. Prior to signal detection, the optimal polynomial order for the trend component is selected using Bayes factor-based model comparison. During the periodogram search, the Signal Detection Efficiency metric is used to assess signal significance. The algorithm is accelerated by a three-step approximation and nonlinear parameter sampling tailored to SPLS. We compare the performance of SPLS with traditional detrending-detection approaches across different orbital periods, signal-to-noise ratios (SNR), and stellar noise levels on an injection–recovery test. When detecting signals with periods of several hundred days and SNRs between 5 and 8, SPLS achieves at least a 20.3% higher true positive rate than other methods at the same 10% false positive rate. Using the threshold determined from the Receiver Operating Characteristic curve analysis, our method also recovers the most true signals while yielding the fewest false positives among all injected samples. The test demonstrates that SPLS improves the detection of low-SNR, long-period transiting planets, particularly in light curves with low to medium stellar noise. It offers the potential for finding Earth twins in future applications to data from Kepler, TESS, and upcoming PLATO and Earth 2.0 missions.

Primary authors: FENG, Fabo (TDLI); RUI, Yicheng (TDLI); ZHENG, Shuyue (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Presenter: ZHENG, Shuyue (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHENG, Shuyue** on **Wednesday, October 8, 2025**

Abstract ID : **122**

V883 Ori' s Dust and Water Emission Are Relics of a Retreating Snowline

Content

V883 Ori is an FU-Orionis-type outburst system whose ALMA Band 6 and 7 images reveal a distinct emission shoulder at 50–70 au in the dust continuum intensity profile. This feature was previously attributed to pile-up of solids caused by the disintegration of pebbles crossing the water snowline. However, recent multi-band observations show continuity in the spectral index across the expected snowline region, disfavoring abrupt changes in grain size. Moreover, extended water emission is detected beyond 80 au, implying a snowline located farther out.
While earlier interpretations relied on static disk models, the snowline in V883 Ori is in fact retreating as the system fades. We therefore construct a time-dependent 2D disk model that follows the cooling and subsequent recondensation of water vapor during the post-outburst dimming phase. The model naturally reproduces both the observed intensity shoulder and the extended water vapor: the shoulder arises from excess surface density produced by vapor recondensation at the moving condensation front, while the outer water vapor reservoir persists due to long recondensation timescales (10^2–10^3 yr) in the disk atmosphere.
As V883 Ori continues to fade, we predict that the intensity shoulder will migrate inward by an observationally significant ~10 au over the next ~35 years.

Primary author: WANG, Yu (Tsinghua University)

Co-authors: Dr HOUGE, Adrien (University of Copenhagen); Dr JIANG, Haochang (Max Planck Institute for Astronomy); Dr KRIJT, Sebastiaan (University of Exeter); MACÍAS, Enrique (European Southern Observatory); ORMEL, Chris (Tsinghua University)

Presenter: WANG, Yu (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WANG, Yu** on **Wednesday, October 8, 2025**

Abstract ID : **123**

Misaligned circumbinary discs around unequal-mass eccentric binaries: alignment, morphology, and binary accretion variability

Content

Binary systems are ubiquitous in the Universe and can host circumbinary discs, which are often observed to be misaligned with the binary orbital plane. Such misalignments can significantly influence disc evolution, accretion dynamics, and binary evolution. We conduct hydrodynamical simulations of circumbinary discs with initial tilts from $0°$ to $180°$ in $15°$ intervals, around eccentric binaries with mass ratios $q_{\rm b} = M_2/M_1 \in \{0.67, 0.43, 0.25, 0.11\}$. Circumbinary discs evolve towards three alignments: coplanar prograde, polar, and coplanar retrograde. The alignment timescale increases as $q_{\rm b}$ decreases. Polar discs form more compact cavities than coplanar discs, and retrograde discs maintain smaller cavities than prograde discs across varying $q_{\rm b}$. Accretion variability depends strongly on disc alignment and binary mass ratio. Coplanar prograde discs exhibit preferential alternating accretion driven by cavity-edge precession. Polar discs always favour accretion onto the primary. Retrograde discs generally do so as well, except for the coplanar retrograde cases with $q_{\rm b} \in \{0.67,\ 0.43\}$, where accretion occurs preferentially onto the secondary. When disc breaking occurs, the inner disc becomes eccentric, causing alternating accretion before aligning polar. As it circularises, the accretion returns to a non-alternating pattern. Disc mass loss rate through accretion depends on the initial tilt. Polar discs are accreted more slowly, while warped and broken discs are accreted more quickly. With the same initial tilt, both prograde discs that do not break and polar discs exhibit increasing mass loss rate as $q_{\rm b}$ decreases. Our findings provide insights into observed circumbinary disc systems and have implications for circumbinary planet formation.

Primary author: YANG, Ruiqi

Co-authors: Dr SMALLWOOD, Jeremy (University of Oklahoma); Prof. DENG, Hongping (Shanghai Astronomical Observatory); Prof. LI, Ya-Ping (Shanghai Astronomical Observatory); Dr FRANCHINI, Alessia (University of Milan); Dr DONG, Ruobing (Peking University); Prof. LIU, Shang-Fei (Sun Yat-sen University)

Presenter: YANG, Ruiqi

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Ruiqi** on **Wednesday, October 8, 2025**

Abstract ID : **124**

Investigating rolling motion of dust monomers by molecular dynamics simulations

Content

Planet formation begins with dust growth. Dust is thought to be an aggregate composed of submicron particles (monomers) and to grow by collisional sticking. The dust growth process through collisions has been investigated using numerical simulations (e.g., Wada et al., 2013; Hasegawa et al., 2021). Numerical simulations employ powder simulations based on the Discrete Element Method (DEM) with dust monomers as elements. In powder simulations, the interactions between contacting dust monomers are calculated. The contact interaction is separated into four components. Among these, rolling resistance torque has been shown to dissipate collisional kinetic energy most effectively during dust collisions (Arakawa et al., 2022), thereby influencing the collision process. Furthermore, the critical length, which determines the magnitude of the rolling resistive torque, is a crucial parameter because it determines the compressive strength of dust aggregates, which defines dust structure. However, while the critical length is theoretically considered to be around 0.2 nm (Dominik & Tielens, 1995), the actual value is unknown. Experiments suggest a critical length of approximately 3.2 nm (Heim et al., 1999), but this has been attributed to the influence of water vapor in the air, and the precise value remains under debate.

This study measures the critical length using molecular dynamics simulations. Molecular dynamics simulation is a method that considers numerous atoms or molecules within an object, solves molecular or atomic motion under intermolecular potentials, and analyzes physical processes. We prepare monomers with radii ranging from 30 to 100 nm using approximately 3 million to 110 million atoms and simulate the rolling motion of contacting two monomers by giving rotational angular velocity. By varying the initial crystal orientation and analyzing the time evolution of the angular velocity, we statistically determine the critical length. We find that the critical length strongly depends on the crystal orientation of the monomers at the contact surface. Because the crystal orientation at the contact surface changes due to rolling motion, the time evolution of the angular velocity is not always constant. However, the average critical length is found to be approximately 0.2 - 0.4 nm, independent of the initial angular velocity or monomer size.

This value is consistent with theoretically predicted values. Furthermore, it is smaller than values used in previous powder simulations and theoretical studies of dust growth (e.g., Kataoka et al., 2013), which assumed the critical length to be 0.8 nm. The compression strength is proportional to the critical length and the cube of density. The balance between the compression strength and the surrounding gas pressure determines the dust density for dust sizes larger than cm-sized. Then, our results suggest that dust grows with a higher density, approximately 1.5 times higher, than previously in this regime.

Primary author: YOSHIDA, Yuki (Kobe University)

Co-authors: KOKUBO, Eiichiro (National Astronomical Observatory of Japan); TANAKA, Hidekazu (Tohoku University)

Presenter: YOSHIDA, Yuki (Kobe University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YOSHIDA, Yuki** on **Wednesday, October 8, 2025**

Abstract ID : **125**

Tracing giant planet formation with multi-transiting warm and temperate Jupiters

Content

Despite decades of efforts, significant uncertainties remain regarding the composition and formation of giant planets. Here, we present our project on studying systems hosting multiple warm or temperate Jupiters, with typical orbital periods between 10s and 100s days. On one hand, with equilibrium temperatures between 300 and 600 K, these planets exhibit detectable atmospheric signatures of C, N, and O carriers, making them sensitive probes of planet formation as both C/O and N/O ratios can be constrained observationally. In addition, having a pair of co-natal warm giants will enable intra-system comparative studies, providing more leverages and fewer degeneracies in distinguishing formation models. On the other hand, the coplanar nature of multi-transiting Jupiters suggests cold dynamical histories that may preserve primordial obliquities when they form. Measuring their current obliquities could yield insights into the angular momentum of their original protoplanetary disks. Our project includes JWST observations of transmission spectra, photometric and RV follow-up on TESS discoveries, and RM observations. We present the first results from our program, including new JWST observations on TOI-2525 and Gemini MAROON-X RVs on two systems.

Primary author: LIN, Zitao (Tsinghua University)

Co-authors: Mr HU, Zhecheng (Tsinghua University); Dr WANG, Sharon Xuesong (Tsinghua University)

Presenter: LIN, Zitao (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LIN, Zitao** on **Wednesday, October 8, 2025**

Abstract ID : **126**

MHD Simulations of Hot Jupiters' Atmospheres

Content

Hot Jupiters are close-in giant planets and are believed to be tidally locked. The day-to-night radiative forcing leads to unique circulation patterns of their atmospheres. Most hydrodynamic models predict strong eastward winds near the equator and a hot spot shifted eastward of the substellar point. These results are consistent with the observations for some hot Jupiters. However, for ultra-hot Jupiters (>2000 K), observations typically reveal smaller hot spot offsets and larger thermal flux differences than those predicted by hydrodynamic models. The magnetic effect is one of the possible explanations for the different characteristics of ultra-hot Jupiters.

Previous studies have investigated magnetic effects using drag terms in hydrodynamic models or 3D magnetohydrodynamic (MHD) models. However, existing 3D MHD models frequently underestimated wind speeds of the atmospheres. To address this, we apply a widely used MHD model, the pencil-code, to better simulate how the magnetic field modifies the wind and temperature distribution on hot Jupiters. We introduced a dipole background magnetic field and a constant atmospheric conductivity to perform MHD simulations for hot Jupiters' atmospheres. Additionally, we set the atmospheric conductivity as a function of temperature and pressure to more realistically capture the magnetic field evolution and Lorentz forces.

Our results indicate that strong background magnetic fields and high conductivity significantly reduce wind speeds, particularly at higher latitudes. The Lorentz forces act mostly as a drag because it is nearly inverse to the wind direction in horizontal directions. In addition, our simulations show the amplification of the induced magnetic field and the self-consistent atmospheric dynamo on ultra-hot Jupiters. Our simulations yet cannot fully explain the observed large flux differences between the dayside to the nightside. A more precise radiative transfer treatment is needed in future research to investigate issues of day-to-night heat transport.

Primary author: LI, Kuan (Shanghai Jiao Tong University)

Presenter: LI, Kuan (Shanghai Jiao Tong University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LI, Kuan** on **Wednesday, October 8, 2025**

Abstract ID : **127**

On the origin of planets in binary systems

Content

In the Core Accretion scenario, planet formation in binary systems with separation of less than 10-20 au is all but impossible (e.g., Thebault & Haghighipour 2015) due to strong dynamical perturbations. The relative scarcity of planets observed to reside in binaries is usually taken to confirm this conclusion. However, recent observations (e.g., Thebault & Bonnani 2025) also show many examples of S-type planets in very tight binaries, indicating that planet formation is far more robust than hitherto believed. We recently proposed an alternative explanation for the underabundance of planets in binaries. We conjecture that planets in binary systems can readily form through disc fragmentation, yet are often ejected to become Free Floating Planets (FFPs). Our numerical simulations showed that this scenario is strongly supported by the surprising abundance of FFPs that cannot be reconciled easily with CA.
Here we present new numerical simulations that demonstrate that this scenario for FFP origin also naturally accounts for the observed S-type planets in binary systems. We map out future steps needed to constrain planet formation in binaries and the origin of FFPs in a single framework.

Primary authors: Prof. NAYAKSHIN, Sergei (University of Leicester); ZHANG, Luyao

Presenter: ZHANG, Luyao

Contribution Type: Poster

Comments:

This paper is the third in our Disc Fragmentation series and is currently in preparation. The first two papers have been submitted to MNRAS. Through this presentation, I would like to share our recent advances and key results with the scientific community.

Status: ACCEPTED

Submitted by **ZHANG, Luyao** on **Wednesday, October 8, 2025**

Abstract ID : **128**

Detections of new young transiting planets with the MuSCAT series

Content

Approximately 6,000 exoplanets have been discovered so far, but most of them orbit mature host stars older than 1 Gyr. In contrast, the number of known planets younger than 1 Gyr is still small. Such young planets are still in the process of evolution, undergoing significant changes in their mass, radius, atmosphere, and orbit. Therefore, they are crucial subjects for unveiling planetary evolution. Among these, transiting planets are key to understanding planetary evolution because their mass, radius, atmosphere, and orbit can be characterized through follow-up observations. The main difficulty in detecting young transiting planets is strong stellar activity of their host stars. Although TESS has discovered dozens of candidate young transiting planets, strong stellar activity makes follow-up observations for validating them difficult. In this context, multi-color simultaneous cameras are powerful instruments for validating young transiting planets. So far, we have developed 4 multi-color simultaneous cameras, named the MuSCAT series, and installed on 1.5-2m class telescopes around the world. In this presentation, I will introduce our ongoing project to detect new young transiting planets, including recent validations of newborn (less than 50 Myr) transiting planets, as well as the current status of our instrument development for Las Cumbres Observatory 1m telescopes in Chile and South Africa.

Primary author: NARITA, Norio (The University of Tokyo)

Presenter: NARITA, Norio (The University of Tokyo)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **NARITA, Norio** on **Wednesday, October 8, 2025**

Abstract ID : **129**

Simulations of coeval binary star and Free Floating Planet formation

Content

Observations indicate that disc fragmentation due to Gravitational Instability (GI) is the likely origin of massive companions to stars, such as giant planets orbiting M-dwarf stars, Brown Dwarf (BD) companions to FGK stars, and binary stars with separations smaller than ˜100 au. We 1 have recently showed that disc fragmentation in young rapidly evolving binary systems inevitably ejects an abundant population of massive Jupiter-mass free-floating planets (FFPs). In this model, a massive disc around an initially single protostar fragments on a number of clumps, and the secondary star is just an oligarch fragment that grows particularly massive. As the system rearranges itself from a singe to a binary star configuration, a dramatic "pincer movement" by the binary ejects planets through dynamical interactions with the stars. Although disc fragmentation is usually believed to form only massive objects, three different pathways for forming small core-dominated planets exist in the literature. Utilising these ideas, in 2 we demonstrated that the same scenario applies to an even more abundant population of smaller FFPs discovered by the microlensing surveys. In this talk I show that the population of binary stars emerging from our simulations echoes key observational statistics of these systems. I conclude that disc fragmentation is a key physical process governing formation of both stellar and planetary mass companions, and the community must invest more in theoretical and simulation research of the topic.

1 Calovic, A., Nayakshin, S., Casewell, S., and Miret-Roig, N., 2025, accepted to MNRAS

2 Nayakshin, S., Zhang, L., Calovic, A., Lee, H., Baruteau, C., Meru, F., and Mayer, L., 2025, subm. to MNRAS

Primary author: NAYAKSHIN, Sergei (University of Leicester)

Co-authors: CALOVIC, Aleksandra (University of Leicester); LEE, Hans (University of Leicester); ZHANG, Luyao (University of Leicester)

Presenter: NAYAKSHIN, Sergei (University of Leicester)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **NAYAKSHIN, Sergei** on **Wednesday, October 8, 2025**

Abstract ID : **130**

Direct imaging discovery of a young giant planet orbiting on Solar System scales

Content

HD 135344 is a visual binary system that is best known for the protoplanetary disk around the secondary star. Various substructures, such as a cavity and spiral arms, point to ongoing planet formation, but putative planets have remained hidden. The circumstellar environment of the A-type primary star, on the other hand, has evolved faster as indicated from the absence of accretion and high infrared excess.

I will present the discovery of a 10 Jupiter mass planet orbiting HD 135344 A at about 20 au. HD 135344 Ab is one of the youngest directly detected planets that has fully formed and orbits on Solar System scales. I will present results on the characterization of its atmosphere, bulk parameters, and orbit, based on four years of VLT/SPHERE and VLTI/GRAVITY observations, yielding first constraints on its formation and dynamical history.

HD 135344 Ab provides a unique window to a young giant planet shortly after formation, without any obscuration by circumstellar dust, therefore enabling accurate luminosity and (in the future) chemical abundance measurements. While its environment is depleted, HD 135344 A may have been a typical Herbig Ae star with a transition disk-like structure not too long ago. This binary system also shows that planet formation and disk evolution timescales can differ for two coeval stars within the same environment.

Primary author: STOLKER, Tomas (Leiden University)

Presenter: STOLKER, Tomas (Leiden University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **STOLKER, Tomas** on **Wednesday, October 8, 2025**

Abstract ID : **131**

How stellar multiplicity shapes disc evolution and planet formation

Content

Spectacular high-resolution imagery from the last decade has revealed that planet formation begins during the turbulent early stages of star formation, when stellar interactions profoundly shape protoplanetary disc structure. Observational evidence increasingly suggests that even apparently isolated stars bear the signatures of past stellar flybys – encounters that leave lasting imprints on disc morphology and may trigger the onset of planet formation. With the majority of stars residing in binary or higher-order multiple systems, these interactions become even more significant. In such environments, circumbinary discs can become misaligned with the binary orbital plane, creating distinctive conditions for circumbinary (P-type) planet formation. Binary companions also truncate their circumstellar discs, directly affecting the formation efficiency of circumstellar (S-type) planets. Recent observations of circumtriple disc architecture further raise intriguing questions about the viability of circumtriple planet formation. I will demonstrate that stellar multiplicity is not merely incidental but fundamental to understanding disc evolution and the diverse pathways of planet formation throughout the galaxy.

Primary author: SMALLWOOD, Jeremy (University of Oklahoma)

Presenter: SMALLWOOD, Jeremy (University of Oklahoma)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **SMALLWOOD, Jeremy** on **Wednesday, October 8, 2025**

Abstract ID : **132**

Diary of a Teenage Super-Jupiter

Content

Planetary oscillations encode giant planet histories. For instance, an impact with a 25 km planetesimal 40,000 years ago can explain Saturn’ s f-mode amplitudes. Giant exoplanets have radii and masses that imply their interiors each contain more than ˜100 Earth masses of solids, that may arise after merging with multiple ˜10 Earth mass solid cores. Here, we show that a giant impact with a young gas giant excites long-lived seismic oscillations that can be detected photometrically. Mode lifetimes are close to the planet’s Kelvin-Helmholtz time, a significant fraction of a young planet’s age. Oscillation periods lie between tens of minutes to an hour, and variability amplitudes can exceed a percent for several million years. Beta Pictoris b is a young super-Jupiter known to be highly metal-enriched. If a Neptune-mass body impacted beta Pictoris b in the past ˜9-18 Myr, the planet could still be ringing with a percent-level photometric variability measurable with JWST.

Primary author: ZANAZZI, John (Pennsylvania State University)

Co-authors: CHIANG, Eugene (University of California, Berkeley); ZHOU, Yifan (University of Virginia)

Presenter: ZANAZZI, John (Pennsylvania State University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZANAZZI, John** on **Wednesday, October 8, 2025**

Abstract ID : **133**

Predictions for circumplanetary disk structure

Content

Determining the conditions for circumplanetary disk formation, and the structure of the gaseous and dust components of such disks when they form, is of interest for direct imaging planet searches and for satellite formation. Several physical effects - including angular momentum transport, tidal forces, thermodynamics, and inflow from the protoplanetary disk - are in play, while current observational constraints are weak enough as to leave room for radically different models. I will present results from recent hydrodynamic and radiation hydrodynamic simulations that provide insight into the predicted structure of the gas in circumplanetary disks. Observationally, the number of detectable circumplanetary disks appears smaller than the number of inferred protoplanets at large orbital radii, and I will discuss a possible origin for this discrepancy.

Primary author: ARMITAGE, Philip (CCA, Flatiron Institute)

Presenter: ARMITAGE, Philip (CCA, Flatiron Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ARMITAGE, Philip** on **Wednesday, October 8, 2025**

Abstract ID : **134**

TOI-880 is an Aligned, Coplanar, Multi-planet System

Content

Although many cases of stellar spin-orbit misalignment are known, it is usually unclear whether a single planet's orbit was tilted or if the entire protoplanetary disk was misaligned. Measuring stellar obliquities in multi-transiting planetary systems helps to distinguish these possibilities. Here, we present a measurement of the sky-projected spin-orbit angle for TOI-880 c (TOI-880.01), a member of a system of three transiting planets, using the Keck Planet Finder (KPF). We found that the host star is a K-type star ($T_{\rm eff} = 5050 \pm 100$ K). Planet b (TOI-880.02) has a radius of $2.19 \pm 0.11 \rm R_{\oplus}$ and an orbital period of 2.6 days; planet c (TOI-880.01) is a Neptune-sized planet with $4.95 \pm 0.20 \rm R_{\oplus}$ on a 6.4-day orbit; and planet d (TOI-880.03) has a radius of $3.40^{+0.22}_{-0.21} \rm R_{\oplus}$ and a period of 14.3 days. By modeling the Rossiter-McLaughlin (RM) effect, we found the sky-projected obliquity to be $|\lambda_c| = 7.4^{+6.8}_{-7.2}{}^{\circ}$, consistent with a prograde, well-aligned orbit. The lack of detectable rotational modulation of the flux of the host star and a low $\rm vsini$ (1.6˜km/s) imply slow rotation and correspondingly slow nodal precession of the planetary orbits and the expectation that the system will remain in this coplanar configuration. TOI-880 joins a growing sample of well-aligned, coplanar, multi-transiting systems. Additionally, TOI-880 c is a promising target for JWST follow-up, with a transmission spectroscopy metric (TSM) of $\sim$ 170. We could not detect clear signs of atmospheric erosion in the Hα line from TOI-880 c, as photoevaporation might have diminished for this mature planet.

Primary author: ZHANG, Elina (Institute for Astronomy, University of Hawaii)

Co-authors: DAI, Fei (University of Hawaii); HALVERSON, Samuel (California Institute of Technology); HOWARD, Andrew (California Institute of Technology); ISAACSON, Howard (University of California Berkeley,); TENG, Huan-yu (National Astronomical Observatories, Chinese Academy of Sciences); WANG, Songhu (Indiana University); WANG, Xian-Yu (Indiana University)

Presenter: ZHANG, Elina (Institute for Astronomy, University of Hawaii)

Contribution Type: Poster

Comments:

Please find the full authors list in the attached published paper.

Status: ACCEPTED

Submitted by **ZHANG, Elina** on **Wednesday, October 8, 2025**

Abstract ID : **135**

Hidef Neighbors: an homogenous planetary spectral library

Content

In this talk, I will present a new homogeneous high-spectral-resolution library of selected solar system objects covering from UV-to-NIR obtained with the X-shooter instrument at Paranal using its Integral Field Unit mode. The first paper includes Saturn, Titan, Uranus, and Neptune along with a first analysis of some test cases in comparative planetology. I will also discuss the current ongoing work extending the first results to extend the utility of the dataset to its full potential.

Primary author: ROJO, Patricio (U de Chile)

Presenter: ROJO, Patricio (U de Chile)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ROJO, Patricio** on **Wednesday, October 8, 2025**

Abstract ID : **136**

Gas Giants and Their Friends: Connections between cold Jupiters and a menagerie of inner planets

Content

Cold Jupiters can play a dominant role in the formation and evolution of planetary systems. Previous work has examined the connection between outer gas giants and individual inner planets types, such as inner super Earths or hot Jupiters, but none have comprehensively looked at the global role gas giants play across all types of inner planet systems. Using public radial velocity data, we construct a sample of ˜1000 systems with one or more inner planets and sufficient sensitivity to outer gas giants. We categorize these inner planets by mass and semi-major axis yielding six populations: super-Earths, hot and cold sub-Saturns, and hot, warm and cold Jupiters. We compute occurrence rates of outer gas giants (1-10 AU; 0.5 - 20 M_J) in systems with each of these six inner planet populations, P(GG|inner planet population), both for all stellar metallicities and after dividing these samples into three metallicity bins ($[\mathrm{Fe/H}] < -0.1$, $-0.1 \leq [\mathrm{Fe/H}] < 0.1$, $[\mathrm{Fe/H}] \geq 0.1$). We compare these occurrence rates to the field star occurrence rate of gas giants P(GG) calculated using the sample from Rosenthal et al. (2021), and find that gas giants are more common in systems with inner planets across all inner planet populations, but this enhancement is only tentative for sub-Saturns, our smallest sample. The enhancement over P(GG) is strongly dependent on metallicity for hot/warm Jupiters and super-Earths, but remains consistent across metallicity for cold Jupiters. In addition to comparing our conditional occurrence rates to the field star values, we compare them to each other, asking the question: do gas giants play different roles given different inner planet types? We discuss how our results can be interpreted in the context of disk solid budget, relative timing of formation, and dynamical histories.

Primary author: BROMLEY, Joshua (University of Toronto)

Co-authors: BRYAN, Marta; LEE, Eve (UC San Diego)

Presenter: BROMLEY, Joshua (University of Toronto)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BROMLEY, Joshua** on **Wednesday, October 8, 2025**

Abstract ID : **137**

Non-uniform protoplanetary disks: the most physical viable birthplace of terrestrial planets

Content

At present, three models, namely, the pebble accretion, non-uniform protoplanetary disk, and the ring model present competing theories for the formation of the terrestrial planets of our solar system. Pebble accretion has been shown to be inconsistent with the isotopic properties of Earth, and the ring model is so highly fine-tuned that the probability of its realization is practically negligible. We show in this talk that a physically viable approach to the formation of terrestrial planets, one whose results will be naturally consistent with the isotopic and geological characteristics of Earth and the compositional properties of other terrestrial planets will have to start from a disk with a non-uniform distribution of protoplanetary bodies. We have carried out 1000 simulations of the late stage of terrestrial planet formation in such disks for a variety of the distributions of planetesimals and protoplanetary objects. Results demonstrate that in addition to the isotopic and composition properties of the planets, this approach also addresses some of the longstanding issues in terrestrial planet formation such as the large mass of Mars, the formation of Venus, and the lack of super-Earths in the inner solar system. We present results of our simulations and discuss their applications to the formation of extrasolar terrestrial planets and super-Earths as well.

Primary author: HAGHIGHIPOUR, Nader (PSI/IfA-Hawaii)

Presenter: HAGHIGHIPOUR, Nader (PSI/IfA-Hawaii)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HAGHIGHIPOUR, Nader** on **Wednesday, October 8, 2025**

Abstract ID : **138**

Leaky Traps and Small Grains in Ringed Protoplanetary Disks

Content

Much of the uncertainty in planet formation can be traced back to our limited knowledge of protoplanetary disks. An exciting breakthrough in this regard was the ALMA observations showing that most nearby bright disks feature ring-like substructures, suggesting localized concentration of dust. I will discuss how these dust traps are much more leaky than previously thought over a range of particle sizes and disk parameters, which has implications on exoplanetary system architecture, atmospheric compositions, and disk chemistry. I will also discuss how we can leverage the ringed disks to infer the grain size and disk turbulence, its implications on dust dynamics within the rings, and what it means for planet formation.

Primary author: LEE, Eve (UC San Diego)

Presenter: LEE, Eve (UC San Diego)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LEE, Eve** on **Wednesday, October 8, 2025**

Abstract ID : **139**

Formation of super-Earths from a ring and resonance disruption by outer eccentric embryos

Content

Observations by Kepler have revealed various properties of super-Earths, such as their orbital distribution, eccentricity, and size. These planets are typically located on short-period orbits around 0.1 au from the star, which is quite different from the orbital distribution of terrestrial planets in the Solar System, which are concentrated around 1 au. Furthermore, new observations by TESS, which also targets younger systems, suggest that super-Earth systems are initially in mean-motion resonances soon after formation, but these resonant relationships tend to be disrupted over timescales of about 100 million years. In this study, we investigated whether the observed characteristics of low-mass planets, including super-Earths and terrestrial planets, can be explained by planet formation simulations. Specifically, we performed N-body simulations that follow the growth of protoplanets formed in a ring around 1 au. The simulations include both the evolution over several million years within the protoplanetary disk and the subsequent long-term evolution after disk dispersal over 100 million years.

Our results show that when the initial total solid mass in the ring is small, about two Earth masses, the protoplanets grow through mutual collisions near 1 au and remain there without significant orbital migration. Such systems can eventually form terrestrial planets similar to those in the Solar System. In contrast, when the initial solid mass is large, about 20 Earth masses, planets grow rapidly to super-Earth size and migrate inward to around 0.1 au. During the disk phase, these planets are captured into mean-motion resonances, forming resonant chains. However, after disk dispersal, the systems can become dynamically unstable, leading to the disruption of the resonances. Such instabilities can reproduce the observed orbital features of super-Earth systems, including the time evolution of period ratios of adjacent planets. We also found that this disruption can be explained by secular perturbations from outer eccentric embryos that naturally form beyond 1 au during the formation process.

Primary author: Dr OGIHARA, Masahiro (Shanghai Jiao Tong University)

Co-authors: Dr KUNITOMO, Masanobu (Kurume University); Prof. MORBIDELLI, Alessandro (Collège de France)

Presenter: Dr OGIHARA, Masahiro (Shanghai Jiao Tong University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **OGIHARA, Masahiro** on **Wednesday, October 8, 2025**

Abstract ID : **140**

The Frequency of Earth-size Planets in the Habitable Zone

Content

The frequency of Earth-size planets in the habitable zone, hereafter $\eta_\oplus$, is a key parameter in the search for and characterization of Earth analogs. However, its value remains poorly constrained because it relies on extrapolations from the population of close-in exoplanets. I will discuss how properly accounting for atmospheric loss in that population is essential for deriving reliable estimates of $\eta_\oplus$, and I will present the most recent results for both Sun-like stars and M dwarfs.

Primary author: PASCUCCI, Ilaria (University of Arizona)

Presenter: PASCUCCI, Ilaria (University of Arizona)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **PASCUCCI, Ilaria** on **Wednesday, October 8, 2025**

Abstract ID : **141**

An event-based realistic astronomy photometric image simulator : Tianyu telescope as an example

Content

We present an event-driven, modular photometric numerical image simulator that generates realistic, per-exposure FITS frames and on-demand light curves from user input events. The system models the full observing stack —a simulated world , camera, mount, hardware, telescope, a comprehensive photon-distribution module including different sky and atmosphere noise and variable objects generated either from physical models or from reconstructed light-curve templates (Lomb–Scargle fits to TESS/Kepler data) and a CMOS sensor chain that converts photons → electrons → voltages → digital images containing realistic noise. The simulator is designed for pipeline validation, injection–recovery tests and data-challenge generation.

Primary author: LI, Kexin (TDLI)

Co-authors: RUI, Yicheng (TDLI); FENG, Fabo (TDLI)

Presenter: LI, Kexin (TDLI)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Comments:

Submit the poster later.

Status: ACCEPTED

Submitted by **LI, Kexin** on **Thursday, October 9, 2025**

Abstract ID : **142**

Transport-induced Chemistry and Vertical Mixing on Temperate sub-Neptune K2-18b

Content

Temperate sub-Neptunes, such as K2-18b, have gained significant attention due to their possible clear-sky conditions facilitating the detection of molecules and their potentially habitable environments. The cool equilibrium temperatures of these planets slow down chemical reactions (chemical timescales >10^{10} s) in the upper atmosphere (<1 bar), making the chemical abundances in this region strongly influenced by vertical transport from deeper layers. In this study, we used a three-dimensional (3D) general circulation model to investigate the transport-induced chemistry and vertical mixing in temperate gas-rich sub-Neptunes, using the parameters of K2-18b as an example. We model K2-18b assuming 180 times solar metallicity and consider it as either a synchronous or an asynchronous rotator, exploring spin-orbit resonances of 2:1, 6:1, and 10:1. We find that the vertical transport affects the chemical structure significantly, with quenching pressure between 10 to 1 bar, making CO_2 and CO more abundant (~10^{-3}) in the upper atmosphere compared to the equilibrium abundance (<10^{-15}), and horizontal winds are found to homogenize chemical composition zonally in the upper atmosphere. Molecular abundances in the photosphere remain consistent across different rotation periods. We employ a passive tracer in the model to estimate the one-dimensional (1D) equivalent eddy-diffusion coefficient (K_{zz}) of K2-18b, providing a parameter useful for future 1D atmospheric models. Additionally, synthetic transmission spectra generated from our model are compared with the JWST observation. This work offers a 3D perspective on transport-induced chemistry in temperate sub-Neptunes and derives vertical mixing parameters to support 1D modeling.

Primary author: LIU, Jiachen (Peking University)

Co-authors: Dr CHRISTIE, Duncan (Max Planck Institute for Astronomy); Dr KOHARY, Krisztian (University of Exeter); Prof. YANG, Jun (Peking University)

Presenter: LIU, Jiachen (Peking University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LIU, Jiachen** on **Thursday, October 9, 2025**

Abstract ID : **143**

From Planetesimals to Dwarf Planets by Pebble Accretion

Content

The size distribution of trans-Neptunian objects (TNOs) in the Kuiper Belt offers crucial insights into the formation and early evolution of the outer Solar System. It is widely believed that, with the exception of the cold classical population, TNOs formed in a primordial belt between 20 and 30 au, before they were dynamically implanted into their current orbits by a migrating Neptune. Recent observational surveys have revealed that the in-situ, dynamically cold population and the dynamically hot, implanted population share an overall similar size distribution, consistent with formation by streaming instability. However, the hot population contains a significantly larger number of massive bodies, including several dwarf planets, indicating that additional growth processes were at play. We propose that pebble accretion in the primordial belt was responsible for this discrepancy. Because pebble accretion operates only on massive bodies, it naturally flattens the high-mass end, consistent with observational constraints. Our results further reveal a correlation (or degeneracy) between the pebble aerodynamic size and the strength of gas turbulence, suggesting that accretion likely took place in environments where pebbles were entrained in the gas—conditions similar to the continuum rings seen observed with ALMA. By combining our results with morphological fits to ALMA images, we infer a typical pebble aerodynamic size (Stokes number) of 0.01, a turbulent diffusivity parameter (alpha) 0.001, and a total accreted pebble mass of roughly 10 Earth masses in the primordial belt, prior to the dynamical instability. TNOs that underwent significant pebble accretion and reached masses above 0.01% of Earth mass therefore satisfy the International Astronomical Union's "round shape" criterion for dwarf planets.

Primary author: ORMEL, Chris (Tsinghua University)

Presenter: ORMEL, Chris (Tsinghua University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ORMEL, Chris** on **Thursday, October 9, 2025**

Abstract ID : **144**

Early Stellar Flybys are Unlikely under New Constraints from Sednoids and Large-q TNOs

Content

Sednoids are extremely distant Trans-Neptunian Objects (TNOs) with large semi-major axes and large perihelion distances. Sednoids are thought to have formed through a combination of early planetary scatterings, which increased their semimajor axes, and additional perturbations beyond the four giant planets, which elevated their perihelion distances. Understanding the formation mechanism of sednoids is of great significance to our understanding of the early dynamical evolution of the solar system.

One hypothesis posits that close stellar flybys could have perturbed objects from the primordial scattering disk, generating the sednoid population. In this study, we run N-body simulations with different stellar encounter configurations to explore whether such a close stellar flyby can satisfy new constraints identified from sednoid (and detached extreme TNO) observation, including the low-inclination ($i < 30°$) profile and the primordial orbital alignment. Our results suggest that flybys with field stars are unable to generate a sufficient population, whereas flybys within the birth cluster fail to produce the primordial orbital alignment. To meet the inclination constraint of detached extreme TNOs, flybys have to be either coplanar ($i_\star \sim 0°$) or symmetric about the ecliptic plane ($\omega_\star \sim 0°, i_\star \sim 90°$). After taking into account their occurrence rate at the early stage of the Solar System, we conclude that stellar flybys that satisfy all constraints are unlikely to happen ($< 5\%$). Future discoveries of additional sednoids with precise orbital determinations are crucial to confirm the low-inclination tendency and the primordial alignment, and to further constrain models of the Solar System's early dynamical evolution.

Primary author: HU, Qingru (Tsinghua University)

Presenter: HU, Qingru (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HU, Qingru** on **Thursday, October 9, 2025**

Abstract ID : **145**

Dynamical Constraints of Formation and Evolution of Circumbinary Systems: Free Eccentricity Analysis from Pluto to Exoplanets

Content

We investigate the formation and dynamical evolution of circumbinary bodies using free eccentricity, a non-Keplerian orbital element defined in the Lee & Peale (2006) and Woo & Lee (2020) framework. For Pluto's small satellites (Styx, Nix, Kerberos, Hydra), we integrate their orbits with the latest ephemerides of the Pluto system (Porter & Canup 2023; Brozović & Jacobson 2024) and extract free eccentricities via Fast Fourier Transform (FFT), propagating reported ephemeris uncertainties. We confirm previous values for Nix, Kerberos, and Hydra but find a significantly different free eccentricity for Styx; this result is consistent across two sets of initial conditions. Tidal evolution simulations under the early in-situ formation scenario fail to reproduce Styx's free eccentricity, indicating that this hypothesis is disfavored or requires additional, unmodeled processes. Extending the analysis to 13 well-characterized circumbinary exoplanets, we perform N-body integrations, measure free eccentricities, forced eccentricities, and other orbital parameters in the Lee & Peale (2006) framework. Our results demonstrate that free eccentricity analysis is a robust tool to probe the formation and long-term evolution of circumbinary satellites and exoplanets.

Primary authors: JIANG, Qunfeng (The University of Hong Kong); Prof. LEE, Man Hoi (The University of Hong Kong)

Presenter: JIANG, Qunfeng (The University of Hong Kong)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JIANG, Qunfeng** on **Thursday, October 9, 2025**

Abstract ID : **146**

An Integrated Framework for Modeling Accretion, Differentiation, and Composition of Terrestrial and Exoplanetary Planets

Content

Understanding the compositional diversity of terrestrial planets requires integrating cosmochemical gradients, accretion dynamics, and metal–silicate differentiation within a unified physical framework. We present a modular Python-based system that couples these processes to model planetary formation from disk chemistry to final composition.

The framework comprises five modules: (A) Cosmochemistry distribution defines radial oxygen fugacity and meteoritic endmember gradients; (B) N-body simulation tracks mass- and time-resolved accretion histories from both narrow-ring and wide-disk initial configurations; (C) Impact process models global magma-ocean and localized partial-melting events that drive transient redox and chemical heterogeneity; (D) Multi-stage core formation iteratively solves metal–silicate partitioning for major and minor elements under evolving P–T–fO_2 conditions; and (E) Comparative planetology connects outputs to Earth, Mars, and differentiated exoplanet compositions.

By coupling dynamical trajectories with geochemical solvers, the framework links collisional growth to chemical differentiation in a self-consistent manner. Benchmark simulations reproduce key observables, including Earth's mantle FeO content, Mars's oxidized interior, and the oxygen fugacity gradient of the early Solar System.

Beyond Solar System applications, the framework enables forward and inverse modeling of rocky exoplanets by embedding cosmochemical and differentiation parameters into probabilistic retrieval schemes. This allows physically grounded interpretation of mass–radius–density observations through constraints derived from formation chemistry and accretion histories.

This unified and extensible system establishes a quantitative bridge between astrophysical dynamics and geochemical evolution, offering a versatile platform for next-generation studies of planetary formation and interior diversity across both Solar and extrasolar contexts.

Primary author: KONG, zhihui

Presenter: KONG, zhihui

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KONG, zhihui** on **Thursday, October 9, 2025**

Abstract ID : **147**

Gas-Accretion Origin of Sulfur Enrichment in close-in exoplanets: Thermal Dissociation of Semi-Volatile Salts

Content

Planetary atmospheric compositions preserve a record of their formation pathways and the history of elemental transport in protoplanetary disks. Since the early JWST programs reported SO_2 in the atmospheres of close-in exoplanet (Rustamkulov et al. 2023), the origin of sulfur in planetary atmospheres has drawn particular attention. Traditionally, because the dominant sulfur carriers in disks were assumed to be refractory minerals such as FeS, high atmospheric sulfur abundances have been attributed to solid accretion processes such as pebble or planetesimal accretion. However, it remains unclear whether solid accretion is the sole pathway for supplying sulfur to planets. Recent comet observations have identified semi-volatile salts containing sulfur -most notably ammonium hydrosulfide, NH_4SH (Altwegg et al. 2022)- which may account for up to ~20% of the sulfur budget (Slavicinska et al. 2024). Thermal dissociation of such salts can enrich disk gas in sulfur near the water snow line -a region favorable for planetary core formation -thereby opening a gas accretion pathway for delivering sulfur to planetary atmospheres.

To elucidate the origin of sulfur observed in giant-planet atmospheres, we model the transport of disk material that includes both volatile ices and semi-volatile ammonium salts. By incorporating salt dissociation into a coupled gas–dust evolution framework with ice sublimation and recondensation, we compute the elemental composition as a function of orbital radius and time. When salt dissociation is included, sulfur abundances near the water snow line are enhanced to several times the solar value (Figure 1). Using these elemental ratios as inputs to photochemical simulations and transmission spectrum calculations, we find that planets that accrete gas interior to the water snow line exhibit prominent SO_2 features at 7–8 μm for equilibrium temperatures of 800–1200 K (Figures 2 and 3). Unlike sulfur enrichment by solid accretion, enrichment originated by salts coenriches nitrogen, implying that the elemental S/N ratio can distinguish between the two pathways. Consistent with this expectation, the warm Neptune WASP-107b exhibits a sulfur- and nitrogen-enriched atmosphere with a high elemental S/N ratio, suggesting that salt dissociation may have been the dominant source of atmospheric sulfur in this system.

Primary author: NAKAZAWA, Kanon (The University of Tokyo)

Co-author: Dr OHNO, Kazumasa (The National Astronomical Observatory of Japan)

Presenter: NAKAZAWA, Kanon (The University of Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **NAKAZAWA, Kanon** on **Thursday, October 9, 2025**

Abstract ID : **148**

Thermal Structure of Magnetized Protoplanetary Disks and Its Implications for Planet Formation

Content

Understanding the temperature structure in protoplanetary disks is essential for developing a comprehensive theory of planet formation. The thermal profile governs the dust composition, which in turn affects the bulk composition of forming planets. In addition, both the growth and orbital migration of protoplanets are strongly regulated by the temperature structure of the disk. Accurate modeling of the thermal structure requires capturing the underlying disk dynamics, including disk accretion and energy transport processes. In this talk, I present our latest global magnetohydrodynamic (MHD) simulations with full non-ideal MHD effects and radiation transport. We show that accretion heating is generally inefficient across a wide range of disk parameters. I also discuss the long-term thermal evolution of magnetized disk models, based on MHD simulation results. Compared to viscously heated disks, MHD disk models more readily lead to the formation of both rocky super-Earths and volatile-rich sub-Neptunes, highlighting the crucial role of MHD disks in shaping planetary systems.

Primary author: MORI, Shoji (Tsinghua University)

Co-authors: BAI, Xue-Ning (Tsinghua University); Prof. TOMIDA, Kengo (Tohoku university); OGIHARA, Masahiro (Tsung-Dao Lee Institute); KUNITOMO, Masanobu (Kurume University)

Presenter: MORI, Shoji (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **MORI, Shoji** on **Thursday, October 9, 2025**

Abstract ID : **149**

Semi-analytical model for the dynamical evolution of planetary systems via giant impacts

Content

In the standard model of terrestrial planet formation, planets grow through giant impacts of planetary embryos after the dispersal of the protoplanetary gas disk. Traditionally, this process has been studied using N-body simulations, which have greatly advanced our understanding. However, they are computationally too expensive to generate sufficiently large planetary populations for statistical comparisons with observations. We present a new semi-analytical model that incorporates orbital and accretionary evolution driven by giant impacts and gravitational scattering. The model is applicable to close-in orbits around stars of various masses and has been validated against N-body simulations. It successfully reproduces the final distributions of planetary mass, semi-major axis, and eccentricity across a wide range of initial conditions, including those from recent planet formation simulations, while requiring significantly less computational time. By integrating this framework with other planet formation processes, a computationally efficient planetary formation model can be developed.

Primary author: Dr KIMURA, Tadahiro (University of Groningen)

Co-authors: Prof. IKOMA, Masahiro (National Astronomical Observatory of Japan); Prof. KOKUBO, Eiichiro (National Astronomical Observatory of Japan); Dr MATSUMOTO, Yuji (Kobe University); Prof. MORDASINI, Christoph (University of Bern)

Presenter: Dr KIMURA, Tadahiro (University of Groningen)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **Dr KIMURA, Tadahiro** on **Thursday, October 9, 2025**

Abstract ID : **150**

Disk Population Synthesis of structured disks with external photoevaporation

Content

With the ever-increasing census of protoplanetary disks observed in mm emission, disk population synthesis studies have become an important tool to constrain expected disk properties and the occurrence of sub-structures. Previous studies have revealed that the observed spectral indices are consistent with ubiquitous substructures emerging at early times. However, it still remains challenging to explain the relation between observed dust and gas radii.

In this work, we perform a disk population synthesis study trying to simultaneously reproduce the observed gas and dust disk radii, the spectral index and the millimetre flux. The substructures are modelled with imposing planetary gaps. We make use of the Tri-PoD dust model for the dust evolution, giving us a more accurate dust distribution in structured disks compared to previous population studies. Furthermore, allowing the consideration of additional effects, namely the potential formation of planetesimals via the Streaming instability in the substructures and the consideration of external photoevaporation.

Our results show how the inferred disk properties change considering our improved model. They show the effect external photoevaporation has on the disk radii and the continued challenge to match them with observations. Furthermore, our results highlight the challenge for dust evolution models to explain the disks with spectral indices below two. To explain these observations, we check if more sophisticated radiative transfer models(RADMC) alleviate this tension. This work highlights the importance of accurately modelling the dust distribution in the substructures in the disk and the resulting dust transport passing through them.

Primary author: KAUFMANN, Nicolas Leo (LMU)

Co-authors: Dr BIRNSTIEL, Til (LMU); Dr PFEIL, Thomas (CCA); Dr STAMMLER, Sebastian (LMU)

Presenter: KAUFMANN, Nicolas Leo (LMU)

Contribution Type: Poster

Comments:

Would also consider a poster if no oral talks are available

Status: ACCEPTED

Submitted by **KAUFMANN, Nicolas Leo** on **Thursday, October 9, 2025**

Abstract ID : **151**

Closeby Habitable Exoplanet Survey (CHES). IV. Planetary Parameters Derived from Angular Distance Variations

Content

The Closeby Habitable Exoplanet Survey (CHES) conducts precision astrometry of ~ 100 FGK-type stars within 10 parsecs to detect and characterize habitable Earth-like planets and super-Earths. This demanding micro arcsecond-level precision necessitates relative astrometry superseding absolute astrometric methodologies for planetary signal extraction. The relative angular distance method, widely used in astrometry, determines the components of angular separation in right ascension and declination. This approach requires knowledge of either the satellite's attitude or the field rotation at different observation epochs, introducing additional sources of error. This work models the variation in the length of the angular distance and separates the primary factors responsible for this variation: proper motion, parallax, and planetary perturbations.

Primary author: TAN, Dongjie (Purple Mountain Observatory,Chinese Academy of Sciences)

Presenter: TAN, Dongjie (Purple Mountain Observatory,Chinese Academy of Sciences)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TAN, Dongjie** on **Thursday, October 9, 2025**

Abstract ID : **153**

Hot Jupiter Origin and Tidal Evolution Constrained by the Age–Frequency Relation

Content

The discovery of hot Jupiters has challenged classical planet formation theory. While multiple formation mechanisms have been proposed, their relative contributions remain unclear. Hot Jupiters also provide a unique testbed for tidal theory, particularly the tidal quality factor, which remains poorly constrained. Using a sample of hot Jupiters orbiting Sun-like stars with kinematic data, we find: (1) a broken age-frequency relation with a distinct ridge at ~2 Gyr, and (2) evidence for multi-origin formation with different timescales. Our analysis yields two key constraints: First, the tidal quality factor for Sun-like stars is log Q ~ 5.7, consistent with observed orbital decay rates. Second, we quantify formation channels showing ~60% form early via in-situ formation, disk migration, planet-planet scattering, or Kozai-Lidov cycles, while ~40% form later on a timescale up to several Gyr via secular chaos. The obliquity distribution of late-arrival hot Jupiters further supports this dichotomy. These results provide a unified framework reconciling hot Jupiter demographics with multi-channel formation.

Primary authors: CHEN, Di-Chang (Sun Yat-sen University); XIE, Ji-Wei (Nanjing University)

Co-authors: Prof. DAI, Fei (University of Hawai' i); Prof. LIU, Chao (National Astronomical Observatories,); MA, Bo (Sun Yat-sen University); Prof. WANG, Songhu (Indiana University,); ZHOU, Jilin (Nanjing University)

Presenter: CHEN, Di-Chang (Sun Yat-sen University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHEN, Di-Chang** on **Thursday, October 9, 2025**

Abstract ID : **154**

Dynamical Analysis of the 5:1 Mean-motion Resonance of the HD 202206 System

Content

The HD 202206 system, featuring two substellar companions in a 5:1 period ratio around a solar-type star, offers a rare opportunity to study high-order mean-motion resonance (MMR) and provides new insights into the dynamical evolution of substellar companions in extrasolar planetary systems. Previous studies established the dynamical structure around the 5:1 commensurability (Correia et al. 2005; Couetdic et al. 2010). More recently, Benedict & Harrison (2017) claimed that this system is nearly face-on, with an inclination of approximately 10°, which implies large masses for the companions, with the inner companion being a low-mass M dwarf. However, this assertion remains controversial. We have performed a new dynamical fit to all available radial velocity data from the CORALIE and HARPS spectrographs. The EXO-STRIKER toolkit was employed for the fitting process (Trifonov 2019). We assessed the long-term stability of the system using a Nested Sampling algorithm (Skilling 2004, 2006; Higson et al. 2019). An analysis of the astrometric jitter around the best fit in the Gaia DR3 catalog and the proper motion anomalies between Hipparcos and Gaia showed that the orbital inclinations are strongly constrained to about 51°. Our best-fit dynamical solution, assuming a coplanar and inclined (i = 51°) configuration, yields the actual mass of 21.22 M_J and 3.08 M_J for the inner and outer companions, respectively. The corresponding orbital periods are 256.26 days and 1298.69 days, with eccentricities of 0.43 and 0.18. An investigation of the five relevant resonant angles (θ_1, θ_2, θ_3, θ_4, θ_5) shows that only one, θ_4, is librating, indicating weak but persistent resonant behavior. Our stability analysis confirms that the system is dynamically stable. The inner companion of HD 202206 has a minimum mass firmly in the brown dwarf regime, while the outer companion is a giant planet. This configuration blurs the boundary between planets and brown dwarfs. Identifying a resonant system that contains both a brown dwarf and a giant planet therefore provides valuable insight into the limits of planet and brown dwarf formation, and into the possibility of a continuous transition between the two populations.

Primary author: CAO, Yingyi (The University of Hong Kong)

Co-authors: LEE, Man Hoi; TRIFONOV, Trifon (Zentrum für Astronomie der Universität Heidelberg); REFFERT, Sabine (Zentrum für Astronomie der Universität Heidelberg)

Presenter: CAO, Yingyi (The University of Hong Kong)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CAO, Yingyi** on **Thursday, October 9, 2025**

Abstract ID : **155**

The Formation of Ultra-short-period Planets under the Influence of the Nearby Planetary Companions

Content

Ultra-short-period (USP) planets, defined as those with orbital periods shorter than 1 day, provide valuable insights into planetary evolution under strong stellar tidal interactions. In this work, we investigate the formation of USP planets in two-planet systems consisting of an inner terrestrial planet accompanied by an outer hot Jupiter (HJ). Our simulation results show USP planets can form through a process driven by secular perturbations from the outer companion, which induce eccentricity excitation, tidal dissipation, and subsequent orbital decay of the inner planet. The probability of USP formation is governed by key factors, including the mass ratio between two planets, their orbital eccentricities, and the tidal dissipation process. 6.7% of our simulations form USP planets, and USP planets form most efficiently when the mass ratio is around 4 $M_{\oplus}/M_{\mathrm{J}}$. Furthermore, the eccentricity of the outer HJ plays a crucial role-moderate eccentricities ($e_{\mathrm{outer}} < 0.1$) favor USP formation, whereas higher eccentricities ($e_{\mathrm{outer}} > 0.1$) enhance the likelihood of orbital instability, often resulting in a lonely HJ. USP planets form more efficiently when the tidal dissipation function of the inner planet is comparable to the values estimated for terrestrial planets in the solar system.

Primary author: ZHU, Jiajun

Presenter: ZHU, Jiajun

Track Classification: Planet formation

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHU, Jiajun** on **Thursday, October 9, 2025**

Abstract ID : **156**

Astrometric Fitting of PDS 70 Planets with Resonant Orbits

Content

PDS 70 is the only known young system where two accreting planets have been directly imaged, making it a key benchmark for testing theories of planet formation, disk instability vs. core accretion, gas accretion, migration, and resonance trapping. To refine these theories, it's crucial to obtain accurate dynamical properties of the planets in this system. Astrometric observations have provided the relative positions of the planets on arcs along their orbits, but fitting these data with Keplerian orbits often leads to unstable solutions on short timescales, making many solutions unlikely. In contrast, fitting the astrometric data with resonant orbits (or periodic orbits) ensures stability. Additionally, resonant orbits provide a relationship between the planet's closeness to resonance, eccentricity, and mass. Therefore, assuming that the PDS 70 planets are in resonance allows more reliable mass constraints and a deeper understanding of the system's dynamical behavior.

Primary author: YI, Tian (Tsinghua University)

Co-authors: HUANG, Shuo (Tsinghua University); ORMEL, Chris (Tsinghua University)

Presenter: YI, Tian (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YI, Tian** on **Thursday, October 9, 2025**

Abstract ID : **157**

Demographics of Close-In TESS Exoplanets Orbiting FGK Main-sequence Stars

Content

Understanding the demographics of close-in planets is crucial for insights into exoplanet formation and evolution. We present a detailed analysis of occurrence rates for close-in (0.5–16 day) planets with radii between 2 and 16 R⊕ around FGK main-sequence stars.

Our study uses a comprehensive sample from four years of TESS-SPOC FFI data cross-matched with Gaia, analysed through our rigorous detection, vetting, and validation pipeline. Using high-confidence planet candidates, we apply a hierarchical Bayesian model to determine occurrence rates in the two-dimensional orbital periodradius plane. Our results are presented using 10-by-10 bins across the period-radius parameter space, offering unprecedented resolution and statistical precision. We find an overall occurrence rate of 12.1+1.0/−0.9%, consistent with Kepler analyses (~11%; Hsu et al. 2019) within 1 sigma. When using identical binning, our occurrence rate posteriors distributions align with Kepler's but have a magnitude smaller uncertainties on average.

For hot Jupiters, given our upper radius limit of 16 R⊕, we estimate the mean occurrence rate density, defined as the occurrence rate per unit logarithmic radius per unit logarithmic period, to be 0.13±0.01%. This value is consistent with the previous TESS result of 0.12±0.01% within 1 sigma.

Additionally, in a volume-limited Gaia subsample within 100 pc in the same parameter region, we measure an overall planet occurrence rate of 10.2+1.3/−1.1% and a hot Jupiter occurrence rate density of 0.14±0.04%. We also provide their dependencies on stellar mass. Our results establishes an improved foundation for constraining theoretical models of exoplanet populations.

Primary author: Dr CUI, Kaiming

Presenter: Dr CUI, Kaiming

Contribution Type: Poster

Comments:

The paper is currently under review, and we have received positive feedback from the referee. It is expected to be published soon.

Status: ACCEPTED

Submitted by **CUI, Kaiming** on **Thursday, October 9, 2025**

Abstract ID : **158**

Can we form substructures by starlight-driven shadowing in dusty, radiative protoplanetary disks?

Content

Protoplanetary disk observations show ubiquitous substructure both at their surface and close to their midplane with gaps, rings, and spirals. While planets often explain such features, substructures are regions of local pressure maxima that can form dust traps, an essential initial condition for dust growth in line with planet formation theories. One proposed mechanism for generating these substructures is stellar-irradiation-driven shadowing, where vertical temperature perturbations cause the disk surface to puff up, casting shadows behind. We investigate the physical conditions for the existence of starlight-driven shadowing and test the viability of this "irradiation instability" argument with radiation hydrodynamical models using the flux-limited diffusion method and frequency-dependent stellar irradiation. We find the existence of a quasi-steady shadows (staircases in the optical surface) and a correlation of such features with the optical depth of the disk. Long term evolution shows the coexistence of these bumps with the vertical shear instability. We also model dust settling in the disk, underscoring the importance of consistent modelling of dust dynamics for accurately resolving the irradiation absorption surface, showing prelimiary ideas for multifluid dust-gas + radiation modelling with PLUTO. We also present synthetic scattered-light images of this flared-staircase disk geometry.

Primary author: SUDARSHAN, Prakruti (Max Planck Institute for Astronomy)

Co-authors: Prof. BIRNSTIEL, Til (LMU Munich); Dr FLOCK, Mario (Max Planck Institute for Astronomy); Dr FUKSMAN, David (Max Planck Institute for Astronomy); Dr ZIAMPRAS, Alexandros (LMU Munich)

Presenter: SUDARSHAN, Prakruti (Max Planck Institute for Astronomy)

Contribution Type: Poster

Comments:

also happy to present a poster if the talk is not selected

Status: ACCEPTED

Submitted by **SUDARSHAN, Prakruti** on **Thursday, October 9, 2025**

Abstract ID : **159**

Assessing the Early Atmospheric History of the TRAPPIST-1 System with Dynamical Constraints

Content

The TRAPPIST-1 system hosts seven planets locked in complex mean motion resonances (MMRs), indicative of a stable yet intricate dynamical history. These planets likely possessed primordial hydrogen-dominated atmospheres that underwent significant photoevaporation-driven mass loss early on. This atmospheric escape may have critically shaped their current orbits and system stability.

We aim to investigate the long-term evolution of the TRAPPIST-1 system with atmospheric mass loss. By exploring the impact of this atmospheric mass loss on orbital configurations, we aim to constrain the planets' initial atmospheric conditions.

We employ N-body simulations to model the long-term evolution of the TRAPPIST-1 system, incorporating mass loss and orbital changes due to angular momentum transfer between escaped gas and the planet. These simulations allow us to track changes in the planets' orbits under different mass loss scenarios, testing various mass loss fractions and angular momentum transfer efficiencies.

Our simulations demonstrate that even modest atmospheric loss (~1.8% mass loss for TRAPPIST-1 b, assuming angular momentum conservation) induces significant orbital reconfiguration. Mass loss drives orbital expansion of the innermost planet, triggering convergent migration. This leads to increased planetary eccentricities and a measurable shift in the 3-body resonant angle of the b-c-d triplet, indicating substantial disruption to the resonant architecture. Crucially, we find that mass loss fractions exceeding ~6% (for reasonable/possible angular momentum transfer efficiencies) can lead to noticeable changes in the system's orbital configuration.

We conclude that the TRAPPIST-1 planets likely retained no more than 6% of their primordial atmospheres during formation, providing new constraints on the system's early atmospheric evolution.

Primary author: OUYANG, Wenzhan (李政道研究所)

Co-authors: MATSUMOTO, Yuji (Kobe University); OGIHARA, Masahiro (Tsung-Dao Lee Institute)

Presenter: OUYANG, Wenzhan (李政道研究所)

Track Classification: Dynamical evolution

Contribution Type: Poster

Status: ACCEPTED

Submitted by **欧阳, 文湛** on **Thursday, October 9, 2025**

Abstract ID : **160**

Exploring Free-Floating Planets with Space-based Microlensing

Content

Galactic microlensing is the only known method capable of detecting sub-Jovian free-floating planets (FFPs). Ground-based surveys have identified a population of ultra-short microlensing events, suggesting that FFPs with masses above that of Earth may be several times more common than stars. I will discuss the discovery and characterization of FFPs through space-based observations.

Primary author: DONG, Subo

Presenter: DONG, Subo

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DONG, Subo** on **Thursday, October 9, 2025**

Abstract ID : **161**

Configuration of Single Giant Planet Systems Generating ‘Oumuamua-Like Interstellar Asteroids

Content

The first discovered interstellar small object, ‘Oumuamua (1I/2017 U1), presents unique physical properties of extremely elongated geometric shape and dual characteristics of an asteroid and a comet. These properties suggest a possible origin through tidal fragmentation, which posits that ‘Oumuamua was produced through intensive tidal fragmentation during a close encounter with a star or a white dwarf, resulting in its shape and ejection from its natal system. According to this mechanism, a high initial orbit eccentricity and a small pericentre of the parent body are necessary to produce ‘Oumuamua-like objects. To verify whether this mechanism can occur in single giant planet systems, we conduct long-term numerical simulations of systems with a low-mass ($0.5M_{\odot}$) host star and a giant planet in this study. We determine that an eccentric orbit ($e_{\mathrm{p}} \sim 0.2$) and a Jupiter-mass ($M_{\mathrm{p}} \sim M_{\mathrm{J}}$) of the planet appears to be optimal to generate sufficient perturbations for the production of ‘Oumuamua-like objects. When the planetary semi-major axis a_{p} increases, the proportion of planetesimals ejected beyond the system $P(\mathrm{ej})$ increases accordingly, while the possibilities of ejected planetesimals undergoing stellar tidal fragmentation $P(\mathrm{tidal}|\mathrm{ej})$ remains relatively constant at $\sim 0.6\%$. Focusing on stellar tidal fragmentation alone, the ratio of extremely elongated interstellar objects to all interstellar objects is $P_{\mathrm{e}} \sim 3\%$.

Primary authors: ZHOU, Jilin (Nanjing University); 郑, 熙凌 (南京大学)

Presenter: 郑, 熙凌 (南京大学)

Contribution Type: Poster

Comments:

https://doi.org/10.1093/mnras/staf234

Status: ACCEPTED

Submitted by **ZHENG, Xi-Ling** on **Thursday, October 9, 2025**

Abstract ID : **162**

The Ophiuchus Disk Survey Employing ALMA (ODISEA): project updates

Content

The Ophiuchus Molecular Cloud hosts the largest population of protoplanetary disks within 200 pc and a significant number of embedded young stellar objects (Class I and Flat Spectrum sources), making it an ideal region for the study of disk evolution and planet formation. ODISEA is the largest ALMA survey of nearby molecular clouds and currently involves observations at six different ALMA Bands (1, 3, 4, 6, 8, and 10) at resolutions ranging from 0.05" to 1.0" . Here we highlight recent results from ODISEA and ongoing work, including the full size distribution of the ~100 brightest disks in the cloud (Dasgupta et al. 2025), numerical models for a unified evolutionary sequence of planet-driven substructures (Orcajo et al. 2025), a multi-frequency analysis of the ~50 brightest targets (Chavan et al. in prep.), the identification of molecular outflows in young brown dwarfs (Gonzalez-Ruilova et al. in prep), and the statistics of substructures in compact disks (Bhowmik et al. in prep.).

Primary author: CIEZA GONZALEZ, lucas alejo

Presenter: CIEZA GONZALEZ, lucas alejo

Track Classification: Disks

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CIEZA GONZALEZ, lucas alejo** on **Thursday, October 9, 2025**

Abstract ID : **163**

Multiwavelength Constraints on Dust Dynamics and Size Evolution in Protoplanetary Disk Rings

Content

Observations with the Atacama Large Millimeter/submillimeter Array and the Jansky Very Large Array have revealed many dust rings in protoplanetary disks, often interpreted as dust traps at gas pressure bumps. Previous studies have typically modeled these rings by assuming a single dust species in drift–diffusion equilibrium, neglecting dust size evolution resulting from coagulation and fragmentation. Our model provides a unified framework for interpreting multiwavelength observations by linking the physical dust distribution to the observed ring properties, thus laying the foundation for observational modeling.

Primary author: YANG, Linhan

Presenter: YANG, Linhan

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Linhan** on **Thursday, October 9, 2025**

Abstract ID : **164**

The Impact of Fiber Cross Contamination on Radial Velocity Precision

Content

High-resolution spectrographs with precise radial velocity (PRV) capabilities require careful considerations in instrumental design and data processing in order to reach the 10cm/s-level precision, which is needed for detecting Earth-like planets.
In this work, we investigate the impact of fiber cross contamination on the RV precision via simulations, as modern PRV spectrographs often have multiple fiber traces on their spectral images. We simulated extracted 1-D spectra under the preliminary design of CHORUS, short for the Canary Hybrid Optical high-Resolution Ultra-stable Spectrograph, a dual-arm PRV spectrograph under construction for the Gran Telescopio de Canarias.
We considered two types of fiber cross contaminations: contamination from calibration traces to neighboring science traces (or cal-sci contamination) and between science traces (or sci-sci contamination). We present results in four different scenarios: photon noise only, cal-sci contamination only, sci-sci contamination only, and all effects combined.
For the preliminary design of CHORUS, we estimated that the cal-sci contamination fraction is smaller than 0.0001% in flux across the whole CCD for either arm, resulting in a negligible impact on the RV precision. Assuming worst-case scenarios, we estimated the sci-sci contamination to be up to 0.1% in some traces, corresponding to an additional RV error of up to 10cm/s.
We demonstrate the importance of considering fiber-trace spacing and cross contamination in PRV spectrographs, and we recommend careful design, operation, and spectral extraction algorithms to minimize and mitigate cross contamination to achieve the best possible instrumental RV precision.

Primary authors: JI, Chenyang (Department of Astronomy, Tsinghua University); WANG, Sharon Xuesong (Tsinghua University)

Co-authors: Dr ZHANG, Kai (NIAOT); Dr WANG, Liang (NIAOT)

Presenter: JI, Chenyang (Department of Astronomy, Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JI, Chenyang** on **Thursday, October 9, 2025**

Abstract ID : **165**

A Deep HST/WFC3/H-alpha Imaging Survey to Probe the Demographics of Accreting Planets at Wide Separations

Content

emission, potentially biasing our understanding of exoplanet demographics at wide separations. Hot-start planets, with higher luminosities during formation, are favored over cold-start giants, which are fainter and harder to detect. Sub-Jovian-mass planets at wide separations also remain largely unexplored. Hα emission from accreting planets offers an alternative method to estimate occurrence rates regardless of thermal evolution and, with sufficient sensitivity, enables searches for lower-mass planets. We present results from a deep HST/WFC3-UVIS Hα imaging survey of over 200 members in the ˜2 Myr-old IC 348 region. Using a deep learning-based image classification model to separate real sources from cosmic-ray-induced false positives, we identify one new brown dwarf companion candidate and provide upper limits on Hα luminosities, accretion luminosities, and mass accretion rates for non-detections. Ultimately this study provides the most precise demographic constraints on an otherwise hidden population of long-period accreting protoplanets.

Primary author: JIANG, Lillian Yushu (University of California, Santa Barbara)

Co-author: BOWLER, Brendan (University of California, Santa Barbara)

Presenter: JIANG, Lillian Yushu (University of California, Santa Barbara)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JIANG, Lillian Yushu** on **Thursday, October 9, 2025**

Abstract ID : **166**

Binary asynchronization and circularization by tidally driven inertial waves

Content

Gaia DR3 has provided an unprecedented view of orbital eccentricity damping by tides raised in stellar binaries. These data reinforce a longstanding discrepancy between the efficiency of tidal circularization observed in binaries with constituent stars on the main sequence or the early red giant branch, viz-a-viz the circularization predicted by classical "equilibrium" tidal theory. Here I demonstrate that tidally driven inertial waves in the convective envelopes of solar-type stars can enhance eccentricity damping by orders of magnitude over equilibrium tides, independent of many uncertainties associated with the role played by convective turbulence. This mechanism provides a possible reconciliation between the observed and theoretically predicted circularization of solar-type, main sequence binaries. Additionally, this channel of tidal eccentricity damping makes novel predictions for the evolution of rotation rates in binary star systems.

Primary author: DEWBERRY, Janosz (University of Massachusetts Amherst)

Presenter: DEWBERRY, Janosz (University of Massachusetts Amherst)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DEWBERRY, Janosz** on **Thursday, October 9, 2025**

Abstract ID : **167**

Elemental and photochemical controls on the atmospheric stability of rocky exoplanets

Content

Metallicity and the C/O ratio are among the most common parameters used to describe exoplanet atmospheres. While these are appropriate metrics for giant hydrogen-dominated planets, they are not suited for capturing the atmospheric complexity of rocky exoplanets. To identify better metrics and explore the range of feasible atmospheric compositions, we investigate which chemistries remain stable against atmospheric escape over long timescales.

We construct a grid of upper atmospheric compositions for an Earth-like planet around a Sun-like star by varying only the molar ratios of H, C, N, O, and S. This extends previous applications of our model, which focused on CO_2–N_2 atmospheres, to a broader chemical parameter space, including potential water-rich cases or SO_2-dominated volcanic atmospheres. To model the steady state for each composition, we use Kompot, our first-principles 1D model, which self-consistently couples atmospheric chemistry with thermal structure and includes key radiative heating and cooling processes, as well as vertical transport via eddy and molecular diffusion. The model is initialised with molecular abundance profiles from the GGchem equilibrium chemistry code.

We find that atmospheric lifetime strongly depends on the bulk elemental composition. It is positively correlated with the elemental fractions of oxygen and carbon, and strongly anticorrelated with the fraction of nitrogen. In terms of elemental ratios, we find that the lifetime decreases with the H/S, H/O, N/O and C/O ratios, in decreasing order of importance. Sulfur does not show a clear effect on either temperature or lifetime on its own. The impact of hydrogen requires further investigation; the current grid only samples low hydrogen fractions (≤5%).

These results provide a new framework for assessing atmospheric stability and offer better guideline parameters for rocky planet atmospheres compared to the C/O ratio or metallicity alone. Our future work will expand this grid by varying planetary mass and XUV irradiation, expanding the parameter space towards the radius valley, thus providing a theoretical context for interpreting upcoming observations with JWST and ESA's Ariel mission

Primary author: STANKOVIC, Ivan

Co-authors: Prof. GÜDEL, Manuel (University of Vienna); Dr VAN LOOVEREN, Gwenaëlle (University of Vienna); ROBELING, Nils-Martin (University of Vienna); Prof. BORO SAIKIA, Sudeshna (University of Vienna)

Presenter: STANKOVIC, Ivan

Contribution Type: Poster

Status: ACCEPTED

Submitted by **STANKOVIC, Ivan** on **Thursday, October 9, 2025**

Abstract ID : **168**

Planetesimal formation via the streaming instability persists under self-consistent MRI turbulence

Content

The formation of planetesimals, the building blocks of terrestrial planets and giant planet cores, remains a key open question in planet formation. The streaming instability (SI) is the leading proposed mechanism, concentrating dust into dense structures that can collapse gravitationally. The critical dust-to-gas surface density ratio Z above which this occurs depends on local dust properties and disk conditions, such as particle Stokes number, pressure gradient, and turbulence. The role of turbulence has recently drawn attention because simulations have shown that modest levels of turbulence forced with zero correlation time can increase the critical Z significantly. This might not necessarily be the case for self-consistently driven magnetorotational (MRI) turbulence though, since MRI turbulence drives zonal flows that concentrate particles. We present the first parameter study of the SI in 3D stratified shearing-box simulations including non-ideal magnetohydrodynamics with ambipolar diffusion. We find that modest turbulence levels ($\alpha \sim 10^{-4}$) yields critical Z values similar to non-turbulent cases, while stronger turbulence ($\alpha \sim 10^{-3}$) increases the critical Z, though rather less than in forced-turbulence models. These results suggest that self-consistently driven MRI turbulence does not necessarily inhibit planetesimal formation via the SI.

Primary author: ERIKSSON, Linn

Presenter: ERIKSSON, Linn

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ERIKSSON, Linn** on **Thursday, October 9, 2025**

Abstract ID : **169**

Can gravitational scattering describe the kinematics of interstellar objects and free floating planets?

Content

Free-floating planets and interstellar objects (ISOs) are likely ejected from their original planetary systems.
Current observations of ISOs put their peculiar velocities at several tens of km/s. We explore the possibility that Chandrasekhar scattering between these small objects and the background of stars is responsible for their current velocity dispersions.

Primary author: LAU, Jun Yan (Tsung Dao Lee Institute, Shanghai Jiao Tong University)

Co-author: LAI, Dong (TDLI)

Presenter: LAU, Jun Yan (Tsung Dao Lee Institute, Shanghai Jiao Tong University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LAU, Jun Yan** on **Thursday, October 9, 2025**

Abstract ID : **170**

Engulfment of Eccentric Planets by Giant Stars: Hydrodynamics and Light Curves

Content

Recent observations suggest that planetary engulfment by a giant star may produce radiation that resembles subluminous red novae (sLRNe). We present three-dimensional (3D) simulations of the interaction between an eccentric $5\,M_J$ giant planet and its $1\,M_\odot$ red giant host star. The planet's pericenter is initially 60% of the stellar radius and is fully engulfed after tens of orbits. Once inside the stellar envelope, the planet generates pressure disturbances that steepen into shocks, ejecting material from the envelope. We use post-processing to calculate the light curves produced by planetary engulfment. We find that the hot stellar ejecta enhances the stellar luminosity by several orders of magnitude. A prolonged hydrogen recombination plateau appears when the ejecta cools to about 10^4 K. The late-time rapid dimming of the light curve follows dust formation, which obscures the radiation. For planets with lower eccentricity, the orbital decay proceeds more slowly, although the observable properties remain similar.

Primary authors: YANG, Mengqi (Shanghai Jiao Tong University); Prof. LAI, Dong (Shanghai Jiao Tong University)

Presenter: YANG, Mengqi (Shanghai Jiao Tong University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Mengqi** on **Thursday, October 9, 2025**

Abstract ID : **171**

Shadow-based Framework for Estimating Transition Disk Geometries

Content

High-resolution optical, infrared, and (sub-)millimeter observations have revealed cavities, rings, and spirals in many protoplanetary disks. In transition disks, a compact inner disk can persist inside the cavity; when it is misaligned with the outer disk, shadows appear on the outer disk. These shadows carry geometric information about both the inner and outer disks, and their positions and widths respond sensitively to the underlying parameters. We present a shadow-based framework that directly infers the three-dimensional geometry of transition disks—with mutually misaligned inner and outer components—from scattered-light images. The method uses two key observables: (i) the horizon of the outer scattering surface (the boundary between the visible and hidden sides) and (ii) the shadow boundaries cast by the misaligned inner disk. The shapes of these curves encode the inner-disk orientation and its thickness (the maximum aspect ratio) as well as the radial variation of the outer surface height, providing geometric leverage. Our model explicitly includes a finite inner-disk thickness and treats the outer-disk scattering-surface height $H(R)$ as a function of cylindrical radius R. We extract the horizon and shadow curves from image gradients and jointly fit model curves to the boundaries, emphasizing geometric locations rather than absolute photometry.

Applied to HD 100453, the framework yields a strongly misaligned inner disk with an inclination of 50° and a position angle of 88°, implying a misalignment of $\sim 70^\circ$ relative to the outer disk and consistent with VLTI/GRAVITY results. The inferred maximum inner-disk aspect ratio is 0.17. Under representative conditions—stellar luminosity $L \approx 6L_\odot$ and an optically thin inner disk—the scattering surface has more than five times the gas pressure scale height. This suggests that small dust grains are abundant above the pressure scale height, plausibly maintained by turbulent mixing or disk winds that vertically disperse gas-coupled particles to high altitudes. On the other hand, the outer disk’s scattering-surface height converges rapidly to $H/R \approx 0.25$ at larger radii, and the inner edge lies at ≈ 16.8 au. The ALMA Band 7 azimuthally averaged intensity increases near ~ 17 au and peaks at ~ 30 au, a pattern consistent with a pressure bump that traps larger grains at or just outside the inner edge. The recovered surface-height information can be used to constrain the dust phase function—via reconstruction of incidence and scattering angles on the image plane—and hence the optical properties of the dust. In addition, combining this purely geometric approach with ALMA temperature maps enables tests of cooling timescales and turbulence drivers in planet-forming disks.

Primary author: ORIHARA, Ryuta (The University of Tokyo)

Co-author: Prof. MOMOSE, Munetake (Ibaraki University)

Presenter: ORIHARA, Ryuta (The University of Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ORIHARA, Ryuta** on **Thursday, October 9, 2025**

Abstract ID : **172**

The Origins of Close-in Neptunes

Content

Close-in Neptunes are among the rarest types of exoplanets, yet perhaps the most informative. The Neptune desert was one of the first demographic features identified in the exoplanet population, and its origins remain a subject of debate. Furthermore, the rapid decline in occurrence between sub-Neptunes and Neptunes—the so-called "radius cliff"—provides important clues about their formation and evolution. In this talk, I will review current ideas regarding the origin of the Neptune desert and discuss their implications in light of the recent discoveries of the Neptunian ridge and polar Neptunes. Finally, I will argue that the radius cliff is not steep enough to be consistent with runaway gas accretion, and that Neptune-mass planets likely became gap-opening before the onset of runaway growth, allowing them to exist with envelope mass fractions that would otherwise imply rapid accretion.

Primary author: OWEN, James (Imperial College London)

Presenter: OWEN, James (Imperial College London)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **OWEN, James** on **Thursday, October 9, 2025**

Abstract ID : **173**

Dust Dynamics in Disk Pressure Bumps and Late Planetesimal Formation

Content

A long-standing challenge in planet formation is explaining how mm–to cm-sized "pebbles" grow into 10–100 km planetesimals. While submicron dust grains can readily stick and grow through low-velocity collisions, further growth is hindered by several barriers. The streaming instability has been proposed to overcome these barriers by forming clumps of pebbles whose density exceeds the gravitational instability limit. However, the streaming instability can work only during the early stage of the disk when there are large amounts of pebbles radially drifting through it. The formation of late planetesimals, such as the chondritic parent bodies in the Solar System, requires both halting the rapid inward drift of pebbles to preserve them over millions of years and eventually concentrating solids to densities high enough to enable gravitational collapse.

Pressure bumps in the gas disk provide one promising solution: they act as dust traps that can preserve material and enhance local dust-to-gas ratios. Observations from ALMA reveal that such dust rings are a ubiquitous feature of protoplanetary disks. However, whether these rings can also serve as the nurseries of planetesimal formation remains an open question. While dust trapping alone may not suffice, it has been shown recently that fluid-dynamical instabilities may operate within pressure bumps, for example the dusty Rossby wave instability (DRWI) (Liu & Bai 2023), and may offer a potential pathway for concentrating dust and triggering the formation of dense clumps that could seed planetesimals. Specifically, Liu & Bai find that for mild pressure bumps, an instability can develop that forms dust clumps while preserving the overall ring structure.

In this work, we investigate the mechanisms that enhance local dust concentration in pressure bumps and how variations in the dust-to-gas ratio affect the dynamics and stability of dust rings. Using fargOCA, a hydrodynamic code, we first reproduce the results of Liu & Bai (2023) in a global, vertically integrated 2D viscous disk, forming high-density dust clumps while preserving the dust ring. Continued dust accumulation in the ring increases both the frequency of clump formation and the maximum clump density.

We then extend our investigation to 3D simulations with dust settling in both viscous and inviscid disks, yielding results distinct from the 2D case. In the viscous case, we find that the instability is suppressed and no clumps are formed. In the inviscid case, the pressure bump is partially flattened, allowing dust to leak past the initial trap. Although no clumps form, the ring develops non-uniform substructures with regions of enhanced dust-to-gas ratio spanning a broad range of heliocentric distances. This can explain why the rings observed by ALMA are radially much broader than they are vertically thick, without having to invoke anisotropic turbulence.

Given the lack of clump formation in the 3D disk, we next consider a late evolutionary phase in which gas is gradually removed through photoevaporation. In the context of all the dust being trapped in multiple rings, gas removal may become the dominant mechanism for enhancing the local dust-to-gas ratio and dust volume density within each ring, offering a possible explanation for the delayed formation of chondrites. Gas removal increases the dust volume density by promoting both sedimentation of dust toward the midplane and radial concentration. Eventually, the dust reaches the Hill density, enabling planetesimal formation via gravitational instability.

This study demonstrates that in a 3D disk, the growth of instabilities and formation of dust clumps in pressure bumps is non-trivial, further highlighting their sensitivity to disk turbulence and vertical structure.

Primary author: TATARELLI, Maya (Observatoire de la Cote d’Azur)

Co-authors: Dr LEGA, Elena (Observatoire de la Cote d’Azur); MORBIDELLI, Alessandro (Collège de France)

Presenter: TATARELLI, Maya (Observatoire de la Cote d’Azur)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TATARELLI, Maya** on **Thursday, October 9, 2025**

Abstract ID : **174**

The Role of Planetary Mass Loss in Shaping Orbital Inclinations and Eccentricities

Content

Planetary post-formation and structural evolution after the gas disk has dissipated play a crucial role in shaping the final orbital architecture, particularly through the process of atmospheric mass loss. The outflowing gas experiences tidal torques from the planet and its host star, leading to angular momentum exchange that drives orbital evolution. Our simulations reveal two key outcomes in shaping mutual inclinations and eccentricities. (1) The mutual inclination between a giant planet and its inner low-mass companion can be excited to values greater than 10 degrees, especially when the inner planet has a higher mass-loss fraction and the gas giant has a shorter orbital period. This mechanism may explain why more warm Jupiters with inner low-mass companions are observed. (2) Planetary eccentricities can be excited to values above 0.1 due to the mass-loss process, offering a potential explanation for the elevated eccentricities of planets that fall between the super-Earth and sub-Neptune regimes.

Primary author: 王, 素

Presenter: 王, 素

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **王, 素** on **Thursday, October 9, 2025**

Abstract ID : **175**

Steady Warps in Protoplanetary Disks: Linear, Nonlinear, and Breaking

Content

An increasing number of protoplanetary disks shows observational signatures of warps and misalignments, raising questions of how disks sustain coherent warps and how they may break into misaligned pieces.

We study the steady-state structures and breaking conditions of warped disks. To focus on the hydrodynamics, while remaining agnostic about what forces the warp, we adopt a simple but physically motivated setup: rather than including an explicit perturber or external torque, we fix the disk inclination angles $\beta_{\rm in}$ and $\beta_{\rm out}$ at the inner and outer boundaries. The disk is hence constrained to accommodate a warp between the boundaries. By varying the boundary misalignment $|\beta_{\rm out} - \beta_{\rm in}|$, we can explore the linear regime, the nonlinear regime, and the onset of breaking, while having good control over the warp amplitude.

Combining this model with analytical theories and three-dimensional hydrodynamic simulations, we carry out a clean and systematic investigation of the hydrodynamic behaviors of warped disks. We find that, with small warps, disks settle into warp steady states that are well described by the linear theory. Moderately warped disks enter the nonlinear regime, showing several distinct features such as torque saturation, vertical "bouncing" motion of gas, and enhanced mass accretion rates. Measurements of these effects in our simulations show good quantitative agreement with nonlinear theories. Strongly warped disks are unstable: these disks are susceptible to a runaway growth of warp amplitude that ultimately leads to disk breaking. This instability may be caused by the nonlinear saturation of the disk internal torque, which occurs roughly when the warp amplitude exceeds a critical value $|\psi|_{\rm crit} \simeq 2\sqrt{\alpha}$ for Keplerian disks.

Primary author: LI, Jiaru (CIERA - Northwestern University)

Co-author: Prof. LITHWICK, Yoram (Northwestern University)

Presenter: LI, Jiaru (CIERA - Northwestern University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LI, Jiaru** on **Thursday, October 9, 2025**

Abstract ID : **176**

The shape and spin of giant exoplanets revealed by JWST

Content

Spin is important for understanding planetary formation and evolution, and a fast spin will flatten the planet. Now, with the high-precision space telescope JWST, the deformation induced by the spin is finally detectable through the transit light curve. Based on JWST observations, we found that the projected shape of Kepler-51d is consistent with a sphere, indicating a very slow spin of such a super-puff. Recently, we have also obtained exclusive JWST data on a double giant system, TOI-2525, which enables us to constrain the shape and spin of this unique system. In this talk, I will present the oblateness detection results for these cold giants and discuss our understanding of the exoplanetary shape and spin at the population level, as well as the implications for the formation and evolution of giant planets.

Primary author: 刘, 权毅 (清华大学)

Co-author: Mr 祝, 伟 (清华大学)

Presenter: 刘, 权毅 (清华大学)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **刘, 权毅** on **Thursday, October 9, 2025**

Abstract ID : **177**

Unexpected Near-Resonant and Metastable States in Young Multi-Planet Systems

Content

Recent observations suggest that the incidence of near-resonant planets declines as planetary systems age, making young planetary systems key signposts of early dynamical evolution. In this talk, I will investigate the dynamical states of three of the youngest transiting multi-planet systems: AU Mic (3-planet, ~20-Myr-old), V1298 Tau (4-planet, ~23-Myr-old), and TOI-2076 (4-planet, ~200-Myr-old). Nearly all of the planet pairs involved in these systems are in near-resonant states with circulating rather than librating resonant angles. The observed system architectures are vulnerable to dynamical excitation, such as divergent resonance encounters induced by planetesimal scattering. While this near-resonant state may represent a transitional phase linking young and mature planetary systems, the evolutionary pathway to this configuration remains unclear. The implications of our results are discussed in the context of the so-called ‘’break-the chains” model.

Primary authors: HU, Zhecheng (Tsinghua University); DAI, Fei (University of Hawaii); ZHU, Wei (Tsinghua University)

Presenter: HU, Zhecheng (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HU, Zhecheng** on **Thursday, October 9, 2025**

Abstract ID : **178**

Mass Loss and Angular Momentum Return Boost Hot Jupiter Survival Rates

Content

The existence of giant extrasolar planets on short-period orbits ("hot Jupiters") represents a challenge to theories of planet formation. A leading explanation invokes perturbations from distant companions, i.e., the Eccentric Kozai-Lidov (EKL) mechanism, which can excite the eccentricities of initially wide-orbiting planets to values of order unity. The resulting tidal dissipation at periastron shrinks and circularizes the orbits to their observed configurations. While observations of orbital misalignment support this scenario, theoretical models have struggled to reproduce the observed hot Jupiter occurrence rate. Population synthesis studies often predict that many source "cold Jupiters" are destroyed by tidal disruption during highly eccentric passages. I will discuss improved treatments of the mass loss and angular momentum return experienced by tidally perturbed planets. New population synthesis studies of giant planets in stellar binaries show that the hot Jupiter survival rate may be enhanced by a factor of ˜2-3, yielding occurrence rates (>0.5% around FGK stars) consistent with observations. Angular momentum return from accreted mass may also produce a pile-up of hot Jupiters near three-day orbital periods that is in statistical agreement with observations. These results suggest that EKL-driven high-eccentricity migration, when combined with realistic planetary responses to mass loss, may be a dominant channel for hot Jupiter formation.

Primary author: WELDON, Grant (University of California, Los Angeles)

Co-authors: HANSEN, Bradley (University of California, Los Angeles); NAOZ, Smadar (University of California, Los Angeles)

Presenter: WELDON, Grant (University of California, Los Angeles)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WELDON, Grant** on **Thursday, October 9, 2025**

Abstract ID : **179**

Mapping the atmospheric escape regimes of water-rich sub-Neptunes

Content

Exoplanet demographic studies suggest that a fraction of sub-Neptunes possess water-rich atmospheres. However, the presence of clouds and hazes often obscures these atmospheres, making direct characterisation via transmission spectroscopy challenging. Atmospheric escape provides an alternative observational window into atmospheric composition and evolution. Accurate modelling of escape processes in water-rich sub-Neptunes is therefore essential for interpreting future observations and deepening our understanding of these planets' atmospheres.
In this talk, I will present new results from AIOLOS, a time-dependent radiative-transfer hydrodynamic code, applied to sub-Neptunes with steam atmospheres. I will map their atmospheric escape regimes and show how mass-loss rates, atmospheric structure, and outflow composition vary with orbital distance. Additionally, I will highlight: (1) the impact of H_2O cooling, (2) fractionation between species due to drag, and (3) the role of O_3 chemistry. I will show that with the above three effects, atmospheric mass-loss can be suppressed on sub-Neptunes at large orbital distances. I will conclude by discussing the implications of our findings for the composition and formation pathways of sub-Neptunes, and how escape signatures can inform both demographic studies and future observational strategies.

Primary author: CHEN, Yixuan (Imperial College London)

Co-authors: Mr MOHANTY, Subhanjoy (Imperial College London); Mr SCHULIK, Matthäus (Imperial College London)

Presenter: CHEN, Yixuan (Imperial College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHEN, Yixuan** on **Thursday, October 9, 2025**

Abstract ID : **180**

Pebble Accretion and Volatile Transport in Convective Envelopes of Protoplanets

Content

Pebble accretion is one of the leading theories of planet formation, providing an efficient pathway for growing planetary cores by accreting mm-cm sized solids. The efficiency of this process, the fate of the pebbles, and volatiles they carry within protoplanetary gas envelopes, are key to understanding the formation and composition of terrestrial planets. We study how convection within planetary envelopes influences both solid accretion and volatile transport using 3D hydrodynamic simulations with Athena++. The envelope is modeled as fully convective, driven by pebble accretion heating, with Lagrangian particles representing solids or volatiles.

Our results show that pebble accretion remains efficient when particles are large enough, corresponding to Stokes numbers above about 0.001 in the disk, which allows them to settle through convective upflows. When the Stokes number is smaller, convection efficiently mix pebbles outward, leading to their recycling back to the disk. These small grains being recycled are likely the main carriers of most volatile materials, leading to rapid volatile loss from the envelope. The sensitivity of accretion efficiency to the Stokes number implies that processes affecting it, such as the choice of drag law and dust growth or fragmentation, can strongly influence accretion outcomes. Overall, our results show that convection acts as a selective filter, allowing solid accretion while driving volatile depletion. This links pebble accretion dynamics to the chemical evolution of forming planets and provides new insight into how terrestrial planets acquire their present-day compositions, as well as the volatile depletion detected in Earth and Mars.

Primary author: XU, Ziyan

Presenter: XU, Ziyan

Contribution Type: Poster

Status: ACCEPTED

Submitted by **XU, Ziyan** on **Thursday, October 9, 2025**

Abstract ID : **181**

Challenges and Promises of Atmospheric Characterization for Self-Luminous Exoplanets, Brown Dwarfs, and M Dwarf Stars

Content

Recent advances in space- and ground-based spectroscopic observations of exoplanets, brown dwarfs, and M dwarfs are reshaping our understanding of their atmospheres, enabling investigations at a level of detail that was not possible only a few years ago. At the same time, interpreting these rich datasets remains at an early stage, with significant practical challenges, despite rapid progress in atmospheric modeling. In this presentation, I will discuss results from our in-depth study of 2MASS 1207 A+b —the system hosting the first directly imaged planetary-mass companion —and how such detailed analyses inform our broader understanding of exoplanet, brown dwarf, and M-dwarf atmospheres. To interpret the JWST spectra of 2MASS 1207 b (late-L), we developed a new atmospheric retrieval framework capable of modeling both homogeneous and inhomogeneous atmospheres, including the effects of patchy clouds and hot spots. Our analysis has, for the first time, quantitatively constrained the properties of its Jupiter-like, spatially inhomogeneous atmosphere, with thick iron and magnesium-silicate clouds covering ~91% of the surface and thin-cloud regions covering the remaining ~9%. This atmospheric structure provides a consistent explanation for the weak 4–5um CO absorption, the absence of 3.3um CH4 features, and the spectrophotometric variability observed by HST and, more recently, JWST. Notably, these findings highlight the importance of exploring a range of model assumptions in retrieval analyses to achieve more robust and less biased atmospheric characterizations. Beyond the planetary companion, I will also present new analyses of the M-type host star, 2MASS 1207 A, based on high-resolution (R~45,000) IGRINS H+K band spectroscopy. With more than 60 retrieval runs of this dataset, I will present new perspectives on M-dwarf atmospheric characterization. Finally, I will briefly outline ongoing efforts to extend these approaches to larger samples of exoplanets, brown dwarfs, and M dwarfs using existing and forthcoming ground-based and JWST observations.

Primary author: ZHANG, Zhoujian (University of Rochester)

Co-authors: MOLLIERE, Paul (Max-Planck-Institut für Astronomie); FORTNEY, Jonathan (University of California, Santa Cruz); MARLEY, Mark (University of Arizona)

Presenter: ZHANG, Zhoujian (University of Rochester)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHANG, Zhoujian** on **Thursday, October 9, 2025**

Abstract ID : **182**

Exploring Helium signatures from Protoplanetary Accretion: The case of Delorme 1 (AB)b

Content

The 13 M_{Jup} circumbinary planet Delorme 1 (AB)b has garnered significant interest since its discovery as an unusually old (40 Myr) accretor. With its nearby distance (47 pc) and wide orbital separation (84 au), this object presents a distinct advantage over other discovered protoplanets, facilitating high-resolution studies of its accretion process. Its past observations with the Ultraviolet and Visual Echelle Spectrograph (UVES) at VLT revealed the first resolved spectral lines (Hγ to H9) from a protoplanet, showing clear profile asymmetries and indications of a magnetospheric accretion geometry. Recently, follow-up observations with UVES (328—685 nm) were conducted over timescales ranging from days to months, yielding high signal-to-noise spectra and enabling the study of line variability. In this talk, I present resolved line profiles of helium emission detected from this planetary-mass companion (PMC) at high resolution (R˜50,000), offering the first look at optical helium line behaviours from such a low-mass object. A comparison with parallel studies in T-Tauri stars and subsequent line analysis reveal significant clues to the physical conditions of the line-emitting region within the accretion geometry. This study comes at the onset of the ESO large program ENTROPY which will bring in more high-resolution spectroscopic observations of PMCs with UVES, providing a novel foundation for population-level studies on helium emission from protoplanets.

Primary author: Dr VISWANATH, Gayathri (gayathri.viswanath@astro.su.se)

Co-authors: BONNEFOY, Mickael (IPAG, CNRS); BOUVIER, Jerome (IPAG, CNRS); DEMARS, Dorian (University of Virginia); DOMINIQUE MARLEAU, Gabriel (University of Duisburg-Essen); DOUGADOS, Catherine (IPAG, CNRS); JANSON, Markus (Stockholm University); SICILIA AGUILAR, Aurora (University of Dundee)

Presenter: Dr VISWANATH, Gayathri (gayathri.viswanath@astro.su.se)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **Dr VISWANATH, Gayathri** on **Thursday, October 9, 2025**

Abstract ID : **183**

Exoplanets & Brown Dwarfs on Wide Orbits: Early Confirmation of Gaia DR3 Candidates

Content

Gaia's astrometric detections are opening a new window into the outer architectures of planetary systems, revealing companions inaccessible to Doppler or transit techniques. We report initial results from our combined northern and southern follow-up program to confirm and characterize Gaia DR3's wide-orbiting companion candidates around low-mass stars. Our observations reveal that roughly two-thirds of the astrometric exoplanet candidate signals turn out to be double-lined spectroscopic binaries. We describe our approach for disentangling false positives from planets and present first statistical insights derived from the validated systems. This work will also prepare us for the upcoming Gaia DR4 release (expected end of 2026), when we can expect not tens but thousands of exoplanet and brown dwarf detections through astrometry. This will enable comprehensive demographic and architecture studies of giant planets and brown dwarfs at wide separations.

Primary author: ALBRECHT, Simon (Aarhus University)

Co-author: Mr KALINOWSKI, Kamil (Aarhus University)

Presenter: ALBRECHT, Simon (Aarhus University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ALBRECHT, Simon** on **Thursday, October 9, 2025**

Abstract ID : **184**

Topological discoseismology of pressure bumps and dips.

Content

Wave topology provides a powerful framework to identify and characterise vibrations arising from hidden features of the wave operator—features tied to the vectorial nature of propagation and lost in local analyse [1,2,3]. These global modes are remarkably robust against perturbations, making them especially valuable for observation. Recent advances in stellar wave topology have revealed, for instance, a key mode probing the rotation of the solar core [4], and have led to strong improvements in analytical expressions for mode frequencies [5].
In this talk, I will show how these concepts extend to astrophysical discs, where an unforeseen epicyclic–acoustic frequency plays a central role. Topological analysis links the cancellation of this frequency to the emergence of global modes with distinctive properties. Notably, this condition correlates with the presence of pressure bumps and dips in the disc, offering predictive insight for discoseismology as well as for planet formation via the onset of resonant drag instabilities.

References :
1 Armand Leclerc, Guillaume Laibe, Pierre Delplace, Antoine Venaille, and Nicolas Perez. Topological Modes in Stellar Oscillations. ApJ, 940(1):84, November 2022

2 Armand Leclerc, Lucien Jezequel, Nicolas Perez, Asmita Bhandare, Guillaume Laibe, and Pierre Delplace. Exceptional ring of the buoyancy instability in stars. Physical Review Research, 6(1):L012055, December 2024

3 Armand Leclerc, Guillaume Laibe, and Nicolas Perez. Wave topology of stellar inertial oscillations. Physical Review Research, 6:043299, Dec 2024

[4] Arthur Le Saux, Armand Leclerc, Guillaume Laibe, Pierre Delplace, and Antoine Venaille. A Core-sensitive Mixed f/g-mode of the Sun Predicted by Wave Topology and Hydrodynamical Simulation. ApJ, 987(1):L12, July 2025

[5] Armand Leclerc and Guillaume Laibe. The Importance of Berry Phase in Solar Acoustic Modes. ApJ, 983(1):L17, April 2025

Primary author: LAIBE, Guillaume (Ens de Lyon)

Presenter: LAIBE, Guillaume (Ens de Lyon)

Contribution Type: Oral Talk

Comments:

The tools and analytical results that we aim to present for the first time here have been developed in the framework of the ERC grant Podcast.

Status: ACCEPTED

Submitted by **LAIBE, Guillaume** on **Thursday, October 9, 2025**

Abstract ID : **185**

Planetary accretion in the vicinity of dusty rings

Content

I will first outline the main properties of thermal forces - the forces acting on a hot perturber embedded in a gaseous medium with thermal diffusivity. I will then show how these forces result in the robust trapping of accreting protoplanets on eccentric orbits that graze dusty rings. This mechanism allows protoplanets to feed on dust with each passage through the ring. Finally, I will discuss some implications of these findings for planetary formation.

Primary author: Dr MASSET, Frederic (Universidad Nacional Autónoma de México)

Presenter: Dr MASSET, Frederic (Universidad Nacional Autónoma de México)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **Dr MASSET, Frederic** on **Thursday, October 9, 2025**

Abstract ID : **186**

Feedback-Regulated Dust Diffusion and Runaway Planetesimal Formation in Protoplanetary Disk Rings

Content

High-resolution ALMA observations have revealed that dust in protoplanetary disks is often concentrated into narrow rings. These ring-like substructures are widely interpreted as dust traps at gas pressure bumps and potential sites of planetesimal formation, yet it remains unclear whether the observed rings are actively forming planetesimals. The physical link between dust concentration, feedback, and disk turbulence remains particularly uncertain.

We first present new 3D magnetohydrodynamic (MHD) simulations with multiple dust species, modeling dust trapping and clumping in self-consistent MRI turbulent gas pressure bumps. From these simulations, we derive a feedback-regulated diffusion model that quantifies how increasing dust loading suppresses turbulence and dust diffusion. We then implement this model in the global dust evolution code DustPy to study how dust feedback shapes the growth, concentration, and conversion of dust into planetesimals in dust rings over disk evolution timescales.

We find that strong feedback triggers a positive loop between dust growth and diffusion suppression, leading to runaway clumping and early planetesimal formation, whereas weak feedback remains ineffective, allowing long-lived, non-clumping rings to persist. Both non-clumping rings and post-formation remnants can yield similarly faint dust rings, implying an observational degeneracy between these two cases. The model further predicts that for the actively clumping rings, the midplane dust-to-gas ratio self-regulates near the streaming instability clumping threshold, consistent with the marginally clumping nature inferred for many ALMA rings.

Our results suggest that feedback-regulated dust diffusion provides a unifying framework connecting the diversity of observed dust rings to the underlying physics of planetesimal formation.

Primary author: XU, Ziyan

Presenter: XU, Ziyan

Contribution Type: Poster

Status: ACCEPTED

Submitted by **XU, Ziyan** on **Thursday, October 9, 2025**

Abstract ID : **187**

Understanding warped circumbinary discs with extremely-high resolution simulations

Content

Circumbinary discs, even though extremely common, challenge the traditional picture of planet formation. More than half of the stars in our galaxy belong to a binary or multiple-star system, a fraction even greater for solar-mass stars. Discs around binary systems frequently exhibit misalignment with respect to the plane of the central binary, which can warp, twist and even break the disc. These deformations alter the accretion flows onto the stars, in ways that are yet to be understood. Can we quantify the accretion process onto each star? How exactly is the shape of the disc affected? Is there an observational signature of the deformations?

Warped circumbinary discs pose a great challenge to numerical simulations. While state-of-the-art SPH simulations use 1 million particles, a factor 10 in spatial resolution, meaning a factor 1,000 in computational power is required to (i) correctly describe regions where the disc is expected to break, (ii) cap the numerical viscosity to allow for physical dissipation processes to develop and (iii) capture local instabilities such as the parametric instability, which is expected to have global, observable consequences on the shape of the disc.

I am one of the developers of SHAMROCK (David—Cléris, Laibe, Lapeyre 2025 1), a next-generation astrophysics code optimized for exascale computing. In this talk, I will present the results from the first SPH simulations of misaligned circumbinary discs at unprecedented resolutions.

1 T David-Cléris, G Laibe, Y Lapeyre, The SHAMROCK code: I –smoothed particle hydrodynamics on GPUs, Monthly Notices of the Royal Astronomical Society, Volume 539, Issue 1, May 2025, Pages 1–33, https://doi.org/10.1093/mnras/staf444

Primary author: LAPEYRE, Yona (CRAL - ENS de Lyon)

Presenter: LAPEYRE, Yona (CRAL - ENS de Lyon)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LAPEYRE, Yona** on **Thursday, October 9, 2025**

Abstract ID : **188**

Updated Forecast for Gaia Astrometric Planet Detections

Content

The Gaia mission promises a new beginning for astrometric planet discovery. The next Gaia data release, scheduled for December 2026, will for the first time provide extensive time-series astrometry with a precision sufficient to detect planets. The most recent comprehensive simulations of the Gaia exoplanet yield were conducted more than 10 years ago. We have re-examined the expected yield using updated models for giant-planet occurrence, the local stellar population, and Gaia's astrometric precision. This presentation will describe a semi-analytic model for the survey that clarifies key scaling relations, as well as more realistic Monte Carlo simulations. We predict 7,500 ± 2,100 planet discoveries in the 5-year dataset (DR4) and 120,000 ± 22,000 over the full 10-year mission (DR5). For about a quarter of DR4 planets, we will be able to measure masses and periods to better than 20%. Most detections will be super-Jupiters on 2-5 AU orbits around GKM-type stars within 500 pc. We also present predictions for the population of false positives due to unresolved binary stars, and mock catalogs to support community preparation for upcoming data releases.

Primary authors: WINN, Joshua (Princeton University); Mr LAMMERS, Caleb (Princeton University)

Presenter: WINN, Joshua (Princeton University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WINN, Joshua** on **Thursday, October 9, 2025**

Abstract ID : **189**

A Comprehensive Analysis of the Panchromatic Transmission Spectrum of the Hot-Saturn WASP-96 b: Nondetection of Haze, Possible Sodium Limb Asymmetry, Stellar Characterization, and Formation History

Content

We conduct a reanalysis of the JWST NIRISS/SOSS observation of the hot-Saturn WASP-96 b. Initial analysis of this data revealed an enhanced Rayleigh scattering slope at the blue end of the transmission spectrum, suggesting the presence of hazes at high altitudes. In this work, we report non-detection of this slope, confirming an atmosphere clear of high-altitude aerosols consistent with the pre-JWST results. Also contrary to the initial result, our results indicate the presence of gray cloud deck, although at relatively low altitudes/high pressures. We further combined the NIRISS/SOSS spectrum with VLT, HST, and Spitzer to produce a transmission spectrum from 0.35 μm to 5 μm. We constrain the mass fraction of multiple chemical species, including: H_2O $= -2.62^{+0.43}_{-0.42}$, K $= -5.76^{+1.05}_{-1.13}$, and Na $= -3.40^{+0.90}_{-0.92}$. C/O ratio and metallicity are \tentatively constrained at substellar values (C/O$_{planet} = 0.57^{+0.07}_{-0.12}$ and [Fe/H]$_{planet} = 0.01^{+0.46}_{-0.52}$ compared to C/O$_{star} = 0.92 \pm 0.25$ and [Fe/H]$_{star} = 0.24 \pm 0.05$). Inputing these composition constraints to interior structure models, we constrain a core mass of 43^{+8}_{-15} $M_{\oplus}$. This, in addition to our inferred super-stellar refractory-to-oxygen ratio ($\Delta \log_{10}(R/O) = 1.48^{+0.57}_{-0.62}$) and substellar C/O ratio, suggests that the core of WASP-96 b likely formed outside of water iceline, underwent disk-driven migration, and accreted its atmosphere inside the carbon soot line. We find evidence of atmospheric leading-trailing terminator asymmetries in the broadened sodium absorption feature with a transit time offset of 50 seconds, while the water features appear symmetric. CH_4, CO, and CO_2 remain unconstrained due to spectral coverage limits. Upcoming JWST NIRSpec/G395H observations (ID 4082, PI: M. Radica) will be crucial for constraining these carbon-bearing species.

Primary author: WANG, Le-Chris (Princeton University)

Co-authors: Dr RUSTAMKULOV, Zafar (Johns Hopkins University); Prof. SING, David (Johns Hopkins University); Dr LOTHRINGER, Joshua (Space Telescope Institute); Mr MCCREERY, Patrick (Johns Hopkins University); Dr THORNGREN, Daniel (Johns Hopkins University); Dr ALAM, Munazza (Space Telescope Institute)

Presenter: WANG, Le-Chris (Princeton University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WANG, Le-Chris** on **Thursday, October 9, 2025**

Abstract ID : **190**

Gone with the Wind: CO Depletion in MHD Wind-Driven Protoplanetary Discs

Content

Recent ALMA observations have revealed a significant decrease in gas-phase CO abundance within protoplanetary discs, with CO depleted by up to two orders of magnitude relative to the interstellar medium. A plausible explanation is CO sequestration in ice on the surfaces of large grains. This mechanism relies on the diffusion of CO from the upper disc layers to the midplane, where temperatures are low enough for freeze-out. The efficiency of this process is sensitive to turbulence strength, with alpha parameters around 10^{-3} required to achieve sufficient depletion on the Myr timescales over which the depletion is observed to occur. However, ALMA has also shown that mm-sized grains form thin midplane dust layers, suggesting that turbulence may be much weaker and MHD winds are prevalent. I will present new results from state-of-the-art cuDisc simulations that model dust-gas dynamics, grain growth, and CO freeze-out to investigate the role of MHD winds in gas-phase CO depletion. Comparing wind-driven and viscously evolving discs, we find that MHD winds significantly enhance CO depletion, turbulence alone cannot account for it, and winds result in shorter depletion timescales. These results suggest that MHD winds may play a key role in shaping disc composition and help explain the rapid CO depletion observed by ALMA.

Primary author: JONCZYK, Zuzanna (University of Leeds)

Co-authors: Dr BOOTH, Richard (University of Leeds); Dr ROBINSON, Alfie (Imperial College London)

Presenter: JONCZYK, Zuzanna (University of Leeds)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JONCZYK, Zuzanna** on **Thursday, October 9, 2025**

Abstract ID : **191**

How Starlight Shapes Hazes: Radiation Pressure in Exoplanet Atmospheres

Content

One of the central goals of exoplanet spectroscopy is to measure atmospheric abundances that may reveal insights into their origins. However, many observed spectra show strong evidence for aerosols, whose presence introduces degeneracies between atmospheric abundances, particle properties, and vertical distribution. These degeneracies make it challenging to constrain atmospheric abundances and therefore limit our ability to interpret planet formation, atmospheric chemistry, and interior evolution. Aerosols are therefore a key component of exoplanet atmospheres, shaping both spectra and albedos, yet their dynamics remain poorly understood.

Recent work shows that stellar radiation pressure, long neglected in atmospheric models, can dominate aerosol dynamics on the hot, low-density exoplanets most frequently observed —those with extended atmospheres that are the most accessible to transmission and reflection observations. Using a 1D dynamical model, I show that 0.1–1 μm aerosols experience accelerations up to x20 stronger than planetary gravity, significantly reducing aerosol concentrations. This can potentially resolve persistent discrepancies between observations and models by producing steeper optical slopes and less muted absorption features in spectra, as well as explaining observed trends in giant planet albedos.

I will present results incorporating fractal aerosol aggregates into the model, which scatter more efficiently than compact spheres. The fractal aerosols' response to stellar radiation may be crucial for interpreting albedo measurements and for improving atmospheric characterisation across the exoplanet population.

Primary author: MCWILLIAM, Naomi (Imperial College London)

Co-authors: MURRAY-CLAY, Ruth (University of California, Santa Cruz); OWEN, James (Imperial College London)

Presenter: MCWILLIAM, Naomi (Imperial College London)

Track Classification: Atmospheres

Contribution Type: Poster

Status: ACCEPTED

Submitted by **MCWILLIAM, Naomi** on **Thursday, October 9, 2025**

Abstract ID : **192**

Warm Giant Exoplanets with Strong Transit Timing Variations

Content

Recent discoveries from TESS have revealed a growing number of exoplanetary systems that exhibit strong transit timing variations (TTVs), many of which consist of warm, Jovian-mass planets near a 2:1 mean-motion resonance (MMR). I will present several remarkable TTV systems identified within the Warm gIaNts with tEss (WINE) collaboration, which systematically characterizes TESS transiting warm giant planets. These systems are particularly valuable for exoplanet studies, as their longer orbital periods enhance TTV amplitudes, enabling the detection of non-transiting companions and providing precise constraints on orbital architectures and planetary properties. However, strong TTV signals often introduce degeneracies in planetary mass, eccentricity, and even orbital period, complicating system characterization. To resolve these ambiguities, a combination of TTV modeling, photo-dynamical analysis, and ground-based radial velocity follow-up is essential. By integrating these techniques, we can reconstruct the formation and dynamical evolution of compact, massive planetary systems, offering insight into their migration histories and resonant interactions. I will discuss the challenges of modeling such multi-planet systems, the influence of dynamical interactions on their architectures, and how the synergy between TTV and RV observations provides a powerful framework for understanding the formation pathways of warm Jovians and planets in general.

Primary author: TRIFONOV, Trifon (Landessternwarte (LSW), Heidelberg, Germany & Department of Astronomy, Sofia University, Bulgaria)

Presenter: TRIFONOV, Trifon (Landessternwarte (LSW), Heidelberg, Germany & Department of Astronomy, Sofia University, Bulgaria)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TRIFONOV, Trifon** on **Thursday, October 9, 2025**

Abstract ID : **193**

In Search of Circumplanetary Disk Candidates at Wide Orbits in the exoALMA Sample

Content

Circumplanetary disks (CPDs) are accretion disks surrounding protoplanets, as hypothesized in planet formation scenarios. Detecting CPDs is crucial for understanding the physical processes of planet and moon formation. However, their small spatial scales and faint emission make them difficult to observe, requiring deep, high-resolution data.

The exoALMA survey (Teague et al. 2025) aims to investigate dynamical substructures within protoplanetary disks in both gas and dust emission at high resolution with the ALMA telescope, establishing one of the deepest observations of planet-forming disks to date. This research specifically targeted the outer disk regions of the exoALMA sample to search for circumplanetary disk candidates, as these areas are less susceptible to contamination from background.

Azimuthally averaged radial noise profiles were derived from the median absolute deviation of deprojected residual maps. These maps were used to construct two-dimensional SNR maps and identify robust, beam-sized high–signal-to-noise features across 15 protoplanetary disk samples. The resulting detections were compared against published CO "kinks," observations in other ALMA bands such as DSHARP, and previously reported planet candidates and disk anomalies.

Three compact ($> 3\sigma$) features with central peaks above 5σ brightness were identified in CQ Tau and V4046 Sgr. In DM Tau, an extended residual structure with a peak significance of 9.46σ was detected at a location not reported in previous observations apart from exoALMA Band 7. However, the feature spans a region much larger than a single beam, suggesting it is unlikely to represent a compact CPD source and may instead trace a background source.

Using the catalogued sources together with identified gap regions and kinematic signatures, the parameter space for potential CPD candidates (e.g., size, mass, planetary characteristics, viscosity, and accretion rate) can be constrained through forward-modeling frameworks such as those presented by Zhu et al. (2018). The resulting derivations provide quantitative estimates of CPD upper limits and support targeted follow-up efforts.

Primary author: WELKE, Vanessa

Co-author: Dr JIANG, Haochang (MPIA)

Presenter: WELKE, Vanessa

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WELKE, Vanessa** on **Thursday, October 9, 2025**

Abstract ID : **194**

Retrograde resonant configurations in planetary systems

Content

Using the software REBOUND 1 we explore the possible stable configurations for the 2/1, 1/2 and 1/1 retrograde mean motion resonances in planetary systems with arbitrary masses through a Monte Carlo method. The simulations were divided in two different cases: 1) varying the mass of one planet; 2) varying masses for both planets. The upper limit for the masses was set to 0.012 Msun as this is near the transition between a planet and a brown dwarf 2. The ratio of the semi-major axis and the orbital eccentricities of the planets were also varied in both simulations. We conclude that fixed point resonant families (identified by libration of all resonant angles 3) exist for a wide range of values of the masses. Configurations with libration of a single resonant angle were also identified. Applying a similar method to the ν Octantis system [4], we explore all possible configurations for the planet, assessing the long-term stability through frequency analysis [5]. By varying the unknown parameters, we constrained the orbit of the planet and found that a nearly resonant configuration is the most probable for the retrograde planet.

1 Rein, Hanno e S-F Liu. "REBOUND: an open-source multi-purpose N-body code for collisional dynamics". Astronomy & Astrophysics 537:A128, 2012.
2 Spiegel, D. S., Burrows, A., & Milsom, J. A.," The deuterium-burning mass limit for brown dwarfs and giant planets" The Astrophysical Journal, 727, 5, 2011.
3 Caritá G. A., Signor A. C., Morais M. H. M., 2022, Monthly Notices of the Royal Astronomical Society, 515, 2280.
[4] Cheng, H. W., Trifonov, T., Lee, M. H., et al. 2025, Nature, 641, 866.
[5] Laskar, J., "Frequency analysis for multi-dimensional systems. Global dynamics and diffusion", Physica D Nonlinear Phenomena, 67, 257, 1993.

Acknowledgements: The authors acknowledge support from grants 2021/11982-5, 2022/08716-4, 2023/02528-4 & 2024/10557-7 of São Paulo Research Foundation (FAPESP) and 305997/2025-4 of Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

Primary author: Mr CEFALI SIGNOR, Alan (São Paulo State University - UNESP ; University of Coimbra - UC)

Co-authors: Prof. C. M. CORREIA, Alexandre (University of Coimbra - UC); Prof. MORAIS, Helena (São Paulo State University - UNESP)

Presenter: Mr CEFALI SIGNOR, Alan (São Paulo State University - UNESP ; University of Coimbra - UC)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CEFALI SIGNOR, Alan** on **Thursday, October 9, 2025**

Abstract ID : **195**

Thermally self-consistent models of protoplanetary discs show snow-lines are constantly on the move

Content

Understanding the structure and evolution of volatile molecules in protoplanetary discs is vital for developing our theories of planet formation. Snow-lines - the surfaces in the disc beyond which molecules freeze-out onto dust grains - are especially important for the compositions of protoplanet cores and envelopes, as they govern whether a particular volatile is in the ice- or gas-phase at a certain location in the disc. The majority of models of dust and volatile evolution in discs treat the snow-line locations as being constant in time due to a fixed passive heating temperature profile. This clearly cannot be the case, as the solid abundance sets the absorption of radiation and therefore the temperature - meaning as the solids evolve so must the temperature. In this talk, I will present the first simulations where dust and volatile evolution are self-consistently coupled to an evolving thermal structure in both the radial and vertical dimensions using the GPU-accelerated code cuDisc. We have implemented a full chemical ice-vapour network that self-consistently updates the opacities as the dust grain compositions are modulated by the condensation of ices. Simulations of the evolution of the CO snow-line for a range of disc parameters (mass, strength of turbulence, fragmentation velocity) find that the snow surface is constantly on the move over the course of several Myr due to changes in the disc thermal structure. This movement is highly dependent on dust microphysics such as the fragmentation velocity; higher values (5 m/s) lead to larger initial snow-line radii and faster outward migration than lower values (1 m/s). Classic models suggested that the "cold-fingering" effect driven by vapour diffusion over the snow-line would lead to a local enhancement of solids and was argued to be a prime site for planetesimal formation - our work shows that this may in fact be insignificant for large swathes of parameter space.

Primary authors: BOOTH, Richard (University of Leeds); OWEN, James (Imperial College London); ROBINSON, Alfie (Imperial College London)

Presenter: ROBINSON, Alfie (Imperial College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ROBINSON, Alfie** on **Thursday, October 9, 2025**

Abstract ID : **196**

Demographics of Embedded Disks: New Insights into the Earliest Stages of Planet Formation

Content

Disks are known to form around young stellar objects as a natural outcome of the star formation process. Although they originate as by-products, these disks play critical roles in both star and planet formation. Disks around Class II sources—commonly referred to as protoplanetary disks—have received significant attention, as they are thought to represent the main phase of planet formation. In contrast, disks around embedded protostars, which are younger and more deeply embedded, have been comparatively understudied.

Recent research, however, highlights the importance of embedded disks in setting the initial conditions for planet formation, motivating the need for a more systematic investigation of their properties. To this end, we have conducted the ALMA Large Program "Embedded Disks in Early Planet Formation (eDisk)", targeting 19 protostars in nearby star-forming regions. The survey includes 1.3 mm continuum observations at ˜0.04″ resolution and molecular line observations (e.g., CO isotopologues) at ˜0.1″ resolution.

This program enables, for the first time, a systematic demographic analysis of embedded disk properties—such as mass and size—and their relation to the central protostar. In this presentation, I will review the main observational results from the eDisk program, with a focus on emerging demographic trends and their implications for disk evolution and early planet formation.

Primary author: OHASHI, Nagayoshi (ASIAA)

Presenter: OHASHI, Nagayoshi (ASIAA)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **OHASHI, Nagayoshi** on **Thursday, October 9, 2025**

Abstract ID : **197**

The effect of planetesimal-driven migration on planet formation from a planetesimal disk

Content

Planet formation in the canonical picture proceeds *in-situ* within a planetesimal disk through runaway and oligarchic growth (Greenberg et al. 1978; Wetherill & Stewart 1989; Ida & Makino 1993; Kokubo & Ida 1996). However, this picture cannot naturally explain the formation timescale of the ice giants and the diversity of exoplanetary systems (Thommes et al. 2002; Borucki et al. 2010). Planetary migration is key to addressing these difficulties. A major channel is planetesimal-driven migration (PDM), in which gravitational scattering by planetesimals let planets migrate over large radial distances (Ida et al. 2000; Kirsh et al. 2009; Minton & Levison 2014; Jinno et al. 2024). Jinno et al. (2024) conducted self-consistent N-body simulations including gravitational interactions among all planetesimals, gas drag, and Type-I migration to investigate the migration process of a single planet by PDM. While this study clarified the impact of PDM, it did not determine whether PDM actually develops self-consistently in a planetesimal disk or how it shapes the planet formation pathway.
Here we present the first high-resolution simulations that start from a large-scale planetesimal disk taking into account planet–gas interactions, planet–planetesimal scattering, full self-gravity among all planetesimals, physical collisions, and planetesimal growth, with no planets initially embedded in the disk. Our results show that protoplanets migrate inward and outward during runaway growth driven by PDM. In addition, orbital repulsion acting with PDM splits the system into two groups: outer protoplanets migrate outward and inner protoplanets inward. This dynamic migration causes rapid radial diffusion of protoplanets and reshapes the early assembly stages of planet formation. Our results provide a viable formation pathway to Earth-like planets, to the cores of the ice giants and the diversity of exoplanetary systems.

Primary author: JINNO, Tenri (Kobe University)

Co-authors: Dr FUNATO, Yoko (The University of Tokyo); Dr MAKINO, Junichiro (Kobe University); Dr SAITOH, Takayuki (Kobe University)

Presenter: JINNO, Tenri (Kobe University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JINNO, Tenri** on **Thursday, October 9, 2025**

Abstract ID : **199**

Distinct Eccentricity - Stellar Obliquity Trends in Three Gas-Giant Mass Regimes

Content

Understanding the joint distribution of orbital eccentricity and stellar obliquity provides a powerful diagnostic of planetary migration histories. However, heterogeneous analyses and inconsistent treatments of uncertainties have long obscured potential empirical trends. We present a uniform reanalysis of 220 exoplanet systems with Rossiter–McLaughlin (RM) measurements and radial velocities. Using a modified version of EXOFASTv2 that jointly fits spectral energy distributions, transit light curves, radial velocities, and RM signals, we derive robust and internally consistent posteriors for eccentricity and obliquity across the entire sample. Our results reveal, for the first time, three distinct dynamical populations in the eccentricity–obliquity plane: (1) sub-Saturns can exhibit both large eccentricities and strong spin–orbit misalignments; (2) Jupiters are misaligned only when nearly circular, predominantly around hot stars; and (3) massive Jupiters and brown dwarfs remain aligned regardless of eccentricity. The observed structure provides new constraints on tidal realignment efficiency and migration pathways across planetary mass regimes, suggesting a transition from violent to quiescent dynamical histories with increasing planetary mass.

Primary authors: WANG, Xian-Yu (Indiana University); WANG, Songhu (Indiana University); BATYGIN, Konstantin

Presenter: WANG, Xian-Yu (Indiana University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WANG, Xian-Yu** on **Friday, October 10, 2025**

Abstract ID : **200**

Multiplicity of giant planet systems

Content

Giant planets, if present, will dominate the formation and evolution of the planetary system, especially the small planets in the inner and potentially habitable region. The number of giant planets is also a good tracer of the dynamical evolution of the giant planets themselves. In this talk, I will show that the intrinsic multiplicity of giant planets revealed by radial velocity surveys disfavors the planet-planet scattering as the leading scenario for eccentricity excitation. I will also show that the inner transiting super Earths found in these known RV systems by TESS confirm the previously proposed strong correlation between the two planet populations. The implications of it will also be discussed.

Primary author: ZHU, Wei (Tsinghua University)

Presenter: ZHU, Wei (Tsinghua University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZHU, Wei** on **Friday, October 10, 2025**

Abstract ID : **201**

Chemical Evolution in the Inner Regions of Protoplanetary Disks around Very Low-Mass Stars

Content

Chemical Evolution in the Inner Regions of Protoplanetary Disks around Very Low-Mass Stars
Abstract: The chemical evolution of protoplanetary disks sets the initial conditions for planet formation and strongly influences the atmospheres and bulk compositions of emerging planets. The inner few AU disk regions, where most rocky planets form, host complex gas-phase chemistry that can be uniquely probed through mid-infrared spectroscopy. With its unprecedented sensitivity and spectral resolution, JWST/MIRI is transforming our view of inner disk chemistry, particularly in faint, low-mass star systems and evolved disks that were previously inaccessible. I will talk about recent insights from MIRI observations, highlight emerging trends in chemical diversity and evolution across different stellar hosts and disk types, and discuss their implications for planet formation, volatile delivery, and planetary atmospheres.

Primary author: Prof. LONG, Feng (PKU)

Presenter: Prof. LONG, Feng (PKU)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Friday, October 10, 2025**

Abstract ID : **202**

Shedding Light on Desert Dwellers

Content

The “sub-Jovian desert” (2 R_p $10R_\oplus$, periods 3 days) is sparsely populated but no longer empty. Recent surveys have revealed that planets residing in the desert are dense (ρ 1 g/cm^3), massive (~10–50 $M_\oplus$), and orbit metal-rich stars that are indistinguishable from those hosting hot Jupiters. However, their origins remain mysterious. In this work we adopt and test the hypothesis that tidal destruction of hot Jupiters can populate the sub-Jovian desert with stripped remnant planets. We first show that stars hosting desert dwellers exhibit Galactic kinematics indicative of an older population descended from those hosting hot Jupiters. We highlight that tidally-driven Roche lobe overflow (RLO) can indeed populate the desert with planets similar to those observed, but only if angular momentum transfer during RLO is inefficient (“lossy” RLO). The entire width of the sub-Jovian desert can be backfilled with the remnants of hot Jupiters that possessed their empirically inferred spread in entropy. In this picture, current desert dwellers such as LTT 9779b should be tidally decaying at an observationally testable rate of $\sim$0.5 ms/yr. Our theory also predicts that desert dweller host stars may rotate up to an order of magnitude more rapidly than field stars; rotation period differences may persist $\sim$Gyr after RLO. Lossy RLO may also manifest as a burst of IR excess that could outshine the host star for up to $\sim 10^3$ yr. If these predictions are confirmed by observations, our theory indicates that desert dwellers can be leveraged to study the interiors of giant planets in exquisite detail.

Primary author: HALLATT, Tim (MIT)

Presenter: HALLATT, Tim (MIT)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **HALLATT, Tim** on **Friday, October 10, 2025**

Abstract ID : **203**

Pre-main sequence evolution of solar type stars with substellar companions

Content

The engulfment of planet and brown dwarf companions by their host stars is expected to occur primarily within the first 100 million years of stellar system formation, while the star is still in its pre-main sequence phase. These engulfment events are expected to alter the host star's photospheric composition in a manner that reflects the composition of the accreted material. However, the extent and duration of this enrichment depends on several factors, including timing and depth of companion engulfment, as well as internal stellar mixing processes such as convective, diffusion and thermohaline mixing. For the first time, we model the accretion of substellar companions onto pre-main sequence stars and examine the evolution of engulfment signatures through to the main sequence. We present preliminary findings from these investigations.

Primary authors: BABATSIKOS, Mia (Monash University); Prof. KARAKAS, Amanda; Dr LIU, Fan; Prof. MANDEL, Ilya

Presenter: BABATSIKOS, Mia (Monash University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BABATSIKOS, Mia** on **Friday, October 10, 2025**

Abstract ID : **204**

Searching for Small Planets Around Brown Dwarfs: Initial Results from the SAINT-EX Transit Survey

Content

Brown dwarfs are substellar objects with masses between those of planets and stars, insufficient to sustain stable hydrogen fusion. Understanding whether such objects can host small planets remains an open and intriguing question in exoplanet science. Observational results from Kepler and other surveys indicate a strong anticorrelation between stellar mass and the occurrence rate of short-period, super-Earth-sized planets (1–$4R$), implying that lower-mass stars host approximate three times as many small planets. If this trend extends into the substellar regime, it could suggest a significant population of small planets orbiting brown dwarfs. However, theoretical models and disk observations indicate that most brown dwarfs possess low-mass protoplanetary disks, often below a Jupiter mass, which may limit the formation of Earth-sized planets.

To explore these possibilities and address these contrasting predictions, we have initiated a dedicated transit survey of brown dwarfs using the SAINT-EX telescope. Our program monitors a carefully selected sample of nearby brown dwarfs to search for small transiting planets. In this conference, I will present the survey objectives, target selection, and some of our initial findings from this ongoing effort.

Primary authors: Dr KHANDELWAL, A. (Instituto de Astronomia, UNAM, Mexico); Dr GÓMEZ MAQUEO CHEW, Y. (Instituto de Astronomia, UNAM, Mexico); Mr ZONG LANG, F. (University of Bern, Switzerland); Dr O. DEMORY, B. (University of Bern, Switzerland); Dr P. MARCANO, M. (Instituto de Astronomia, UNAM, Mexico); Mr SCHROFFENEGGER, U. (University of Bern, Switzerland); Ms PLAUCHU FRAYN, I. (Instituto de Astronomia, UNAM, Mexico); Mx COLLABORATION, Saint-Ex

Presenter: Dr KHANDELWAL, A. (Instituto de Astronomia, UNAM, Mexico)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KHANDELWAL, Akanksha** on **Friday, October 10, 2025**

Abstract ID : **205**

Azimuthal-drift Streaming Instabilities in Accreting Protoplanetary Disks

Content

The streaming instability (SI) is a key mechanism for forming km-sized planetesimals from dust or pebbles in the core accretion scenario of planet formation. In disks with a radial pressure gradient, SI can locally enhance the dust-to-gas ratio, leading to gravitational collapse and overcoming the collisional and radial drift barriers. Recent studies have revealed a new variant, the azimuthal-drift streaming instability (AdSI), driven by azimuthal drift and effective even without a radial pressure gradient. We perform a large parameter survey using axisymmetric shearing box simulations to study both classical SI and AdSI. With dust initially settled at the midplane, we find that when the dust-to-gas ratio $\varepsilon \geq 1$, AdSI produces vertically extended dust filaments that enhance the local dust density and can reach clumping thresholds sufficient for gravitational collapse. We also include vertical gravity to track the dust-settling process. Our results demonstrate that AdSI can induce strong dust clumping and may trigger classical SI, offering a new pathway for planetesimal formation in regions of weak radial pressure gradients.

Primary author: WANG, Shiang-Chih (NTHU / ASIAA)

Co-author: LIN, Min-Kai (ASIAA)

Presenter: WANG, Shiang-Chih (NTHU / ASIAA)

Contribution Type: Poster

Comments:

If my abstract is not accepted for an oral presentation, I would like to present it as a poster instead.

Status: ACCEPTED

Submitted by **WANG, Shiang-Chih** on **Friday, October 10, 2025**

Abstract ID : **206**

Was there a Rogue Planet in the Early Solar System? Evidence and Future Tests

Content

Over the past two decades, outer Solar System surveys have greatly expanded our inventory of Trans-Neptunian Objects (TNOs), revealing complex structures in the Kuiper Belt that challenge our understanding of the early Solar System. Notably, there is a substantial icy body population in the distant Kuiper Belt beyond 50 au, including a group of objects known as Sednoids. We propose that a super-Earth-mass planet, temporarily present in the early Solar System—dubbed a "rogue planet" —can account for these observed features. Our simulations demonstrate that such a rogue planet can sufficiently populate the distant Kuiper Belt while preserving the low-inclination cold classical belt, consistent with recent observation surveys. One observable constraint to test the rogue planet hypothesis is the primordial orbital alignment of sednoids. By integrating the orbits of the four known sednoids (including 2023 KQ14, the 4th sednoid discovered in 2025 by FOSSIL) backward over the age of the Solar System, we find that their apsidal lines tightly clustered only once, around 4.2 Gyr ago, indicating a primordial event imprinted a particular apsidal orientation on early TNOs. If future Solar System surveys like LSST confirm this finding, it would strongly support the rogue planet hypothesis as a coherent explanation for the formation of the outer Solar System.

Primary author: HUANG, Yukun (NAOJ)

Co-author: Prof. GLADMAN, Brett (UBC)

Presenter: HUANG, Yukun (NAOJ)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HUANG, Yukun** on **Friday, October 10, 2025**

Abstract ID : **207**

A reunion of old friends: Radial velocity characterisation of giant planets in the Gaia era

Content

The journey to 6000 exoplanets began with giant planets found by the radial-velocity method. In the 30 years that followed, instruments and techniques have improved such that Earth-size planet discoveries are practically commonplace. While much attention is being given to ever-smaller planets, I argue that our forgotten giant friends are due for a renaissance. I describe several open science questions that critically rely on continued observations of long-period giant planets.

To find truly Earth-like planets, we must understand Jupiter-like planets. Cold giant planets appear to be correlated with small inner planets. Nearly 200 cold giant planets are known from radial-velocity planet searches. But their true masses remain unknown due to the limitations of the technique. Gaia astrometry, paired with the radial velocities, permits measurements of 3-dimensional architecture for these systems. We show examples of Jupiter analogs for which this analysis has made surprising revelations. Understanding full system architectures is critical for modelling their dynamical histories, including the volatile-delivery regimes experienced by any inner terrestrial worlds.

The presence of giant planets can also disrupt the orbits of inner habitable worlds. Surprisingly, archival radial-velocity data remain unable to exclude giant planets near the habitable zone for many nearby stars to be targeted by future direct imaging surveys such as NASA's planned Habitable Worlds Observatory. We present results of simulated observing campaigns to determine optimal strategies for thorough vetting of candidate target stars.

Primary author: Prof. WITTENMYER, Rob (University of Southern Queensland)

Presenter: Prof. WITTENMYER, Rob (University of Southern Queensland)

Contribution Type: Oral Talk

Comments:

Invited talk, Fabo suggested RV detection of giant planets.

Status: ACCEPTED

Submitted by **Prof. WITTENMYER, Rob** on **Friday, October 10, 2025**

Abstract ID : **208**

Closeby Habitable Exoplanet Survey (CHES). IV. Synergy between Astrometry and Direct Imaging Missions of the Habitable World Observatory for Detecting Earth-like Planets

Content

The detection and characterization of habitable planets around nearby stars persist as some of the foremost objectives in contemporary astrophysics. This work investigates the synergistic integration of astrometric and direct imaging techniques by capitalizing on the complementary capabilities of the Closeby Habitable Exoplanet Survey (CHES) and Habitable Worlds Observatory (HWO). Planetary brightness and position vary over time due to phase effects and orbital architecture, information that can be precisely provided by CHES' s astrometric measurements. By combining the precise orbital constraints from CHES with the imaging capabilities of HWO, we evaluate the improvements in detection efficiency, signal-to-noise ratio, and overall planet yield. Completeness is quantified as the fraction of injected planets that are successfully detected, while yields are estimated for various scenarios using terrestrial planet occurrence rates derived from the Kepler data set. Our results indicate that prior astrometric data significantly enhance detection efficiency. Under the adopted detection limit, our analysis indicates that prior CHES observations can increase completeness by approximately 10% and improve detection efficiency by factors ranging from 2 to 30. The findings underscore the importance of interdisciplinary approaches in the search for and characterization of habitable worlds.

Primary authors: Prof. CHEN, Guo (Purple Mountain Observatory, CAS); Prof. DONG, Yao; Dr HUANG, Xiumin (pmo); TAN, Dongjie (Purple Mountain Observatory,Chinese Academy of Sciences); Prof. WANG, Su (PMO); BAO, chunhui (PMO); Prof. JI, Jianghui

Presenter: BAO, chunhui (PMO)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BAO, chunhui** on **Friday, October 10, 2025**

Abstract ID : **209**

Orbital Architecture of Planetary Systems Formed by Gravitational Scattering and Collisions

Content

In the standard formation models of terrestrial planets in the solar system and close-in super-Earths in non-resonant orbits recently discovered by exoplanet observations, planets are formed by giant impacts of protoplanets or planetary embryos after the dispersal of protoplanetary disk gas in the final stage. This study aims to theoretically clarify a fundamental scaling law for the orbital architecture of planetary systems formed by giant impacts. In the giant impact stage, protoplanets gravitationally scatter and collide with one another to form planets. Using N-body simulations, we investigate the orbital architecture of planetary systems formed from protoplanet systems by giant impacts. We systematically vary the physical and orbital parameters of initial protoplanet systems and examine their effects on planetary system architecture. As system orbital architecture parameters, we focus mainly on the mean orbital separation between adjacent planets and the mean orbital eccentricity of planets in a planetary system. We find that the orbital architecture is determined by the ratio of the two-body surface escape velocity of planets $v_{\rm esc}$ to the Keplerian circular velocity $v_{\rm K}$, $k = v_{\rm esc}/v_{\rm K}$. The mean orbital separation and eccentricity are about $2ka$ and $0.3k$, respectively, where a is the system semimajor axis. With this scaling, the orbital architecture parameters of planetary systems are nearly independent of the initial conditions of protoplanet systems.

Primary author: KOKUBO, Eiichiro (National Astronomical Observatory of Japan)

Presenter: KOKUBO, Eiichiro (National Astronomical Observatory of Japan)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **KOKUBO, Eiichiro** on **Friday, October 10, 2025**

Abstract ID : **210**

Stability of Unevenly Spaced, Unequal-Mass Multi-Planet Systems

Content

This study conducts a 10^7-year-long-term dynamical evolution analysis of initially coplanar circular orbit planetary systems with unequal spacing and unequal masses using N-body numerical simulations based on REBOUND. The focus is on exploring the relationship between system stability and orbital parameters. The main conclusions are as follows: The stability of the system significantly improves with increases in the initial average orbital spacing, the initial average planetary mass, and the semi-major axis of the innermost planet. After undergoing dynamically unstable evolution, the nine-planet system predominantly ends up with 2-3 surviving planets (accounting for 80% of cases), while complete planetary loss or minimal dissipation ($N \geq 6$) is extremely rare. The final average eccentricity of the system exhibits a positive correlation with system stability, and this correlation coefficient weakens as the semi-major axis of the innermost planet increases. Due to random sampling of initial parameters, the survival probability of planets shows no orbital location preference. The dynamical instability events in the system are dominated by scattering, with more compact systems being more prone to planetary collisions and mergers. In dynamically unstable systems, the final average orbital spacing ($k_{f.avg}$) of the reorganized systems primarily depends on the number of remaining planets (N_c) and the reduced planetary mass (μ), showing no significant correlation with the initial average orbital spacing or the semi-major axis of the innermost planet. This relationship can be expressed by a linear equation: $k_{f.avg} = k_\mu N_c + b_\mu$. In dynamically unstable systems, the system's stability timescale (T) is correlated with the initial minimum orbital spacing ($k_{i.min}$), the relationship follows:$log\ T = k_{a_0} log\ (k_{i.min}) + b_{a_0}$, k_{a_0} , $b_{a_0}$are parameters correlated with the initial semi-major axis (a_0) of the system's innermost orbit.

Primary author: 杨, 🄵 (紫金山天文台)

Presenter: 杨, 🄵 (紫金山天文台)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **杨, 🄵** on **Friday, October 10, 2025**

Abstract ID : **211**

Terrestrial planet and asteroid belt formation by Jupiter–Saturn chaotic excitation: A comprehensive dynamical model for the inner solar system

Content

The Jupiter–Saturn chaotic excitation (JSCE) scenario offers a plausible explanation for several observed properties of the inner solar system. However, simultaneously replicating the orbits and masses of the four terrestrial planets, the main properties of the asteroid belt, and other inner solar system constraints remains elusive.

Here, we investigate the simultaneous formation of the four terrestrial planets (Mercury, Venus, Earth, and Mars) and the asteroid belt within the JSCE scenario. We found that our terrestrial systems satisfy several constraints in the inner solar system.

An analysis of 37 optimally formed terrestrial planet systems allowed us to constrain the planets' building blocks, accretion history, and other fundamental properties. First, the terrestrial planets obtained orbits and masses that closely resemble those observed in our solar system. Additionally, key findings include the occurrence of Moon-forming giant impacts within approximately 60 Myr, late bombardment of the terrestrial planets by disk objects formed within 2 au, and the acquisition of bulk water during the first 10–20 Myr of Earth's formation. In particular, achieving Earth's estimated bulk water content required the disk to initially contain sufficient water mass in objects beyond approximately 1–1.5 au. This implies that Mercury, Venus, and Mars acquired water in amounts comparable to Earth's during their formation.

Finally, our model asteroid belt explains the asteroid belt's orbital structure, small mass, and taxonomic distribution (S-, C-, and D/P-types). The current asteroids represent a mixture of local asteroids that survived the dynamical depletion of the primordial asteroid belt by JSCE and captured asteroids from trans-Jovian reservoirs during the giant-planet instability/migration.

Primary author: SOFIA LYKAWKA, Patryk (Kindai University)

Co-author: ITO (伊藤), Takashi (孝士) (National Astronomical Observatory of Japan)

Presenter: SOFIA LYKAWKA, Patryk (Kindai University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SOFIA LYKAWKA, Patryk** on **Friday, October 10, 2025**

Abstract ID : **212**

Unveiling the Chemical Abundance Pattern of Solar Analogs Hosting Debris Disks

Content

The peculiar depletion of refractory elements (e.g., Fe, Ni, Al) in the solar photosphere compared to nearby solar twins remains a mystery in stellar astrophysics and star-planet connection. Theoretical studies suggest possible links to planet formation or disk-related processes. However, debris disks, tracers of planet formation and collisions, have been largely unexplored in this context. We are conducting the first systematic high-resolution abundance study of 69 debris-disk-hosting solar analogs identified through a cross-match between Gaia DR3 and recent debris disk catalogs. By comparing their detailed abundance patterns, especially the [X/Fe] versus condensation temperature (Tc) slope, with a large control sample of over 10000 solar analogs with precise abundance measurements available in the literature, we aim to identify potential chemical signatures imprinted by disk-related evolution. Our results constrain the connection between disks and stellar chemical properties and thus provide new insights into the origin of the solar abundance anomaly.

Primary author: ZHANG, Jiayue

Presenter: ZHANG, Jiayue

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHANG, Jiayue** on **Friday, October 10, 2025**

Abstract ID : **213**

Find Stellar Companions Around S-type Transiting Systems with Long-term Trend Transit Timing Variations

Content

Unresolved companions influence the estimation of planetary radii, consequently impacting research on statistical properties. Additionally, close companions suppress the occurrence rate of planets. To gain a deeper understanding of planetary formation and evolution in binary systems, we suggest using the Light Travel Time Effect (LTTE) to detect companions through long-term transit observations. The LTTE arises from the Keplerian motion between a stellar companion (at distances of about 5-20 AU) and the host planet. Through forward numerical analysis, we ascertain that LTTE can induce more significant long-term Transit Timing Variations (TTV) than dynamic perturbations. By combining data from missions such as Kepler, TESS, PLATO, and ET2.0, the photometric observations will span a baseline of over 8000 days. We try to extract long-term TTV signals by employing the LTTE model and other alternative mechanisms to analyze both real and simulated data. We present a catalog of possible transiting S-type binary systems. Our retrieval results are consistent with the dominated region identified in forward analysis, demonstrating the capability of our retrieval code in accurately reproducing the properties of companions within this region. Finding companions via LTTE is an efficient and straightforward method to sculpt the architecture of planetary systems and conduct statistical research.

Primary author: ANDONG, Chen (Nanjing University)

Presenter: ANDONG, Chen (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ANDONG, Chen** on **Friday, October 10, 2025**

Abstract ID : **214**

Formation of planets in the hot Neptune desert

Content

Exoplanet observations are currently revealing a striking "hot Neptune desert", a region of period-radius or period-mass parameter space where planets have rarely been found. TOI-2196b is one of the rare samples within the desert. Here we present a new formation mechanism caused by mass-loss of planet due to the radiation of the host star for TOI-2196b. We carry out numerical simulations for initial multi-planet systems considering various mass-loss rates of planets, characteristic timescales of planet mass loss and tidal dissipation parameters. Planets experience collisions, merging and tidal circulation and orbital decay. As a result, one planet like TOI-2196b forms with one potential companion. We also made a statistical study on the formation of planets in Neptune desert by numerical simulations to explore the formation mechanism of planets in the Neptune desert. Results demonstrate that the probability of planet formation in this region is correlated with planetary mass-loss rates, tidal forces, and other factors.

Primary authors: Ms 董, 瑶 (中国科学院紫金山天文台); 包, 纲 (中国科学院紫金山天文台); Ms 王, 素 (中国科学院紫金山天文台)

Presenters: Ms 董, 瑶 (中国科学院紫金山天文台); 包, 纲 (中国科学院紫金山天文台); Ms 王, 素 (中国科学院紫金山天文台)

Track Classification: Planet formation

Contribution Type: Poster

Status: ACCEPTED

Submitted by **包, 纲** on **Friday, October 10, 2025**

Abstract ID : **215**

The evolution of semiconvective layers in gas giants with large compositional gradients

Content

The existence of extended compositional gradients in the deep interiors of the Solar System gas giants is supported by recent observations, although the origin and exact thermodynamic structure of these regions remains poorly understood. According to longstanding results in stellar evolution, fluid parcels from the convective layers directly adjacent to these compositionally-stabilized regions are expected to overshoot slightly the boundary between two zones, leading to mixing and gradual erosion of the stratified region. However, previous direct numerical simulations of this process focused on the regime of strong convection and weak stratification characteristic of stars, which is not obviously translated into the planetary regime. Here, we present the results of direct numerical simulations studying the convective overshoot process in the strong-stratification regime. We find that, when the effect of artificial numerical viscosity is carefully accounted for, the remaining hydrodynamical evolution still drives erosion of the stratified region. We quantitatively compare this growth with common semi-analytic prescriptions for convective overshoot. Our results can be used to model hydrodynamic erosion of deep stably-stratified regions in 1D planetary evolution models.

Primary author: INAI, Masayuki (The University of Tokyo)

Co-authors: SU, Yubo; Mr SUR, Ankan (University of California, Los Angeles)

Presenter: INAI, Masayuki (The University of Tokyo)

Track Classification: Planetary structure

Contribution Type: Poster

Status: ACCEPTED

Submitted by **INAI, Masayuki** on **Friday, October 10, 2025**

Abstract ID : **216**

Radiation Hydrodynamics of Self-gravitating Protoplanetary Disks: Direct Formation of Gas Giants via Disk Fragmentation

Content

Gravitational instability (GI) has long been considered a viable pathway for giant planet formation in protoplanetary disks (PPDs), especially at wide separations or around low-mass stars where core accretion faces challenges. However, a primary drawback is that disk fragmentation from GI was generally found to produce over-massive clumps, typically in the brown dwarf mass range, although most numerical studies adopted simplified cooling prescriptions or limited numerical resolution. We conduct a suite of global three-dimensional radiation hydrodynamics simulations of self-gravitating PPDs using the meshless finite-mass (MFM) method. By implementing radiation transport via the M1 closure and varying disk mass and opacity, we show that increasing disk mass and lowering opacity promote fragmentation by enhancing cooling. Non-fragmenting disks settle into a gravito-turbulent state with low-order spirals and angular momentum transport characterized by $\alpha \sim \beta_{\rm cool}^{-1}$. In fragmenting disks, a subset of gravitationally bound clumps survives as long-lived fragments. Their initial masses form a consistent distribution around $\Sigma \cdot \lambda_{\rm T} \cdot 2(c_s/\Omega_{\rm K})$ (with λ_T the Toomre wavelength), corresponding to $\sim 0.3 - 10\,M_{\rm J}$, consistent with gas giants. These results demonstrate that GI can produce planet-mass fragments under more realistic conditions, reinforcing it as a viable gas giant formation pathway and motivating further studies. Furthermore, we will present preliminary results on the global 3D self-gravitating PPD evolution with non-ideal MHD.

Primary author: NI, Yang (Tsinghua University)

Co-authors: Prof. DENG, Hongping (Shanghai Astronomical Observatory); Prof. BAI, Xue-Ning (Tsinghua University)

Presenter: NI, Yang (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **NI, Yang** on **Friday, October 10, 2025**

Abstract ID : **217**

Exoplanets in Binary Star Systems

Content

Exoplanets have been discovered in binary star systems orbiting around one of the stars in a circumstellar orbit or around the binary in a circumbinary orbit. In this talk, I will discuss the dynamics of both types of planets and the constraints that they place on the formation and evolution of planetary systems. For two of the tightest binaries with circumstellar planets, HD 59686 and nu Octantis, dynamical fitting of the radial velocity data and stability analysis show that the planets are most likely on retrograde orbits, and high-resolution imaging has allowed us to determine the nature of the secondary stars. The orbits of circumbinary planets can be significantly non-Keplerian, and the free eccentricity is determined by dynamical processes during the formation and/or subsequent evolution of the planets. We have examined all known circumbinary planets and determined their free eccentricities. I will also discuss the prospect of observing the precession of circumbinary planets.

Primary author: LEE, Man Hoi (The University of Hong Kong)

Presenter: LEE, Man Hoi (The University of Hong Kong)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LEE, Man Hoi** on **Friday, October 10, 2025**

Abstract ID : **218**

Orbital Instabilities in apdisally-aligned compact planetary systems.

Content

Compact protoplanet systems are an outcome of oligarchic growth of planetesimals, with low-mass protoplanets with orbital separations of $K \approx 10$ mutual Hill radii. Those protoplanets evolve to Earth-mass bodies through giant impacts after gravitational instabilities are triggered. On the other hand, Kepler observations reveal older, non-resonant and more massive systems with orbital separations clustered at K>10 Hill radii, suggesting long-term stability despite similar compactness.

In this context, which orbital parameters could lead protoplanet systems toward Giant Impact phase or allow them to remain stable? How do different dynamical architectures lead planetary systems toward a chaotic evolution or to a stable state?

In this work, we focused on the role of eccentricities in the dynamical instabilities of compact planetary systems. We observed that, while eccentricities can sharply decrease instability timescales for systems with randomized pericenters, apsidally-aligned systems have instability timescales similar to their circular counterparts.

Additionally, we observe that this "apsidal protection" mechanism can allow for long-lived planetary systems with eccentricities up to $e = 0.1$ for earth-mass systems, after which instability timescales also show sharp decreases. We also observe that in such systems, the "critical eccentricity" for which systems become unstable seem to be sensitive to the orbital separation between the planets and to mean motion resonances.

Primary author: TEIXEIRA GUIMARÃES, Gabriel (NAOJ/SOKENDAI)

Co-author: KOKUBO, Eiichiro (NAOJ)

Presenter: TEIXEIRA GUIMARÃES, Gabriel (NAOJ/SOKENDAI)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TEIXEIRA GUIMARÃES, Gabriel** on **Friday, October 10, 2025**

Abstract ID : **219**

Sulfur Cycle on Terrestrial Exoplanets: Constraining Habitability through Spectroscopy

Content

The presence of liquid water on terrestrial exoplanet surfaces is fundamental to the search for habitable worlds and life beyond Earth. Atmospheric sulfur species, especially SO_2 have been proposed as tracers of surface water (Loftus et al. 2019), based on the contrast between Earth, where volcanic sulfur is removed by wet deposition, and Venus, where it accumulates in a dry atmosphere. While water vapor itself is a direct indicator of surface water, cloud formation at various altitudes can obscure water vapor signatures below cloud decks, making direct detection challenging. Therefore, simultaneous observations of multiple species, including sulfur compounds whose chemistry depends on water content, are essential for robust surface-water characterization.

Despite the potential of sulfur species as surface water tracers, the systematic dependence of atmospheric sulfur abundance on water vapor abundance and volcanic outgassing rates remains poorly constrained. Outgassing rates can vary by orders of magnitude across tectonic regimes, raising concerns about observational degeneracies. Detectability also depends on host star type and observational technique.

To address these uncertainties, we conducted a comprehensive parameter survey of the atmospheric sulfur cycle across M-, K-, and G-type host stars for Earth-analogue rocky exoplanets using the Photochem atmospheric photochemical module implemented in the Atmos code (e.g., Arney et al. 2016) and petitRADTRANS radiative transfer code (Mollière et al. 2019). We systematically varied water vapor abundance and volcanic sulfur outgassing rates to quantify impacts on atmospheric composition and observed spectra. We evaluated three observational approaches: transmission spectroscopy with JWST, and thermal emission and reflected light spectroscopy with future missions such as LIFE and HWO, to identify optimal strategies for each stellar type.

Our results demonstrate that atmospheric SO_2 abundance shows systematic dependence on both water vapor abundance and volcanic outgassing rates. SO_2 absorption strengthens when water vapor decreases because OH oxidation and wet deposition become less efficient, and also increases with higher outgassing rates. Importantly, we quantify the observational degeneracy between these two parameters across different host star types and observational techniques. This quantitative mapping establishes the fundamental challenge for inferring surface water from sulfur species alone and provides a framework for designing multi-species observational strategies with current and future missions.

Primary author: YOSHIDA, Kaito (The University of Tokyo)

Co-author: KUROKAWA, Hiroyuki (The University of Tokyo)

Presenter: YOSHIDA, Kaito (The University of Tokyo)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YOSHIDA, Kaito** on **Friday, October 10, 2025**

Abstract ID : **220**

Beyond the Ice Line: Unveiling Giant Planets combining Gaia, radial velocity and high contrast imaging

Content

Giant planets (GPs) are the primary architects of planetary systems: they reshape protoplanetary disks, influence the assembly and long-term stability of inner rocky worlds, and may facilitate the delivery of volatiles—conditions favorable to habitability. Despite this central role, their demographics and dynamical impact are still weakly constrained at 5–30 au, the very domain occupied by Jupiter and Saturn. Existing techniques each probe a partial, biased slice of parameter space: transits favor short periods; radial velocities lose robust traction beyond ≈8 au and yield only m sin i; high-contrast imaging is most sensitive to massive, young giants at wide separations; microlensing measures mass ratios for distant, often metal-poor hosts. Consequently, mature Jupiter/Saturn analogs remain largely absent from current samples.
Leveraging a careful re-calibration of Gaia DR3 astrometric diagnostics (RUWE, AEN), we uncover outer companions to various king of stars: young stars (Lagrange et al, 2024), stars with disks (Lagrange et al, to be submitted), nearby M dwarfs (Destriez et al, to be submitted), some of which already hosting inner planets. By combining Gaia data with archival RVs and direct-imaging (including JWST) constraints, we narrow the companions to giant planet or brown dwarf regimes. JWST coronagraphy can resolve the remaining mass–semi-major-axis degeneracies, delivering detections or stringent upper limits. Such results provide new leverage on disk–planet and planet–planet interactions and preview the discovery space that Gaia DR4 will open.
I will present these new findings enabled by the Gaia + RV + high-contrast imaging synergy and outline how the same approach with DR4 time-series astrometry will transform giant-planet demographics, dynamics, and hence the understanding of their formation processes, while delivering benchmark targets for the ELTs and future flagship missions.

Primary author: LAGRANGE, Anne-Marie (CNRS/Paris Observatory/PSL)

Presenter: LAGRANGE, Anne-Marie (CNRS/Paris Observatory/PSL)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LAGRANGE, Anne-Marie** on **Friday, October 10, 2025**

Abstract ID : **221**

Convergent and Divergent Planet Migration Driven by a Dead Zone in Protoplanetary Disks

Content

The formation and migration of planets in protoplanetary disks with dead zones remain insufficiently studied as a novel aspect of understanding planetary system architectures. In this study, we investigate the migration of planets with varying masses at different initial locations in a protoplanetary disk with a ring-shaped dead zone by numerical simulations and theoretical analysis. We identify formation conditions of hot Jupiters and super-Earths, and reveal the underlying mechanisms for migration stagnation and reversal. Two kinds of torque in planet-disk interaction —the Lindblad torque and the corotation torque —are characterized; they compete to dominate the migration direction of the planet. Results show that hot Jupiters migrate outward from the dead zone midline by the Lindblad torque as well as the accretion processes. For super-Earths, they exhibit inward convergent migration from both sides of the dead zone due to the corotation torque, finally trapped near dead zone midline. These findings improve our understanding of planetary migration and its driven mechanisms, providing clues to the formation of observed planetary systems.

Primary authors: CAO, Zhuoya; LI, Yaping; LIN, Douglas N. C. (UC Santa Cruz); MAO, Shude (Westlake University)

Presenter: CAO, Zhuoya

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CAO, Zhuoya** on **Friday, October 10, 2025**

Abstract ID : **222**

Numerical solutions of radiative transfer in a parallel-slab incorporating millimeter wavelength scattering for protoplanetary disks

Content

Recent ALMA observations suggest that dust masses in protoplanetary disks may be insufficient to form the observed exoplanet population. However, disk dust mass estimates can change substantially when dust scattering is considered. We therefore re-evaluate disk dust masses with a model that treats anisotropic scattering.
In this work, we numerically solve the radiative transfer equation for a plane-parallel slab, including anisotropic scattering. Our computations show that, because scattering reduces the emergent continuum at fixed dust mass, accounting for anisotropic scattering tends to increase the dust mass inferred from the millimeter continuum. In a fiducial case with the DSHARP dust model at an observing wavelength of 870 μm and a maximum grain radius of 100 μm, the inferred disk dust mass increases by up to a factor of two. This result indicates that a substantial fraction of disks may contain sufficient dust mass to form planetary systems even when standard no-scattering estimates fall short.
Beyond total intensity, we also derive the emergent polarization from the disk by numerically solving the radiative transfer equation for polarization with anisotropic scattering. Applying these results to polarization observations enables rapid constraints not only on dust mass but also on grain size and porosity.

Primary author: KITADE, Naoya (NAOJ)

Co-author: Dr KATAOKA, Akimasa (NAOJ)

Presenter: KITADE, Naoya (NAOJ)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KITADE, Naoya** on **Friday, October 10, 2025**

Abstract ID : **223**

Zodiacal dust as a testbed for the radiative torque theory

Content

Dust spin dynamics has received significant attention in astronomy because polarized emissions from spinning dust provide information about magnetic field structures and dust size. Even more intriguing is that differential absorption and scattering by helical grains can generate radiative torques (RATs). Numerical calculations have shown that RATs can spin up large grains to superthermal rotation, leading to centrifugal stresses that can surpass the grain's maximum tensile strength, causing the grain to break into smaller fragments. We investigate the influence of RATs on the size evolution of dust in the heliosphere. We incorporate the RAT disruption into a power-law collisional cascade model for dust fragmentation. We consider the dust fraction trapped in the high-angular momentum (high-J) attractor points as a free parameter. We conclude that the detected beta-meteoroids should not be trapped in high-J attractors, thereby providing a constraint on the RAT theory in environments with strong radiation fields, such as the zodiac and exozodi dust.

Primary author: GU, Pin-Gao

Co-authors: Dr HOANG, Thiem (KASI); Dr NG, Chi-Hang (ASIAA, National Taiwan University)

Presenter: GU, Pin-Gao

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GU, Pin-Gao** on **Friday, October 10, 2025**

Abstract ID : **224**

Dust evolution proved by shadows in protoplanetary disks: A case study of HD 142527 disk

Content

Planet formation begins with dust growth and planetesimal formation within protoplanetary disks surrounding young stars. To understand these processes, it is essential to estimate dust grain sizes from disk observations. In this study, we develop a new method to constrain grain size based on the estimation of cooling timescales. Our approach utilizes transitional disks that possess an inclined inner disk casting shadows on the outer disk, whose temperature variations serve as a tracer of dust properties. By constructing a three-dimensional model of the disk surface using near-infrared scattering light images and comparing it with sub-millimeter dust continuum maps, we estimate the spatial offset between the irradiated and shadowed regions to derive the cooling timescale. We then build an analytical model that calculates the cooling timescale at the observed height with an assumed turbulent diffusion intensity to infer the dust surface density and dust grain size. Applying this method to the protoplanetary disk around HD 142527, we find that the disk's northern shadowed region cools on a timescale of a few percent of the orbital period and that the maximum grain size consistent with the observations is approximately 0.1-1 mm. We also find that the conditions required for the vertical shear instability, which needs a short cooling timescale, are satisfied, allowing turbulence with an intensity consistent with near-infrared observations. This study demonstrates that estimating cooling timescales is an effective tool for constraining dust grain size. Our approach can be generally applied to other transition disks with inner-disk-induced shadows.

Primary authors: Dr FUKUHARA, Yuya (Academia Sinica Institute of Astronomy and Astrophysics); Dr ORIHARA, Ryuta (The University of Tokyo)

Co-authors: MUTO, Takayuki (Kogakuin University); Prof. OKUZUMI, Satoshi (Institute of Science Tokyo)

Presenter: Dr FUKUHARA, Yuya (Academia Sinica Institute of Astronomy and Astrophysics)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **FUKUHARA, Yuya** on **Friday, October 10, 2025**

Abstract ID : **225**

Systematic search for free-floating planets in KMTNet microlensing survey

Content

The origin of free-floating planets is still unclear, which needs constraints from observations. Microlensing is currently the only method to detect them in a wide range of masses. FFP events last for hours to days, and the KMTNet survey's 3 global sites provide quasi-continuous observation within 1 day. To improve the sensitivity on these events, we built a new full-frame photometry and event search pipeline, and tested it on a 1-year 1-square-degree image sample. The pipeline improves light curve quality, detects several new microlensing events, and decreases the mass detection limit by nearly one order-of-magnitude. In the future, the pipeline can be applied to the full KMTNet data and other surveys.

Primary author: QIAN, Qiyue (Tsinghua University)

Co-authors: Dr YANG, Hongjing (Westlake University); ZANG, Weicheng (Westlake University); MAO, Shude (Westlake University)

Presenter: QIAN, Qiyue (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **QIAN, Qiyue** on **Friday, October 10, 2025**

Abstract ID : **226**

Core-Envelope Misalignment in Kepler-56: Implications for Planet Formation and Evolution

Content

The planets around the red giant Kepler-56 have long been an enigma: the only known case where multiple transiting planets possess orbits which are mutually aligned, and yet all misaligned from the rotational axis of their host star. Also uniquely, this misalignment between planetary orbits and stellar spin was detected using asteroseismology, rather than more commonly applied measurements of the Rossiter-McLaughlin effect. I describe how advances to asteroseismic theory lead to a reinterpretation of existing observational data. In particular, Kepler-56 itself is now found to possess an exotic rotational configuration: its core and envelope rotate around different axes. The rotational axis of its core remains misaligned from the orbits of both inner planets, while that of the envelope lies in the sky plane, and may well be aligned with them. I discuss implications of this result for our understanding of tidal interactions, planet formation and engulfment, and stellar magnetic activity.

Primary author: ONG, Joel (University of Sydney)

Presenter: ONG, Joel (University of Sydney)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ONG, Joel** on **Friday, October 10, 2025**

Abstract ID : **227**

Toward Multidimensional Atmospheric Retrievals in the JWST Era: A Case Study of WASP-121b

Content

JWST now delivers phase-resolved spectra with precision that exposes genuinely multidimensional structure, rendering traditional 1D retrievals inadequate for interpreting heat transport and chemistry on ultra-hot Jupiters. We present a lean, physics-informed approach to phase-curve analysis that foregrounds interpretability and speed while avoiding heavy model complexity. In parallel, we introduce high-resolution processing to JWST phase-curve time series—refined spectral calibration to better utilize information across wavelength and orbital phase. Applied to WASP-121b, the method reproduces the observed day–night contrast, improving cross-phase consistency without proliferating nuisance parameters. The results point to a meaningful role for hydrogen dissociation–recombination heat transport and provide tighter, more uniform constraints on longitudinal temperature structure. More broadly, this offers a scalable baseline for multidimensional retrievals in forthcoming JWST surveys, bridging the gap between rapid empirical fits and full GCMs.

Primary author: YANG, Yuanheng (PMO, CAS)

Presenter: YANG, Yuanheng (PMO, CAS)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Yuanheng** on **Friday, October 10, 2025**

Abstract ID : **228**

A Warm Jovian Exoplanet Exhibiting Transit Timing Variations Indicating a Nearby Companion, and Evidence for a Cold Jupiter from HARPS and FEROS Observations

Content

TOI-2361 is a solar-type G-dwarf star with a mass of 0.996 ± 0.04 $M_\odot$ and a radius of 0.988 ± 0.02 $R_\odot$. It hosts a transiting warm Jovian-mass planet, TOI-2361 b, with an orbital period of approximately P_b = 8.7 days, identified by TESS observations in Sectors 10, 37, and 63. The TESS transit measurements of TOI-2361 b exhibit strong transit timing variations (TTVs) with an amplitude of about five hours, suggesting a close massive planet perturber. As part of the WINE collaboration, we performed radial velocity follow-up observations with the FEROS and HARPS spectrographs, confirming the transiting candidate's planetary nature. A self-consistent N-body analysis of the radial velocities and TTVs revealed the presence of a second, outer Saturn-mass companion, TOI-2361 c, with a period P_c ˜ 18 days, near but outside the 2:1 mean-motion resonance (MMR) commensurability. Additionally, the long observational baseline of the FEROS radial velocities suggests the existence of a third, long-period super-Jovian-mass companion in a colder orbit around 3.5 au. The TOI-2361 system is particularly intriguing due to two massive planets in warm orbits and a Jovian-mass planet in a colder orbit. Hence, TOI-2361 represents an important multi-planet system whose dynamical architecture and exoplanet compositions provide valuable insights into the formation and evolution of gas giants around solar-type stars.

Primary authors: STEFANOV, Stefan (1) Sofia University; 2) IANAO BAS); TRIFONOV, Trifon (Landessternwarte (LSW), Heidelberg, Germany & Department of Astronomy, Sofia University, Bulgaria)

Presenter: STEFANOV, Stefan (1) Sofia University; 2) IANAO BAS)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **STEFANOV, Stefan** on **Friday, October 10, 2025**

Abstract ID : **229**

Cold Classical Kuiper Belt Objects as Primordial Planetesimals

Content

Cold Classical Kuiper belt objects (CCKBOs) are considered first-generation planetesimals that formed 42–47 au from the Sun and remained untouched since. Formation is thought to proceed by the streaming instability followed by gravitational collapse. Previous calculations along these lines are inconsistent with the CCKB ' s supposedly pristine nature, because they assume orders of magnitude more solid mass than is actually present in the CCKB (a few thousandths of an Earth mass), and do not explain how to expel the >99% extra mass. We present what doesn't work (formation in a pressure bump), what works (clumping while drifting radially), and the bigger picture of how the CCKB forms as the "last gasp" of a dissipating solar nebula.

Primary author: LI, Rixin (University of California Berkeley)

Co-author: CHIANG, Eugene (University of California, Berkeley)

Presenter: LI, Rixin (University of California Berkeley)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LI, Rixin** on **Friday, October 10, 2025**

Abstract ID : **230**

A two-dimensional axisymmetric viscous radiation hydrodynamic model of circumplanetary disks

Content

Circumplanetary disks (CPD) are important to planet formation and moon formation. However, CPDs are extremely poorly understood due to the lack of observables and comprehensive theoretical models. To fill this gap, we present a two-dimensional viscous axisymmetric radiation hydrodynamic model of CPD that can calculate many important quantities, such as the density, temperature, accretion efficiency, and angular frequency of a CPD. We adopt Shakura-Sunyaev α disk model for turbulent viscosity and flux-limited-diffusion approximation for radiation transport. The model is built with {\tt Guangqi}, a new radiation hydrodynamic code that can work with a complex equation of state, and precisely conserve angular momentum along the polar direction. To exhibit the capability of our model, we carry out 9 simulations and seek their quasi-steady-state (QSS) solutions. We demonstrate the self-consistent, physically induced energy conversion and high precision energy conservation of our CPD model. Within the 9 models, the accretion efficiency varies from 30% to 80%, and decreases as the angular momentum of the infalling gas increases. We find that the silicate dust may be sublimated inside the CPD when α is small or the mass feeding rate is high. We also find that, as the planet mass increases, the disk aspect ratio decreases, and the morphology of the circumplanetary material transits from circumplanetary envelope to CPD.

Primary authors: CHEN, Zhuo (Tsinghua University); YANG, Jing (Tsinghua University); BAI, Xue-Ning (Tsinghua University)

Presenter: CHEN, Zhuo (Tsinghua University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHEN, Zhuo** on **Friday, October 10, 2025**

Abstract ID : **231**

Follow-up of TESS Exoplanet Candidates with the TRAPPIST and SPECULOOS Networks

Content

The TRAPPIST and SPECULOOS networks of robotic telescopes play a pivotal role in the confirmation and characterization of exoplanets discovered by TESS. TRAPPIST operates two 60-cm telescopes in Chile (TRAPPIST-South) and Morocco (TRAPPIST-North), while SPECULOOS comprises four 1-m telescopes in Chile (SPECULOOS-South) and one in Tenerife (SPECULOOS-North, soon to be two), complemented by the SAINT-Ex telescope in Mexico. These facilities provide high-precision, seeing-limited photometry for I-band magnitudes of 8.5–14 (TRAPPIST) and 9.5–15 (SPECULOOS/SAINT-Ex), enabling the detection and refinement of transits of small planets. To date, TRAPPIST has conducted 768 observations (346 from North, 422 from South) covering 579 TESS Objects of Interest (TOIs), while SPECULOOS/SAINT-Ex has obtained 115 observations of 80 TOIs. Recent results include the confirmation of several TESS candidates, with additional validation studies currently led by TRAPPIST and SPECULOOS team members. These efforts highlight the essential contribution of robotic telescope networks to the follow-up and characterization of exoplanets discovered by space-based missions.

Primary author: SOUBKIOU, Abderahmane (ExoTIC Lab - UR Astrobiology, University of Liège, Liège, Belgium)

Co-author: Prof. GILLON, Michaël (ExoTIC Lab - UR Astrobiology, University of Liège, Liège Belgium)

Presenter: SOUBKIOU, Abderahmane (ExoTIC Lab - UR Astrobiology, University of Liège, Liège, Belgium)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SOUBKIOU, Abderahmane** on **Friday, October 10, 2025**

Abstract ID : **232**

Stellar Chemical Signatures of Planetary Ingestion and Planet Formation

Content

Ingestion of planetary material and/or planet formation can imprint a distinct chemical signature into the host star ' s photosphere. Detecting these ' planet signatures ' , however, is challenging due to unknown occurrence rate, small amplitudes of planet signals and heterogeneous star samples with large differences in stellar ages. Co-natal stars, such as binary stars offer a unique opportunity to detect stellar chemical signatures of planets thanks to their shared origin an d identical initial chemical composition. Here we establish and report high-precision chemical abundances (˜ 0.015 dex; 3%) for a large, homogeneous sample of 125 pairs of stars moving together (91 with shared origin, i.e., co-natal) with a well defined selection function using Gaia DR3. Our sample represents a ten-fold increase in sample size and a least five-fold increase in precision over traditional spectroscopic analysis of binary star systems. We identified at least 7 new instances of planetary ingestion, corresponding to an occurrence rate of about 8%. An independent Bayesian indicator was deployed, which can effectively disentangle the planet signatures from other factors, such as random abundance variation and atomic diffusion. Our study thus provides clear evidence of planet signatures and facilitates a deeper understanding of the star–planet–chemistry connection by providing observational constraints on the mechanisms of planet engulfment, formation and evolution.

Primary author: Prof. LIU, Fan (NAOC)

Co-authors: Prof. TING, Yuan-Sen (ANU); Prof. YONG, David (ANU); Prof. BITSCH, Bertram (University College Cork); Prof. KARAKAS, Amanda (Monash University); Prof. MURPHY, Michael T. (Swinburne University of Technology); Prof. JOYCE, Meridith (Konkoly Observatory); Prof. DOTTER, Aaron (Dartmouth College); Prof. DAI, Fei (University of Hawaii)

Presenter: Prof. LIU, Fan (NAOC)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LIU, Fan** on **Friday, October 10, 2025**

Abstract ID : **233**

The Variation of Ozone on the Terrestrial Planetary Atmosphere due to Continual Stellar Flares

Content

Planetary atmosphere, specifically atmospheric ozone, could protect life from harmful ultraviolet (UV) radiation. However, the compositions of planetary atmosphere will be strongly affected by stellar activities, especially stellar flares. During flares, stellar UV spectrum will change and stellar energetic particles (SEPs) will inject into planetary atmosphere, and result in the change of photochemical equilibrium in atmosphere. Based on different stellar flare energy of solar-type star and diffierent flare frequency distribution (FFD), the effects of continual stellar flares on the ozone column depth of earth-like atmosphere have been simulated with 1D coupled photochemistry-climate model, atmos. Our simulations show that ozone column depth depends on the profile of stellar UV spectrum. The stellar UV enhancements during flares have less effect on atmospheric ozone, while abundant NOx produced due to SEPs injection dominates the change of ozone concentration by removing ozone significantly. When the ozone balances again after a secular simulations of active and continual stellar flares, its concentration decreases by 1 - 2 orders of magnitude. We also give a quantitative relation between ozone equilibrium column depth and stellar FFD parameters via simulations. With given FFD parameters α and β of solar-type star, we could easily determine whether a planet is ozone depletion or not. The ground UV flux has been calculated to assess habitability of planets. The conclusions help to characterize the habitability of exoplanets around flaring stars, and provide theoretical predictions for the future observations of transmission spectrum.

Primary authors: LIU, HUIGEN (Nanjing University); ZHU, Zhan-Yi (Nanjing University)

Presenter: ZHU, Zhan-Yi (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHU, Zhan-Yi** on **Friday, October 10, 2025**

Abstract ID : **234**

Primary-secondary atmospheric transition of sub-Neptunes: implications for helium depletion and the radius valley

Content

Short-period sub-Neptunes are ubiquitous in extrasolar systems. These planets are generally believed to retain primary atmospheres originating from the protoplanetary disk. However, strong atmospheric escape followed by degassing from their interiors can lead to a transition to secondary atmospheres, which are depleted in less soluble gases such as helium. Such primary and secondary atmospheres may be distinguishable through observations of escaping hydrogen and helium. In this study, we investigate how the transition from primary to secondary atmospheres affects the composition and population of short-period sub-Neptunes. We performed evolutionary simulations that couple atmospheric escape driven by stellar X-ray and extreme-ultraviolet irradiation with degassing of hydrogen, helium, and water from rocky interiors, using a one-dimensional planetary structure model. A statistical approach was further employed to assess the role of interior degassing in atmospheric replenishment. Our results show that the transition occurs in low-mass, close-in planets that experience substantial atmospheric loss. These planets develop helium-depleted and water-enriched atmospheres, reflecting the low and high solubilities of helium and water in magma, respectively. We propose that the transition from primary to secondary atmospheres provides a natural explanation for the non-detection of helium in relatively small ($< 2.5\ R_\oplus$) exoplanets. Furthermore, continuous replenishment via interior degassing prolongs atmospheric lifetimes, suggesting that escape alone may not fully account for the observed radius valley among short-period exoplanets.

Primary author: KUROKAWA, Hiroyuki (The University of Tokyo)

Co-authors: Mr KOBAYASHI, Issei (Institute of Science Tokyo); Prof. SCHAEFER, Laura (Stanford University); OKUZUMI, Satoshi (Institute of Science Tokyo)

Presenter: KUROKAWA, Hiroyuki (The University of Tokyo)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **KUROKAWA, Hiroyuki** on **Friday, October 10, 2025**

Abstract ID : **235**

Planet formation by disc fragmentation: the impact of dust growth on opacity

Content

It is often argued that gravitational instability of realistic protoplanetary discs is only possible at distances larger than ˜60 au from the central star, requiring high disc masses and accretion rates, and that therefore disc fragmentation results in the production of brown dwarfs rather than gas giant planets. However, the effect of dust growth on opacity can be very significant but has not been taken into account in the models of fragmenting discs. We consider dust opacity that depends on both temperature and maximum grain size, and using it, we estimate the properties of a critically fragmenting protoplanetary discs. We find that dust growth promotes disc fragmentation at disc radii as small as ˜30 au. The critical disc masses and accretion rates are smaller, and the initial fragment masses are in the gas giant planet mass regime. We conclude that formation of gas giant planets by disc fragmentation may be more likely than usually believed, and that future numerical models of the process must take into account both dust growth and dust mobility with respect to gas.

Primary author: LEE, Hans (University of Leicester)

Presenter: LEE, Hans (University of Leicester)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LEE, Hans** on **Friday, October 10, 2025**

Abstract ID : **236**

Disrupting Resonances: The Impact of Cold Jupiter Scattering on Inner Mean Motion Resonances

Content

A key feature in Kepler multi-planet systems is the tendency for adjacent planet pairs to lie just wide of low-order mean motion resonances (MMRs), such as 2:1 and 3:2. This asymmetry in the period ratio distribution has motivated numerous theoretical efforts, particularly those exploring mechanisms that perturb resonant configurations without significantly altering orbital separations. Transit timing variations (TTVs) further suggest that many of these systems possess non-zero free eccentricities, consistent with dynamical excitation.

In this work, we explore whether the orbital instability of cold Jupiters (CJs)—specifically through planet–planet scattering—can perturb inner super-Earth (SE) systems initially in or near MMR. Using N-body simulations and secular theory, we focus on three key questions: (1) how close an unstable CJ must approach to significantly excite the resonant angles of an inner SE pair; (2) how frequently CJs scatter inward to interact with the inner system; and (3) what secular effects these perturbations impart on the long-term resonant dynamics.

Our results show that while the period ratios of SE pairs are often preserved, their resonant angle libration amplitudes can be excited toward 180 degrees, a regime that predisposes the system to delayed instability. In more extreme cases, direct incursions of a CJ can destabilize or even destroy the inner system.

This mechanism provides a natural pathway for generating dynamically hot inner systems and may contribute to the observed trough-peak structure in the period ratio distribution of Kepler multis near resonant values.

Primary author: GUO, Kangrou (Tsung-Dao Lee Institute)

Presenter: GUO, Kangrou (Tsung-Dao Lee Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **GUO, Kangrou** on **Friday, October 10, 2025**

Abstract ID : **237**

Massive Retrograde Moons May Survive During Different Hot Jupiters' Migration Scenario

Content

Searching for exomoons is attempted via Kepler and TESS, but none is confirmed. Theoretically, similar with Jupiter, the gas giants are possible to generate moons. However, HJs which are considered to form outside and then move close to the star are thought not easy to sustain the original moons via dynamical effects. In this paper, we assume the HJ to form at 1 AU and move inward via disk migration or migration due to planet secular coplanar. Then we simulate the dynamics of exomoon-planet systems during migration, and we want to study the fates of different original moons. We find that both prograde and retrograde moons could maintain stable after disk migration, although the retained fraction of retrograde moons is 5 times higher than the prograde moons. Only massive and retrograde moons (greater than 10 Earth masses) might survive around HJs during the coplanar excitation. Furthermore, 6% of the original Jupiter-like planet can also form free-floating planets after undergoing coplanar excitation, and most of them retain their moons. Our results focus on the fate of the exomoons and provide a clue on where to find the moon for future missions.

Primary authors: LI, Chenyang (Nanjing University); PU, Yangjun (Nanjing University)

Co-author: LIU, HUIGEN (Nanjing University)

Presenter: PU, Yangjun (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **PU, Yangjun** on **Friday, October 10, 2025**

Abstract ID : **238**

Discovery of an Eccentric Hot Super-Jupiter Transiting the Edge of an Early-A-type star

Content

Hot Jupiters orbiting hot stars ($_{\rm eff} > 7000K$) are suggested to have experienced high-eccentricity migration, often evidenced by the tendency for misaligned orbits, despite their circular orbits. In this study, we present the discovery of an eccentric hot Jupiter with a mass of ~ 8 and a radius of ~1.5 orbiting an A-type star in ~2.2 days, identified from the TESS transit survey and subsequent follow-up observations. We measured the stellar parameters using the data from the high-resolution spectrograph Seimei/GAOES-RV and obtained the planetary parameters from the photometric data acquired by TESS and ground-based telescopes (LOCGT(2m)/MuSCAT3, RCO 40cm telescope, OACT 91 cm telescope, and SCT in Herges-Hallenberg). This is the first discovery of an eccentric hot Jupiter around a hot star, suggesting that this system has undergone high-eccentricity migration. We detected nodal precession by measuring the change in its impact parameter. This implies that the orbital axis is almost perpendicular to the stellar rotational axis, and its transit will no longer be observable within the next 10 years. Nevertheless, this planet is anticipated to be a compelling target for future atmospheric observations, given the hint of atmospheric variability detected in this study.

Primary author: WATANABE, Noriharu (The University of Tokyo)

Co-authors: NARITA, Norio (The University of Tokyo); FUKUI, Akihiko (The University of Tokyo); SATO, Bun'ei (Institute of Science Tokyo); ISOGAI, Keisuke (Kyoto University); LIVINGSTON, John (Astrobiology Center); DE LEON, Jerome (The University of Tokyo); KAWAI, Yugo (The University of Tokyo); HAYASHI, Yuya (The University of Tokyo); HUBER, Daniel (University of Hawaii); IKOMA, Masahiro (National Astronomical Observatory of Japan); OMIYA, Masashi (Astrobiology Center); IZUMIURA, Hideyuki (National Astronomical Observatory of Japan); TAJITSU, Akito (National Astronomical Observatory of Japan); KUSAKABE, Nobuhiko (Astrobiology Center); TAMURA, Motohide (The University of Tokyo)

Presenter: WATANABE, Noriharu (The University of Tokyo)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **Dr WATANABE, Noriharu** on **Friday, October 10, 2025**

Abstract ID : **239**

Self-consistently Modeling the Upper Atmospheres of Gas Giants

Content

The recent discovery of diverse exoplanetary atmospheres and the capabilities of the James Webb Space Telescope (JWST) to detect a wide range of molecular species have increased the need for models that can self-consistently calculate the thermal and chemical structure of gas giants with only the input of a boundary condition. Disequilibrium chemistry plays a central role in shaping these observed exoplanet spectra, particularly through photochemical and escape processes. To address this, we extend the capabilities of the Kompot code (Johnstone et al. 2018), a one-dimensional, first-principles, self-consistent thermo-chemical model to simulate the upper atmosphere of gas giants. Unlike parameterized approaches, Kompot solves the coupled hydrodynamical, chemical, and thermal balance equations without prescribing a temperature profile, allowing the physical structure to emerge from the underlying processes. It also allows for feedback between the chemistry and the thermal structure. Previously, the Kompot code has been used to simulate the atmospheres of Earth-like exoplanets to estimate secondary atmosphere retention (See Van Looveren et al. 2025). Our results establish the first benchmarks of Kompot for gas giants, demonstrating its ability to reproduce observations. These results establish the first benchmarks of Kompot for gas giants, demonstrating its ability to reproduce both model predictions and observations. The work lays the foundation for applying Kompot to giant exoplanets exposed to diverse stellar environments, where disequilibrium chemistry and thermal structure jointly determine the observable signatures seen by JWST.

Primary author: ROBELING, Nils-Martin (University of Vienna)

Co-author: STANKOVIC, Ivan

Presenter: ROBELING, Nils-Martin (University of Vienna)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ROBELING, Nils-Martin** on **Friday, October 10, 2025**

Abstract ID : **240**

A General Framework with Rapid Convergence for Planetary System Fitting Using Multiple Observational Methods

Content

With the rapid development of ground- and space-based facilities such as Gaia, TESS, and the upcoming CSST, vast amounts of high-precision time-series data are becoming available for exoplanet studies. These multi-modal observational data—comprising radial velocity, astrometric, and direct imaging measurements, among other sources—require an efficient and robust orbital fitting framework capable of integrating heterogeneous datasets.
In this work, we develop a program for fitting Keplerian planetary orbits that builds upon the high-efficiency C-language MCMC core (Nii-C; Sheng Jin et al. 2024). This program supports joint orbital fitting across multiple observational techniques and enables rapid convergence and accurate inference of planetary orbital parameters from diverse datasets. We demonstrate its performance through four representative examples involving different data combinations—such as radial velocity plus astrometry, Gaia and CSST astrometric data, and imaging-based orbital constraints. The convergence and sampling efficiency are quantitatively assessed using the Gelman–Rubin ($\hat{R}$) diagnostic and benchmarked against other public software packages. The results show that our implementation achieves superior convergence efficiency and parameter estimation accuracy while maintaining broad applicability to multi-observation planetary system analyses, providing a unified and scalable tool for future high-precision orbit retrieval studies.

Primary author: 吕, 余潭 (中国科学院紫金山天文台)

Presenter: 吕, 余潭 (中国科学院紫金山天文台)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **吕, 余潭** on **Friday, October 10, 2025**

Abstract ID : **241**

Boundary layer accretion of circumplanetary disks: implications for the terminal spin of gas giants

Content

In the last stage of gas giants formation, they are expected to be surrounded by circumplanetary disks (CPDs). At the inner edge of this disk, gas settles onto the more slowly rotating planet through a boundary layer (BL). Previous work suggested that as the planet rotates faster, the BL widens and eventually disappears at a critical spin. Meanwhile, they observed the solution of mass decretion and spin-down. In this study, we conduct 2D axisymmetric viscous hydrodynamic simulations of CPDs, taking into account radiation transfer, with the flux-limited diffusion approximation to estimate the terminal spin rate of accreting planet. The model is built with {\tt Guangqi}, which adopts the passive scalar angular momentum algorithm. At low spin cases ($\Omega_p = 0.2\ \Omega_b$), We observe steep angular velocity gradient across the BL, and accretion. The planet mass and angular momentum accretion rate decreases with increasing planet's rotation rate, while the viscous torque increases. We speculate that there is a critical spin rate for the accreting planet, at which the disk solution transitions from spin-up to spin-down, coexisting with ongoing mass accretion.

Primary authors: YANG, Jing (Tsinghua University); CHEN, Zhuo (Tsinghua University); BAI, Xuening (Tsinghua University); LIN, Douglas N. C. (UC Santa Cruz)

Presenter: YANG, Jing (Tsinghua University)

Track Classification: Planet formation

Contribution Type: Poster

Status: ACCEPTED

Submitted by **YANG, Jing** on **Friday, October 10, 2025**

Abstract ID : **242**

Exploring Exoplanetory Systems from the Perspective of the Solar System

Content

Among nearly 6,000 known exoplanets, none resembles our Solar System in architecture. Understanding this uniqueness requires both improved detection sensitivity and insight into whether the Solar System represents a typical or exceptional case. I will introduce two of the ongoing programs at Tsinghua ExoLab investigating exoplanets through the lens of our Solar System. First, we explore whether exoplanets exhibit trends analogous to the inverse relationship between metallicity and planetary mass seen in the Solar System, using atmospheric composition measurements to test this correlation. Second, we conduct searches for potentially habitable Earth-like planets around nearby bright stars, paving the way for future studies of biosignatures beyond Earth.

Building on these goals and beyond, we are developing science programs for the upcoming spectrograph, CHORUS (Canary Hybrid Optical high-Resolution Ultra-stable Spectrograph), a next-generation instrument for the 10-meter Gran Telescopio Canarias designed to reach 10 cm/s precision. Among its main science drivers, CHORUS will open a new window for detecting terrestrial planets around nearby Sun-like stars. Our ongoing precursor programs include refining target selection and mitigating stellar activity, paving the way for the discovery and characterization of Earth analogs.

Primary author: WANG, Sharon Xuesong (Tsinghua University)

Presenter: WANG, Sharon Xuesong (Tsinghua University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WANG, Sharon Xuesong** on **Friday, October 10, 2025**

Abstract ID : **243**

Detection and atmospheric characterization of temperate Jupiters with NGTS, TESS and JWST

Content

Transits provide the opportunity for detailed characterisation of exoplanets, including their bulk and atmospheric composition and their orbital alignment, placing key constraints on their formation and evolution. However, until recently our sample of transiting planets was very strongly biased to short orbital periods and high temperatures. In this talk, I will describe the main science programme of the Next Generation Transit Survey (NGTS), which aims to identify and characterise giant planets at longer-orbital periods with temperate atmospheres. The NGTS facility is an array of twelve telescopes at the ESO Paranal Observatory, Chile, that are optimized for high-precision photometry of bright stars and exoplanet transits: routinely matching TESS for photometric precision. We are following up and confirming tens of long-period planet candidates that we identify through single-transit events in TESS data. Where necesary, we can allocate a telescope to monitor continuously for whole observing seasons until additional transits are recovered (e.g. NGTS-11b & NGTS-36b). In some cases, orbital periods can be determined more rapidly through alias chasing or precovery of additional transits in archival NGTS data (e.g. NGTS-29b and NGTS-30b). In all cases, determination of precise orbital periods significantly reduces the required number of precious radial velocity measurements needed to confirm and measure the mass of each planet. Once confirmed, we carry out observations with larger facilities to charcaterize the atmospheres and orbital alignment of these temperature Jupiters. This includes atmospheric characterisation with JWST, and Rossiter-McLaughlin measurements with the ESO Very Large Telescope, with which we are co-located. I will present examples of each.

Primary author: WHEATLEY, Peter (University of Warwick)

Presenter: WHEATLEY, Peter (University of Warwick)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WHEATLEY, Peter** on **Friday, October 10, 2025**

Abstract ID : **244**

Planet Formation Initiated by Infall-Induced Pressure Bumps

Content

High-resolution continuum observations have revealed that axisymmetric ring-like substructures are common in protoplanetary disks, often interpreted as dust trapping in local pressure maxima. These pressure bumps are crucial for planet formation, as they efficiently concentrate pebbles and can trigger the streaming instability. Meanwhile, recent discoveries of infall streamers indicate that disk evolution is not isolated but is significantly influenced by the environment. Late infall of material from the surrounding molecular cloud can both replenish the disk' s planet-building reservoir and dramatically alter its structure. While recognized as a potential mechanism for generating pressure bumps, the role of late infall in planet formation remains poorly explored. In this talk, I present a numerical study on how pressure bumps induced by late infall promote planet formation and shape diverse planetary systems. Using the dust evolution code DustPy, we simulated dust drift and coagulation in a disk undergoing late infall, tracking the transformation of pebbles into planetesimals via streaming instability. We explored a wide parameter space to identify the conditions for planetesimal formation in infall-induced pressure bumps. By coupling DustPy with the parallelized N-body code SyMBAp, we extended the simulation to include subsequent planet growth via pebble and gas accretion along with planet-disk interactions. The abundant material supplied by late infall facilitates the formation of giant planets even at large orbital distances. These giants, in turn, exert torques that create secondary pressure bumps, producing multiple rings and enabling multi-generational planetesimal formation.

Primary author: Mr ZHAO, Haichen (Max Planck Institute for Solar System Research)

Co-authors: Dr DRĄŻKOWSKA, Joanna (Max Planck Institute for Solar System Research); Dr LAU, Tommy Chi Ho (University of Chicago); Prof. BIRNSTIEL, Til (University of Munich); Dr STAMMLER, Sebastian (University of Munich)

Presenter: Mr ZHAO, Haichen (Max Planck Institute for Solar System Research)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHAO, Haichen** on **Friday, October 10, 2025**

Abstract ID : **245**

A multifluid approach to pebble accretion

Content

Pebble accretion is a key mechanism for planet formation, but most studies so far assume a monodisperse (single size) pebble population. In reality, protoplanetary disks contain a wide distribution of particle sizes, which drift, interact, and accrete at different rates. We present a multifluid hydrodynamic framework that captures pebble accretion in a fully coupled gas-dust system, allowing us to explore the process from a hydrodynamical perspective. Using FARGO3D, we model multiple dust species representing a continuous pebble size distribution and include the mutual drag forces and back-reaction between solids and gas. We confirm the validity of our framework, and provide new insights into the end of pebble accretion, at the pebble isolation mass. Since this fluid framework opens the door to studying pebble accretion in conjunction with gas dynamics, we create the possibility to research planet-disk interactions such as (dust-)gap opening and instabilities.

Primary authors: KONIJN, Tom (Delft University of Technology); Dr PAARDEKOOPER, Sijme-Jan (Delft University of Technology)

Presenter: KONIJN, Tom (Delft University of Technology)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **KONIJN, Tom** on **Friday, October 10, 2025**

Abstract ID : **246**

Population Synthesis for White Dwarf Debris Disk Observables

Content

Polluted white dwarfs have enabled the study of the diverse chemical composition of planetary material in exoplanetary systems. The origin of elemental abundances observationally found within the atmospheres of polluted white dwarfs is thought to come from debris disks created from tidally disrupted asteroids (Jura, 2003). The processes that transport material from the debris disk onto the white dwarf remain uncertain, however Poynting-Robertson drag (PR drag) is one of the key forces acting on the dust (Burns et al., 1979; Rafikov, 2011b,a; Bochkarev & Rafikov, 2011; Metzger et al., 2012). Beyond material transport onto white dwarfs, the literature has also noted a possible relationship between the observationally measured infrared excess and the mass accretion rate in polluted white dwarfs (Bonsor et al., 2017; Brouwers et al., 2022; Rogers et al., 2020). However no prior studies have addressed the relationship between the mass accretion rate and infrared excess from both a theoretical and observational perspective. Within this work, we extend a previous model of PR driven evolution of debris disks (Rafikov, 2011b; Bochkarev & Rafikov, 2011) to include the evolution of the infrared excess and mass accretion rate. The mass accretion rate driven by PR and the infrared excess are both radiation induced mechanisms, and it would be expected they are correlated to one another. Theoretically we synthesized a large population of debris disk and evolved their observable features over time. From an observational standpoint we compiled data points with both a measured mass accretion rate and infrared excess (Williams et al., 2024; Rocchetto et al., 2015). We found that for the global populations of debris disks, a linear relationship emerged between the infrared excess and mass accretion rate. The comparison of the theoretical and observational sample of data revealed an overlap in the optically thick region of disks but did not display an exact correlation.

References
Bochkarev K. V., Rafikov R. R., 2011, Astrophysical Journal, 741, 36
Bonsor A., Farihi J., Wyatt M. C., van Lieshout R., 2017, , 468, 154
Brouwers M. G., Bonsor A., Malamud U., 2022, , 509, 2404
Burns J. A., Lamy P. L., Soter S., 1979, , 40, 1
Jura M., 2003, Astrophysical Journal, 584, L91
Metzger B. D., Rafikov R. R., Bochkarev K. V., 2012, Monthly Notices of the Royal Astronomical Society, 423, 505
Rafikov R. R., 2011a, Monthly Notices of the Royal Astronomical Society, 416, L55
Rafikov R. R., 2011b, Astrophysical Journal, 732, L3
Rocchetto M., Farihi J., G¨ansicke B. T., Bergfors C., 2015, Monthly Notices of the Royal Astronomical Society, 449, 574
Rogers L. K., Xu S., Bonsor A., Hodgkin S., Su K. Y., von Hippel T., Jura M., 2020, Monthly Notices of the Royal Astronomical Society, 494, 2861
Williams J., Gaensicke B., Swan A., O' Brien M., Izquierdo P., Cutolo A.-M., Cunningham T., 2024, arXiv e-prints, p. arXiv:2409.16046

Primary authors: SEMERKINA, Maria (Imperial College London); Prof. RAFIKOV, Roman (University of Cambridge)

Presenter: SEMERKINA, Maria (Imperial College London)

Contribution Type: Poster

Comments:

If this does not get accepted for a talk could I would like to apply for a poster presentation of this content. Thank you for your help.

Status: ACCEPTED

Submitted by **SEMERKINA, Maria** on **Friday, October 10, 2025**

Abstract ID : **247**

Late-Stage Planetesimal Formation in the Solar System within a Pressure Bump

Content

Carbonaceous chondrites (CCs) are among the most primitive meteorites in the solar system, and their parent bodies likely formed a few million years after the formation of the solar system began. These meteorites contain three main components (refractory inclusions, chondrules, and fine-grained matrix) whose relative proportions vary systematically with the time their parent bodies formed. These variations suggest that the components of CCs were sorted and concentrated by dynamic processes in the protoplanetary disk. It has been proposed that these materials were trapped in a pressure bump created by Jupiter as it opened a gap in the disk. In this talk, we test such a scenario using Monte Carlo simulations of dust transport and collisional evolution during the late stages of a protoplanetary disk. Our model tracks how refractory inclusions, chondrules, and matrix-like grains evolve and form planetesimals near the outer edge of a Jupiter-induced gap. The results show that the observed link between CC composition and planetesimal formation time can be readily explained if their parent bodies formed in the same pressure bump that persisted for two million years. Together, these findings suggest that a long-lived pressure bump beyond Jupiter was a key site for planetesimal formation during the final stages of solar system formation.

Primary author: GURRUTXAGA, Nerea

Co-authors: Dr DRAZKOWSKA, Joanna (Max Planck Institute for Solar System Research); Prof. KLEINE, Thorsten (Max Planck Institute for Solar System Research); Mr VAIKUNDARAMAN, Vignesh (Max Planck Institute for Solar System Research)

Presenter: GURRUTXAGA, Nerea

Contribution Type: Poster

Status: ACCEPTED

Submitted by **GURRUTXAGA, Nerea** on **Friday, October 10, 2025**

Abstract ID : **248**

Population Synthesis for White Dwarf Debris Disk Observables

Content

Polluted white dwarfs have enabled the study of the diverse chemical composition of planetary material in exoplanetary systems. The origin of elemental abundances observationally found within the atmospheres of polluted white dwarfs is thought to come from debris disks created from tidally disrupted asteroids (Jura, 2003). The processes that transport material from the debris disk onto the white dwarf remain uncertain, however Poynting-Robertson drag (PR drag) is one of the key forces acting on the dust (Burns et al., 1979; Rafikov, 2011b,a; Bochkarev & Rafikov, 2011; Metzger et al., 2012). Beyond material transport onto white dwarfs, the literature has also noted a possible relationship between the observationally measured infrared excess and the mass accretion rate in polluted white dwarfs (Bonsor et al., 2017; Brouwers et al., 2022; Rogers et al., 2020). However no prior studies have addressed the relationship between the mass accretion rate and infrared excess from both a theoretical and observational perspective. Within this work, we extend a previous model of PR driven evolution of debris disks (Rafikov, 2011b; Bochkarev & Rafikov, 2011) to include the evolution of the infrared excess and mass accretion rate. The mass accretion rate driven by PR and the infrared excess are both radiation induced mechanisms, and it would be expected they are correlated to one another. Theoretically we synthesized a large population of debris disk and evolved their observable features over time. From an observational standpoint we compiled data points with both a measured mass accretion rate and infrared excess (Williams et al., 2024; Rocchetto et al., 2015). We found that for the global populations of debris disks, a linear relationship emerged between the infrared excess and mass accretion rate. The comparison of the theoretical and observational sample of data revealed an overlap in the optically thick region of disks but did not display an exact correlation.

References
Bochkarev K. V., Rafikov R. R., 2011, Astrophysical Journal, 741, 36
Bonsor A., Farihi J., Wyatt M. C., van Lieshout R., 2017, , 468, 154
Brouwers M. G., Bonsor A., Malamud U., 2022, , 509, 2404
Burns J. A., Lamy P. L., Soter S., 1979, , 40, 1
Jura M., 2003, Astrophysical Journal, 584, L91
Metzger B. D., Rafikov R. R., Bochkarev K. V., 2012, Monthly Notices of the Royal Astronomical Society, 423, 505
Rafikov R. R., 2011a, Monthly Notices of the Royal Astronomical Society, 416, L55
Rafikov R. R., 2011b, Astrophysical Journal, 732, L3
Rocchetto M., Farihi J., G¨ansicke B. T., Bergfors C., 2015, Monthly Notices of the Royal Astronomical Society, 449, 574
Rogers L. K., Xu S., Bonsor A., Hodgkin S., Su K. Y., von Hippel T., Jura M., 2020, Monthly Notices of the Royal Astronomical Society, 494, 2861
Williams J., Gaensicke B., Swan A., O' Brien M., Izquierdo P., Cutolo A.-M., Cunningham T., 2024, arXiv e-prints, p. arXiv:2409.16046

Primary authors: SEMERKINA, Maria (Imperial College London); Prof. RAFIKOV, Roman (University of Cambridge)

Presenter: SEMERKINA, Maria (Imperial College London)

Track Classification: Disks

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SEMERKINA, Maria** on **Friday, October 10, 2025**

Abstract ID : **249**

An Efficient MCMC+N-Body Code for Precise Orbital Fitting of Time Series Data

Content

We present an open-source N-body fitting code for the accurate orbital determination of multiple planetary systems. This code is based on Nii-C MCMC, which has a fast convergence speed. We implemented an N-body fitting module in the Nii-C MCMC using the Runge-Kutta-Fehlberg method. We have successfully tested the astrometry models of this N-body fitting code and are extending the radial velocity (RV) and transit time variation (TTV) fitting models. We hope this tool will facilitate precise orbital fitting of time series data for multiple planetary systems, including astrometry, RV, and TTV of exoplanets.

Primary author: JIN, Sheng (Anhui Normal University)

Presenter: JIN, Sheng (Anhui Normal University)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **JIN, Sheng** on **Friday, October 10, 2025**

Abstract ID : **250**

Exoplanet-Hosting Binary Systems as a Probe of Determinism in Planet Formation

Content

A foundational question implicitly underlying studies of exoplanet demographics and orbital architectures is that of how deterministic the process of planet formation is. That is, to what extent do similar initial conditions produce distinct system outcomes? To what extent does stochasticity shape the outcomes of planet formation, given a known set of initial conditions? The macroscopic planetary formation and evolution process does not lend itself naturally to standard laboratory experiments, such that this question cannot be tested directly. Nevertheless, I will demonstrate that this limitation can be circumvented through comparative demographics using populations with natural "control samples": planet-hosting twin binary star systems, with near-equal-mass stars each born in similar environments. I will outline the specific population of nearby, close- to moderate-separation edge-on binaries for which this comparison can be most effectively conducted, leveraging known trends in exoplanet systems' 3D orbital architectures as well as dynamical considerations relevant for this subset of binary star systems.

Primary author: RICE, Malena (Yale University)

Presenter: RICE, Malena (Yale University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **RICE, Malena** on **Friday, October 10, 2025**

Abstract ID : **251**

The Second Earth Spectrograph (2ES)

Content

The Second Earth Spectrograph (2ES, www.2es.dk) is a next-generation extreme-precision radial velocity spectrograph to be installed at the MPG/ESO 2.2m Telescope on La Silla, Chile. Dedicated to an intensive >5-year observing campaign, 2ES aims to detect Earth-size planets in habitable zones orbiting the brightest, nearest solar-type stars. Crucial for this goal is achieving extreme RV precision through a combination of nightly high-cadence, uniformly distributed observations, extreme instrumental stability, high spectral resolution, and high signal-to-noise spectra. Stellar activity remains the greatest obstacle necessitating the collection of extensive, uniformly sampled datasets to allow for robust modeling and detection. Over five years, 2ES will observe ˜30 bright, quiet solar-type stars nightly. Given that occurrence rate studies suggest that small planets are common, 2ES will enable the detection of Earth analogs orbiting the brightest and nearest solar-type stars in the Southern Hemisphere, if stellar activity can be overcome. The hardware of the spectrograph is fully funded, and construction is planned for 2026. The discovery of Earth-sized planets in habitable zones around the brightest solar-type stars would create a lasting legacy since these planets would serve as the most promising targets for atmospheric characterization and future biosignature searches using next-generation flagship telescopes, such as the Habitable Worlds Observatory.

Primary author: BUCHHAVE, Lars A. (DTU Space, Technical University of Denmark)

Presenter: BUCHHAVE, Lars A. (DTU Space, Technical University of Denmark)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **BUCHHAVE, Lars A.** on **Friday, October 10, 2025**

Abstract ID : **252**

Substructures induced by ”dust-drag” in protoplanetary disks

Content

Recent studies increasingly suggest that turbulence in protoplanetary disks is weak, leading to enhanced dust settling and conditions favorable for dust–gas instabilities. Dust dynamics in such disks are strongly affected by aerodynamic gas drag. While the global dust-to-gas mass ratio in disks is typically low, the local dust-to-gas density ratio can exceed unity in the midplane due to dust settling under gravity, leading to significant dynamical feedback from dust onto the gas. We present two-dimensional, vertically stratified, axisymmetric simulations exploring this regime, in which the midplane dust-to-gas density ratio surpasses one across the entire radial extent of a viscous disk. For viscous parameters α \lesssim 10^{-4}, the coupled dust–gas dynamics give rise to "birdie-like" substructures, consisting of a vertically extended, low-density region with a dust-to-gas scale height ratio \gtrsim 10% (even without dust diffusion) and a dense, settled region where the ratio exceeds three. Our results highlight the importance of including dust back-reaction in studies of disk dynamics and provide new insights into how ring- and clump-like dust substructures, and potentially planetesimals, can emerge naturally from gas–dust interactions in weakly turbulent disks.

Primary author: BI, Jiaqing (Max Planck Institute for Astronomy)

Co-authors: FLOCK, Mario (Max-Planck-Institute for Astronomy Heidelberg); OSTERTAG, Dominik (Max-Planck-Institute for Astronomy Heidelberg)

Presenter: BI, Jiaqing (Max Planck Institute for Astronomy)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **BI, Jiaqing** on **Friday, October 10, 2025**

Abstract ID : **253**

Microlensing Surveys for Free-Floating Planets: From Ground to Space

Content

I will introduce the ongoing and future microlensing free-floating planet (FFP) surveys led by our team, including the KMTNet survey, the DECam Rogue Earth And Mars Survey (DREAMS), and the Earth 2.0 (ET) space microlensing survey. The KMTNet survey is sensitive to FFPs across a mass range from super-Earth to super-Jupiter, while the DREAMS survey extends the sensitivity to Mars and even Moon masses. The future ET mission will advance beyond the pure-ground surveys to directly measure the mass of FFPs by employing space–ground simultaneous observations. I will report on the latest progress of these surveys and present some preliminary results.

Primary author: YANG, Hongjing (Westlake University)

Presenter: YANG, Hongjing (Westlake University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YANG, Hongjing** on **Friday, October 10, 2025**

Abstract ID : **254**

Understanding the Planetary Formation and Evolution in Star Clusters(UPiC)-II: Catalog of planets/candidates in Open Clusters and Moving Groups

Content

Detecting planets in open clusters provide unique clues to test different formation scenarios due to cluster environments. Especially, the planets in young open clusters, with more precise ages, are crucial to trace the evolution of planetary systems. As the second work of UPiC, we focus on the stars which are probably in groups and have transiting planets or candidates around. To investigate the differences in planetary systems across stellar groups, we divide the groups into Open Clusters(OCs) and Moving Groups(MGs) based on the Jacobi radius. By utilizing the latest star cluster catalogs and cross-matching them with transiting planets/candidates, we obtain a larger catalog of planets in OCs and MGs, which includes 102 confirmed planets and 169 planetary candidates, with 103 planets/candidates in OCs and 168 in MGs. The parameters of OCs and MGs are refitted and some substructures are identified via HDBSCAN aglorithm. We also explored the correlation between the surrounding stellar number density of planet-hosting stars and age, finding that the surrounding stellar number density in open clusters hardly changes with age, especially for stars within the Jacobi radius. In contrast, for planet-hosting stars in moving groups, there is a significant decrease in stellar density with age. Additionally, we find that the fraction of planets in moving groups is higher than that in open clusters. Considering that these stars are more likely to become field stars, we reasonably speculate that a large portion of the planets around field stars may originate from MGs or low-mass OCs.

Primary author: DAI, Yuan-Zhe (Nanjing University)

Co-author: LIU, HUIGEN (Nanjing University)

Presenter: DAI, Yuan-Zhe (Nanjing University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **DAI, Yuan-Zhe** on **Friday, October 10, 2025**

Abstract ID : **255**

Planet migration and mean motion resonances in protoplanetary disks: theory and observational implications

Content

Kepler/TESS and other observations have detected over 6,000 exoplanets, which exhibit diverse planetary populations. There remains a lack of consensus in understanding the formation and evolution mechanisms of distinct planetary populations. Planet-disk interactions during the protoplanetary disk stage and the resulting migration are recognized as one of the critical physical processes regulating the early formation. To this end, this work investigates planet-disk interactions through multidimensional hydrodynamic numerical simulations, encompassing accretion and migration processes of single planets, the emergence and dissipation of resonances in multi-planet systems, and the effects of turbulence. Based on numerical simulations and analytical analyses, this study emphasizes the crucial importance of accurately accounting for planet-disk interactions in their dynamical evolution. The potential observational implications of these mechanisms are further explored.

Primary author: LI, Yaping (Shanghai Astronomical Observatory)

Presenter: LI, Yaping (Shanghai Astronomical Observatory)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LI, Yaping** on **Friday, October 10, 2025**

Abstract ID : **256**

Inside-Out Planet Formation

Content

The systems with tightly-packed inner planets (STIPs), typically with several planets of Earth to super-Earth/mini-Neptune masses on well-aligned, sub-AU orbits may host the most common type of planets in the Galaxy. They pose a great challenge for planet formation theories, which fall into two broad classes: (1) formation in the outer disk followed by inward migration; (2) formation in situ. I review the pros and cons of these classes, before focusing on a theory of sequential in situ formation from the inside-out via creation of successive unstable rings fed from a continuous stream of small (˜cm size) "pebbles," drifting inward via gas drag. Pebbles first collect at the pressure trap associated with the transition from a magnetorotational instability (MRI)-inactive ("dead zone") region to an inner MRI-active zone. A pebble ring builds up until it either becomes gravitationally unstable to form an Earth to super-Earth-mass planet directly or induces gradual planet formation via core accretion. The planet continues to accrete until it becomes massive enough to isolate itself from the pebble accretion flow via gap opening. The process repeats with a new pebble ring gathering at the new pressure maximum associated with the retreating dead-zone boundary. I discuss the theory ' s predictions for planetary masses, relative mass scalings with orbital radius, and minimum orbital separations, and their comparison with observed systems. I end by discussing the implications of this model for the chemical composition of the Super-Earths/Mini-Neptunes, e.g., as may be probed by JWST and Ariel, and potential causes of diversity of planetary system architectures, i.e. STIPs versus Solar System analogs.

Primary author: TAN, Jonathan (Chalmers Univ. & Univ. of Virginia)

Presenter: TAN, Jonathan (Chalmers Univ. & Univ. of Virginia)

Contribution Type: Oral Talk

Comments:

This is submitted as an invited talk

Status: ACCEPTED

Submitted by **TAN, Jonathan** on **Friday, October 10, 2025**

Abstract ID : **257**

The Fate of Tidally Disrupted Gas Giants: Dynamical Evolution and Observational Implications

Content

Gas giants on highly eccentric orbits experience intense tidal forces from their host stars, potentially resulting in partial or catastrophic disruption. In this study we analyzes their dynamical evolution through hydrodynamical simulations and analytical models. The outcomes of tidal disruption depend sensitively on the planet's interior structure and periastron distance. In general, coreless gas giants or those with small cores are prone to ejection from the system during the closest encounters. Conversely, planets with large cores are more resilient, with subsequent flybys stripping away most of the gaseous envelope, leaving dense remnants. We discuss the implications for the sub-Jovian desert, highlighting how these processes contribute to the observed scarcity of intermediate-mass planets in close-in orbits and inform exoplanet population demographics.

Primary author: LIU, Shangfei (Sun Yat-sen University)

Presenter: LIU, Shangfei (Sun Yat-sen University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LIU, Shangfei** on **Friday, October 10, 2025**

Abstract ID : **258**

Polycyclic aromatic hydrocarbon (PAH) abundances in the disk around T Chamaeleontis (T Cha): PAH sizes, ionization fraction, and mass during JWST observations

Content

Context: In protoplanetary disks (PPDs), polycyclic aromatic hydrocarbons (PAHs), and very small grains in general, influence the disk processes, and hence they may modulate the disk evolutionary trajectory and also the planet formation pathways. As PAHs are well-coupled to the gas and trace the disk surfaces, they efficiently absorb the stellar FUV radiation and photoelectrically heat the gas. Thus, they can be instrumental in disk thermodynamics and chemical network, and also in disk dispersal through FUV photoevaporation. Yet, their characteristics are not well-understood in the context of PPDs.

This work: We aim to characterize the PAHs in the PPD around the T Tauri star T Chamaeleontis (T Cha). Our objective is to estimate the PAH abundances, in terms of their sizes, ionization fraction, and mass, in the disk of T Cha.

Methodology: We mainly use the archival mid-IR JWST spectrum of T Cha, which shows strong mid-IR aromatic infrared bands (AIBs) that are commonly associated with the PAH emission. We perform spectral fitting of the observed AIBs to identify the possible underlying PAH emission components. We transfer the stellar radiation through a parametric disk model in order to reproduce the mid-IR continuum and AIB features, as well as the optical photometric and millimetre band fluxes of T Cha. We include stochastically heated PAH dust grains in our model to reproduce the AIBs, and hence estimate the PAH abundances self-consistently from the modelling.

Results: We estimate the PAH characteristics in T Cha, with other important disk parameters, from our modelling. The overall disk morphology - an inner and an outer disk separated by a dust gap - derived in this work is consistent with the previous results from Spitzer, VLT, and ALMA observations. Corresponding to our best fiducial model, we estimate a population of small PAHs of < 30 C atoms, with an ionized PAH fraction of ~0.15. We also obtain a PAH-to-dust mass ratio of $\sim 7 \times 10^{-3}$, which amounts to $\sim 17\%$ of the PAH-to-dust mass ratio observed in the ISM and points toward a high value estimated among disks. We predict the outer disk having a wall with smaller dust grains with sizes limited up to μm-order, in order to fit the slope of the continuum within $14 - 25$ μm. We propose a possibility of sub-micron dust grains within the gap to justify an observed plateau around ~10 μm in the JWST spectrum.

Main conclusions: While our model have degeneracies, we can predict a population of smaller and mostly neutral PAHs in the disk of T Cha. We also suggest that the disk might be undergoing FUV photoevaporation noting a high PAH-to-dust mass ratio.

Primary author: BANDYOPADHYAY, Rahul (Universidad de Chile)

Co-author: CASASSUS, Simon (Universidad de Chile)

Presenter: BANDYOPADHYAY, Rahul (Universidad de Chile)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BANDYOPADHYAY, Rahul** on **Friday, October 10, 2025**

Abstract ID : **259**

Binary-lens Microlensing Degeneracy: Impact on Planetary Sensitivity and Mass-ratio Function

Content

Gravitational microlensing is a unique method for discovering cold planets across a broad mass range. Reliable statistics of the microlensing planets require accurate sensitivity estimates. However, the impact of the degeneracies in binary-lens single-source (2L1S) models that affect many actual planet detections is often omitted in sensitivity estimates, leading to potential self-inconsistency of the statistics studies. In this work, we evaluate the effect of the 2L1S degeneracies on planetary sensitivity by simulating a series of typical microlensing events and comprehensively replicating a realistic planet detection pipeline, including the anomaly identification, global 2L1S model search, and degenerate model comparison. We find that for a pure-survey statistical sample, the 2L1S degeneracies reduce the overall planetary sensitivity by 5–10%, with the effect increasing at higher planet-host mass ratios. This bias leads to an underestimation of planet occurrence rates and a flattening of the inferred mass- ratio function slope. This effect will be critical for upcoming space-based microlensing surveys like the Roman or Earth 2.0 missions, which are expected to discover $O(10^3)$ planets. We also discuss the computational challenges and propose potential approaches for future applications.

Primary authors: SHANG, Yuxin (Tsinghua University); YANG, Hongjing (Westlake University)

Co-authors: Prof. GOULD, Andrew (Ohio State University); MAO, Shude; Prof. YEE, Jennifer (Center for Astrophysics, Harvard & Smithsonian); ZANG, Weicheng (Westlake University); Mr ZHANG, Jiyuan (Tsinghua University); 钱, 奇🄵 (清华大学天文系)

Presenter: SHANG, Yuxin (Tsinghua University)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **SHANG, Yuxin** on **Friday, October 10, 2025**

Abstract ID : **260**

The Eclipse-Yarkovsky Effect Is Decreting Planetary Rings

Content

The long-term evolution and eventual fate of planetary rings remain fundamental open questions in planetary science. While viscous diffusion, meteoroid bombardment, and resonant interactions are well-established drivers of ring dynamics, these mechanisms alone cannot fully explain the features of Saturn's rings and the "missing Martian ring" problem. In this talk, I introduce the Eclipse-Yarkovsky (EY) effect—a thermal recoil force arising from periodic planetary eclipses—as a previously underappreciated but potentially dominant mechanism for angular momentum transport in optically thin rings. I will present analytical and numerical results showing that the EY torque induces a net outward migration of ring particles, effectively "decreting" the ring from the inside out, opposite to the traditional view that planetary rings are accretion rings. I will discuss applications to the sharp inner edges of Saturn's ring and the role of the EY effect in removing the Martian rings that formed the moon Phobos. These findings suggest that planetary rings are not only shaped by gravity and collisions, but also significantly by thermal forces.

Primary author: ZHOU, Wen-Han

Co-authors: Dr AGRUSA, Harrison (Observatoire de la Côte d'Azur); KOKUBO, Eiichiro (National Astronomical Observatory of Japan)

Presenter: ZHOU, Wen-Han

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHOU, Wen-Han** on **Friday, October 10, 2025**

Abstract ID : **261**

Formation of planetary cores in spontaneously generated long-lived dust traps during the secular evolution of magnetized protoplanetary disks

Content

Understanding the properties of the planet-forming environments –the protoplanetary disks (PPDs) –is critical, as they provide the initial conditions for the planet formation process. However, one of the main challenges is the elusive role of detailed microphysics on the complex and interdependent physico-chemical processes that control their dynamics and evolution. In particular, an outstanding gap in the current planet formation theory is about the first steps of the planet formation process; namely how, when and where the initially ISM-like dust particles grow into millimeter- to centimeter-sized pebbles and planetesimals, the building blocks of planetary cores.
In this talk, I will propose a new way to alleviate this outstanding problem. PPDs are weakly magnetized accretion disks that are subject to the magnetorotational instability (MRI), one of the main magnetized processes responsible for their angular momentum transport and gas turbulence. The nonideal magnetohydrodynamic (MHD) effects prevent the MRI from operating everywhere in PPDs, leading to a complex dichotomy between MRI active regions with higher turbulence and non-MRI regions with lower turbulence.
I will present the first numerical framework that describes the evolution of PPDs over millions of years powered by the MRI. It captures the MRI-driven gas evolution via sophisticated nonideal MHD calculations that account for the effect of the dynamics and growth of the solid dust particles. An exciting MRI-powered mechanism that can spontaneously generate short- and long-lived pressure maxima in the " effective" MRI-active layer of PPDs is unveiled. Within the long-lived pressure maxima, I will show that dust particles can be efficiently trapped, grow into pebbles, and reach high enough dust-to-gas mass ratios to trigger the formation of planetesimals via the streaming instability. These planetesimals and pebbles can further interact to form planetary cores.

Primary author: Dr DELAGE, Timmy (Imperial College London)

Co-authors: Dr PINILLA, Paola (Mullard Space Science Laboratory); Dr CHI HO LAU, Tommy (University of Chicago); Dr FLOCK, Mario (Max Planck Institute for Astronomy); Dr OKUZUMI, Satoshi (Institute of Science Tokyo)

Presenter: Dr DELAGE, Timmy (Imperial College London)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DELAGE, Timmy** on **Friday, October 10, 2025**

Abstract ID : **262**

A Spectroscopic Phase Curve of K2-141 b, an Ultra-Short Period Rocky Planet

Content

Determining whether rocky planets have atmospheres is an essential step towards assessing their habitability. A subclass is the ultra-short period (USP) planets, defined as those with orbital periods of less than a day. While inhospitable themselves due to their equilibrium temperatures (> 2000 K) exceeding the melting point of rock, they provide valuable insights into whether rocky planets may retain their atmospheres under the influence of extreme stellar radiation. One well-studied USP is K2-141 b, which orbits a K dwarf every 6.9 hours. Previous Spitzer phase curve observations were suggestive of a tenuous atmosphere but could not conclusively rule out a more substantial one. Here we present a JWST/NIRSpec thermal phase curve of this planet including two secondary eclipses. We measure its day and nightside brightness temperatures, bond albedo, and search for offsets in peak brightness from the substellar point. We find the planet has an atmosphere or a highly reflective surface, but weathering means the latter scenario is unlikely. Finally, we discuss our findings in the greater context of recent studies suggesting that highly irradiated rocky planets can retain atmospheres.

Primary author: WANG, Gavin (Johns Hopkins University)

Co-author: Dr ESPINOZA, Néstor (Space Telescope Science Institute)

Presenter: WANG, Gavin (Johns Hopkins University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WANG, Gavin** on **Friday, October 10, 2025**

Abstract ID : **263**

Catching the Tail of a Runaway-Accreting Protoplanet Candidate

Content

By definition, planets formed inside protoplanetary disks. Observing protoplanet that is in the action of their formation will be unparallaled for planet formation studies. Yet, confirming the presence of embedded protoplanets remains a major challenge in the field. So far, majaroty of these evidence is indirect. Despite the search in the past decade using multiple tracers across a large sample of disk, protoplanet detections have been reported in solely a handful of systems, with PDS 70 and WISPIT 2 remaining the only two robust anchors.

I will present multiple lines of evidence for a new protoplanet candidate inside a disk gap. This candidate stands out due to its combination of a high accretion rate—necessary to account for the molecular chemical footprint in the host and the hydrogen recombination line in the optical—and a low planetary mass of Saturn to Jupiter, as inferred from CO kinematics. I will discuss the attempts and challenges to confirm it using multiple instruments from the Subaru, VLT/I, and JWST. Finally, I will discuss the lessons learned and the byproducts. If confirmed, this planet would be the first detection of a gap-opening planet in the early evolutionary phase of runaway gas accretion, which would be a cornerstone of core-accretion giant-planet formation.

Primary author: JIANG, Haochang (MPIA)

Presenter: JIANG, Haochang (MPIA)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **JIANG, Haochang** on **Friday, October 10, 2025**

Abstract ID : **265**

Gas and Dust Evolution in the Inner Disc: Secular Instabilities and Implications for Planet Formation

Content

Understanding the origin of super-Earths and sub-Neptunes requires detailed models of the inner regions of protoplanetary discs, where these planets are eventually observed. The structure and evolution of the inner disc –notably, its turbulence, thermal state, and dust evolution –directly shape the conditions for planet formation and migration.

To investigate this, we have developed the first global, time-dependent 2D (R–z) disc simulations that self-consistently couple gas–dust dynamics, viscosity driven by the magneto-rotational instability, radiative transfer, a realistic chemical network with grain charging, and coagulation and fragmentation of grains.

We present first results from our model, demonstrating: (i) the critical role of grain charging in dust evolution; (ii) the emergence of secular instability in the inner disc – specifically, the first demonstration of such instabilities with a realistic ionization chemistry and magneto-hydrodynamic treatment, and, moreover, the first exploration of secular instability in the inner disc incorporating dust evolution; (iii) the characteristic timescales over which these instabilities operate. Finally, we will discuss the implications of these effects for planet formation in the inner disc environment.

Primary author: WILIAMS, Morgan (Imperial College London)

Presenter: WILIAMS, Morgan (Imperial College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **WILIAMS, Morgan** on **Friday, October 10, 2025**

Abstract ID : **266**

Preparing for the Next Decade of Exoplanet and Stellar Research: The Mauve and Twinkle Space Missions

Content

We are currently in the Golden age of exoplanets discovery with over 6000 exoplanets confirmed and over 200 characterized. In the next five to ten years, missions such as Earth 2.0 and Ariel will study and characterize many more targets to create a more diverse sample. Preparing for these missions requires leveraging current and near-future facilities to refine our understanding of planetary atmospheres and stellar activity.

In this context, I will present science opportunities of two satellites, Mauve (Launching Nov 2025), focusing on monitoring stellar flares through time in the UV and Visible spectrophotometry (200–700 nm) and Twinkle, designed to characterise extrasolar planets and protoplanetary disks in the Visible and Infrared (spectroscopy 0.5-4.5 microns).

In this talk, I will highlight key science cases for Mauve and how these investigations will contribute to understanding stellar magnetic activity and variability across diverse spectral types. Additionally, I will demonstrate how recent advances from JWST observations, better show Twinkle's observational capabilities in the context of exoplanet atmospheres. Specifically, through retrieval analysis of several exoplanets' spectra, we illustrate how Twinkle's flexible telescope-time allocation significantly improves the characterisation of atmospheric parameters and molecular abundances.

These missions are developed by Blue Skies Space (BSSL), a space science data company, leveraging recent advancements in space technology and the rapidly evolving global scientific landscape to drastically reduce satellite development time and costs. Our vision is to accelerate and expand the availability of new datasets to researchers worldwide, complementing the facilities delivered by space agencies.

Primary author: ZHANG, Tailong (Blue Skies Space Ltd.)

Co-authors: Mr ARCHER, Richard (Blue Skies Space Ltd.); SABA, Arianna (Blue Skies Space Ltd.); Prof. TENNYSON, Jonathan (University College London); Dr TESSENYI, Marcell (Blue Skies Space Ltd.); TINETTI, Giovanna (King's College London); Mr WILCOCK, Benjamin (Blue Skies Space Ltd.)

Presenter: ZHANG, Tailong (Blue Skies Space Ltd.)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHANG, Tailong** on **Friday, October 10, 2025**

Abstract ID : **267**

Hot Gaps Carved by Giant Planets Complicate Ice Line Locations and Trigger Dust Ring Formation in Disks

Content

Protoplanets interact with their natal disks and can generate prominent gas and dust substructures such as gaps and rings. However, it remains unclear how these planet-induced substructures modify the disk temperature and how the resulting temperature changes subsequently affect the substructures. To address this, we perform iterative multi-fluid hydrodynamical and Monte Carlo radiative transfer simulations of planet–disk interactions. We find that the temperature in a structured disk deviates significantly from that of a smooth disk due to giant planet formation. In particular, a deep gap carved by a giant planet can increase the local disk temperature by several tens of kelvin. Such temperature variations can shift the locations of volatile ice lines, potentially leading to the formation of multiple dust rings, as confirmed by our dust evolution simulations. These findings may explain the lack of a simple correlation between dust ring positions and ice line locations inferred from assumed smooth-disk temperature profiles in recent ALMA surveys.

Primary author: CHEN, Kan (KIAA-PKU)

Co-authors: CHI HO LAU, Tommy (University of Chicago); PINILLA, Paola (Mullard Space Science Laboratory); Dr KAMA, Mihkel (UCL)

Presenter: CHEN, Kan (KIAA-PKU)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHEN, Kan** on **Friday, October 10, 2025**

Abstract ID : **268**

Tracing Hot Jupiter Formation Histories with Advanced Telescopes Through Constraining Atmospheric Elements in The Presence of Clouds

Content

The formation environment, accretion history, and migration path of giant planets play a crucial role in shaping their chemical composition. In particular, the solid versus gas accretion across different icelines during planet migration significantly influences the planetary internal and atmospheric compositions, which in turn leave fingerprint in the observed spectra. From the observational perspective, processes such as atmospheric chemistry, internal mixing, and cloud formation further complicate the spectral signatures. Previous studies have investigated the constraints of linking formation scenarios with observed atmospheric properties. Building on this, I aim to explore the observational side of the problem, examining how such connections can be established under ideal conditions with current techniques.

In this presentation, I will focus on how capable current advanced space telescopes like JWST and Ariel are to distinguish elemental ratios and chemical composition in the planetary atmosphere between different formation and migration scenarios, particularly in the presence of clouds. Specifically, I will show the result of atmospheric retrieval reflect molecular abundances shaped by distinct accretion histories, how complexities such as temperature–pressure profiles and cloud contributions affect the robustness of our conclusions and identify molecules that is most sensitive for this difference. Finally, I will highlight the impact of instrumental limitations on detecting and interpreting these chemical tracers.

Primary author: ZHANG, Tailong (Blue Skies Space Ltd.)

Co-authors: MA, Sushuang (King's College London); Dr PACETTI, Elenia; TINETTI, Giovanna (King's College London)

Presenter: ZHANG, Tailong (Blue Skies Space Ltd.)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **ZHANG, Tailong** on **Friday, October 10, 2025**

Abstract ID : **270**

Probing the early evolution of planetary systems

Content

Stars in young associations, open clusters and co-moving groups can be precisely dated, which make them promising targets for exoplanet searches seeking to probe the early evolution of planetary systems. I will present a dedicated search for young planets in both TESS 2-min and Full-Frame Image (FFI) data, which has so far detected the second youngest transiting planet to date, new single and multi-planet systems between 100-500 Myr, and many promising new candidates. Beyond detection, I will focus on the characterisation of select systems via spectroscopic transit monitoring with VLT/ESPRESSO and VLT/CRIRES+ to (i) measure obliquities, which range from aligned to significantly misaligned, and (ii) constrain atmospheric mass loss rates. The growing population of well-characterised young planets is poised to provide useful observational constraints on migration mechanisms and radius evolution through atmospheric loss and contraction. I will conclude with an outlook towards PLATO and the population of young stars due to be observed.

Primary author: GILLEN, Edward (Queen Mary University of London)

Co-author: COLLABORATION, Planets and Stellar Activity through Time

Presenter: GILLEN, Edward (Queen Mary University of London)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **GILLEN, Edward** on **Friday, October 10, 2025**

Abstract ID : **271**

RV+Astrometric detection of three cold Jupiters and revised orbits of two companions around nearby M-dwarfs

Content

Cold Jupiters play an important role in understanding planet formation and the dynamical evolution of planetary systems. However, the formation mechanisms of cold Jupiters remain unclear, especially those around M-dwarfs, emphasizing the need to increase the observed sample. In this work, we combine RV data with Gaia and Hipparcos astrometry data and jointly model both datasets in the framework of MCMC to constrain absolute planetary masses and orbital inclinations. Here we report three cold Jupiters: HD203432 b, HD361 b, and HIP88962 b. All of them seem to be single-planet systems, with orbital periods of 6502^{+132}*{-64} d, 7555^{+308}*{-296} d, and 6311^{+594}*{-368} d, and with masses of 3.73 \pm 0.75 M_J, 3.93^{+0.46}*{-0.31} M_J, and 4.89^{+0.67}*{-0.54} M_J, respectively. In addition, we revise two companions around two M-dwarfs which were only RV-detected before: GJ649 b and HIP10812 b, with orbital periods of 599.74^{+2.86}*{-2.81} d and 168.836 \pm 0.002 d, and with masses of 1.48^{+0.25}*{-0.23} M_J and 45.05^{+4.23}*{-3.99} M_J, respectively.

Primary authors: XUAN, Yifan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University); Mr XIAO, Guang-yao (TDLI, SJTU); Prof. FENG, Fabo (TDLI, SJTU); Prof. BUTLER, Paul R. (Earth and Planets Laboratory, Carnegie Institution for Science, 5241 Broad Branch Road, NW, Washington, DC 20015, USA)

Presenter: XUAN, Yifan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Track Classification: Exoplanet detection and statistics

Contribution Type: Poster

Status: ACCEPTED

Submitted by **XUAN, Yifan** on **Friday, October 10, 2025**

Abstract ID : **272**

Chondritic meteorites, 覆水难收?

Content

Most rocks that fall to Earth from space are chondrites, filled with chondrules — mm-sized igneous spheres of near-solar composition, formed more than 4.5 billion years ago. What melted these "droplets of fiery rain" (Sorby 1877) and collected them into chondrite parent bodies? We review some current thinking. For all their primitive characteristics, chondrules might be incidental to planet formation, and not fundamental. The case is best made by CB chondrites, whose silicate chondrules and metal nodules may be second-generation condensates from vaporizing collisions between first-generation asteroids. We propose a solution to the 覆水难收 (Humpty Dumpty) problem — how thermal instability can reassemble melt droplets from an asteroid collision into CB parents.

Primary author: CHIANG, Eugene (UC Berkeley)

Presenter: CHIANG, Eugene (UC Berkeley)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **CHIANG, Eugene** on **Friday, October 10, 2025**

Abstract ID : **273**

Old New Worlds: Reconstructing the history of a white-dwarf exoplanet

Content

Planetary systems are ubiquitous, but not eternal. The search for exoplanets orbiting white dwarfs (WDs) is one of the most exciting frontiers of planetary astronomy today. I will illustrate recent theoretical and observational progress on this topic by focusing on the extraordinary exoplanet WD1856+534b, a super-Jupiter transiting a nearby WD host. I will summarize the leading hypotheses for WD1856b's survival and orbital migration following the death of its host star and describe how recent/ongoing JWST observations of this system provide crucial information to determine which hypothesis (if either) better explains the system's properties. Finally, I will describe key gaps in our current understanding of WD1856b, discuss the future research required to close them, and comment on prospects for uncovering a larger population of transiting WD exoplanets in the near future.

Primary author: O'CONNOR, Christopher (CIERA, Northwestern University)

Presenter: O'CONNOR, Christopher (CIERA, Northwestern University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **O'CONNOR, Christopher** on **Friday, October 10, 2025**

Abstract ID : **274**

Fascinating Complexity: Zonal Circulation, Polar Vortices, and Atmospheric Waves in Brown Dwarfs and Giant Exoplanets

Content

Fascinating new time-resolved data from space-based observatories reveal a surprising complexity in brown dwarfs and directly imaged exoplanets: Vigorous atmospheric circulation often gives rise to three-dimensional atmospheric structures, which in turn fundamentally impact clouds and physical/chemical properties. These then shape the photometric and spectral appearance of ultracool atmospheres. The atmospheric structures and their evolution complicate the interpretation of spatially and temporally unresolved observations.
In this talk, I will review the types of evidence emerging on the spatial complexity and temporal evolution of ultracool atmospheres. I will also explore how the emerging picture on atmospheric circulation, cloud cover, and non-equlibrium chemistry informs the interpretation of existing data and the design of new observations.

Primary author: Prof. APAI, Daniel (The University of Arizona)

Presenter: Prof. APAI, Daniel (The University of Arizona)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **APAI, Daniel** on **Friday, October 10, 2025**

Abstract ID : **275**

Pulsation timing of A-type stars for exoplanet detection

Content

Some pulsating stars are excellent clocks. When those stars are found in binary systems, their orbital motion causes small changes in their distance from us. This alters the travel time for pulsations emitted by the star arriving at Earth, causing the 'ticks' of the clock to arrive early or late. These time delays can be used to construct a map of the binary orbit, yielding parameters which are analogous to radial velocities from photometry alone. In this talk, I will discuss pulsation timing of the A-type delta Scuti stars as a tool to probe exoplanet and binary companions. Pulsation timing is immune to data gaps and increases in sensitivity with the orbital period and is thus well suited for upcoming missions, such as ET2.0.

Primary author: HEY, Daniel (University of Hawaii)

Co-author: HUBER, Daniel (University of Hawaii)

Presenter: HEY, Daniel (University of Hawaii)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **HEY, Daniel** on **Friday, October 10, 2025**

Abstract ID : **276**

An Adolescent, Near-Resonant Planetary System Near the End of Photoevaporation

Content

Young exoplanets provide vital insights into the early dynamical and atmospheric evolution of planetary systems. Many sub-Neptune systems younger than 100 Myr exhibit mean-motion resonances, likely established through convergent disk migration. Over time, however, these resonant chains are often disrupted, mirroring the Nice model proposed for the Solar System. We present a detailed characterization of the ∼200-Myr-old TOI-2076 system. We demonstrate that its planets are near but not locked in mean-motion resonances, making the system dynamically fragile. The four planets have comparable core masses but display a monotonic increase in H/He envelope mass fractions (stripped-1%-5%-5%) with decreasing stellar insolation. This trend is consistent with atmospheric mass-loss due to photoevaporation, which predicts that planetary envelopes either erode completely or stabilize at a residual level of ∼1% by mass within the first few hundred million years. Additionally, previous detections of metastable helium outflows rule out a pure water-world scenario. Our findings suggest significant dynamical and atmospheric evolution will occur at young ages of exoplanet systems.

Primary author: WANG, Mutian (Nanjing University)

Co-authors: DAI, Fei (University of Hawaii); Prof. LIU, Huigen (Nanjing University); Prof. MANN, Andrew (The University of North Carolina at Chapel Hill,); Prof. CHEN, Howard (Florida Institute of Technology); HU, Zhecheng (Tsinghua University); PETIGURA, Erik (UCLA); LEE, Eve (UC San Diego); WINN, Joshua (Princeton University); Prof. LELEU, Adrien (University of Geneva); Dr COLLINS, Karen (CfA); Ms BARBER, Madyson (The University of North Carolina at Chapel Hill,); Dr GOLDBERG, Max (Nice observatory); Dr GIACALONE, Steven (Caltech)

Presenter: WANG, Mutian (Nanjing University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **WANG, Mutian** on **Friday, October 10, 2025**

Abstract ID : **277**

Timing the Stellar and Substellar Evolution with Radial-Velocity Asteroseismology

Content

Recent advances in extreme-precision radial-velocity spectroscopy have enabled an exciting frontier of asteroseismology for cool main-sequence dwarfs, providing robust age benchmarks for both stellar and substellar evolution. We present two representative cases observed with Keck Planet Finder. For the K3 V planet host HD 219134—where oscillations are undetectable in photometry—we measure an asteroseismic age of 10.2 +/- 1.5 Gyr, the first such determination for a main-sequence star cooler than 5000 K. This benchmark provides a key calibration point for stellar spin-down relations and will anchor future gyrochronology-based age estimates for exoplanet hosts, including those observed by upcoming missions such as HWO. In the HR 7672 system, combined seismic and rotational analyses of the primary G0 V star yield an age of 2.15 +/- 0.36 Gyr. This constrains the cooling models of its brown dwarf companion near the stellar-substellar boundary. Evolutionary models incorporating updated opacities and equations of state achieve the best consistency, highlighting the value of such benchmarks. Together, these results demonstrate that radial-velocity asteroseismology can provide essential calibration points for age-dating methods fundamental to substellar and exoplanet evolution studies.

Primary author: LI, Yaguang (University of Hawaii)

Presenter: LI, Yaguang (University of Hawaii)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **LI, Yaguang** on **Friday, October 10, 2025**

Abstract ID : **278**

Super-Earth Exoplanets are Common in Jupiter-like Orbits

Content

Exoplanets classified as super-Earths are frequently found on short-period orbits near their host stars, but their occurrence at wider separations remains poorly constrained. Gravitational microlensing is sensitive to planets on wide orbits. In this talk, I introduce the microlensing planetary sample from the KMTNet survey, which is six times larger than previous samples and extends to mass ratios an order of magnitude lower. The observations favor a bimodal population, with distinct peaks corresponding to super-Earths and gas giants. I will discuss how this structure likely reflects differences in formation pathways.

Primary author: ZANG, Weicheng (Westlake University)

Presenter: ZANG, Weicheng (Westlake University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **ZANG, Weicheng** on **Friday, October 10, 2025**

Abstract ID : **279**

Coronagraphic Imaging of Cold Giants with JWST

Content

Most observed multi-planet systems are co-planar, in a dynamically "cold" configuration of concentric orbits like our own Solar System. I will present the first images of 14 Herculis c with the James Webb Space Telescope (JWST) NIRCam coronagraph. This mature, cold gas giant is the first exoplanet directly imaged in a dynamically " hot" system. With large
eccentricities and a nonzero mutual inclination, the architecture of this system points to a turbulent past and dramatic ongoing angular momentum exchange between the planetary orbits. The temperature of the planet (~275K) rivals both the coldest imaged exoplanets and the coldest known brown dwarfs, while its photometry at 4.4 microns is consistent with
the presence of carbon disequilibrium chemistry and water ice clouds in the atmosphere. 14 Her c presents a unique laboratory to study many aspects of giant planet formation and evolution simultaneously, and is an exciting demonstration of the mid-infrared high contrast performance of JWST. I will also present on preliminary, on-going work to image HD 222237 b, a cold (~200K), nearby, eccentric giant planet with JWST/MIRI.

Primary author: BALMER, William (Johns Hopkins University)

Presenter: BALMER, William (Johns Hopkins University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **BALMER, William** on **Friday, October 10, 2025**

Abstract ID : **280**

A Differentially Rotating Star Suggests a Dynamically Exciting Past

Content

The spin states of stars in compact binaries are generally thought to be well-understood: tidal dissipation efficiently synchronizes the stellar spin period to binary's orbital period. It was thus a surprise when asteroseismic data revealed that a few such binaries contain stars rotating much slower than their synchronous rates, by factors of tens to hundreds. Here, I will present detailed follow-up observations of one such star confirming that its surface still spins synchronously. Taken in conjunction with the asteroseismic constraints, this implies strong differential rotation, from the slowly rotating core to the synchronized envelope. I propose that this is due to a combination of dynamical evolution driven by a known tertiary companion and a secular spin-orbit resonance. Broadly, this result supports the long-standing hypothesis that short-period stellar binaries are formed dynamically, though with a more compact initial architecture than typically assumed. It is also a novel probe of angular momentum transport in stellar interiors.

Primary authors: SU, Yubo; ALBRECHT, Simon (Aarhus University); Prof. STEFÁNSSON, Guðmundur (University of Amsterdam); WINN, Joshua (Princeton University)

Presenter: SU, Yubo

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **SU, Yubo** on **Friday, October 10, 2025**

Abstract ID : **281**

Towards an optical line list for methane

Content

The peak of the radiation from a Jupiter-like planet is in the optical regime. One of the primary identifiable features are methane absorption bands. To accurately interpret optical spectra of exo-Jupiters, reliable synthetic spectra are required, which in turn depend on comprehensive line lists for key visible species. Currently, no suitable line list exists for methane transitions in the optical range. Here, we present initial steps toward constructing such a list. Using ESPRESSO spectra of the slowly rotating Titan, we apply a conservative detection strategy that slightly overestimates solar and telluric contributions to better isolate Titan ' s intrinsic spectral features. This enables the identification of over 6000 methane absorption features. To evaluate the effect of spectral resolution, we compare ESPRESSO and UVES data for Titan. In overlapping regions, ESPRESSO reveals twice as many features, underscoring the benefits of higher-resolution observations.Nevertheless, most detected features remain unresolved, and the reported features largely represent blended absorption structures. We also discuss ongoing experimental and ab initio theoretical efforts.

Primary author: JONES, Hugh (University of Hertfordshire)

Presenter: JONES, Hugh (University of Hertfordshire)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **JONES, Hugh** on **Friday, October 10, 2025**

Abstract ID : **282**

At the Edge of Discovery: Probing Planetary Architectures with TTVs and Gaia Astrometry

Content

Cool gas giants (CGGs) on multi-year orbits with masses hundreds of times that of Earth are the protagonists of planetary formation and evolution. These giants form beyond the ice line due to the abundance of building material and stable temperatures for gas retention. Due to observational biases and limitations, transit and radial velocity (RV) surveys have detected only a few dozen CGGs beyond the ice line. Transit timing variations (TTVs) offer a powerful means to uncover these hidden giants by tracing the minute gravitational imprints they leave on inner transiting planets. However, TTVs are inherently degenerate—each signal can correspond to multiple unseen configurations—making it challenging to extract definitive system architectures. In this talk, I will present work aimed at breaking these degeneracies by combining population-level TTV analyses with dynamical modeling –including the identification of the "exoplanet edge," a boundary in TTV period space that constrains the range of viable perturbers. Finally, I will discuss how upcoming Gaia DR4 epoch astrometry, when fused with TTV, RV, and transit data, will provide the critical dynamical leverage needed to map the full architecture of planetary systems and reveal the prevalence and formation pathways of cool gas giants.

Primary author: Dr YAHALOMI, Daniel (Flatiron Institute, Center for Computational Astrophysics)

Presenter: Dr YAHALOMI, Daniel (Flatiron Institute, Center for Computational Astrophysics)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YAHALOMI, Daniel** on **Friday, October 10, 2025**

Abstract ID : **283**

Resonant Chains as the Initial Configuration of Kepler-like Planetary Systems

Content

Ancient philosophers like Pythagoras and Kepler speculated that the planets of the Solar System might be arranged in resonant orbits: where their periods follow simple integer ratios (e.g., 3:2, 2:1). However, except for Neptune and Pluto, the current-day Solar System planets are largely non-resonant. Similarly, most of the ˜1000 confirmed exoplanetary systems (typical age of ˜5 Gyr old) also exhibit non-resonant configurations. Our work recently revealed that a large fraction (˜80%) of planetary systems younger than 100 Myr appear to be near mean-motion resonance. We also found that the fraction of resonant systems decreases steadily with time. In this talk, I will also highlight how transit timing variations (TTVs) can serve as a powerful tool to probe the dynamic state of young planetary systems. Many young planets are already near resonant (circulating) rather than in resonance (librating), thereby poised to go unstable. Resonant-chain planetary systems also serve as ideal testbeds for the evolution of planetary atmospheres since they have not experienced collision-induced mass loss. I will introduce some recent JWST observations of young resonant planets.

Primary author: Prof. DAI, Fei (University of Hawaii)

Presenter: Prof. DAI, Fei (University of Hawaii)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Friday, October 10, 2025**

Abstract ID : **284**

Why are high-order mean motion resonances weak? A geometric answer

Content

The importance in planetary dynamics of first-order mean motion resonances (MMRs) and the weakness of their higher-order counterparts is well known and falls out of the combinatorics of the classical disturbing function expansion of the gravitational potential. We provide an alternate, simpler geometric explanation for this effect. In a first-order N:N-1 MMR, the inner planet overtakes its outer neighbor at conjunction once per cycle. In a kth-order N:N-k MMR, there are k conjunctions per cycle, and we show that the k-fold symmetry of where these conjunctions occur leads to an ever-better cancelation of their effects, providing a physical intuition for why higher order MMRs get progressively weaker, and why only low-order MMRs are well represented in exoplanet demographics.

Primary author: TAMAYO, Daniel (Harvey Mudd College)

Co-authors: Ms JONES, Elizabeth (Harvey Mudd College); Dr HADDEN, Samuel (CITA); Mr TEEKAMONGKOL, Mickey (Harvey Mudd College); Mr TRONGDEE, James (Harvey Mudd College)

Presenter: TAMAYO, Daniel (Harvey Mudd College)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAMAYO, Daniel** on **Friday, October 10, 2025**

Abstract ID : **285**

Ocean circulation on synchronously-rotating lava worlds

Content

Synchronously-rotating lava worlds are 1:1 tide-locked hot super-Earths in close-in orbits, with day-side temperatures above the melting point of general rocks, forming hemispheric magma oceans. In the context of fluid dynamics, three key questions are: How wide is the ocean in horizontal direction? How deep is the ocean in vertical direction? How efficient is the horizontal ocean heat transport? In prior to observations, we develop new 2D and 3D global numerical ocean models to simulate the ocean circulation on synchronously-rotating lava worlds. Two key challeges in developing the models are 1) the vertical and laternal boundaries of the ocean are unknown, and 2) the viscosity and diffusivity between solid and liquid phases change over 10-20 orders.

Based on the simulation results, we will show that the ocean circulation is dominated by wind forcing rather than thermal forcing, ocean depth is less than 1000 m, large-scale horizontal gyres form with ocean currents near the west boundaries being much stronger than that in the center domain and near the east boundaries (called as "western intensification"), and the deepest ocean is not right at the substellar point but in the middle latitudes as the vertical diffusivity is moderate or large. In most regions, the effect of ocean heat transport on the surface temperature is much weaker than the stellar radiation, so no significant eastward or westward shift in thermal phase curve is found. These studies establish a first picture for the 3D ocean circulation for synchronously-rotating lava worlds.

Primary authors: Ms KANG, Wanying (MIT); Ms LAI, Yanhong (TDLI); Mr TANG, Chengyao (PKU); Prof. YANG, Jun (Peking University)

Presenter: Prof. YANG, Jun (Peking University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YANG, Jun** on **Saturday, October 11, 2025**

Abstract ID : **286**

Directly imaging runaway accretion

Content

The hunt is on for the dozens of protoplanets hypothesized to reside in circumstellar disks with imaged gaps and spirals. How bright are these planets? Are they done forming? Or are we catching them in the act –and if so, what will they grow to become? The answers to these questions depend on how the runaway phase of gas accretion unfolds. We lay out a unified theory describing runaway growth from Earths to super-Jupiters in mass. We take stock of the handful of accreting substellar companions discovered so far, and discuss what their spectra can teach us about gas accretion.

Primary author: CHOKSI, Nick (Caltech)

Presenter: CHOKSI, Nick (Caltech)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **CHOKSI, Nick** on **Saturday, October 11, 2025**

Abstract ID : **287**

Co-natal stars depleted in refractories are magnetically more active - possible imprints of planets

Content

Chemical abundance anomalies in twin stars have recently been considered tell-tale signs of interactions between stars and planets. While such signals are prevalent, their nature remains a subject of debate. On the one hand, exoplanet formation may induce chemical depletion in host stars by locking up refractory elements. On the other hand, exoplanet engulfment can result in chemical enrichment, and both processes potentially produce similar differential signals. In this study, we aim to observationally disentangle these processes by using the Ca II infrared triplet to measure the magnetic activity of 125 co-moving star pairs with high signal-to-noise ratio, and high-resolution spectra from the Magellan, Keck, and VLT (Very Large Telescope) telescopes. We find that co-natal star pairs in which the two stars exhibit significant chemical abundance differences also show differences in their magnetic activity, with stars depleted in refractories being magnetically more active. Furthermore, the strength of this correlation between differential chemical abundances and differential magnetic activity increases with condensation temperature. One possible explanation is that the chemical anomaly signature may be linked to planet formation, wherein refractory elements are locked into planets, and the host stars become more active due to more efficient contraction during the pre-main-sequence phase or star-planet tidal and magnetic interactions.

Primary author: YU, Jie (Nanjing University)

Presenter: YU, Jie (Nanjing University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YU, Jie** on **Saturday, October 11, 2025**

Abstract ID : **288**

Accretion Light Echoes and Halpha Variability of a Protoplanet Candidate

Content

Giant planets generate accretion luminosity as they form. Much of this energy is radiated in strong Halpha line emission, which has motivated direct imaging surveys at optical wavelengths to search for accreting protoplanets. However, compact disk structures can mimic accreting planets by scattering emission from the host star. I will describe an approach to distinguish accreting protoplanets from scattered-light disk features using "accretion light echoes." This method relies on variable Halpha emission from a stochastically accreting host star to search for a delayed brightness correlation with a candidate protoplanet. We apply this method to the candidate protoplanet AB Aur b with a dedicated Hubble Space Telescope Wide Field Camera 3 program designed to sequentially sample the host star and the candidate planet in Halpha while accounting for the light travel time delay of the source. AB Aur b is over 50 times more variable than its host star. We test whether the host and companion brightness changes are correlated, which would suggest scattering, or are unrelated, which may support the protoplanet hypothesis. More broadly, accretion light echoes offer a useful new tool to explore the nature of protoplanet candidates with well-timed observations of the host star prior to deep imaging in Halpha.

Primary author: BOWLER, Brendan (University of California, Santa Barbara)

Presenter: BOWLER, Brendan (University of California, Santa Barbara)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **BOWLER, Brendan** on **Saturday, October 11, 2025**

Abstract ID : **289**

LTT9779b as a Unique Laboratory to Understand Survivability in the Neptune Desert

Content

Large-scale transit surveys coupled with follow-up radial-velocity measurements have revealed large populations of hot rocky super-Earths and hot gas giant planets orbiting very close to their host stars (orbital periods < 4-5 days). However, it quickly became apparent that there exists very few Neptunes at similar orbital periods, giving rise to the so called Neptune Desert. Models that incorporate photoevaporation and planet migration can mostly explain this feature yet other processes may be at play, particularly for those with the shortest orbital periods, Roche Lobe Overflow or Tidal Disruption for example. I will discuss our efforts to discover new hot Neptunes located in the Desert, and our follow-up programs to understand their atmospheric chemistries and physical processes, providing insights that allow us to unlock their formation and evolution histories. I will particularly focus on the LTT9779 system, showcasing results from ground- and space-based facilities that we have used to gain a deeper insight into the extreme end of the Neptune population.

Primary author: JENKINS, James (Universidad Diego Portales)

Presenter: JENKINS, James (Universidad Diego Portales)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **JENKINS, James** on **Saturday, October 11, 2025**

Abstract ID : **290**

Examining the role of magma oceans in shaping sub-Neptune atmospheres

Content

Sub-Neptunes with substantial atmospheres are expected to possess magma oceans in contact with the overlying gas, with chemical interactions between the atmosphere and magma playing a critical role in shaping the planet's atmospheric composition. Early JWST observations have found a number of highly metal-enriched sub-Neptune atmospheres, which may result from several processes including accretion of icy material at formation or from magma-atmosphere interactions. While initial work examining these interactions was limited to studying conditions at the atmosphere-mantle boundary, the field is now moving towards coupled atmosphere-interior models, which can describe the effect of magma ocean interactions on the upper atmosphere which is probed by spectroscopic observations.

In this talk, I will discuss modelling techniques to determine observable signatures of magma-atmosphere interactions. I will examine how different conditions at the atmosphere-mantle boundary and different core and mantle compositions impact the upper atmospheric composition, and compare these results to recent JWST observations of sub-Neptune atmospheres. I will also examine the conditions under which magma oceans are expected to persist, and discuss scenarios in which molten rock may solidify due to the extreme surface pressures of some sub-Neptunes.

Primary author: NIXON, Matthew (Arizona State University)

Presenter: NIXON, Matthew (Arizona State University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **NIXON, Matthew** on **Saturday, October 11, 2025**

Abstract ID : **291**

Orbital Architectures of Planet-Hosting Binaries & Triples

Content

In stellar multiple systems, orbits on the scale of ~10 to 100 au appear to suppress planet occurrence. However, some planetary systems do form and survive in close binaries, and the reasons why provide clues to important factors in successful planet formation. The Kepler sample remains the preeminent source of planetary demographics and, crucially, is also agnostic to stellar multiplicity. I will present a decade-long astrometric survey of the closest-separation binaries among a volume-limited subset of the Kepler sample. These multiples can only be resolved with large-aperture diffraction-limited data, and adaptive optics imaging and masking from Keck/NIRC2 provides uniquely stable astrometry over very long time baselines. I will summarize some of the key findings from this long-running program, focusing in particular on the role of alignment between stellar and planetary orbital planes. With a sample size ~3x larger than previous work at these binary separations, we are now able to compare the orbital properties of different subsets of our sample, allowing us to test for trends in orbital architectures as a function of host star mass, single- versus multi-transiting systems, and binary separation.

Primary author: DUPUY, Trent (Institute for Astronomy, University of Edinburgh)

Presenter: DUPUY, Trent (Institute for Astronomy, University of Edinburgh)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **DUPUY, Trent** on **Saturday, October 11, 2025**

Abstract ID : **292**

Atmospheric Diversity in the Sub-Neptune Regime

Content

Atmospheric characterisation of sub-Neptune exoplanets is an exciting new frontier of exoplanetary science. Sub-Neptunes, planets with sizes between those of Earth and Neptune, dominate the known exoplanet population across a wide range of stellar hosts. These planets represent the most diverse family of the exoplanet population, including rocky gas dwarfs, water worlds, and mini-Neptunes, with a wide range of possible atmospheric, surface and interior conditions. With no analogue in the solar system, these planets open fundamental questions in planetary processes, origins, and habitability, and present new avenues in the search for life elsewhere. Numerous observational efforts are underway for the detection and characterisation of such planets. In particular, sub-Neptunes orbiting M dwarfs present a promising avenue for their detection and atmospheric characterisation, including those in the habitable zones of their host stars. The advent of JWST is revolutionising this frontier with unprecedented detections of atmospheric signatures of such planets, especially for temperate sub-Neptunes orbiting nearby M dwarfs. In this talk we will present new advancements in the atmospheric characterisation of sub-Neptunes with JWST, which provide key insights into their atmospheric processes, internal structures, surface conditions, formation pathways and potential habitability. In particular, we will discuss the chemical signatures and atmospheric diversity of sub-Neptunes revealed by JWST spectra and their implications for understanding planetary processes and habitability in the sub-Neptune regime.

Primary author: MADHUSUDHAN, Nikku (University of Cambridge)

Presenter: MADHUSUDHAN, Nikku (University of Cambridge)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **MADHUSUDHAN, Nikku** on **Saturday, October 11, 2025**

Abstract ID : **293**

Charting the cosmic shoreline with JWST

Content

Which rocky planets have atmospheres? To address this foundational question, a powerful approach is to measure thermal emission from the planets with JWST. To first order, thick atmospheres circulate heat efficiently from dayside to nightside, and thus lower the dayside temperature. In this talk, I will review the current state of rocky planet thermal emission measurements. So far, the dozen or so planets that have been observed have very hot daysides –consistent with a simple picture in which all of them are low-albedo bare rocks. I will put these results in the context of the "cosmic shoreline", an empirical framework motivated by Solar System observations to guide expectations about whether atmospheres are expected. I will discuss the carbon dioxide abundance and initial volatile inventory of the planets. I'll also highlight recent phase curve observations of the innermost TRAPPIST-1 planets, and the most precise ever spectrum of the surface of the airless planet LHS 3844b. I'll close with prospects for pushing to cooler planets with the 500-hour Rocky Worlds Program on JWST.

Primary author: KREIDBERG, Laura (MPIA)

Presenter: KREIDBERG, Laura (MPIA)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **KREIDBERG, Laura** on **Saturday, October 11, 2025**

Abstract ID : **294**

Gaia: Towards the DR4 and DR5 exoplanet candidate catalogues

Content

I will review the recent impact in the exoplanet field of high-precision absolute astrometry in terms of characterization of the orbits and masses of planetary systems based on the publication of the third major data release (DR3) of ESA's Gaia mission. I will then provide a perspective look at the expectations for the first-ever major catalogue of candidate exoplanets from Gaia DR4 astrometry (primarily), slated to be published at the end of 2026, including a summary of the products the community can expect and the needs for supporting observations. I will conclude with an overview of the impact on exoplanet demographics from DR4 and the final Gaia data release (DR5).

Primary author: SOZZETTI, Alessandro (INAF - Osservatorio Astrofisico di Torino)

Presenter: SOZZETTI, Alessandro (INAF - Osservatorio Astrofisico di Torino)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **SOZZETTI, Alessandro** on **Saturday, October 11, 2025**

Abstract ID : **295**

The Changing Transit Shape of TOI-3884 b

Content

Characterising stellar magnetism is paramount to our understanding of planetary habitability around M-dwarfs. Starspots are caused by strong magnetic features that inhibit magnetic convection, and they serve as direct tracers of the strength of magnetic activity. M-dwarfs are more active than the Sun, have larger, darker spots, including long-lived spots at the poles.

I will present the photometric analysis of six transits of the TOI-3884 b, obtained with the 1.2m Euler telescope. The observations indicate that the transit shape is chromatic and asymmetric as a result of persistent starspot crossings. This, along with the lack of high-amplitude photometric variability, indicates that the rotational axis is tilted along our line of sight and the parent-occulted starspot is located close to the stellar pole. Our observations reveal that the transit shape changes over time, and so far no two observations match perfectly. These variations are not caused by a decay or growth of the starspot, but due to a slight misalignment between the spot centre and stellar pole, which we measured to be $5.64 \pm 0.64°$. This spin-spot angle has only been measured for a handful of planets. In addition, utilising recurrent spot occultations, we measured the sky-projected spin-orbit obliquity to $37.3 \pm 1.5°$, and true spin-orbit angle to $54.3 \pm 1.4°$.

Primary author: CHAKRABORTY, Hritam (University of Geneva, Switzerland)

Presenter: CHAKRABORTY, Hritam (University of Geneva, Switzerland)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **CHAKRABORTY, Hritam** on **Saturday, October 11, 2025**

Abstract ID : **296**

An Analytical Model for the Eccentricity Cascade: Hot Jupiter Formation via S-type Instability

Content

A widely explored pathway for hot Jupiter (HJ) formation is high-eccentricity migration driven by von Zeipel-Lidov-Kozai cycles induced by an exterior companion. However, for a distant or low-mass companion, this mechanism typically demands that the planet's initial orbit be very nearly perpendicular to that of the companion. In previous work (Yang et al. 2025), we demonstrated that such fine-tuning can be circumvented in the HAT-P-7 system due to the presence of an intermediate body that efficiently couples the orbits of the planet and the distant companion – a mechanism we termed the *eccentricity cascade* (EC). In this work, we analytically characterize the dynamics governing the EC and delineate the parameter space within which it effectively operates.

Our qualitative results are as follows: (i) The proto-HJ's eccentricity is most efficiently excited when the inner triple is on the verge of dynamical instability, (ii) the addition of a distant fourth body allows this instability to be approached gradually, and (iii) the instability mechanism is closely related to the stability of circumstellar (S-type) planets in binaries. By deriving an analytic criterion for S-type instability, we obtain closed-form expressions describing the onset of the EC. Our results show that efficient HJ formation via the EC occurs across a broad range of intermediate perturbers, highlighting its potential as a robust migration channel.

Primary author: YANG, Eritas (Princeton University)

Co-author: SU, Yubo

Presenter: YANG, Eritas (Princeton University)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **YANG, Eritas** on **Saturday, October 11, 2025**

Abstract ID : **297**

Towards a chemical survey of exoplanets

Content

Thousands of planets orbiting stars other than our own are being discovered. Even within the limits of our current observational capabilities, studies of extrasolar planets have provided a unique contribution to improving our view of the place that the Solar System and the Earth occupy in the galactic context.

A key observable for planets is the chemical composition and state of their atmospheres. Knowing what atmospheres are made of is essential to clarify, for instance, whether a planet was born in the orbit it is observed in or whether it has migrated a long way; it is also critical to understand the role of stellar radiation on escape processes, chemical evolution and climate. The atmospheric composition is the only indicator able to discriminate an habitable/inhabited planet from a sterile one.

The arrival of more performing and dedicated facilities from space and the ground in the coming decade, will provide an unprecedented opportunity to study in depth the atmospheres of these worlds. The Ariel Space Telescope, in particular, will enable a paradigm shift: by identifying the chemical constituents of hundreds of planets in various mass/temperature regimes, we would be looking no longer at individual cases but at populations. Such a universal view is critical to understand the processes of formation and evolution and how planets behave in various environments, as I will illustrate in my talk.

Primary author: Prof. TINETTI, Giovanna (King's College London)

Presenter: Prof. TINETTI, Giovanna (King's College London)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Sunday, October 12, 2025**

Abstract ID : **298**

Recovering the orbital motion of the planets in the solar system through sedimentary geological records

Content

To recover the past evolution of planetary motion in the Solar System, we can build the most precise model possible, taking into account all small effects that affect planetary trajectories, and adjust this model to all available observations, both from Earth and from space. This is the principle behind planetary ephemerides such as INPOP or DE. The accuracy of these models is determined by comparison with the available observations, covering a few centuries. However, to understand the past evolution of planetary motions over millions of years (Ma), the long-term propagation of such solutions has intrinsic limitations.

Indeed, a first obstacle is that it is difficult to assert that the Solar System has not been affected by external phenomena over extended timescales, such as passing stars. Moreover, planetary motion is chaotic (Laskar, 1989), and the exponential divergence of the orbits practically limits any deterministic prediction to about 60 Ma.

To go beyond this horizon of predictability, additional information is required. I will show here how such information can be retrieved from geological sedimentary data.

Variations in Earth' s orbit and axial tilt induce climatic changes on its surface, which are recorded in sedimentary deposits. These are the so-called Milankovitch cycles. The problem is that this record is extremely noisy, full of unconformities, and expressed in terms of depth rather than time. A critical aspect of this analysis is thus the estimation of the sedimentation rate, which determines the time–depth transfer function relating geological depth to time.

Within the AstroGeo project, we have devised a method to establish a continuous time–depth transfer function throughout the record, accommodating variable sedimentation rates, and to extract the primary astronomical signal from the geological sequence. This is achieved using a genetic algorithm that adapts to a wide range of sedimentation rate variations. This statistical approach enables the reconstruction of an astronomical signal (e.g., eccentricity and/or precession) purely from the stratigraphic sequence.

This opens the possibility of following the orbital evolution of the Solar System in the remote past, beyond the horizon of predictability imposed by the laws of celestial mechanics.

Ref: N. Hoang, J. Laskar, N. Hara, Y. Wu, A.Sultanov, M. Sinnesael, T. Westerhold, P. Bujons, AstroGeoFit. A Genetic Algorithm and Bayesian approach for the Astronomical Calibration of the Geological Timescale, 2025, Paleoceanography and Paleoclimatology.

Primary author: Prof. LASKAR, Jacques (IMCCE, Observatoire de Paris)

Presenter: Prof. LASKAR, Jacques (IMCCE, Observatoire de Paris)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Sunday, October 12, 2025**

Abstract ID : **299**

Do Super Jupiters Look Like Jupiter? Not Necessarily. - A General Circulation Study for a Planetary-mass Companion

Content

Large-amplitude variations are commonly observed in the atmospheres of directly imaged exoplanets and brown dwarfs. VHS 1256B, the most variable known planet-mass object, exhibits a near-infrared flux change of nearly 40%, with red color and silicate features revealed in recent JWST spectra, challenging current theories. Using a general circulation model, we demonstrate that VHS 1256B's atmosphere is dominated by planetary-scale dust storms persisting for tens of days, with large patchy clouds propagating with equatorial waves. This weather pattern, distinct from the banded structures seen on solar system giants, simultaneously explains the observed spectra and critical features in the rotational light curves, including the large amplitude, irregular evolution, and wavelength dependence, as well as the variability trends observed in near-infrared color-magnitude diagrams of dusty substellar atmospheres.

Primary author: Prof. TAN, Xianyu (TDLI)

Presenter: Prof. TAN, Xianyu (TDLI)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Sunday, October 12, 2025**

Abstract ID : **300**

Multi-method Exoplanet Science in the Gaia Era

Content

Astrometry is revolutionizing exoplanet science through Gaia's ongoing data releases. We have confirmed hundreds of giant planets and brown dwarfs using Hipparcos and Gaia data, revealing the formation boundary between planets and stars. Combined with radial velocity measurements, transit/eclipse timing, and direct imaging, Gaia provides the capability to determine 3D orbital architectures and conduct statistical studies of planetary formation and evolutionary processes, including migration and scattering. Our ability to fully exploit the planetary census from Gaia's future data releases will ultimately depend on significantly enhanced spectroscopic, coronagraphic, and photometric infrastructure.

Primary author: FENG, Fabo (TDLI)

Presenter: FENG, Fabo (TDLI)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Sunday, October 12, 2025**

Abstract ID : **301**

Towards Detecting Earth-like Planets Around Sun-like Stars with the Second Earth Initiative Spectrograph (2ES)

Content

We present a homogeneous target selection pipeline for the Second Earth Spectrograph (2ES), an extreme-precision radial velocity instrument designed to detect Earth-mass planets in habitable zones. 2ES will conduct nightly observations of ˜30 stars over 5 years at the MPG/ESO 2.2m telescope, providing the high-cadence uniform sampling essential for mitigating stellar activity noise.

Our target selection employs a rigorous pipeline that prioritizes the brightest (V < 8 mag) and quietest (log R'HK < -4.8) nearby solar-type stars while ensuring strategic overlap with current and future space missions (TESS, PLATO, HWO). For each stellar candidate, we calculate minimum detectable amplitudes by properly accounting for major noise sources, including instrumental stability, photon noise, p-mode oscillations, and granulation, then derive mass detection limits within habitable zones to rank candidates by their Earth-analogue detection potential.

The optimized target list maximizes 2ES's potential for discovering temperate terrestrial planets around the nearest, brightest and quietest stars. The pipeline is highly customizable and adaptable to other Earth-analogue surveys.

Primary authors: BUCHHAVE, Lars; ZHAO, Jinglin (DTU Space)

Presenter: ZHAO, Jinglin (DTU Space)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Wednesday, October 15, 2025**

Abstract ID : **302**

The Earth 2.0 (ET) Space Mission

Content

The Earth 2.0 (ET) Survey Mission is one of the four space missions in the China's Space Origins Exploration Program. It is scheduled for launch in the winter of 2028, with the goal of deploying a dedicated space observatory at the Sun–Earth L2 point to systematically search for Earth-like exoplanets. The mission will be equipped with six wide-field transit telescopes and one microlensing telescope, using large-format CMOS detectors to achieve ultra-high-precision photometric observations. During its four-year prime mission, ET will continuously monitor over two million nearby late-type dwarf stars to search for transit signals, while in the summer seasons it will observe about 30 million stars in the direction of the Galactic bulge to detect microlensing events. Simulation studies suggest that ET could, for the first time, discover about 17 Earth analogs and approximately 25 free-floating Earths, along with more than 4,000 terrestrial planets and tens of thousands of other types of exoplanets. This report will present the mission design, key technological innovations, and the significant potential impact of ET in advancing the search for Earth-like planets and the broader field of exoplanet science.

Primary author: Prof. GE, Jian (Shanghai Astronomical Observatory, Chinese Academy of Sciences)

Presenter: Prof. GE, Jian (Shanghai Astronomical Observatory, Chinese Academy of Sciences)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Thursday, October 16, 2025**

Abstract ID : **303**

Closeby Habitable Exoplanet Survey (CHES): An Astrometric Mission to Explore Nearby Habitable Worlds

Content

The detection and characterization of habitable exoplanets constitute a major frontier in contemporary astronomy. The National Medium- and Long-Term Space Science Development Plan (2024–2050) of China identifies "nearby habitable exoplanet exploration" as a strategic research priority.
In this framework, the Closeby Habitable Exoplanet Survey (CHES) mission (http://www.ps.pmo.cas.cn/CHES/) is designed to search for Earth-like planets within the habitable zones of about 100 Sun-like stars located within ˜32 light-years of the Sun, using space-based astrometry with microarcsecond precision. This survey will provide accurate measurements of planetary masses and three-dimensional orbital configurations, enabling the establishment of a comprehensive database of nearby planetary systems.
CHES will employ a 1.2 m space telescope operating at the Sun–Earth Lagrange L2 point for a nominal five-year mission. The mission is expected to achieve significant advances in the detection of Earth analogs around nearby solar-type stars. By adopting an innovative astrometric technique, CHES will offer distinctive capabilities for detecting habitable planets and addressing key questions in planetary science, including the frequency of nearby habitable worlds, the uniqueness of Earth, and the processes governing planetary system evolution toward habitability.

Primary author: Prof. JI, Jianghui (Purple Mountain Observatory, Chinese Academy of Sciences)

Presenter: Prof. JI, Jianghui (Purple Mountain Observatory, Chinese Academy of Sciences)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Thursday, October 16, 2025**

Abstract ID : **304**

Lessons Learnt from Bridging Exoplanets and AI: The Ariel Data Challenge Series

Content

The emergence of data-driven algorithms in recent decades has seen a surge in astrophysical applications, including exoplanetary science. Ariel is an ESA M4 mission dedicated to surveying 1000 exoplanets through infrared spectroscopy, scheduled to launch in 2029. The number of exoplanets observed and the quality of the spectra will represent a significant improvement over the current state of the art. This poses significant challenges to the community in terms of both data reduction and characterization, which typically require considerable computational resources. To address these impending challenges, the annual Ariel Data Challenge seeks insights and innovative approaches from the global data science and AI community. We have hosted two editions (2024 and 2025) focused on data reduction techniques, where participants were asked to develop fast solutions for reducing raw Ariel observations into transmission spectra. By analyzing the performance of over 2000 teams that participated across both editions, we identified common patterns (ML to augment traditional solutions) in winning solutions and confirmed that classical techniques such as Bayesian inference remain competitive methods for uncertainty quantification. We will also share lessons learned about bridging disciplines beyond exoplanetary science.

Primary author: Dr YIP, Kai Hou (King' s College London)

Presenter: Dr YIP, Kai Hou (King' s College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Friday, October 17, 2025**

Abstract ID : **305**

High Mutual Inclinations are Ubiquitous in Hierarchical Giant Planet Pairs

Content

The mutual orbital inclination in a planetary system reflects its formation history in dynamics. A co-planar configuration, like our solar system, suggests a smooth formation process, whereas a highly inclined configuration indicates a dynamically violent pathway to the system's present state. High-precision astrometry enables the measurement of orbital inclinations for distant, massive companions. Combined with inner transiting planets—whose inclinations are close to 90° and are also measurable—the line-of-sight mutual inclination (ΔI) can be determined for a number of multi-planet systems. In this study, we present measurements and statistics of ΔI for a sample of hierarchical giant planet pairs. We find that half of these pairs exhibit significant mutual inclination at the 1σ level, and one-fourth are significant at the 3σ level. Using hierarchical Bayesian testing, we show that the ΔI distribution is distinct from a hypothetical coplanar configuration. Further dynamical analysis indicates that one-third of the systems in our sample are undergoing significant ZLK oscillation. Our results demonstrate that significant mutual inclinations are ubiquitous in hierarchical giant planet pairs, and that ZLK oscillations are likely common in highly inclined systems.

Primary authors: Prof. FENG, Fabo (Tsung-Dao Lee Institute); Ms HUANG, Xiumin (Tsung--Dao Lee Institute); Dr TENG, Huan-Yu (National Astronomical Observatories); Mr XIAO, Guang-Yao (Tsung-Dao Lee Institute)

Co-authors: Prof. DAI, Fei (University of Hawai'i); Prof. LAI, Dong (Tsung-Dao Lee Institute); Prof. LIU, Yu-Juan (National Astronomical Observatories)

Presenter: Mr XIAO, Guang-Yao (Tsung-Dao Lee Institute)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **XIAO, Guang-Yao** on **Monday, October 27, 2025**

Abstract ID : **306**

Multi-transiting systems tend to be aligned and coplanar

Content

Measuring the stellar obliquity in multi-transiting planetary systems helps determine whether the orbit of an individual planet has been tilted or if the entire protoplanetary disk was initially misaligned. In this study, we present stellar obliquity measurements for three such systems: TOI-880 (Zhang et al., 2025), TOI-942 (Teng et al., 2024), and HD 93963 (Teng et al., 2025). Combining our observational data with dynamical analyses, we find that the transiting planets in all three systems are both aligned and coplanar. Together with previous observations, these results suggest that multi-transiting systems generally tend to be aligned and coplanar.

Primary author: Dr TENG, Huanyu (National Astronomical Observatories, Chinese Academy of Sciences)

Co-authors: DAI, Fei; ZHANG, Elina (Institute for Astronomy, University of Hawaii)

Presenter: Dr TENG, Huanyu (National Astronomical Observatories, Chinese Academy of Sciences)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TENG, Huanyu** on **Monday, October 27, 2025**

Abstract ID : **307**

Progress of East Asian Planet Search Network

Content

The East Asian Planet Search Network (EAPS-Net) surveys 860 late-G (including early-K) giant stars with precise radial velocities, aiming to search for planets around intermediate-mass stars in their evolved stages. The EAPS-Net began 20 years ago and discovered 50 exoplanetary systems using 2m-class telescopes in east Asia. Here we report our latest progress.

Primary author: Dr TENG, Huanyu (National Astronomical Observatories, Chinese Academy of Sciences)

Co-author: TEAM, EAPS-Net

Presenter: Dr TENG, Huanyu (National Astronomical Observatories, Chinese Academy of Sciences)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TENG, Huanyu** on **Monday, October 27, 2025**

Abstract ID : **308**

Generative AI for Doppler Detection of Earth-Like Exoplanets Around Sun-Like Stars

Content

The search for Earth-like planets around Sun-like stars is now limited less by instrumentation than by stellar activity: the turbulent and spotted surfaces of stars imprint spectral variations that can mask or mimic the Doppler shifts of small planets. To address this challenge, I present Æstra, a generative machine-learning framework designed to disentangle true Doppler shifts from spurious, activity-induced signals by learning detailed representations of stellar variability. Machine learning is particularly well-suited for this task because it can model complex spectral features without requiring prior knowledge of the underlying physical processes. I will introduce the core ideas behind the method, demonstrate results from solar data including injection–recovery tests, and discuss the path toward applications on exoplanet host stars.

Primary author: LIANG, Yan (Yale University)

Presenter: LIANG, Yan (Yale University)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **LIANG, Yan** on **Tuesday, October 28, 2025**

Abstract ID : **309**

Limiting Eccentricity in Restricted Hierarchical Three-Body Systems with Short-Range Forces

Content

A hierarchical three-body model can be widely applied to diverse astrophysical settings, from satellite-planet-star systems to binaries around supermassive black holes. The octupole-order perturbation on the inner binary from the tertiary can induce extreme eccentricities and cause orbital flips of the binary, but short-range forces such as General Relativity (GR) may suppress extreme eccentricity excitations. In this paper, we consider restricted hierarchical three-body systems, where the inner binary has a test-mass component. We investigate the maximum possible eccentricity (call "limiting eccentricity") attainable by the inner binary under the influence of tertiary perturbation and GR effect. In systems with sufficiently high hierarchy, the double averaging (DA) model is a good approximation; we show that the orbits which can flip under the octupole-order perturbation reach the same limiting eccentricity, which can be calculated analytically using the quadrupole-order Hamiltonian and including the GR correction. In systems with moderate hierarchy, DA breaks down and the so-called Brown Hamiltonian is often introduced as a correction term; we show that this does not change the limiting eccentricity. Finally, we employ the single averaging (SA) model and find that the limiting eccentricity in the SA model is higher than the one in the DA model. We derive an analytical scaling for the modified limiting eccentricity in the SA model.

Primary authors: HUANG, Xiumin (TDLI, SJTU); LAI, Dong (TDLI)

Co-author: LIU, Bin (Zhejiang University)

Presenter: HUANG, Xiumin (TDLI, SJTU)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **黄, 秀敏** on **Tuesday, October 28, 2025**

Abstract ID : **310**

Nearby companions of hot Jupiters via disk migration

Content

Hot Jupiters (HJs) are thought to form primarily high-eccentricity migration or disk migration. Among these, HJ systems with nearby companions are expected to form by disk migration. TESS observation showed about 7.3% of HJs have nearby companions. Furthermore, observations suggests that dynamically young HJs with circular orbits, which likely form by disk migration, are more likely to have nearby companions than the dynamically old HJs. In contrast, a previous study showed only 33% of HJs have nearby companions when HJs and the other super-earths are captured 3:2 mean motion resonance by type-I migration. Their results may have a dependence on the migration speed of the planets. In this study, we investigate the relationship between the migration speed and number of nearby companions by simulating planetary orbits with reboundx code.

Primary author: OKAMOTO, Tamami (Tsung-Dao Lee Institute)

Co-author: OGIHARA, Masahiro (Tsung-Dao Lee Institute)

Presenter: OKAMOTO, Tamami (Tsung-Dao Lee Institute)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **OKAMOTO, Tamami** on **Tuesday, October 28, 2025**

Abstract ID : **311**

A Dwarf Planet on an Extremely Wide Orbit

Content

I will discuss a recent discovery of a trans-Neptunian object (TNO) 2017 OF201. It is interesting in three ways. (1) It is large enough to qualify as a dwarf planet. Assuming a typical albedo of 0.15, its diameter is estimated to be 700 km. (2) Its orbit is extremely wide and extends to the inner Oort cloud, with (a, q, i) = (850 au, 45 au, 16 deg) precisely determined from 24 observations over 20 years. In fact, it has the widest orbit among dwarf planet candidates, and it is the second-largest in its dynamical population, only next to Sedna. (3) Its orbital orientation lies well outside the claimed clustering of other extremely TNOs, posing a challenge to the Planet-Nine hypothesis.

Primary author: Dr CHENG, Sihao (Perimeter Institute)

Presenter: Dr CHENG, Sihao (Perimeter Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Tuesday, October 28, 2025**

Abstract ID : **312**

CHEPS Extended: Four Jupiter analogues orbiting metal-rich stars

Content

The population of long-period giant planets is key for understanding planetary system architectures and formation pathways, but these 'cold-Jupiters' remain under-sampled. Radial velocity (RV) surveys lose sensitivity at multi-AU separations and do not provide true planetary masses, and transit surveys have poor detection probabilities for such planets. Absolute astrometry from the Hipparcos and Gaia missions offer an extraneous probe for stellar motion that can break the orbital inclination degeneracy and improve detection confidence. Extending the Chile-Hertfordshire ExoPlanet Survey (CHEPS) by combining RV data spanning up to 16 years with absolute astrometry, we search and characterise cold giants around metal-rich FGK stars. We upgrade the \emp˜framework, incorporating astrometric differencing, to jointly fit RVs and astrometry for five CHEPS targets. We perform Bayesian model comparison to asses the evidence for planetary signals, compute baseline and phase-coverage metrics to quantify the astrometric contribution, and derive posterior distributions for orbital parameters using Adaptive Parallel Tempering. Our analysis confirms and characterises orbital parameters for two known planets in HIP 21850 and detects five new planets: a warm Jupiter–HIP 10090c, with orbital period $P = 321.8^{+0.3}_{-0.6}$˜d and mass $M = 0.85^{+0.03}_{-0.12}\ M_J$, and four Jupiter analogues–HIP 8923b with $P = 14.1^{+0.4}_{-0.7}$˜yr and $M = 9.98^{+0.78}_{-0.16}\ M_J$, HIP 10090b with $P = 8.1^{+0.3}_{-0.3}$˜yr and $M = 3.87^{+0.65}_{-0.60}\ M_J$, HIP 39330b with $P = 12.7^{+0.6}_{-0.7}$˜yr and $M = 1.68^{+0.16}_{-0.13}\ M_J$, and HIP 98599b with $P = 7.3^{+0.1}_{-0.1}$˜yr and $M = 6.85^{+0.10}_{-0.22}\ M_J$. Adding astrometry reduces period and mass uncertainties by factors between 3-10, whilst increasing the Bayes' factors by up to ~ 60. The synergy of long-baseline RVs and absolute astrometry provides a robust pathway to discover and characterise cold giant planets and metal-rich Solar-System analogues. Our results demonstrate that astrometric samples meaningfully improve detection confidence and convert minimum masses into true masses. This approach fills the demographic gap between RV and direct imaging sensitivities and prepares the field for forthcoming astrometric missions that will allow to find stellar systems like our own.

Primary author: PEÑA, Pablo (Instituto de Estudios Astrofísicos, Universidad Diego Portales)

Co-authors: FENG, Fabo (TDLI); JENKINS, James (Universidad Diego Portales); SAHA, Suman (Universidad Diego Portales); XIAO, Guang-Yao (Tsung-Dao Lee Institute)

Presenter: PEÑA, Pablo (Instituto de Estudios Astrofísicos, Universidad Diego Portales)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **PEÑA, Pablo** on **Tuesday, October 28, 2025**

Abstract ID : **315**

Oblique Exorings Masquerading as a Puffy Planet – The Dynamical History of HIP 41378f

Content

The planet HIP 41378f is the most puzzling of the so-called super-puff planets with anomalously low density, as its large orbital separation precludes many of the most accepted theories for super-puff formation. A theory that has gained traction in recent years is that the transit profile of a ringed planet could reproduce such an anomalous density. A transiting planet would require significant planetary obliquity for rings to have such an effect on the transit lightcurve. We show as HIP-41378f is in a resonant chain, the dynamics of the system are such that the planet can likely be in such a high obliquity state. We verify our results with N-body simulations, and show that over a wide range of parameter space rings can indeed reproduce the anomalous density measurement.

Primary author: Dr LU, Tiger (Flatiron Institute)

Presenter: Dr LU, Tiger (Flatiron Institute)

Contribution Type: Oral Talk

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Wednesday, November 26, 2025**

Abstract ID : **316**

Hydrocarbon Hazes on Temperate sub-Neptune K2-18b supported by data from the James Webb Space Telescope

Content

K2-18b, a sub-Neptune orbiting within the habitable zone of an M dwarf, has attracted significant attention following Hubble (HST) and, more recently, James Webb Space Telescope (JWST) observations that reveal detectable atmospheric features, most notably methane. However, observations from the JWST MIRI LRS instrument between 5–12 μm show spectral features that require a larger scale height compared with near- infrared data, leading to inconsistent gas abundances and temperature constraints between MIRI- and NIR-only analyses.

We present a new interpretation of K2-18b’ s atmosphere that incorporates the optical properties of laboratory-derived haze analogues to explain the full spectrum. Hazes and clouds, common in Solar System atmospheres, are also expected in many exoplanetary environments. Of particular interest are hydrocarbon hazes, produced through photochemical reactions involving methane in a hydrogen-dominated atmosphere.

We perform free-chemistry Bayesian retrievals on the combined NIRISS, NIRSpec, and MIRI LRS data spanning 0.8–12 μm, considering two types of haze analogues: Titan-like, and those forming in water-rich atmospheres. In both cases, our results indicate an H_2- dominated mini-Neptune atmosphere with a low mean molecular weight, suggesting that hydrocarbon hazes provide a plausible explanation for the combined spectra of K2- 18b. Future work using self-consistent models and additional mid-infrared observations will be essential to confirm the presence of hazes on K2-18b and advance our understanding of sub-Neptune populations ahead of future chemical surveys, such as Ariel.

Primary author: Ms LIU, Ruohan (University College London)

Presenter: Ms LIU, Ruohan (University College London)

Contribution Type: Poster

Status: ACCEPTED

Submitted by **TAN, Xianyu** on **Wednesday, November 26, 2025**