

Table of contents

A complex structure of escaping helium spanning more than half the orbit of the ultra-hot Jupiter WASP-121 b, Romain Allart [et al.]	5
Three years of atmospheric characterization with The Near Infra-Red Planet Searcher (NIRPS), Romain Allart [et al.]	7
Searching for planetary companions around solar-type stars within 25 pc using Gaia astrometry, Aniruddha Aramanekoppa	8
The BINARYS tool, Carine Babusiaux	9
GAIA synergies with MICADO, Pierre Baudoz	10
Coupling Atmospheric Fractionation and Hydrodynamic Escape: Implications for Sub-Neptunes, Junaid Ramzan Bhat [et al.]	11
SAXO+: a technology demonstrator and science precursor for PCS, Anthony Boccaletti	12
Observational and experimental results on the debris disk around HR 4796, Myriam Bonduelle [et al.]	13
From ExTrA to EXTRASTEP, Xavier Bonfils [et al.]	14
Diverging Sub-Neptune Radii from coupled Water Dissolution in Magma Oceans and Photoevaporation, Remo Burn [et al.]	15
Interactions between the atmosphere and the underlying magma oceans in large exoplanets, Razvan Caracas	16
Characterizing the atmosphere of HIP 67522 b with the combination of VLT/CRIRES+ and JWST/NIRSpec transmission spectra, Estelle Chabrol [et al.]	17
Mapping the latitudinal variations of the atmospheres of brown dwarf and exoplanets, Benjamin Charnay [et al.]	19

Calculation of the key influence of the planetary parameters on the size of the habitable zone, Guillaume Chaverot [et al.]	20
A predictive framework for realistic star-planet radio emission in compact systems, Judy Chebly	21
High-Resolution Spectra from 3D Radiative-Hydrodynamical Simulations of M Dwarf Atmospheres, Andrea Chiavassa	22
HCN VUV Absorption Cross Sections at High Temperature for Warm Exoplanet Atmosphere Modeling, Alexandro Collado [et al.]	23
Modeling coronagraphic Observations with JWST/MIRI – Application to the debris disk HD181327, Margot Courtoux	24
Water-rich atmospheres under variable XUV: the case of Proxima Centauri b, Andrea Damonte [et al.]	25
Modeling the atmospheres of magma ocean hosting exoplanets and their characterisation using high-resolution spectroscopy, Spandan Dash [et al.]	26
A new population of giant planets around M dwarfs with Gaia, Florian Destrieux [et al.]	28
What causes the dust’s asymmetric emission in the inner parts of protoplanetary disks seen by the VLTI ?, Siméo Evelain [et al.]	29
Vibrationally excited H ₂ mutes the He I triplet line at 1.08 μm on warm exo-Neptunes, Antonio García Muñoz	30
Long-term follow-up and characterization of exoplanets from Antarctica with ASTEP, EXTRASTEP and PLATO, Luke Gauvrit [et al.]	31
Realistic modulations of star-planet magnetic interaction and associated Ohmic heating in short-period exoplanets, Clémence Gourvès [et al.]	32
Atmosphere or Bare Rock? Joint JWST Eclipse and Transit Constraints on TOI-270 b, Amélie Gressier	33
A decade of monitoring HIP 41378, a transiting multi-planetary system, Salomé Grouffal [et al.]	34
Characterization of eleven transiting warm Jupiters with SOPHIE and TESS, Neda Heidari [et al.]	35

Exoplanet interferometry in the mid-infrared with MATISSE, Mathis Houllé [et al.]	36
FIRST-PL : Halpha differential imaging of protoplanets with a visible photonic lantern, Elsa Huby [et al.]	37
Secondary gas discs in warm exo-asteroids belts, Paul Huet [et al.]	38
Investigating aerosols as a way to reconcile K2-18 b JWST MIRI and NIRISS/NIRSpec observations, Adam Yassin Jaziri [et al.]	39
Exoplanets by the Thousands: A DR3 Glance at the Gaia DR4 Harvest, Flavien Kiefer	40
Surface properties of the day and night sides of K2-141 b, Charles Le Losq [et al.]	41
Cold Giants in the Gaia Era, Anne-Marie Lagrange	43
Atmospheric characterization of HIP 67522b with VLT/CRIRES+, Alexis Lavail	44
Convection inhibition in the atmosphere of mini-Neptune planets : implications for K2-18b like planets, Jeremy Leconte [et al.]	45
Exoplanets demographics in the era of ELT, Lucile Mignon [et al.]	47
Disequilibrium chemistry in the atmosphere of exoplanets, Cyril Markovitch . . .	48
3D simulation of 55 Cnc e's climate and clouds, Maxime Maurice [et al.]	50
The GPI reanalysis with PACO: the largest survey of young stars to date and a new circumbinary planet, Johan Mazoyer [et al.]	51
Is the line bisector a reliable indicator of supergranulation-induced radial velocity variations?, Nadège Meunier [et al.]	52
Exoplanet detection limits of Gaia DR4 astrometry, Tung Lam Nguyen [et al.] .	53
Energetics of star-planet magnetic interactions: Novel insights from 3D modelling, Arghyadeep Paul [et al.]	54
Modelling the Milky Way exoplanet population, Chloé Padois	55
Nouvelles détections de planètes et dernières nouvelles du programme de suivi à long terme du SLS pour la recherche d'exoplanètes proches avec SPIRou, Charpentier Paul [et al.]	56

Next-Generation Exo-REM Atmosphere Models: Application to VHS 1256 b to Emulate Patchy Clouds, Alice Radcliffe [et al.]	57
First brown dwarf mid-infrared spectrum with VLTI/MATISSE: HD984B, Jules Scigliuto [et al.]	58
Atmospheric Wind Measurements as Probes of Magnetic Fields in Ultra-Hot Jupiters, Julia Seidel [et al.]	59
Preparation for Gaia DR4: simulations of epoch astrometry for non-single stars, Katarina Sivkova	60
Thermodynamics of miscibility and its implications for the structure of sub-Neptunes, Paolo Sossi	61
Unveiling the composition of inner disks with JWST to enable the interpretation of the composition of planetary atmospheres, Benoît Tabone [et al.]	62
New planetary-mass companions found in debris disks using Gaia, Sven Toucheboeuf [et al.]	63
On the preferential locations for planet formation in protoplanetary disks, Marion Villenave	64
Speeding-up atmospheric retrievals by linearising Mie theory, Maël Voyer [et al.]	65
Composition and dynamics of exocomets around Beta Pic., Théo Vrignaud [et al.]	66
Gone with the wind: the outward migration of eccentric giant planets in wind-launching disks, Gaylor Wafflard-Fernandez	67
MIRI Direct Imaging of Exoplanets: Coronagraphic and Non-Coronagraphic Performance in the Background-Limited Regime, Jonas Wehrung-Montpezat [et al.]	68
Low-frequency radio emissions from stellar and exoplanetary systems, Philippe Zarka [et al.]	69
opening of the Sub-Neptunes and Magma Ocean session, Sebastien Charnoz	70
The Gaia spectroscopic catalogue of exoplanet and host star parameters, Patrick De Laverny	71
Liste des auteurs	71

A complex structure of escaping helium spanning more than half the orbit of the ultra-hot Jupiter WASP-121 b

Romain Allart ^{* 1}, Louis-Philippe Coulombe ², Yann Carteret ³, Jared Splinter ⁴, Lisa Dang ⁵, Vincent Bourrier ⁶, David Lafrenière ²

¹ Institut Trottier de Recherche sur les Exoplanètes, Université de Montréal – Canada

² Institut Trottier de Recherche sur les Exoplanètes, Université de Montréal – Canada

³ Université de Genève – Switzerland

⁴ McGill University – Canada

⁵ University of Waterloo – Canada

⁶ Observatoire de Geneve – Switzerland

The near-infrared helium triplet has emerged as a powerful tool for studying atmospheric escape in exoplanets, offering crucial insights into their long-term evolution. Atmospheric escape is a fundamental process that sculpts the atmospheres of close-in exoplanets, gradually altering their composition and potentially leading to the complete loss of volatile layers over time. Understanding the mechanisms driving mass loss is essential for constraining the formation and evolutionary pathways of exoplanets, particularly those exposed to extreme stellar irradiation. Modeling the helium triplet remains challenging due to uncertainties in the XUV flux received and in the complex interactions between metastable helium and the surrounding stellar environment. Current approaches often overestimate mass loss rates, temperatures, and the physical extent of escaping atmospheres. Models often adopt unphysical parameter values to compensate for missing physics and chemistry.

This work presents JWST/NIRISS observations of a helium phase curve around the iconic ultra-hot Jupiter, WASP-121b, providing evidence of the longest continuous atmospheric escape. We detect an absorption signature that persists for over 17 hours - covering 55% of the planet's orbit - leading the planet's transit by more than 5h and trailing it by over 10h. This extended absorption corresponds to an optically thick region spanning approximately 110 planetary radii (~ 0.1 AU). Our results show that the ultra-hot Jupiter WASP-121b sustains a strong outflow, separating into two tails trailing and leading the planet. The persistent absorption from these tails, together with their measured radial velocity shifts, suggests that they remain in a collisional fluid regime at large distances from the planet and display very different dynamics. While qualitatively consistent with theoretical expectations, the observed helium structure is not self-consistently reproduced by current models, limiting constraints on the mass-loss rate. Nonetheless, the WASP-121b stream shape fits quite well with the stream-versus-bubble theory proposed by Macleod et al. (2025), which suggests that planets with low Rossby number at the scale of the Hill sphere should exhibit a sustainable stream rather than a spherical expansion of the gas.

These findings open a new, unexpected window into the study of extreme atmospheric escape processes, highlighting the necessity of refining our observational strategies for both ground- and space-based missions and of adopting a more careful interpretation of current observations, potentially biased by the lack of an extended baseline. Additionally, current 3D particle and

*Speaker

hydrodynamic models fail to reproduce such an intense, extended, and asymmetric signal, emphasizing the urgent need for more sophisticated joint modeling efforts to fully capture the complex physics of atmospheric escape and its impact on exoplanetary evolution.

Three years of atmospheric characterization with The Near Infra-Red Planet Searcher (NIRPS)

Romain Allart ^{* 1}, Stefan Pelletier ², Valentina Vaulato ², Luc Bazinet ¹,
Lucile Mignon ³, Xavier Delfosse ⁴, François Bouchy ⁵, René Doyon ⁶

¹ Institut Trottier de Recherche sur les Exoplanètes, Université de Montréal – Canada

² Observatoire Astronomique de l'Université de Genève – Switzerland

³ Institut de Planétologie et d'Astrophysique de Grenoble – Université Grenoble Alpes, Centre National de la Recherche Scientifique, Institut national des sciences de l'Université, Université Joseph Fourier - Grenoble 1, Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture, Institut Polytechnique de Grenoble - Grenoble Institute of Technology, Université Savoie Mont Blanc, Institut national des sciences de l'Université, Centre National d'Études Spatiales [Toulouse] – France

⁴ Institut de Planétologie et d'Astrophysique de Grenoble – IPAG Grenoble – France

⁵ Observatoire Astronomique de l'Université de Genève – Switzerland

⁶ Institut Trottier de Recherche sur les Exoplanètes, Université de Montréal – Canada

NIRPS is a fiber-fed high spectral resolution spectrograph assisted by adaptive optics installed on the 3.6m telescope of ESO at LaSilla, Chile. Operated simultaneously with HARPS, NIRPS covers the Y, J, and H bands. In this talk, I will describe the objectives of the NIRPS consortium that has been allocated 725 GTO nights over 5 years. A third of this time is dedicated to in-depth spectral characterizations, to provide detailed, high-fidelity, high signal-to-noise transmission and emission spectra in preparation for the ELT era, as well as large, comprehensive atmospheric and orbital architecture surveys with the goal to observe over 70 exoplanets, ranging from ultra-hot Jupiters to temperate terrestrial planets. Over the program's first half, we have prioritized the best exoplanets across the exoplanet population, including many JWST targets. For the second part of our program, we have tighten our objectives by conducting 1) an in-depth characterization of a handful of exoplanets to study their atmospheres over 5 years; 2) a transit survey of hot Jupiters and puffy Neptunes to characterize their atmospheric composition; 3) an helium survey to understand the correlation between the Neptunian desert-ridge-savanna, mass loss rate and orbital architecture; and 4) an emission survey to constrain the condensation phase and the photo-dissociation of water in ultra-hot Jupiters. During the talk, I will highlight key results we have obtained since the start of operations, including detections of escaping atmospheres, atmospheric variability, and constraints on the atmospheric composition of warm Neptunes to hot Jupiters. These results will showcase the potential of NIRPS to deliver high-fidelity atmospheric spectra to constrain the formation and evolution of exoplanets at the statistical level. Looking ahead, I will discuss how extending NIRPS into the K band will unlock a new realm of atmospheric science, enhancing and securing long-term follow-up of exoplanet atmospheres to study their variability. Finally, NIRPS lays the groundwork for ELT spectrographs such as ANDES, and I will showcase how the lessons learned from NIRPS can be applied to the next generation of state-of-the-art instruments.

*Speaker

Searching for planetary companions around solar-type stars within 25 pc using Gaia astrometry

Aniruddha Aramanekoppa * ¹

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université – France

Context: The hunt for exoplanets is a thriving field thanks to next-generation instruments such as the James Webb Space Telescope (JWST), and upcoming projects including the Extremely Large Telescope (ELT) and Habitable Worlds Observatory (HWO). Identifying giant exoplanets around solar-type stars will enable direct imaging and spectroscopic studies of systems that may host potentially habitable worlds.

Aims: This work surveys nearby solar-type stars and aims to detect new giant exoplanets using stellar astrometric excess noise, complemented by archival direct imaging and radial velocity data. The targets studied in this investigation are limited to a 25-pc sphere to ensure possible direct detection with the ELT.

Methods: The Fifth Catalogue of Nearby Stars (CNS5) is used to select eligible solar-type stars within 25 pc. We search for bound companions using the GaiaPMEX tool, which makes use of the renormalized unit weight error (*ruwe*) from *Gaia* and the proper motion anomaly (PMA) between *Hipparcos* and *Gaia*.

Results: The results from GaiaPMEX for 294 targets indicate the presence of bound companions around many stars in our sample. After excluding the previously known companions, the archival radial velocity and direct imaging data will be used to characterise new planetary companions and set constraints on their masses and semi-major axes.

Conclusion: The newly identified planetary candidates will be prime targets for future follow-up observations by JWST and HWO, offering opportunities to study giant planets that may influence potentially habitable exoplanets.

*Speaker

The BINARYS tool

Carine Babusiaux * ¹

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Centre National d'Études Spatiales [Toulouse], Institut National des Sciences de l'Univers, Université Savoie Mont Blanc : UMS832, Centre National de la Recherche Scientifique, Université Grenoble Alpes [2020-....] – France

I will present BINARYS (orBIt determiNAtion with Absolute and Relative astrometRY and Spectroscopy, Leclerc et al. 2023), a tool to combine Gaia astrometry with Hipparcos, direct imaging and radial velocities to derive dynamical masses. It can work with Gaia single star solutions combined with Hipparcos (Leclerc et al. 2023), Gaia DR3 NSS solutions (Chevalier et al. 2023) and Gaia DR4 epoch astrometry. I will illustrate it with the mass-luminosity relation derived by Chevalier et al. 2023 and discuss the next updates of the public version planned.

*Speaker

GAIA synergies with MICADO

Pierre Baudoz * ¹

¹ LIRA, Observatoire de Paris – Observatoire de Paris – France

MICADO, the first-light near-infrared imager for the European Extremely Large Telescope (ELT), will feature a dedicated high-contrast imaging mode designed specifically for observing and characterizing exoplanets and circumstellar disks. Offering significantly improved sensitivity and angular resolution over current instruments like SPHERE and GPI, MICADO is expected to make substantial contributions to our understanding of planetary systems.

Numerical simulations have been carried out to estimate the performance showing that MICADO will extend SPHERE's effective search area for very young giant and massive planets to shorter orbital separations (a few AU) from nearby stars and around more distant stellar associations (100-150 pc), enabling better synergy with Gaia and radial velocity study capabilities.

While Gaia's astrometry can provide new planets and constrain the orbital parameters and masses of companions identified through indirect methods, MICADO will complement Gaia by directly imaging exoplanets and obtaining their spectra in the Near-Infrared.

With first scientific light expected around 2030, MICADO will benefit from exoplanet solutions of Gaia Data Release 4 (DR4), which will likely be further enhanced by complementary observations (e.g. RV measurements, SPHERE imaging, new astrometric measurements with GRAVITY,...). The DR4 and DR5, anticipated within the first years of MICADO operations, will enable the identification of promising exoplanet systems for follow-up imaging and spectroscopy, provide accurate planet positions for optimized observing strategies, and deliver the stellar context (e.g. kinematics and multiplicity) necessary to robustly interpret MICADO observations.

This contribution presents the expected performance of MICADO's high-contrast mode and illustrates potential scientific applications in synergy with Gaia.

*Speaker

Coupling Atmospheric Fractionation and Hydrodynamic Escape: Implications for Sub-Neptunes

Junaid Ramzan Bhat * ¹, Antonio García Muñoz ², Diana Valencia ³

¹ Department of Astrophysics – Université Paris-Saclay, Université Paris Cité, CEA, CNRS, AIM, 91191, Gif-sur-Yvette, France – France

² Department of Astrophysics – Université Paris-Saclay, Université Paris Cité, CEA, CNRS, AIM, 91191, Gif-sur-Yvette, France – France

³ University of Toronto, Scarborough (UTSC) – Canada

Sub-Neptunes are the most abundant class of exoplanets found in the universe, yet they have no analogue in our own Solar System. Understanding their atmospheres and the underlying physical processes remains of prime interest. Despite significant progress in exoplanet observations and modeling, many aspects of sub-Neptune atmospheres remain poorly constrained. In particular, their atmospheric evolution and the connection between processes occurring at different heights in the atmosphere remain largely unexplored.

In this work, we aim to investigate how gravitational fractionation in the middle atmosphere above the homopause affects atmospheric loss occurring in the upper atmosphere, and the implications of this interaction for the survival of atmospheres of exoplanets. To this end, we employ a hydrostatic photochemical model with updated H–He–O chemistry to study the effects of gravitational fractionation. This framework is coupled with a one-dimensional hydrodynamic model of atmospheric escape to examine the interaction between these two processes.

Our findings will shed light on how strong the coupling between these processes is, which key chemical processes are involved, and whether there are any inherent limitations to this interaction. The approach developed here can be extended to planets irradiated by strongly flaring M-dwarfs, where atmospheric loss is expected to be much more prominent.

*Speaker

SAXO+: a technology demonstrator and science precursor for PCS

Anthony Boccaletti * ¹

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, CY Cergy Paris Université – France

SAXO+ is a second stage adaptive optics system developed by the SPHERE+ consortium which is part of the ELT/PCS roadmap. The goal is to boost the contrast performance of SPHERE at short angular separations with a series of innovative technics, both hardware and software. SAXO+ is due for on-sky testing beginning 2028. Beyond the demonstration phase, the consortium will promote SAXO+ as a dedicated mode for science exploitation on SPHERE. The detection and characterization of exoplanets and circumstellar disks constitutes the main science driver. More specifically, SAXO+ aims 1/ to provide access to the bulk of the young giant planet population down to the snow line (3-10 au), to bridge the gap with complementary techniques (radial velocity, astrometry); and 2/ to observe fainter and redder targets in the youngest (1 – 10 Myr) associations compared to those observed with SPHERE to directly study the formation of giant planets in their birth environment.

SAXO+ works in cascade with SAXO and implements an IR double pyramid system coupled to a fast tip/tilt modulator, a GPU-based real time computer, a 32x32 MEMS deformable mirror, and a low noise IR camera. It will achieve a maximum frequency of ~ 2.7 kHz for bright stars and will be able to observe targets as faint as $J=12.5$. According to simulations, SAXO+ will provide a significant improvement in contrast performance compared to SAXO for very bright stars by an order of magnitude, and also for stars redder than $J=9$ by one to even two orders of magnitude. In the demonstrator phase, SAXO+ will mainly serve to test several flavors of AO control algorithms on-sky involving linear and non linear solutions as well as machine learning methods.

We will present the science cases, and the status of the project, and we will also discuss the interest and impact for PCS at the technical and astrophysical levels.

*Speaker

Observational and experimental results on the debris disk around HR 4796

Myriam Bonduelle * ¹, Julien Milli ², Olivier Poch ²

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Université Grenoble Alpes, CNRS :
UMR5274, CNRS – France

² Institut de Planétologie et d'Astrophysique de Grenoble – Université Grenoble Alpes, CNRS :
UMR5274, CNRS – France

Planetary systems are formed within circumstellar disks, initially called protoplanetary and consisting of gas, ice and dust particles. With the depletion of all (or most of) the gas and dust, these protoplanetary disks evolve into debris disks, reservoirs of planetesimals, km-sized rocky and icy bodies, whose mutual collisions grind the material into small μm - or mm-sized particles. Debris disks are therefore thought to be the markers of a successful formation of planetesimals, and the dust they contain is an indicator of the composition of exoplanetary materials. Scattered light observations of disks allow to access the optical properties of this dust (scattering phase function, degree of linear polarisation, spectra), and because these properties depend on the physical properties of the particles (size, composition, shape...), observations in scattered light of a debris disk, combined with experimental and numerical models, make it possible to constrain the nature of the dust particles and trace back to the composition of the planetesimals/planets that formed them.

We aim at understanding the properties of the dust particles in the debris disk orbiting around the A type star HR4796, using scattered light observations and laboratory experiments.

This work presents new VLT/SPHERE visible/near infrared observations of HR4796 at several wavelengths for both polarised and unpolarised light. To extract the optical properties (SPF and DoLP) we use a novel forward-modelling approach, combining angular differential imaging (ADI), polarised differential imaging (PDI), and a parametric description for both the SPF and the DoLP. We then measure the SPF and the DoLP of a sample of iron sulphide that we prepared, using the spectro-goniometer SHADOWS, hosted at IPAG.

Through a Markov Chain Monte Carlo algorithm, we obtain converged parameters sets to model the geometry, SPF, and DoLP of the disk for all the wavelengths we studied. We also obtain laboratory measurements on a wide range of wavelengths, and find that the variation of the DoLP with λ of the measured sample (FeS) reproduces well the variation in λ of the DoLP obtained in the observations.

*Speaker

From ExTrA to EXTRASTEP

Xavier Bonfils * ¹, Jose Almenara Villa ², Tristan Guillot ³, Jean-Baptiste Daban ⁴

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

² Observatoire de Geneve – Switzerland

³ Laboratoire Lagrange, CNRS, Observatoire de la Cote d'Azur – Université de Nice-Sophia Antipolis, Observatoire de la Cote d'Azur (OCA) – France

⁴ Observatoire Midi-Pyrénées – Université Toulouse III - Paul Sabatier, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique – France

ExTrA relies on an innovative method to achieve high-precision infrared photometry. Articulated around 3 robotic telescopes, it employs a multi-object spectrograph that resolves 120 spectral channels of 6 nm each (R=200). On one hand, this resolution allows for the masking of channels affected by atmospheric variations; on the other, the broad spectral range (0.9–1.6 μm) enables the simultaneous collection of more photons, thereby increasing efficiency. ExTrA plays an integral role in the follow-up of candidates identified by TESS and PLATO by confirming their planetary nature from the ground, detecting timing variations, and even finding additional planets. In a few years of operation at ESO/La Silla, ExTrA has contributed to the discovery of around thirty planets and led several detections that are now being followed up by the JWST. We shall present these contributions, as well as our tandem with ASTEP and our new joint-TTV program, EXTRASTEP.

*Speaker

Diverging Sub-Neptune Radii from coupled Water Dissolution in Magma Oceans and Photoevaporation

Remo Burn * ¹, Komal Bali ², Caroline Dorn ², Rafael Luque ³

¹ Observatoire de la Côte d'Azur – Université Côte d'Azur – France

² Institute for Particle Physics and Astrophysics [ETH Zürich] – Switzerland

³ Instituto de Astrofísica de Andalucía = Institute of Astrophysics of Andalusia – Spain

Formation models predict the migration of sub-Neptunes from cold regions in the disk to the observable inner region, leading to volatile-rich compositions at birth. Their final masses and radii, however, are shaped by chemical, geological, thermodynamic, and photoevaporative evolution over Gyr timescales. I will show how the interior distribution and phase of volatiles treated as water can affect the sub-Neptune population in mass-radius space and their transition across the Radius Valley toward rocky planets. In particular, sequestration of water into the magma ocean can strongly impact the planetary radii resulting after photoevaporative loss of the atmospheres. Moreover, future studies should include the full diversity of major volatile species and their partitioning and evolution in sub-Neptunes.

*Speaker

Interactions between the atmosphere and the underlying magma oceans in large exoplanets

Razvan Caracas * ¹

¹ Institut de Physique du Globe de Paris (IPG Paris) – CNRS – France

The question of hydrogen dissolution in a silicate planet is longstanding within the Earth and planetary science community (1). Its presence and amount can drastically change the functioning of the planet from the redox state to the characteristics of its atmosphere. This question becomes of utmost importance when studying exoplanets sub-Neptunes and super-Earths. Here, we employ ab initio molecular dynamics to compute the solubility of hydrogen in a magma ocean with bulk silicate Earth composition (2,3). We find that magma oceans can dissolve almost 2 wt% hydrogen at typical conditions relevant to their interface with hot and dense atmospheres. The hydrogen influx changes the redox state of the magma ocean (which becomes reduced), and generates a massive outflux of oxygen, which combines with atmospheric hydrogen to form large amounts of water vapor. Numerous other complex chemical species are released into the atmosphere. This changes profoundly the thermal and chemical evolution of the primitive atmosphere for early Earth-like conditions. For sub-Neptune exoplanets, this offers an amazing diagnostic tool, as their atmospheres would bear spectral signatures observable from space telescopes. These atmospheric composition changes are a testable signature of hidden magma oceans on exoplanets. Moreover, the uptake of volatiles by the magma implies that sub-Neptunes are more volatile-rich than once thought.

1 Hirschmann, M. M., Withers, A. C., Ardia, P. & Foley, N. T. Solubility of molecular hydrogen in silicate melts and consequences for volatile evolution of terrestrial planets. *Earth and Planetary Science Letters* 345-348, 38-48 (2012). <https://doi.org/10.1016/j.epsl.2012.06.031>

2 McDonough, W. F. & Sun, S. s. The composition of the Earth. *Chemical Geology* 120, 223-253 (1995).

3 Caracas, R., Hirose, K., Nomura, R. & Ballmer, M. D. Melt–crystal density crossover in a deep magma ocean. *Earth and Planetary Science Letters* 516, 202-211 (2019). <https://doi.org/10.1016/j.epsl.2019.03>

*Speaker

Characterizing the atmosphere of HIP 67522 b with the combination of VLT/CRIRES+ and JWST/NIRSpec transmission spectra

Estelle Chabrol ^{*} ¹, Sandrine Vinatier ¹, Elsa Ducrot ^{1,2}, Alexis Lavail ³, Florian Debras ³, Adrien Masson ⁴

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, CY Cergy Paris Université – France

² Astrophysique Interprétation Modélisation – Commissariat à l'énergie atomique et aux énergies alternatives, Institut National des Sciences de l'Univers, Université Paris-Saclay, Centre National de la Recherche Scientifique, Université Paris Cité, Commissariat à l'énergie atomique et aux énergies alternatives : UMR_{E9005}, *Centre National de la Recherche Scientifique* : UMR₇₁₅₈, *Université Paris Cité* : UMR₇₁₅₈ – France

³ Institut de recherche en astrophysique et planétologie – Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, Université de Toulouse – France

⁴ Centro de Astrobiología (CAB), CSIC-INTA, Camino Bajo del Castillo s/n, 28692, Villanueva de la Cañada, Madrid, Spain – Spain

Discovered in 2020, HIP 67522 b is a hot jupiter transiting a 0.017 Gyr G3V-type star (Rizzuto et al. 2020). This young exoplanet has been observed in transmission using JWST/NIRSpec in the near infrared between 3 and 5 μm , which led to detections ($\sim 6\sigma$) of molecules such as H₂O and CO₂, as well as weaker tentative detections ($\leq 3\sigma$) of CO, H₂S and SO₂ (Thao et al. 2024). Their retrieval analysis also constrained the exoplanet mass to approximately 13.8 Earth masses. Its extended atmosphere makes it an excellent candidate for transiting spectroscopy.

Last year, HIP 67522 b was observed during transit using the VLT/CRIRES+ spectrograph in the K-band. This dataset revealed strong detections of CO and H₂O and a tentative HDO detection (Lavail et al. in prep). They also attempted to constrain the exoplanet mass, finding a value of approximately 29 Earth masses. Since these results are not fully consistent with the lower spectral resolution JWST/NIRSpec data analysis, we propose to combine the two datasets in a joint retrieval analysis in order to potentially break degeneracies among the retrieved parameters such as the planetary mass. We used the same VLT/CRIRES+ dataset and applied a different data reduction pipeline. We also reduced and analyzed the same JWST/NIRSpec dataset of Thao et al. (2024). By combining these datasets, this study aims at further improving current constraints on HIP 67522 b unique properties. We will present our methodology and current results obtained by combining these two VLT/CRIRES+ and JWST/NIRSpec transmission spectroscopy datasets.

References

- Rizzuto, Aaron C. et al. (July 2020). "TESS Hunt for Young and Maturing Exoplanets (THYME). II. A 17 Myr Old Transiting Hot Jupiter in the ScoCen Association". In: 160.1, 33, p. 33. doi: 10.3847/1538-3881/ab94b7. arXiv: 2005.00013 (astro-ph.EP).
- Thao, Pa Chia et al. (Dec. 2024). "The Featherweight Giant: Unraveling the Atmosphere of

^{*}Speaker

a 17 Myr Planet with JWST". In: 168.6, 297, p. 297. doi: 10.3847/1538-3881/ad81d7. arXiv: 2409.16355 (astro-ph.EP).

Mapping the latitudinal variations of the atmospheres of brown dwarf and exoplanets

Benjamin Charnay ^{*} ^{1,2}, Sam De Regt ³, Mathieu Ravet ⁴, Lucas Teinturier ⁵, Flavien Kiefer ⁵, Mickaël Bonnefoy ⁴, Gaël Chauvin ⁶, Allan Denis ⁷, Paulina Palma-Bifani ⁵, Alice Radcliffe ⁵, Arthur Vigan ⁷

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Université Paris Diderot - Paris 7, Sorbonne Université : UMR8109, Centre National de la Recherche Scientifique – France

² Laboratoire d'Astrophysique de Bordeaux – CNRS : UMR5804, CNRS – France

³ Leiden Observatory – Netherlands

⁴ IPAG – CNRS : UMR5274, CNRS – France

⁵ LIRA – CNRS – France

⁶ MPIA – Germany

⁷ LAM – CNRS : UMR7326, CNRS – France

A major challenge for exoplanet observations is to transform spatially unresolved exoplanet observations to 3D or 2D maps in order to understand their climates and the physical/chemical/dynamical processes shaping their atmospheres. During this talk, we will present a new method - Differential Molecular Rotational Broadening - to map latitudinal variations in the atmospheres of brown dwarfs and exoplanets. This method consists in comparing the apparent rotational broadening of individual molecules from high-resolution spectra of brown dwarfs or exoplanets. It was motivated by 3D simulations of cloudy brown dwarfs (Teinturier et al., *Nature Astronomy*, 2026), predicting preferential cloud formation around the equator, associated with equator-pole thermal and chemical gradients. After validation of our method on synthetic observations, we apply it to VLT-CRIRES observations of the atmosphere of the brown dwarf DENIS J0255-4700. Our results confirm the existence of latitudinal chemical variations, with a depletion of CH₄ and NH₃, at low latitudes, consistent with an equatorial cloud belt approximately present between latitudes $\pm 15^\circ$, as predicted by GCM simulations. This is the first evidence for latitudinal chemical variations in the atmosphere of a brown dwarf as well as a spectroscopic evidence for an equatorial cloud belt. Finally, our method has a great potential with current and future observatories (i.e. the ELT). It could be applied to multiple brown dwarfs and exoplanets to map their atmospheres from reflected light or thermal emission, and to study various atmospheric processes, such as clouds, aurora, photochemistry and zonal winds.

*Speaker

Calculation of the key influence of the planetary parameters on the size of the habitable zone

Guillaume Chaverot * ¹, Lucile Mignon ², Xavier Delfosse ³

¹ Institut de Planétologie et d'Astrophysique de Grenoble (IPAG) – Université Grenoble Alpes – France

² Institut de Planétologie et d'Astrophysique de Grenoble (IPAG) – Université Grenoble Alpes – France

³ Institut de Planétologie et d'Astrophysique de Grenoble (IPAG) – Université Grenoble Alpes – France

One of the objectives of the study of telluric exoplanets is the discovery of liquid water on their surface, a sine qua non condition for the appearance of life as we know it. Such temperate objects are inaccessible to current instruments, apart from the several significant contributions made by JWST, such as to our understanding of the TRAPPIST-1 system for instance. Future instruments, such as ANDES@ELT, PCS@ELT, HWO and LIFE, will enable to go even further in characterizing this type of planet, with Proxima-b as a prime target.

The concept of the habitable zone (HZ) is a generic tool that brings together all the processes affecting the phase of water on the surface of a planet. It is defined as a virtual zone within which a planet can maintain liquid water. However, this concept remains incomplete. Indeed, the interest of the community has so far mainly focused on the effect of stellar type on the position of the inner and outer edges of this HZ (e.g. Kasting et al. 1993, Selsis et al. 2007, Kopparapu et. al. 2013).

We will present recent results (Chaverot et al., in prep.), based on 1D climate modeling, highlighting the key influence of the planetary parameters (atmospheric composition and total pressure, planetary mass), for various stellar types, on the position of the HZ. Thanks to major updates of the opacity data of CO₂ (Chaverot et al., 2025), we show that atmospheric composition has a major influence on the size of the HZ. As atmospheric composition of temperate rocky planets is still largely unknown, we introduce the notion of uncertainty of the edges of the HZ, induced by planetary parameters. We also present the effect of planetary parameters as simple and comprehensive trends for the benefit of observers and instrumentalists. Indeed, understanding the limits of habitability is essential to reinforce the science cases of projects such as PCS@ELT by estimating the observability of relevant targets.

*Speaker

A predictive framework for realistic star-planet radio emission in compact systems

Judy Chebly * ¹

¹ Commissariat à l'énergie atomique et aux énergies alternatives – Département d'instrumentation Numérique (CEA, LIST), IMSIA, UMR 9219, CNRS, CEA, EDF, UNIVERSITY OF PARIS-SACLAY
– France

Magnetic star–planet interactions (SPI) are expected to produce low-frequency radio emission, yet such signals remain undetected due to weak intrinsic power, directional beaming, and Earth's ionospheric cutoff. I will present a framework that links stellar magnetism, planetary properties, and orbital configuration to predict SPI-driven radio emission and identify the most promising targets for observation. By combining Zeeman Doppler Imaging magnetic maps with 3D magnetohydrodynamic stellar wind simulations and the ExPRES code, this approach predicts how SPI signals should appear, allowing them to be distinguished from stellar or background emission. Applied to benchmark systems such as Tau Boo, HD 179949, and HD 189733, it provides a data-driven strategy to guide radio campaigns and systematically explore magnetic SPI across exoplanetary systems. The framework can be tested on specific observing epochs associated with earlier tentative radio detections, enabling direct, time-resolved comparisons between predicted SPI signatures and existing radio data

*Speaker

High-Resolution Spectra from 3D Radiative-Hydrodynamical Simulations of M Dwarf Atmospheres

Andrea Chiavassa * ¹

¹ Observatoire de la Côte d'Azur – Université Côte d'Azur, CNRS, Laboratoire Lagrange – France

M dwarfs are the most common stars in the solar neighbourhood and play a key role in the scientific objectives of the Extremely Large Telescope, particularly in the search for and characterization of exoplanets. They are fully convective, and their low mass, radius, and luminosity make it easier to detect smaller planets, especially in the close-in habitable zones typical of these stars. Their low effective temperatures result in a plethora of molecular line transitions throughout the optical spectrum and atomic line transitions. Line transitions that may also be present in the hosted planets.

Time-dependent representation of the background stellar disk with 3D radiative-hydrodynamical (RHD) simulations is a natural and necessary step forward toward a better understanding of stellar properties and for a detailed and quantitative analysis of the atmospheric signatures of the hosted planets. I will present the spectra of M dwarf stars computed from 3D RHD simulations. I will describe the stellar dynamics at high spectral resolution as well as the first applications to the cross-correlation technique, strengthening and contextualizing any inference on planets in the solar neighbourhood that will be possible via ELT. Theoretical efforts for obtaining detailed line formation physics, using time-dependent hydrodynamical simulations, will be crucial in determining spectroscopic-based parameters on these stars as well as their impact on the atmospheric signatures of planets.

*Speaker

HCN VUV Absorption Cross Sections at High Temperature for Warm Exoplanet Atmosphere Modeling

Alexandro Collado * ¹, Olivia Venot ¹, Benjamin Fleury ¹, Zoé Perrin ¹, Roméo Veillet ², Nicolas Fray ¹, Yves Benilan ¹, Xavier Landsheere ¹, Antoine Jolly ¹, Maxime Feingesicht ¹, Sylvain Triquet ¹, Pascal Zapf ¹

¹ Laboratoire Interuniversitaire des Systèmes Atmosphériques – Institut National des Sciences de l’Univers : UMR7583, *Université Paris – Est Créteil Val – de – Marne – Paris12* : UMR7583, *Centre National de la Recherche Scientifique* : UMR7583, *Université Paris Cité* : UMR7583, *Institut National des Sciences de l’Univers, Université Paris – Est Créteil Val – de – Marne – Paris12, Centre National de la Recherche Scientifique, Université Paris Cité* – France

² Astrophysics Group, University of Exeter, EX4 4QL Exeter, UK – United Kingdom

New generation of telescopes such as JWST (and future missions like ARIEL and PLATO), have provided a wealth of data, leading to major advances in the characterization of exoplanets. The interpretation of these observations relies on atmospheric models that require accurate physico-chemical data as inputs to keep pace with the rapid improvement of telescopes. Among these data, vacuum ultraviolet (VUV) absorption cross sections are essential for describing radiative transfer and photodissociation processes in kinetic models. We provide new temperature-dependent VUV absorption cross sections of hydrogen cyanide (HCN), a key C/H/N species in exoplanetary atmospheres, in order to improve the accuracy of photochemical and radiative transfer models for hot exoplanets. We measured the VUV absorption cross section of HCN between 115 and 200 nm at 300, 500, and 700 K using a vacuum ultraviolet spectroscopic setup at the LISA laboratory. The new data were then implemented into the 1D thermo-photochemical model FRECKLL to quantify their impact on atmospheric physico-chemical processes. The absorption cross section of HCN increases with temperature, especially at wavelengths longer than 160 nm, with up to an order of magnitude enhancement near 200 nm. Photochemical simulations show that using the high-temperature cross section leads to a decrease in HCN abundance in the upper atmosphere and induces greater changes for other key species (e.g., CH₄, H₂S, H₂O, C₂H₂). The enhanced absorption also modifies the opacity of other species, affecting their photodissociation. Our results demonstrate that temperature-dependent VUV absorption cross sections are crucial for realistic modeling of hot exoplanet atmospheres. The new HCN data provide improved inputs for kinetic and radiative models, and highlight the need for further high-temperature laboratory measurements of key atmospheric species.

*Speaker

Modeling coronagraphic Observations with JWST/MIRI – Application to the debris disk HD181327

Margot Courtoux * ¹

¹ Laboratoire d’Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l’Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Université PSL – France

Direct imaging of exoplanets is challenging due to the high contrast with their host stars and their small angular separations. The coronagraphs of MIRI on board the James Webb Space Telescope (JWST) offer a new opportunity to observe young exoplanetary systems at mid-infrared wavelengths, while preserving high-contrast imaging and angular resolution. In the mid-infrared range we expect better sensitivity than in the near-infrared to detect protoplanets and circumplanetary disks (CPDs) in young systems, although the opacity of CPDs can reduce the luminosity of the embedded planets. To date, only a few young systems hosting protoplanets have been robustly detected in the near-infrared with the VLT/SPHERE (PDS 70 b & c, WISPIT 2b).

However, a new challenge arises from the thermal emission of the circumstellar disk (CSD) in these systems, and more specifically warm dust components in the inner regions (~ 10 au) which are poorly resolved by MIRI. As a result, their image is dominated by the diffraction. To address this issue, we have developed a pipeline that combines DDiT+ thermal emission models with STPSF to simulate the JWST/MIRI 4QPM coronagraphic response.

We present the application of this method to the HD181327 debris disk, which was observed with MIRI as part of PID#3662. For the first time, we observe an inner disk, undetected with ALMA and VLT/SPHERE, at ~ 20 AU, as well as formerly known planetesimals belt at $\sim 85-90$ AU. In a next step, this pipeline will be used to analyse coronagraphic images of younger systems where the central emission from the CSD is even more problematic to detect protoplanets and CPDs.

Co-authors : Anthony Boccaletti, Laurent Pueyo, Eric Pantin, Anne-Marie Lagrange, Clément Perrot, Mathilde Mâlin, Julien Milli

*Speaker

Water-rich atmospheres under variable XUV: the case of Proxima Centauri b

Andrea Damonte *^{1,2,3,4}, Antonio García Muñoz¹, Giuseppina Micela²

¹ CEA- Saclay – Commissariat à l'énergie atomique et aux énergies alternatives – France

² INAF - Osservatorio Astronomico di Palermo – Italy

³ Université Paris Cité – Université Paris Cité, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France – France

⁴ Università degli studi di Palermo - University of Palermo – Italy

Building upon previous characterizations of the high-energy environment of Proxima Centauri and its temporal variability, we model a water-rich atmosphere for Proxima Centauri b using a 1D hydrodynamical, multi-species photochemical model. We explore atmospheres composed of hydrogen and oxygen, with water mixing ratios at the lower boundary ranging from 0.1% and 2%, spanning altitudes from 1 to 15Rp. Our simulations reveal relatively cold atmospheric profiles where molecular species survive at unexpectedly high altitudes. We investigate the physical mechanisms allowing for the persistence of these molecules and analyze how they are linked to the specific XUV spectral distribution of the host star. Furthermore, we characterize how the dominant chemical pathways for molecules and ions respond to stellar activity, specifically analyzing the impact of intense XUV flaring events. This study provides essential insights into the phenomena triggered by high-energy radiation in the atmospheres of sub-Neptunes and Super-Earths. Such modeling is critical for interpreting the demographics and transmission spectra of other small exoplanets, and to anticipate in which cases they may have retained an atmosphere.

*Speaker

Modeling the atmospheres of magma ocean hosting exoplanets and their characterisation using high-resolution spectroscopy

Spandan Dash ^{* 1}, Sebastien Charnoz ², Aurélien Falco ³, Pascal Tremblin ⁴, Pierre-Olivier Lagage ⁵, Fabian Seidler ⁶, Paolo A. Sossi ⁶, Matteo Brogi ⁷

¹ Institut de Physique du Globe de Paris – Institut de Physique du Globe de Paris, Université Paris Cité – France

² IPGP – Institut de Physique du Globe de Paris – France

³ Laboratoire de Météorologie Dynamique (UMR 8539) – CNRS – France

⁴ Maison de la Simulation (MDLS) – CEA-DRF-MDLS – Maison de la Simulation Bâtiment 565 - Digiteo CEA Saclay, France

⁵ UMR Astrophysique, Instrumentation-Modelisation, à Paris-Saclay (AIM Paris-Saclay) – Commissariat à l’Energie Atomique et aux Energies Alternatives (CEA) - Saclay – CEA Saclay, point courrier 131, 91191 Gif-sur-Yvette, France

⁶ Institute of Geochemistry and Petrology [ETH Zürich] – Switzerland

⁷ Dipartimento di Fisica, Università degli Studi di Torino, via P. Giuria 1, 10125, Torino, Italy – Italy

Ultra-hot rocky exoplanets and a sub-set of volatile-rich sub-Neptune exoplanets hosting magma oceans at the bottom of their atmospheres present unique opportunities to study surface-atmosphere interactions. The composition of both mineral and vapour-rich mixed atmospheres in such exoplanets is dictated by outgassing from the surface magma ocean, which in turn is influenced by its oxygen fugacity (fO_2). In this presentation, we aim to examine the diversity of these classes of atmospheres and comment on the ground-based high-resolution ($R > 25000$) observabilities of a few example cases. First, we examine the case of fO_2 dependent mineral atmospheres, ranging from SiO dominated at reducing mantle conditions to O_2 dominated at oxidizing mantle conditions, on 55 Cnc e by assuming a bulk silicate Earth mantle composition and a substellar dayside temperature of $T = 2500$ K, in the near-infrared wavelength region. Coupling our simulator for synthesizing realistic observations from high-resolution ground-based spectrographs (Ratri) to our high-resolution cross-correlation spectroscopy (HRCCS) analysis pipeline (Upamana), we found that these mineral atmospheres would all be detectable and differentiable from each other within 2σ , based on the assumed fO_2 value, with 11 hours of observation of the dayside of 55 Cnc e with the CARMENES spectrograph. This kind of high-resolution spectral analysis is thus readily able to distinguish between a planet with an Earth-like redox state (with $fO_2 \sim 3.5 \log_{10}$ units above the iron-wüstite, IW buffer) and a Mercury-like planet ($fO_2 \sim 5 \log_{10}$ units below IW). Thus, the HRCCS technique holds promise for cataloguing the diversity of redox states among the rocky exoplanetary population using current and future generation of ground-based spectrographs. Then we examine how outgassing from the mantle (including the case of different fugacity regimes) can influence the composition of volatile-rich mixed atmospheres in both H-rich (varying between purely H_2 dominated to purely H_2O dominated) and C-rich atmospheres (varying between purely CO dominated to purely

*Speaker

CO₂ dominated). We further comment on their high-resolution observabilities using current and future generation of ground-based instruments.

A new population of giant planets around M dwarfs with Gaia

Florian Destrieux * ^{1,2}, Anne-Marie Lagrange ², Guillaume Hébrard ³,
Flavien Kiefer ^{1,2}

¹ Institut d'Astrophysique de Paris – Université Pierre et Marie Curie [UPMC] - Paris VI, INSU, CNRS : UMR7095, Université Pierre et Marie Curie (UPMC) - Paris VI – France

² Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, Cergy Paris Université – France

³ Institut d'Astrophysique de Paris – Institut National des Sciences de l'Univers, Sorbonne Université, Centre National de la Recherche Scientifique, Institut national des sciences de l'Univers, Institut national des sciences de l'Univers – France

M-type stars, the most common in the universe, are a major focus for surveys because they are well-suited for detecting low-mass planets in the habitable zone. Despite their importance in the formation and evolution of low-mass planets, little is known about giant planets (GPs) in M star systems. Detecting long period GPs (with semi-major axis typically greater than 1 au) is difficult with transit methods and challenging with radial velocities (RV) due to the faintness and relatively high activity level of M stars. This significant limitation can be effectively addressed by combining RV and direct imaging (DI) with Gaia-Hipparcos absolute astrometry. In this context, I used the GaiaPMEX tool presented in Kiefer et al. (2025) to detect GPs around all M stars closer than 15 pc with Gaia Data Release 3 data. GaiaPMEX uses astrometric data from Gaia and Hipparcos data when available to build a two-dimension confidence map to constrain the mass and the semi-major axis of the companion. When combining these maps with RV and DI detection limits, we can rule out binary companions, as well as identifying and characterizing planetary companions. I built a catalog of M dwarfs within 15 pc and using GaiaPMEX, I performed a systematic search for GPs. This work revealed at least 36 new substellar companions including 10 GPs along with 76 additional substellar companion candidates. I will present the methods and results of this survey which will allow the study of a new population of long period GPs and in particular, to derive the radial distribution of GPs around M dwarfs beyond ~ 1 au.

*Speaker

What causes the dust's asymmetric emission in the inner parts of protoplanetary disks seen by the VLTI ?

Siméo Evelain * ¹, Clément Baruteau ¹, Héloïse Méheut ²

¹ IRAP – CNRS, Université de Toulouse – France

² Laboratoire Lagrange – CNRS, Université Côte d'Azur – France

Interferometric observations conducted with the VLTI have revealed asymmetric near-infrared dust emission in the innermost regions of several protoplanetary disks, where planets are expected to form and migrate. Moreover, some of these observations show a temporal variability in the asymmetry, which can not be explained by axisymmetric disk models. We explore the hypothesis that a vortex generated by the Rossby Wave Instability (RWI) is responsible for dust trapping, and therefore for the asymmetric emission. To investigate this scenario, we carried out 2D and 3D hydrodynamical simulations with the FARGO3D code to model the inner parts of protoplanetary disks, which feature a transition between an inner strongly turbulent region and an outer weakly turbulent region. Our simulations show that this transition can trigger the formation of a dust-trapping vortex due to the RWI, whose lifetime can be significantly increased by the presence of multiple planets near the transition region. Our simulations results are post-processed with RADMC-3D dust radiative transfer calculations to compute synthetic dust emission maps in the near-infrared, and synthetic interferometric observations are then produced with the ASPRO2 tool. In this communication, we will discuss the possibility to reproduce, with our setup, the observed asymmetries in the inner regions of HD 163296 and the possible contribution of planets to account for these asymmetries.

*Speaker

Vibrationally excited H₂ mutes the He I triplet line at 1.08 μm on warm exo-Neptunes

Antonio García Muñoz * ¹

¹ CEA- Saclay – Commissariat à l'énergie atomique et aux énergies alternatives – France

The He I triplet line at 1.08 μm is a unique tracer of atmospheric escape on exoplanets. It complements other tracers such as the H I Balmer and Paschen lines, occasionally found on ultrahot Jupiters, and the H I Lyman- α line, detected on a few Neptune-sized and bigger planets. The He I triplet line provides also valuable insight into the chemical composition of the planets – a fact that remains to be fully explored. This insight into chemical composition is complementary to the insight obtained from more established techniques such as broadband IR spectroscopy and, based on recent line discoveries, enables the further characterization of sub-Neptunes. In this presentation, I will describe the He I triplet line formation process in the atmospheres of warm exo-Neptunes, which differs significantly from how the line is formed on bigger/hotter planets. A key difference is that hydrogen often survives undissociated to high altitudes on the warm exo-Neptunes, but not on the bigger/hotter planets. The H₂ survival prompts the dissociative charge exchange $\text{He}^+ + \text{H}_2(v) \rightarrow \text{He} + \text{H}^+ + \text{H}$, which is inefficient for ground-state H₂ ($v=0$) but becomes fast when the molecule is vibrationally excited ($v \geq 1$). This reaction depletes the atmosphere from He⁺, thereby muting the He I triplet line. The strength of this line is therefore sensitive to where the H₂-to-H transition occurs in the atmosphere. This investigation shows that the interpretation of atmospheric features on sub-Neptunes must take into account the possibly molecular nature of their atmospheres.

*Speaker

Long-term follow-up and characterization of exoplanets from Antarctica with ASTEP, EXTRASTEP and PLATO

Luke Gauvrit ^{*} ¹, Tristan Guillot ¹, Xavier Bonfils ², Jose Almenara Villa ², Jean-Baptiste Daban ³, Astep Team ^{1,2,4,5,6}

¹ Laboratoire Lagrange, CNRS, Observatoire de la Cote d'Azur – Université de Nice-Sophia Antipolis, Observatoire de la Cote d'Azur (OCA) – France

² Institut de Planétologie et d'Astrophysique de Grenoble – Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

³ Observatoire Midi-Pyrénées – Université Toulouse III - Paul Sabatier, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique – France

⁴ L'Institut polaire français Paul-Emile Victor – Ministère de l'Éducation nationale, de l'Enseignement supérieur et de la Recherche – France

⁵ University of Birmingham [Birmingham] – United Kingdom

⁶ Agence Spatiale Européenne = European Space Agency – Centre national d'études spatiales - CNES (FRANCE) – France

With its unique location, ASTEP (Antarctic Search for Transiting Exoplanets) has been contributing to the discovery of many interacting planetary systems on long-period orbits (tens to hundreds of days). The chopping signal from planet-planet interactions can yield significant TTVs that can be measured without ambiguity, allowing strong constraints on planetary masses. The extremely low densities of some of these planets raise important questions about how such systems form. Future follow-up combining ASTEP, ExTrA and Cryoscope as part of the EXTRASTEP program will be crucial to further characterize these systems. PLATO should also discover key systems with transiting planets on very long orbits. We will review recent progress on the characterization of these systems and on the modeling of their planets.

*Speaker

Realistic modulations of star-planet magnetic interaction and associated Ohmic heating in short-period exoplanets

Clémence Gourvès * ¹, Antoine Strugarek ², Arghyadeep Paul ¹

¹ CEA Saclay – CEA, CEA – France

² CEA Saclay (CEA) – CEA – 91191 Gif-sur-Yvette cedex, France

While many physical parameters of exoplanets are now well understood, exoplanetary magnetic fields remain largely unexplored, despite playing a crucial role in assessing dynamo theories and atmospheric retention. To better understand this key physical parameter, star-planet magnetic interactions (SPMI) present a promising avenue of investigation. In existing analytical model (Saur et al. 2013, Lanza et al. 2013, Paul & Strugarek 2025) the total SPMI power energy is correlated with the strength of the exoplanetary magnetosphere. Though, all these models have considered so far that the planet was interacting with a homogenous medium along its orbit. This assumption fails for complex stellar magnetic fields, such as during solar maximum, and motivates the need for more realistic modelling.

I will present a 3D MHD stellar wind model, explicitly including for the first time the orbital motion of its exoplanet. The planet’s hypothetical magnetosphere is also modelled and I will show that its size induces significant variations in the topology of the Alfvén surface. Our *ab-initio* modelling also demonstrates how variations in the orbital phase affect the excitation and transport of Alfvén waves triggered by the planet, leading to drastic changes in the propagation of Alfvén wings over the two-day orbital timescale. As a result, the magnetic interaction between the planet and its environment is found to vary significantly along the orbit and to depend sensitively on the assumed size of the exoplanet magnetosphere. Such strong spatio-temporal variability in magnetic energy transport is expected to directly impact the dissipation of electromagnetic energy in the planetary ionosphere, in particular through Ohmic heating of the upper atmosphere. This process therefore emerges as a key consequence of time-variable star–planet magnetic interactions.

We demonstrate that such modelling is now needed to go beyond order-of-magnitude estimates and towards a precise characterisation of SPMI. Ultimately, these modelling efforts open new prospects for constraining the magnetospheric sizes of close-in exoplanets and for improving our understanding of magnetic coupling between magnetospheres and exoplanet upper atmospheres.

*Speaker

Atmosphere or Bare Rock? Joint JWST Eclipse and Transit Constraints on TOI-270 b

Amélie Gressier * ¹

¹ Université de Montréal – Canada

A fundamental question in exoplanet science is whether rocky planets orbiting M dwarfs can retain atmospheres, and how this shapes the formation and evolution of compact planetary systems. In this talk, we focus on TOI-270 b, a ~ 500 K rocky planet orbiting one of the most extensively studied nearby M-dwarf systems with JWST (Benneke et al. 2024, Holmberg et al. 2024). The data are drawn from JWST observations as part of the Hot Rocks Survey (Cycle 2 Large Program, PID 3730; PI: H. Diamond-Lowe and J. Mendoca), providing MIRI eclipse photometry at $15\ \mu\text{m}$, where CO is expected to produce a strong emission signature. The TOI-270 system hosts two sub-Neptunes exterior to TOI-270 b and has been widely studied observationally and theoretically, including planet formation, atmospheric evolution, and system structure. Characterising the atmosphere-or lack thereof-of the innermost, most terrestrial planet is critical for understanding the formation history, atmospheric evolution, and diversity of the system, as well as constraining the properties of the sub-Neptunes.

TOI-270 b has been observed in four secondary eclipses with JWST/MIRI using the F1500W filter. These observations are combined with transit and radial velocity measurements in a comprehensive global analysis, refining orbital and physical parameters. Building on earlier indications of a possible atmosphere from NIRSpec transit observations alone (Coulombe et al. 2025), we present one of the first joint analyses of JWST transmission spectroscopy and MIRI eclipse photometry for a rocky exoplanet.

We introduce new atmospheric retrievals and updated interpretations of the NIRSpec transmission spectroscopy and $15\ \mu\text{m}$ MIRI eclipse measurements. We also compare the data to model grids spanning a range of atmospheric pressures and surface albedos. This combined approach helps distinguish between atmospheric emission and an airless surface, while highlighting the respective strengths and limitations of transmission and eclipse techniques for rocky planets. Although the study is ongoing, preliminary results suggest TOI-270 b is unlikely to host a substantial atmosphere. More broadly, this work establishes TOI-270 b as a key test bench for the wider set of MIRI emission observations from the DDT program, for which data are now being collected. We show how joint transit and eclipse measurements advance atmospheric interpretation and inform observing strategies for future studies of temperate rocky exoplanets.

*Speaker

A decade of monitoring HIP 41378, a transiting multi-planetary system

Salomé Grouffal * ¹, Alexandre Santerne ²

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

² Institut de Planétologie et d'Astrophysique de Grenoble – Institut National des Sciences de l'Univers, Centre National d'Études Spatiales [Toulouse], Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

Multi-planet systems provide key insights into planet formation and evolution, as their orbital architecture might preserve the dynamical history of planets formed in a common protoplanetary disk. However, most well-characterised systems are compact and have short orbital periods, while transiting multi-planet systems at longer periods remain rare due to observational bias.

The HIP 41378 system stands out in this context. It hosts five transiting and one non-transiting planet with orbital periods up to 1.5 years, offering a rare opportunity to explore planetary architectures in an environment that is more similar to the Solar System.

In this talk, I will present the results of a worldwide campaign over a decade of high-precision radial-velocity monitoring (HARPS, HARPS-N, HIRES, and ESPRESSO) combined with space-based photometry (Kepler, TESS, CHEOPS). The analysis of the data allows us to determine the masses and orbital configuration of all known planets and reveals an architecture composed of two dynamically distinct subsystems: an inner system of three planets near a 1:2:4 mean-motion resonance chain, and an outer system of three long-period planets (278, 390 and 542 days of orbital period) with a slight tilt with respect to the inner system. We also find a decrease in planetary density with semi-major axis among the transiting planets, highlighting the diversity of compositions at long periods. We confirmed the super-puff nature of the outer transiting planet HIP 41378 f and present the different hypotheses to explain its nature (rings, hazes, etc). I will finally discuss new near-infrared spectroscopic observations of HIP 41378 f with SPIRou, which offer novel constraints on its properties.

HIP 41378 thus provides a benchmark system for studying transiting planets on wide orbits, illustrating the observational challenges they pose for future observations with PLATO.

*Speaker

Characterization of eleven transiting warm Jupiters with SOPHIE and TESS

Neda Heidari * ¹, Guillaume HÉbrard ², Sophie Team ³, Et Al ⁴

¹ Institut d'Astrophysique de Paris – Université Pierre et Marie Curie (UPMC), Sorbonne Université – France

² Institut d'Astrophysique de Paris (IAP) – Université Pierre et Marie Curie [UPMC] - Paris VI, INSU, CNRS : UMR7095, Université Pierre et Marie Curie (UPMC) - Paris VI – 98bis, bd Arago - 75014 Paris France, France

³ LAM – Laboratoire d'Astrophysique de Marseille, Marseille – France

⁴ Grenoble – Université Grenoble Alpes – France

While several thousand exoplanets have now been confirmed, the number of known transiting warm Jupiters ($10 \text{ d} < P < 200 \text{ d}$) remains relatively small. These planets are generally believed to form beyond the snow line and subsequently migrate to their present orbits. Because they are sufficiently distant from their host stars, they mitigate proximity effects and so offer valuable insights into planet formation and evolution. In this talk, I will present the detection and characterization of 11 warm Jupiters discovered as part of the TESS–SOPHIE survey. These planets have orbital periods ranging from 20 to 94 d, masses between 0.05 and 2.9 MJ, and radii spanning 0.3 to 1.5 RJ. Within this sample, TOI-7025b, TOI-6883b, and TOI-5110b stand out for their orbital eccentricities, ranging from 0.6 to 0.8-among the largest planetary eccentricities measured to date. In addition, TOI-6883b, TOI-6457b, TOI-2537b, TOI-2295b, TOI-5893b, TOI-7176b, and TOI-7025b, with equilibrium temperatures between 307 and 800 K, provide valuable low-irradiation benchmarks for testing models of hot-Jupiter inflation.

*Speaker

Exoplanet interferometry in the mid-infrared with MATISSE

Mathis Houllé * ¹, Florentin Millour ², Jules Scigliuto ³, Bruno Lopez ⁴

¹ IPAG – IPAG Grenoble – France

² Observatoire de la Côte d’Azur – Institut National des Sciences de l’Univers, Centre National de la Recherche Scientifique – France

³ Observatoire de la Côte d’Azur – Université Côte d’Azur – France

⁴ Laboratoire Lagrange – Université Côte d’Azur, CNRS, OCA, Bd de l’Observatoire, Nice, France – France

Optical long-baseline interferometry can disentangle planetary and stellar signals at close separations ($< 0.3''$), providing precise astrometry and spectra of young giant planets, as demonstrated by the pioneering work with the VLTI/GRAVITY instrument in K band. Through its association with the fringe tracker of GRAVITY, the MATISSE instrument is now extending this capability to the mid-infrared. We will present the first demonstration on Beta Pictoris b, for which we obtained its first continuum spectrum between 2.8 and 5 μm (L & M bands), at a spectral resolution of 500. We will then present the ongoing efforts to reach fainter targets, such as the protoplanets of PDS 70 and their circumplanetary disk emission in the mid-infrared. The ongoing assessment of MATISSE’s detection limits is targeted towards Gaia DR4, which may detect dozens of companions accessible to MATISSE characterization in 2027.

*Speaker

FIRST-PL : H α differential imaging of protoplanets with a visible photonic lantern

Elsa Huby ^{*} ¹, Sebastien Vievard ², Sylvestre Lacour ¹, Manon Lallement ³, Mathias Nowak ⁴, Olivier Guyon ^{5,6,7,8}, Jehanne Sarrazin ⁴, Kim Yoo Jung ⁹

¹ LIRA, Observatoire de Paris – Observatoire de Paris – France

² University of Hawaii – United States

³ Institut de Planétologie et d’Astrophysique de Grenoble – Institut National des Sciences de l’Univers, Centre National d’Études Spatiales [Toulouse], Centre National de la Recherche Scientifique, observatoire des sciences de l’univers de Grenoble, Université Grenoble Alpes – France

⁴ LIRA, Observatoire de Paris – Paris Observatory – France

⁵ Subaru Telescope – United States

⁶ Steward Observatory, University of Arizona – United States

⁷ Wyant College of Optical Sciences [University of Arizona] – United States

⁸ Astrobiology Center of NINS – Japan

⁹ UCLA – United States

Accreting protoplanets can be detected and characterized through their H α emission, but such observations require high angular resolution and contrast at small separations. FIRST-PL is a post-AO instrument on the SCExAO platform at the Subaru Telescope, which recently passed commissioning and will be open for observations in the second semester of 2026. The photonic lantern (PL) is a device based on a particular optical fiber with a high photon throughput, placed in the focal plane of the telescope. It has several fiber outputs, which are imaged and dispersed at a spectral resolution of 3000 over the 630–800 nm range. The PL response depends on the input wavefront, producing distinct flux distributions, for instance depending on the presence of the on-axis star and an off-axis companion. By calibrating this spatial response and inverting the model, images can be reconstructed at each spectral channel, enabling integral-field capabilities at very high angular resolution. Several observing modes are offered, enabling ultra-precise spectro-astrometry on the H α line of compact objects and image reconstruction, including H α differential imaging, particularly suited to detecting and characterizing protoplanets.

*Speaker

Secondary gas discs in warm exo-asteroid belts

Paul Huet ^{*} ¹, Quentin Kral ²

¹ LIRA-Observatoire de Paris – LIRA, Observatoire de Paris, CNRS, Université PSL, Sorbonne Univ., Univ. Paris Cité, 92190 Meudon, France – France

² Laboratoire d'études spatiales et d'instrumentation en astrophysique = Laboratory of Space Studies and Instrumentation in Astrophysics – Institut National des Sciences de l'Univers, Observatoire de Paris, Sorbonne Université, Centre National de la Recherche Scientifique, Université Paris Cité – France

The relatively recent discovery of gas (carbon monoxide) in debris discs has revolutionised our understanding of the evolution of systems after the disappearance of the primordial disc. The mechanism for the formation of this gas through the sublimation of CO ice is widely supported by comparisons with observations. The observed discs are cold and located in the outer regions of their systems. However, there are also belts closer to their stars, near another ice line—the water ice line. This is notably the case in the Solar System with the asteroid belt. Thus, Kral et al. (2024) proposed a new mechanism explaining the origin of Earth's water through the formation of a secondary water gas disc in the Solar System.

We propose to extend the study of these types of discs to extrasolar systems. We have therefore modelled the evolution of such discs based on their characteristics, particularly the mass of the central star. The aim is to determine the typical features of these discs and, specifically, to predict if and when they are observable. These simulations also provide access to the mass of water accreted onto an inner planet.

*Speaker

Investigating aerosols as a way to reconcile K2-18 b JWST MIRI and NIRISS/NIRSpec observations

Adam Yassin Jaziri * ¹, Thomas Drant ²

¹ Laboratoire Atmosphères, Milieux, Observations Spatiales – Université de Versailles Saint-Quentin-en-Yvelines, Institut National des Sciences de l’Univers, Sorbonne Université, Centre National de la Recherche Scientifique – France

² ETH University, Center for Origin and Prevalence of Life, Department of Earth and Planetary Sciences – Switzerland

Recent JWST observations of the temperate sub-Neptune K2-18 b with NIRISS SOSS/NIRSpec G395H and MIRI LRS have yielded apparently inconsistent results: the MIRI spectra exhibit spectral features nearly twice as large as those seen at shorter wavelengths, challenging the high-metallicity, CH₄-rich nonequilibrium model that fits the NIRISS/NIRSpec data. We performed a suite of atmospheric retrievals on both datasets, including free-chemistry, nonequilibrium, and aerosol models, using laboratory-derived complex refractive indices for a variety of photochemical haze analogs. Free retrievals systematically output lower metallicities than inferred by self-consistent chemical disequilibrium models, and the inclusion of absorbing aerosols, especially CH₄-dominated, nitrogen-poor tholins, can further reduce the inferred metallicity by over an order of magnitude. These hazes reproduce the observed NIRISS slope through scattering and match MIRI features via C–H bending absorption near 7 μm , while yielding particle properties consistent with photochemical production in H₂-rich atmospheres. Although their inclusion improves the joint fit and reduces tension between datasets, it also significantly lowers the retrieved CH₄ abundance, highlighting degeneracies between metallicity, composition, and aerosol properties. Our results underscore the importance of aerosol absorption in interpreting temperate sub-Neptune spectra and motivate future JWST observations and laboratory work to break these degeneracies.

*Speaker

Exoplanets by the Thousands: A DR3 Glance at the Gaia DR4 Harvest

Flavien Kiefer * ¹

¹ LIRA – Institut National des Sciences de l’Univers, Observatoire de Paris, Université Paris Diderot - Paris 7, Sorbonne Université : UMR8109, Centre National de la Recherche Scientifique : UMR8109 – France

One of the primary goals of the Gaia mission is the detection of new exoplanets around stars in our Galaxy. This promise is now on the verge of being fulfilled, with the upcoming release of astrometric time series for the two billion stars monitored by Gaia, along with orbital solutions for millions of them. Already known planets are being rediscovered, and their previously inferred orbits refined, thanks to Gaia astrometry—either alone or in combination with Hipparcos data. These detections and characterizations demonstrate that Jupiter-like planets are within Gaia’s reach out to distances of ~ 100 pc from the Sun, with the prospect of discovering several thousand new exoplanets. In this review, I aim to summarize the current state of the art in exoplanet detection—both through Gaia-only analyses and in combination with other methods—highlighting recent developments, successes, and identified caveats based on Gaia DR3 data. Finally, I will raise a series of critical questions for the community, intended to stimulate discussion on how best to prepare for the upcoming Gaia data tsunami expected by the end of 2026, and to design efficient strategies for future follow-up efforts.

*Speaker

planet's structure. Accurate models of molten rock properties like viscosity, which can vary by orders of magnitude, are essential for such studies. Unfortunately, current models for predicting the viscosity of molten rocks are not readily applicable to extra-terrestrial magmas, owing to limits in the thermal, compositional and pressure ranges they cover. In this study, we first trained *gpvisc*, a new machine learning model for predicting molten magma viscosity, applicable in diverse scenarios, including magma oceans on lava planets. We then calculated the viscosity of K2-141 b's magma ocean under different compositions. Phase diagram calculations suggest that the dayside is fully molten, with extreme temperatures primarily controlling viscosity. Even in the absence of major volatiles (H, C, N), a tenuous rock-vapour atmosphere (0.1 bar) might exist around a 40° radius from the substellar point. At higher longitudes, atmospheric pressure drops, and by 90° , magma viscosity rapidly increases as solidification occurs. The nightside surface is likely solid, but previously estimated surface temperatures above 400 K imply a partly molten mantle, supporting geothermal flux through vertical convection.

Cold Giants in the Gaia Era

Anne-Marie Lagrange * ¹

¹ LESIA – PSL paris – France

Giant planets likely govern the assembly and long-term stability of planetary systems, including inner rocky worlds. Yet our knowledge is scarcest precisely where Solar System analogs reside, at $\sim 5\text{--}30$ au, because individual detection techniques (transits, RVs, high-contrast imaging, microlensing) each probe only a biased portion of the mass–semi major-axis plane. In this talk, I will present the results of surveys combining Gaia DR3 astrometry (and, when available, Gaia–Hipparcos proper-motion anomalies) with RV and high-contrast imaging. They reveal and characterize new outer companions around young stars, debris-disk systems, M stars, some being iconic systems. These newly identified planets will be prime targets for JWST and ELT imaging and atmospheric follow-up.

*Speaker

Atmospheric characterization of HIP 67522b with VLT/CRIRES+

Alexis Lavail * ¹

¹ Institut de recherche en astrophysique et planétologie – Institut National des Sciences de l’Univers : UMR5277, Université Toulouse III - Paul Sabatier, Observatoire Midi-Pyrénées, Centre National de la Recherche Scientifique : UMR5277, Institut National des Sciences de l’Univers, Centre National de la Recherche Scientifique – France

Young transiting exoplanets provide unique windows into planetary evolution during the critical first hundred million years when atmospheric escape and contraction are most active. We present VLT/CRIRES+ high-resolution transmission spectroscopy of HIP 67522b, a 17 Myr old planet with an extraordinarily low bulk density ($< 0.10 \text{ g cm}^3$) that makes it one of the most favorable targets for atmospheric characterization.

Using 92 spectra obtained in the K2166 band, we detect HO at 20σ and CO at 5σ -detection significances far exceeding typical ground-based observations-confirming the planet’s extremely extended atmosphere. A velocity offset of -2.7 km s^{-1} indicates day-to-night atmospheric circulation, while the rotation velocity constraint ($< 1.8 \text{ km s}^{-1}$ at 3σ) is consistent with tidal locking at this young age.

Our Bayesian retrievals yield a mass of $29.8 \pm 3 M_{\oplus}$, approximately twice the JWST-derived value of $13.8 M_{\oplus}$, creating a 3σ tension that questions the planet’s true nature. We derive a super-solar C/O ratio and a subsolar metallicity, results that are inconsistent with previous JWST constraints. Most intriguingly, we report a tentative 2σ detection of HDO with a D/H enrichment factor of ~ 1000 relative to the protosolar ratio, which would represent the first detection of deuterium in an exoplanet atmosphere.

Such extreme fractionation cannot arise from formation processes alone and would require extraordinarily rapid atmospheric escape, potentially driven by the intense XUV flux from this magnetically active, frequently flaring young star. These findings highlight both the power of combining space-based and ground-based observations and the challenges in reconciling different observational techniques. Further observations are essential to confirm the HDO detection and investigate whether young, highly irradiated planets routinely exhibit signatures of ongoing deuterium fractionation.

*Speaker

Whether it is inside or outside of the Solar System, the atmospheric structure of Neptune and Neptune like planets remains rather poorly constrained. On the observational side, JWST has opened the Pandora box with the observation of warm sub-Neptunes like K2-18b; thanks to their relatively large size compared to terrestrial planets. However, on the theoretical side, models of the atmospheric structure and dynamics of these atmospheres are relatively scarce. In particular, it has been proposed that water (or methane) condensation could shut down convection in planets where it is heavier than the background hydrogen rich atmosphere (like Neptune; Leconte et al. 2017). But the dynamics of this effect has never been studied in 3D and its impact of this on observations (in particular for exoplanets) has never been assessed.

I will show results from a 3D cloud-resolving model that we adapted to the study of temperate hydrogen rich atmospheres. This work shows how water condensation naturally shuts down convection in these objects as has been predicted by simple linear theory. Then, we will show how the thermal and compositional structure of these atmospheres is modified. Finally, we will discuss how the structure we find invalidates the possibility of oceans under the atmosphere of K2-18b.

Exoplanets demographics in the era of ELT

Lucile Mignon ^{*} ¹, Guillaume Chaverot ², Isabelle Boisse ³, Lucie Leboulleux ², Léna Parc ⁴

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Centre National de la Recherche Scientifique
– France

² Institut de Planétologie et d'Astrophysique de Grenoble – CNES – France

³ Laboratoire d'Astrophysique de Marseille (LAM) – INSU, CNRS : UMR7326, Aix Marseille
Université – Pôle de l'Étoile Site de Château-Gombert 38, rue Frédéric Joliot-Curie 13388 Marseille
cedex 13, France

⁴ Observatoire Astronomique de l'Université de Genève – Switzerland

The start of ELT operations within the next five to ten years will open a new window for exoplanet characterisation through reflected-light. Rather than focusing on theoretical performance limits or extrapolations from already known planets, this talk adopts a pragmatic perspective: around which stars are the most favourable candidates expected, and how many could realistically exist?

Using the currently known population of nearby stars, we estimate the number and nature of planets accessible in reflected light, based on recent planet occurrence rates derived by our team and state-of-the-art estimates of key planetary parameters, such as albedo and radius. This population approach provides realistic expectations volume of samples for the ELT era and offers a priority guide for identifying the most promising targets for future observations.

This work combines several areas of expertise within the French exoplanet community, including radial-velocity surveys, high-contrast imaging, atmospheric modelling, and instrumental development. It also highlights the importance of long-term, high-precision radial-velocity programmes, such as SOPHIE, SPIRou, NIRPS, HARPS, etc, in preparing the scientific return of ELT reflected-light observations. **Together, these ongoing efforts place the community in a strong position to prepare and fully exploit upcoming reflected-light capabilities with the ELT.**

*Speaker

Disequilibrium chemistry in the atmosphere of exoplanets

Cyril Markovitch * ¹

¹ Astrophysique Interprétation Modélisation – Commissariat à l'énergie atomique et aux énergies alternatives, Institut National des Sciences de l'Univers, Université Paris-Saclay, Centre National de la Recherche Scientifique, Université Paris Cité, Commissariat à l'énergie atomique et aux énergies alternatives : UMR_{E9005}, *Centre National de la Recherche Scientifique* : UMR₇₁₅₈, *Université Paris Cité* : UMR₇₁₅₈ – –France

Since the first discovery of a hot Jupiter in 1995 (Mayor & Queloz, 1995), and the detection of the atmosphere of one of them (Charbonneau et al., 2002) the accurate modeling of exoplanetary atmospheres has become central to understand planet formation, chemical composition, and whether their pressure and temperature conditions support the existence of liquid water at their surfaces. With the advent of *JWST* and the forthcoming *ARIEL* mission, increasingly precise atmospheric spectra will be available, revealing chemical signatures that challenge traditional models based solely on thermochemical equilibrium. A striking example is the detection of SO in the atmosphere of WASP-39b, which cannot be explained by equilibrium chemistry alone (Tsai et al., 2023). These observations highlight the crucial role of disequilibrium processes. Recent investigation of disequilibrium chemistry has explored the effects of stellar irradiation and vertical transport (Evans-Soma et al., 2025; Tsai et al., 2023). In this work, we take a step further, and explore **non-thermal chemistry driven by fast hydrogen atoms**. Such energetic atoms can overcome activation barriers and trigger endothermic reactions inaccessible to the thermal gas. Non-thermal chemistry has been shown to play a key role in Titan's atmospheric chemistry, notably in the formation of complex organic molecules (Hörst et al., 2012) and has been investigated in the context of atmospheric escape (Shematovich, 2010). However, its impact on **chemical reaction networks within exoplanet atmospheres** remains largely unexplored.

Here, we investigate whether non-thermal chemistry can significantly alter the atmospheric composition of exoplanets. To address this question, we define new rate coefficients that do not consider a Maxwellian energy distribution of species. For instance, the photodissociation of H₂ will give two fast H atoms, which will then mostly elastically interact with the gas, lose their energy until reaching the thermal energy. We track those fast hydrogens with a Monte-Carlo code to reconstruct their energy distribution which will deviate from the Maxwellian distribution. We applied our new Monte-Carlo code to fast hydrogen atoms evolving in an atmosphere of H, H₂ and He.

Our results demonstrate substantial deviations from Maxwellian distribution of velocities and emphasize the importance of incorporating **quantum mechanical cross sections for elastic scattering**. Comparisons with existing literature validate our approach. This work lays the foundation for incorporating non-thermal chemistry into self-consistent atmospheric models, with future applications to realistic exoplanet atmospheres observed by *JWST*.

References

*Speaker

- García Muñoz, A., Asensio Ramos, A., & Faure, A. (2024). NLTE modelling of water-rich exoplanet atmospheres. Cooling and heating rates. *Icarus*, *415*, 116080. <https://doi.org/10.1016/j.icarus.2024.116080>
- Hörst, S. M., Yelle, R. V., Buch, A., Carrasco, N., Cernogora, G., Dutuit, O., Quirico, E., Sciamma-O'Brien, E., Smith, M. A., Somogyi, Á., Szopa, C., Thissen, R., & Vuitton, V. (2012). Formation of Amino Acids and Nucleotide Bases in a Titan Atmosphere Simulation Experiment. *Astrobiology*, *12*(9), 809–817. <https://doi.org/10.1089/ast.2011.0623>
- Madhusudhan, N. (2019). Exoplanetary Atmospheres: Key Insights, Challenges, and Prospects. *Annual Review of Astronomy and Astrophysics*, *57*(1), 617–663. <https://doi.org/10.1146/annurev-astro-081817-051846>
- Mayor, M., & Queloz, D. (1995). A Jupiter-mass companion to a solar-type star. *Nature*, *378*(6555), 355–359. <https://doi.org/10.1038/378355a0>
- Moses, J. I., Visscher, C., Fortney, J. J., Showman, A. P., Lewis, N. K., Griffith, C. A., Klippenstein, S. J., Shabram, M., Friedson, A. J., Marley, M. S., & Freedman, R. S. (2011). DISEQUILIBRIUM CARBON, OXYGEN, AND NITROGEN CHEMISTRY IN THE ATMOSPHERES OF HD 189733b AND HD 209458b. *The Astrophysical Journal*, *737*(1), 15. <https://doi.org/10.1088/0004-637X/737/1/15>
- Shematovich, V. I. (2010). Suprathermal hydrogen produced by the dissociation of molecular hydrogen in the extended atmosphere of exoplanet HD 209458b. *Solar System Research*, *44*(2), 96–103. <https://doi.org/10.1134/S0038094610020024>
- Tsai, S.-M., Lee, E. K. H., Powell, D., Gao, P., Zhang, X., Moses, J., Hébrard, E., Venot, O., Parmentier, V., Jordan, S., Hu, R., Alam, M. K., Alderson, L., Batalha, N. M., Bean, J. L., Benneke, B., Bierson, C. J., Brady, R. P., Carone, L., ... Yurchenko, S. N. (2023). Photochemically produced SO₂ in the atmosphere of WASP-39b. *Nature*, *617*(7961), 483–487. <https://doi.org/10.1038/s41586-023-05902-2>

3D simulation of 55 Cnc e's climate and clouds

Maxime Maurice ^{* 1}, Aurélien Falco ², Benjamin Charnay ³, Elsa Ducrot ⁴, Martin Turbet ⁵, Jeremy Leconte ³, Spandan Dash ⁶, Alice Maurel ⁵, Yangcheng Luo ⁵, Sebastien Charnoz ⁶

¹ Laboratoire Magmas et Volcans – Institut de Recherche pour le Développement, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, Université Clermont Auvergne – France

² Observatoire de la Côte d'Azur – Université Côte d'Azur – France

³ Laboratoire d'Astrophysique de Bordeaux [Pessac] – Université de Bordeaux, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique – France

⁴ Observatoire de Paris – Centre National de la Recherche Scientifique, Université Paris sciences et lettres – France

⁵ Laboratoire de Météorologie Dynamique (UMR 8539) – Institut National des Sciences de l'Univers, Ecole Polytechnique, Sorbonne Université, Centre National de la Recherche Scientifique, Département des Géosciences - ENS-PSL, Ecole Nationale des Ponts et Chaussées – France

⁶ Institut de Physique du Globe de Paris – Institut National des Sciences de l'Univers, Institut National de l'Information Géographique et Forestière [IGN], Université de la Réunion, Institut de Physique du Globe de Paris, Centre National de la Recherche Scientifique, Université Paris Cité – France

Due to the high signal-to-noise of their observations, highly irradiated, ultra-short period exoplanets are the best target for the characterization of rocky exoplanets and interior-atmosphere interactions. Whether or not such exoplanets can retain a volatile-rich, secondary atmosphere, is key to our understanding of the cosmic shoreline and more generally of exoplanetary atmospheres. Recently, it was suggested that the highly irradiated super-Earth 55 Cnc e could have a carbon-rich secondary atmosphere. In this case, this atmosphere would be further affected by the evaporation of refractory species from its day-side magma ocean. Refractory vapors would condense upon temperature drop, forming clouds at the terminator and possibly on the night-side. Atmospheric composition and clouds would have a major impact on emission spectroscopy as well as on the thermal phase curve of the planet, potentially explaining the observed variability of eclipses of 55 cnc e. In this contribution, we will present 3D GCM simulations of the climate of 55 Cnc e accounting for the evaporation/condensation/precipitation of refractory species, and discuss perspectives of observations of this exoplanet by JWST.

*Speaker

The GPI reanalysis with PACO: the largest survey of young stars to date and a new circumbinary planet

Johan Mazoyer ^{* 1}, Vito Squicciarini ², Anne-Marie Lagrange ³, Christian Wilkinson ⁴, Antoine Chomez ⁴, Philippe Delorme ⁵, Olivier Flasseur ⁶, Flavien Kiefer ⁴, Stephane Bergeon ⁷, Alice Radcliffe ³, Evelyne Alecian ⁷, Damien Albert ⁷, Nadège Meunier ⁷

¹ LIRA – Observatoire de Paris, Observatoire de Paris-Université PSL, Centre National de la Recherche Scientifique - CNRS – France

² University of Exeter – United Kingdom

³ LIRA – Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université, 5 place Jules Janssen, 92195 Meudon, France – France

⁴ LIRA – Observatoire de Paris-Meudon, Observatoire de Paris Meudon – France

⁵ Institut de Planétologie et d’Astrophysique de Grenoble – Institut National des Sciences de l’Univers, Centre National d’Études Spatiales [Toulouse], Centre National de la Recherche Scientifique, observatoire des sciences de l’univers de Grenoble, Université Grenoble Alpes – France

⁶ Centre de Recherche Astrophysique de Lyon (CRAL) – Ecole Normale Supérieure de Lyon, Université Claude Bernard Lyon 1, Institut National des Sciences de l’Univers, Centre National de la Recherche Scientifique – 9 Avenue Charles André 69561 ST GENIS LAVAL CEDEX, France

⁷ IPAG – Université Grenoble Alpes – France

Radial velocity studies targeting evolved stars have shown that giant planets are more commonly found around metal-rich hosts, around more massive stars, and tend to be clustered around the ice line. However, the critical 5-20 au region, where Jupiter and Saturn reside, is poorly constrained by this method. Direct imaging (DI), the only method capable of targeting planetary systems in their infancy, has the potential to fill this gap. While waiting for groundbreaking technological advancements such as those predicted for the ELT and Roman, state-of-the-art post-processing algorithms can enable the detection of faint companions that had been previously overlooked in archival data.

Within the ERC-funded COBREX project, we collected hundred of archival observations from the ground-based DI instruments GPI; these data were uniformly reduced using the PACO algorithm. We will present the results of this endeavor: the re-analysis of 400 stars from the GPIES survey (Squicciarini, Mazoyer et al 2025a), the largest survey of young stars to date. Thanks to the exquisite detection sensitivity and the large sample size, we derived the most precise constraints on wide giant planet frequency ever obtained by DI, allowing for a comparison with the competing giant planet formation models of core accretion and gravitational instability. In addition to this, the project led to the discovery of a 6 M_{Jup} planet orbiting the binary HD 143811, the second planet detected with GPI (Squicciarini, Mazoyer et al 2025b). HD 143811 b is one of the few circumstellar planets to be imaged to date, and the first one with a < 100 au. Its peculiarities raise exciting questions about its formation and its relationship with single-star companions and free-floating planets - urging for dedicated orbital and spectroscopic follow-up studies.

*Speaker

Is the line bisector a reliable indicator of supergranulation-induced radial velocity variations?

Nadège Meunier * ¹, Sophia Sulis ², Lionel Bigot ³, Niamh O’sullivan ⁴,
Thierry Roudier ⁵

¹ IPAG – Université Grenoble Alpes – France

² Laboratoire d’astrophysique de Marseille – CNRS : UMR7326 – France

³ Joseph Louis LAGRANGE – Université Nice Sophia Antipolis (1965 - 2019), Institut National des Sciences de l’Univers, Observatoire de la Côte d’Azur, Université Côte d’Azur, Centre National de la Recherche Scientifique – France

⁴ Denys Wilkinson Building, Department of Physics, University of Oxford – United Kingdom

⁵ Institut de recherche en astrophysique et planétologie – Institut National des Sciences de l’Univers, Centre National de la Recherche Scientifique, Université de Toulouse – France

Stellar supergranulation is a major astrophysical limitation to the detection and characterization of small exoplanets. Many processes, involving magnetic structures and flows at different spatial and temporal scales, affect the measurement of radial velocities and prevent the detection of low-mass exoplanets such as Earth analogues. Among those processes, supergranulation is expected to have an amplitude around 80 cm/s for Sun-like stars, which impedes the search for planets at long orbital periods such as in the habitable zone around solar-type stars with expected signal around 10 cm/s. This will be a limitation for the PLATO follow-up. After a brief overview of those processes and a focus on supergranulation, we will present an original approach to evaluate if line shape properties could be used to mitigate radial velocity variation due to supergranulation. For that purpose, time series of 3D MHD simulations of granulation are rescaled based on supergranulation properties in order to simulate the contribution of spectral lines due to supergranulation, at different positions on the disk. Those are then integrated over the full disk. We will present the first results and conclude with a comparison with solar HARPS-N observations.

*Speaker

Exoplanet detection limits of Gaia DR4 astrometry

Tung Lam Nguyen * ¹, Anne-Marie Lagrange ¹, Flavien Kiefer ¹

¹ LIRA – Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université, 5 place Jules Janssen, 92195 Meudon, France – France

The forthcoming Gaia Data Release 4 (DR4) will open new horizons for exoplanet detection through epoch astrometry. We explore the detection thresholds by simulating and analyzing Gaia astrometric time series across ranges of orbital parameters and companion masses. The accuracy of recovered parameters primarily depends on the ratio of the astrometric signature to the total measurement noise, which can be considered as the signal-to-noise ratio. Degeneracy arises for orbital periods exceeding Gaia DR4's 5.5 yr baseline, where multiple models are able to explain the same astrometric data. Complementary data from other techniques and instruments will be essential to fully exploit Gaia epoch astrometry.

*Speaker

Energetics of star–planet magnetic interactions: Novel insights from 3D modelling

Arghyadeep Paul * ¹, Antoine Strugarek ^{1,2}

¹ LDE3, CEA Paris Saclay – Département d’Astrophysique, IRFU – France

² CEA Saclay (CEA) – CEA – 91191 Gif-sur-Yvette cedex, France

Star–planet magnetic interactions (SPMIs) in the sub-Alfvénic regime are believed to generate localized chromospheric hotspots on host stars due to a transfer of power from the planet back to the host star, and also offer a potential observational probe of exoplanetary magnetic fields. However, existing analytical scaling laws for SPMI powers often differ by orders of magnitude from each other. In this work, we use 3D numerical simulations of planets orbiting within sub-Alfvénic stellar winds to establish a robust upper limit on the power transferred from a planet to its host star. By systematically varying planetary properties and local stellar wind conditions, we derive a numerically calibrated scaling law for the interaction power. We find that commonly used analytical prescriptions, though showing a similar trend, may underestimate the total power of SPMIs. Our results highlight the importance of the extended Alfvén wing structure interacting with the stellar wind, rather than the planetary obstacle alone, and also demonstrate that direct extrapolation from Jovian planet–moon analogies to star–planet systems requires caution due to fundamental differences in local plasma conditions.

*Speaker

Modelling the Milky Way exoplanet population

Chloé Padois * ¹

¹ Universitat de Barcelona – Spain

The number of detected exoplanets increased significantly in the last decade, finally allowing us to study the exoplanet population from a Galactic point of view. But the detected population is not completely representative of the entire exoplanet population, due to observational biases. Aiming to simulate a realistic Galactic exoplanet population, we combine planetary formation models and our best knowledge of stellar and exoplanet statistics. We present the process we developed to generate a synthetic exoplanet population, from any given stellar population, considering the relation between exoplanet occurrence rates and host-star properties.

In order to test our generated exoplanet population, we simulated exoplanets in the Kepler field of view, reproducing the selection function of Kepler’s exoplanet census. Comparing our simulated ”detectable” planets and the exoplanets detected by Kepler, we identified the model parameters to refine to obtain an even more realistic simulation (e.g. the absence of the observed radius gap).

We also generate exoplanet populations in different regions of the simulated Galaxy. Our results suggest that terrestrial planets, even if they are largely underrepresented in current detections, are extremely abundant in all regions of the Galaxy.

We apply the same exoplanet creation process to the future PLATO long-duration phase fields to estimate the number of detectable planets and compare our estimate with existing studies, and will extend it to other future missions in the future, like Gaia NIR.

*Speaker

Nouvelles détections de planètes et dernières nouvelles du programme de suivi à long terme du SLS pour la recherche d'exoplanètes proches avec SPIRou

Charpentier Paul * ¹, Claire Moutou ²

¹ Institut de recherche en astrophysique et planétologie – Université Toulouse III - Paul Sabatier, Centre National de la Recherche Scientifique, Centre National de la Recherche Scientifique : UMR5277 – France

² Institut de recherche en astrophysique et planétologie (IRAP) – Université Toulouse III - Paul Sabatier, Institut National des Sciences de l'Univers, Observatoire Midi-Pyrénées, Centre National de la Recherche Scientifique – France

Les naines M sont des cibles privilégiées pour la recherche d'exoplanètes en raison de leur fréquence et de la meilleure détectabilité des planètes de faible masse par vitesse radiale (VR). Les progrès récents en instrumentation ont étendu les observations de VR du domaine optique à l'infrarouge (IR), permettant une étude plus efficace des naines M, qui abritent fréquemment des planètes rocheuses. Le domaine IR offre une sensibilité accrue aux VR et des signaux d'activité stellaire potentiellement réduits, ce qui le rend particulièrement adapté à ces étoiles. Pour les étudier, nous utilisons le spectropolarimètre infrarouge SPIRou, pour caractériser leur activité stellaire, leur champ magnétique et rechercher des signaux planétaires. La haute résolution de ce spectromètre permet une étude raie-par-raie et l'utilisation d'outils statistiques avancés afin d'extraire un maximum d'information contenu dans les spectres. Ces dernières avancées ont permis entre autres d'extraire et d'introduire de nouveaux indicateurs d'activité robustes, de mieux comprendre la nature des signaux d'activité stellaire dans les VR, et enfin de découvrir de nombreuses nouvelles exoplanètes. Leur découverte contribue au recensement des systèmes planétaires proches et offre des cibles prometteuses pour les futures études.

*Speaker

Next-Generation Exo-REM Atmosphere Models: Application to VHS 1256 b to Emulate Patchy Clouds

Alice Radcliffe ^{*} ¹, Benjamin Charnay ¹, Anne-Marie Lagrange ¹, Flavien Kiefer ¹

¹ LIRA – Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université, 5 place Jules Janssen, 92195 Meudon, France – France

Clouds are a defining feature of brown dwarf and exoplanet atmospheres, producing a broad range of colours on the colour–magnitude diagram. Cloud cover is likely to be inhomogeneous in many objects, with observed rotational variability offering a key hint at thick and thin cloud zones being exposed over time. Yet current one-dimensional (1D) atmosphere models, often lacking any parameter to tune cloud optical thickness, typically fail to adequately characterise highly cloudy substellar objects, especially those with complex cloud structures.

We have recently addressed these limitations by upgrading the previous Exo-REM atmosphere model (Charnay et al. 2018), and by devising a more nuanced approach to better describe heterogeneous cloud cover on directly-imaged objects with pre-computed 1D grids. To this end, we have computed new grids of models (Exo-REM k26*), from low- to high-resolutions: these incorporate a cloud sedimentation parameter, *f*_{sed}, to govern cloud opacity and thus enabling even the reddest of objects to be accessed on a CMD, revealing a trend of decreasing *f*_{sed} along the L–T transition. Crucially, we have devised a two-column forward modeling framework to better emulate objects with patchy clouds, whereby they are mimicked with a linear combination of two spectra with the same bulk properties but differing cloud optical thickness. Applying Exo-REM k26 in this framework to the notoriously variable VHS 1256 b achieves a significantly improved global fit compared to all previous attempts using single 1D models (Petrus et al. 2024, Lueber et al. 2024). We find that a ~ 50-50% split of thick and thin clouds best describes its atmosphere, further confirming the hypothesis of patchy clouds. In particular, with this approach we achieve a successful fit of the strong 10 μ m silicate cloud absorption in the MIRI/MRS data of VHS 1256 b, where previous 1D grids failed, owing to the formerly unexplored low-*f*_{sed} regime in the new model. Notably, our best-fit model of the JWST spectrum proves to fit closer than that of a global circulation model for VHS 1256 b (Tan et al. 2025), owing to the disequilibrium chemistry included in Exo-REM.

In summary, we wish to present the novelties of Exo-REM k26, how to use the models in a two-column framework, as well as the result we achieve on VHS 1256 b (Radcliffe et al. *subm.*). We establish the next-generation Exo-REM k26 grids as a robust framework for interpreting future observations: the addition of the *f*_{sed} dimension, as well as the two-column approach for inhomogeneous cloud distributions, prove vital for accurately characterizing cloudy sub-stellar objects. As we move towards bridging the gap between directly imaged and close-in exoplanets in the imminent ELT era, these techniques will be crucial in paving the way for studying smaller and cooler worlds, ultimately bringing us closer to understanding the full diversity of planetary systems.

* https://lesia.obspm.fr/exorem/YGP_grids/Exo-REMk26/

*Speaker

First brown dwarf mid-infrared spectrum with VLTI/MATISSE: HD984B

Jules Scigliuto ^{*} ¹, Florentin Millour ^{*}

², Bruno Lopez ^{*}

2

¹ Laboratoire Lagrange – Université Côte d’Azur, CNRS, OCA, Bd de l’Observatoire, Nice, France –
France

² Laboratoire Lagrange – Université Côte d’Azur, CNRS, OCA, Bd de l’Observatoire, Nice, France –
France

Interferometry is opening a new window on the study of substellar companions by extending spectral characterization beyond the limits of direct imaging. After the successes of GRAVITY in the K band, the MATISSE instrument now enables the observation of exoplanets and brown dwarfs in the mid-infrared, where the star–companion contrast is more favorable and molecular signatures become particularly rich. With its four-telescope beam combination, long baselines, and the GRA4MAT off-axis fringe tracking upgrade, MATISSE provides the sensitivity and stability required to isolate faint companion signals at angular separations inaccessible to single-aperture facilities.

In this presentation, I will present the mid-infrared interferometric characterization of HD 984 B, a young brown dwarf orbiting at a small angular separation from its host star. The L, M, and N bands covered by MATISSE probe deep atmospheric layers and contain key diagnostic features, including absorption from H₂O, CO, and CH₄, as well as signatures of silicate and iron clouds. These spectral constraints allow us to probe the effective temperature, surface gravity, cloud properties, and atmospheric composition of HD 984 B, providing valuable insight into the physics of young, low-mass substellar atmospheres.

HD 984 B is significantly fainter and closer to its host star than previously studied targets such as beta Pictoris b, placing it near the sensitivity limits of MATISSE. Its observation therefore constitutes a stringent test of mid-infrared interferometric techniques. To enable this measurement, I developed dedicated data processing tools and optimized observational strategies designed to enhance signal extraction for low-flux companions. These results demonstrate that MATISSE can now access a new regime of colder and more challenging substellar objects, paving the way for the systematic interferometric characterization of brown dwarfs and young giant exoplanets in the mid-infrared.

*Speaker

Atmospheric Wind Measurements as Probes of Magnetic Fields in Ultra-Hot Jupiters

Julia Seidel * ¹, Vivien Parmentier ¹

¹ Joseph Louis LAGRANGE – Observatoire de la Côte d’Azur, Université Côte d’Azur – France

The magnetic field strengths is arguably one of the most important characteristics of planets with far reaching implications from atmospheric retention to habitability. Nonetheless, current scaling laws are based on Solar System and stellar measurements and predict values for exoplanets that differ by orders of magnitude. Ultra-hot Jupiters, with the strong ionisation of their atmospheres, provide a unique opportunity to empirically constrain these scaling laws given that the magnetic forces should directly affect atmospheric circulation.

In this talk, I present a comparative study of atmospheric wind measurements via the iron signature of known transiting ultra-hot Jupiters observed with ESPRESSO and MAROON-X. We reanalyse all available data for a homogeneous population survey and measure the wind speed of day-to-night winds in the upper atmosphere over a broad range of equilibrium temperatures.

We identify a clear and monotonic decrease in wind speed with increasing temperature. This behaviour is inconsistent with purely hydrodynamic circulation models but is naturally reproduced when magnetic drag is included. Interpreting the observed trend implies atmospheric magnetic field strengths of at most a few Gauss, comparable to Jupiter’s field strength.

These results establish observational constraints on magnetic fields in hot giant exoplanets and demonstrate that magnetic effects are a primary regulator of atmospheric circulation in strongly irradiated regimes. They provide a concrete benchmark for magnetic scaling laws and demonstrate the power of population studies in deducing secondary characteristics of the exoplanet population.

*Speaker

Preparation for Gaia DR4: simulations of epoch astrometry for non-single stars

Katia Sivkova * ¹

¹ Observatoire de Paris – Observatoire de Paris–Meudon – France

The third Gaia data release (DR3) demonstrated Gaia’s capability for exoplanet detection using astrometric data. However, this analysis relied on conservative cuts to avoid spurious solutions and on Gaia data alone, potentially leading to prominent sources remaining undetected, as epoch astrometry was not published in DR3.

In the fourth Gaia data release (DR4), epoch astrometry will be released to the community for the first time, allowing for a more careful treatment of potential candidates and for synergy with ground based data. The data are expected to be published at the end of 2026, making this an ideal moment to prepare for the next data release.

We present a Python tool to simulate Gaia epoch astrometry for binary systems, whether the companion is visible or not. The simulations require orbital parameters of the system. We use the black hole system BH3, previously discovered by the Gaia consortium, as a test case to validate the approach.

By testing the tool on BH3 and several well-known binary systems, we find that Gaia DR3 proper motion measurements are biased when orbital motion is not considered, and that this bias can be corrected. Orbital motion is also suspected to be a major source of bias in parallax measurements in some cases. These effects have not yet been tested on exoplanet systems and will be investigated in future analyses.

By simulating Gaia epoch astrometry, which is not yet publicly available, this work prepares future DR4 analyses applicable to all types of companions. The approach specifically targets sources that may be missed by the conservative Gaia Non-Single Star treatment.

*Speaker

Thermodynamics of miscibility and its implications for the structure of sub-Neptunes

Paolo Sossi * ¹

¹ Institute of Geochemistry and Petrology [ETH Zürich] – Switzerland

Les sub-Neptunes – planètes ” gonflées ” dotées d’atmosphères (” enveloppes ”) riches en hydrogène représentant jusqu’à plusieurs pour cent de leur masse – offrent désormais une nouvelle perspective sur les processus de formation planétaire. Leurs compositions non solaires et les pressions gigapascals qui y règnent placent les enveloppes des sub-Neptunes au-delà de leurs points critiques, conditions où leur structure et leur constitution internes restent largement indéterminées. Par conséquent, on ignore encore si les sub-Neptunes abritent des environnements habitables ou des surfaces analogues à la Terre primitive. Si les systèmes riches en hydrogène ont historiquement été négligés en raison de leur pertinence limitée pour la Terre actuelle et de la difficulté à maintenir des conditions riches en hydrogène à haute pression, nous examinons ici les propriétés thermodynamiques pertinentes pour comprendre leurs équilibres de phase. L’objectif est de déterminer quelles architectures de sub-Neptunes sont physiquement stables, comment les compositions atmosphériques sont liées à la structure profonde et pourquoi les sub-Neptunes évitent une accréation de gaz efficace qui les conduirait à devenir des géantes gazeuses.

*Speaker

Unveiling the composition of inner disks with JWST to enable the interpretation of the composition of planetary atmospheres

Benoît Tabone * ^{1,2}, Pacôme Estève ³, Emilie Habart ⁴, Ewine Van Dishoeck ⁵, Thomas Henning ⁶

¹ Institut d'astrophysique spatiale – Institut National des Sciences de l'Univers, Université Paris-Saclay, Centre National de la Recherche Scientifique, Centre National de la Recherche Scientifique : UMR8617 – France

² IAS – Université Paris-Saclay, Sorbonne Universités – France

³ IAS – Université Paris-sacaly – France

⁴ IAS – Paris-Saclay Universty – France

⁵ Leiden Observatory – Netherlands

⁶ Max Planck Institute for Astronomy – Germany

Planets form, migrate, and obtain their elemental composition in disks orbiting young stars (a few Myrs). The elemental composition of gas and solids in disks is expected to vary with time and distance to the star due to various processes such as the radial drift of icy pebbles, chemical reactions, and sublimation of ices. One of the emerging opportunities for the exoplanet community is to constrain the formation history of planets by measuring the elemental composition of their atmospheres. This is a driving science goal of JWST and the future ELT, and constitutes the scientific ground of the ARIEL mission. However, linking the composition of planets to their formation history can only be done if the distribution of elements between gas and solids in disks is observationally constrained. With its extensive spectroscopic capabilities in the near- and mid-IR, JWST is now providing a unique access to the composition of planet-forming regions of disks.

In this contribution, I will review the first results obtained with JWST, which has extensively surveyed over 200 planet-forming disks with full spectroscopy from at least 5 to 27 micron (MIRI-MRS). This unique sample will eventually provide us with vital constraints on the chemical composition of gas and solids around stars of various stellar types to enable the interpretation of the composition of planets. I will highlight three results that demonstrate the unique potential but also the limitations of JWST, namely :

1) The discovery of an extremely rich hydrocarbon chemistry (benzene, C₂H₂, C₄H₂) in the disks around very low-mass stars, brown dwarfs, and even planetary-mass companions, hinting at the potential destruction of refractory carbon. This process could lead to the formation of carbon-poor rocky planets around M-dwarf (e.g. TRAPPIST 1).

2) The signature of drifting icy pebbles, which enriches the inner disk in oxygen in the gas-phase, leading to metal-rich and low C/O atmospheres of gas-giants formed inside the water snowline.

3) The composition of the inner disks of planet-hosting disks like PDS 70, highlighting the impact of forming giant planets like Jupiter on the formation of inner planets like our own.

Along with these first results, I will present the modelling approaches we are developing to retrieve the composition of the gas and dust from the JWST spectra. This talk will highlight the need for synergies between the characterization of exoplanets, falling into the perimeter of the AT-Exosystèmes, and the observations of disks, typically covered by the AT-PS and PCMI.

*Speaker

New planetary-mass companions found in debris disks using Gaia

Sven Toucheboeuf ^{*} ¹, Anne-Marie Lagrange ¹, Flavien Kiefer ¹, Pascal Rubini ¹, Julien Milli ², Luca Matrà ³, Hervé Beust ², Clément Perrot ¹, Mathilde Mâlin ⁴, Anthony Boccaletti ¹, Christian Wilkinson ¹, Philippe Delorme ²

¹ LIRA – Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université, 5 place Jules Janssen, 92195 Meudon, France – France

² Univ. Grenoble Alpes – CNRS, IPAG, F-38000 Grenoble, France – France

³ School of Physics, Trinity College Dublin, the University of Dublin, College Green, Dublin 2, Ireland – Ireland

⁴ STScI, Steven Muller Building, 3700 San Martin Drive, Baltimore, MD 21218, USA – United States

When spatially resolved, debris disks often exhibit structures (gaps, rings, spirals) that may indicate the presence of unseen planetary-mass companions. We use Gaia data and the Gaia-Hipparcos proper motion anomaly (PMA) together with the GaiaPMEX tool (Kiefer et al. 2024) to detect unseen planets in the 94 systems with resolved debris disks. When companions are identified, we combine the GaiaPMEX results with high-contrast imaging and radial velocity data to further constrain their mass and orbital properties.

We will present the results of this survey, and in particular, the new planetary-mass companions found. Some, found in multiple systems, call for revised dynamical modeling of planet-planet or planet-disk interactions. Current or upcoming facilities, VLTI/Gravity, JWST/AMI, or ELT, will provide improved orbital and possibly spectral characterization of these companions.

We will also present new candidate companions, as well as meaningful upper limits on the possible presence of companions in the 0-100 au range around a few emblematic stars and stars hosting well-defined ring-like structures.

*Speaker

On the preferential locations for planet formation in protoplanetary disks

Marion Villenave * ¹

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

To form giant planets during protoplanetary disk lifetime, small micron sized particles must grow rapidly to larger grains. Characterizing the radial and vertical structure of these gas-rich disks around young stars is crucial for understanding this process. More specifically, important vertical concentration of solids, allowed by efficient vertical settling, is particularly favorable for efficient planet formation and growth. This presentation will discuss recent results constraining vertical dust concentration as a function of radius in protoplanetary disks. While vertical settling is typically efficient in the outer disk, some systems display intermediate regions ($<$ half the disk radius) with reduced settling efficiency, making these area less conducive to efficient planet formation. This suggests that planet formation might be more efficient at large orbital distances from the star, challenging our current understanding of the mechanisms at play.

*Speaker

Speeding-up atmospheric retrievals by linearising Mie theory

Maël Voyer * ¹, Quentin Changeat ²

¹ Astrophysique Interprétation Modélisation – Commissariat à l'énergie atomique et aux énergies alternatives, Institut National des Sciences de l'Univers, Université Paris-Saclay, Centre National de la Recherche Scientifique, Université Paris Cité, Commissariat à l'énergie atomique et aux énergies alternatives : UMR_{E9005}, *Centre National de la Recherche Scientifique* :

UMR₇₁₅₈, Université Paris Cité : UMR₇₁₅₈ – France

² Kapteyn Astronomical Institute [Groningen] – Netherlands

The unprecedented wavelength coverage and sensitivity of the James Webb Space Telescope (JWST) permits to measure the absorption features of a wide range of condensate species from Silicates to Titan tholins. However, including the optical properties of condensed particles within retrieval frameworks remains computationally expensive, limiting our ability to fully exploit JWST observations. In this talk, I will present how we improve the computational efficiency and scaling behavior of aerosol models in atmospheric retrievals. In our recently accepted paper (Voyer & Changeat (2026), accepted for A&A) we pre-compute extinction efficiency (Q_{ext}), scattering efficiency (Q_{scat}) and asymmetry parameter (g) grids for seven condensate species (Silicates and Titan tholins). The pre-computed Q_{ext} grids significantly reduce computation time between 1.4 and 17 times with negligible differences on the retrieved parameter. They are freely available on Zenodo and represent a significant step forward to handle both high information content (JWST) and population level datasets (ARIEL).

*Speaker

Composition and dynamics of exocomets around Beta Pic.

Théo Vrignaud * ¹, Alain Lecavelier ¹

¹ IAP – Institut d’Astrophysique de Paris, Institut d’Astrophysique de Paris. – France

Exocomets are comets orbiting other stars than the Sun. They can be detected when their tails transit their host stars, either in photometry (for dust tails) or spectroscopy (for gaseous tails). As tracers of volatile-rich material in young planetary systems, exocomets provide a unique opportunity to probe the interactions between small bodies and forming or recently formed exoplanets. For decades, exocomets have been observed transiting the young star Beta Pictoris (20 Myr), primarily via variable absorption features in atomic lines (Ca II, Fe II, Mg II, etc). However, their element compositions could never be constrained, neither in the Beta Pic system nor in any other system, due to a lack of appropriate data and to a poor understanding of the chemistry of exocometary tails. In this talk, I will present the results of a new observation campaign of Beta Pic with the Hubble Space Telescope (Program 17790, PI. T. Vrignaud), specifically designed to measure the C/Fe ratios of individual exocomets through observations in C I and Fe II lines. This program led to the detection of several new exocomets, for which large C/Fe ratios were measured (C/Fe = 10-30 in all objects). This represents the first measurement of the composition of individual small bodies outside the Solar System. The composition of Beta Pic exocomets appear to be consistent with Solar System comets (e.g. C/Fe = 16 for 1P/Halley), indicating that both populations share a similar nature: objects rich in volatiles and formed far from their host stars. In addition, constraints on the transit distances of the detected objects ($d \sim 1$ au) indicate that exocomets around Beta Pic could be actively transporting volatiles to the inner system, with a potential impact on the composition of exoplanets in the habitable zone.

*Speaker

Gone with the wind: the outward migration of eccentric giant planets in wind-launching disks

Gaylor Wafflard-Fernandez * ¹

¹ Institut de Planétologie et d'Astrophysique de Grenoble – Université Grenoble Alpes – France

Recent studies indicate that circumstellar disks exhibit weak turbulence, with their dynamics and evolution being primarily influenced by magnetic winds. However, most numerical studies have focused on planet-disk interactions in disk models with prescribed turbulence. In this talk, I aim to explore the complex interactions between a Jovian planet and a magnetized wind-driven accretion disk via high-resolution 3D global non-ideal magneto-hydrodynamic (MHD) simulations, using the GPU-accelerated code IDEFIX. In particular, I will focus on the orbital and eccentricity evolution of the planet, as well as the back-reaction of the planet on the gas behavior and the wind dynamics. I will show that slow outward migration and eccentricity growth appear to be common outcomes of planet-disk-wind interactions, which may contribute significantly to both the long orbital periods and the moderate eccentricities of warm jupiters. Additionally, eccentric massive protoplanets embedded in circumstellar disks could play a role in generating structured outflows.

*Speaker

MIRI Direct Imaging of Exoplanets: Coronagraphic and Non-Coronagraphic Performance in the Background-Limited Regime

Jonas Wehrung-Montpezat ^{* 1}, Anthony Boccaletti ¹, Anne-Marie Lagrange ^{1,2}, Clément Perrot ¹, Christian Wilkinson ¹, Mathilde Mâlin ³

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, CY Cergy Paris Université – France

² Institut de Planétologie et d'Astrophysique de Grenoble – Institut National des Sciences de l'Univers, Centre National d'Études Spatiales [Toulouse], Centre National de la Recherche Scientifique, observatoire des sciences de l'univers de Grenoble, Université Grenoble Alpes – France

³ Space Telescope Science Institute – United States

The Mid-Infrared Instrument (MIRI) onboard JWST has recently demonstrated its ability to directly image cold exoplanets, notably through the detection of TWA 7b and Eps Ind Ab in coronagraphic mode (Lagrange et al. 2025; Matthews et al. 2024). Motivated by future observing strategies, we investigate the relative performance of MIRI's coronagraphic and non-coronagraphic imaging (NCI) modes in the background-limited regime.

We estimate detection limits from coronagraphic observations of TWA 7 and Eps Ind A and compare them to limits derived from F1500W imaging data obtained on white dwarfs and on M-dwarf stars from the Hot Rocks survey. The analysis reveals a significant discrepancy between the noise levels measured in several NCI datasets and the predictions from the JWST Exposure Time Calculator, with observed noise exceeding expectations by up to an order of magnitude for long integrations. This excess noise does not average down with exposure time and exhibits correlations consistent with detector reset-related systematics.

We show that these effects are strongly mitigated in datasets that include dedicated background observations, dithering, and higher group counts, as illustrated by both coronagraphic observations and white dwarf imaging data. In contrast, Hot Rocks observations, originally designed for transit spectroscopy and therefore not optimized for direct imaging, are particularly affected by time-correlated noise, complicating a direct comparison with coronagraphic performance.

Our results highlight the critical role of detector systematics and observing strategy when assessing MIRI high-contrast capabilities. An objective comparison between coronagraphic and non-coronagraphic imaging requires dedicated datasets acquired with comparable observational setups. These findings have important implications for the design of future JWST programs targeting exoplanet direct imaging in the mid-infrared.

*Speaker

Low-frequency radio emissions from stellar and exoplanetary systems

Philippe Zarka ^{* 1,2}, Cyril Tasse ³, Xiang Zhang ^{1,4}, Corentin Louis ¹,
Emilie Mauduit ^{1,2}, Jean-Mathias Griessmeier ^{2,5}, Jake Turner ⁶, Laurent
Lamy ^{1,7}, Julien Girard ^{1,2}, Alan Loh ^{1,2}, Quentin Duchêne ⁸, Benjamin
Poux-Bouret ⁸

¹ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, CY Cergy Paris Université – France

² Observatoire Radioastronomique de Nançay – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Université d'Orléans – France

³ Laboratoire d'étude de l'Univers et des phénomènes eXtrêmes – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université – France

⁴ CSIRO – Australia

⁵ Laboratoire de Physique et Chimie de l'Environnement et de l'Espace – Institut National des Sciences de l'Univers, Université d'Orléans, Centre National de la Recherche Scientifique, Centre National d'Études Spatiales [Paris] – France

⁶ Department of Astronomy, Cornell University – United States

⁷ Laboratoire d'Astrophysique de Marseille – Aix Marseille Université, Institut National des Sciences de l'Univers, Centre National d'Études Spatiales [Toulouse], Centre National de la Recherche Scientifique – France

⁸ Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, CY Cergy Paris Université – France

After a long and difficult period of emergence, the detection of low-frequency radio bursts from star-planet interactions and exoplanetary magnetospheres is now reaching maturity. Dozens of detections of circularly polarized radio bursts have been obtained with the LOFAR and NenuFAR radiotelescopes, thanks to the development at Observatoire de Paris of a new powerful method combining the advantages of imaging and time-frequency analysis, well adapted to the detection of slow polarized transients. Applied to SKA, this method will hopefully bring many hundred more detections. The theoretical framework to interpret these bursts is well-developed, based on the physics of Solar system planetary magnetospheres' dynamics and of radio emission generation, embedded in simulation codes such as Palantir (to predict emitted frequencies and flux densities) and ExPRES (to interpret observed dynamic spectra). I will summarize the state-of-art of this research field at the crossing of star-planet plasma interactions, comparative exo-magnetospheric physics, and exo-space weather.

*Speaker

opening of the Sub-Neptunes and Magma Ocean session

Sebastien Charnoz * 1,2

¹ IPGP – Institut de Physique du Globe de Paris – France

² Université Paris Cité /IPGP/CNRS – Université Paris Cité, Institut de physique du globe de Paris,
CNRS, F-75005 Paris, France – France

opening of the Magma Ocean session

*Speaker

The Gaia spectroscopic catalogue of exoplanet and host star parameters

Patrick De Laverny * ¹

¹ Observatoire de la Cote d'Azur (OCA) – CNRS : UMS2202 – B.P. 4229 06304 Nice Cedex 4, France

A new, large and homogeneous catalogue of precise exoplanet host star (EHS) and exoplanet properties will be presented. It is based on Gaia/DR3 astrometric, photometric, and GSP-Spec spectroscopic data, complemented by some ground-based spectroscopic survey informations. The catalogue contains the stellar atmospheric parameters, luminosity, radius, mass, Galactic kinematic and orbital properties for 2573 host stars. The mass and radius of 3556 exoplanets were then rescaled, fully consistently with the stellar data. This catalogue can be adopted to study individual planets, planet populations, and planet formation within their Galactic context.

It is found that the EHS population is rather diverse in their chemical and Galactic properties, although they are all found in the Solar vicinity, close to the Local spiral arm. Most EHS belong to the thin disc, but some older thick disc and halo members have also been identified. Moreover, the stellar effective temperatures, luminosities, and radii are found to be more precise than literature values. For instance, the new stellar radii allow to reduce significantly the uncertainty on the planetary radii uncertainties, leading to a finer analysis of the planet evaporation valley around $1.8 R_{\oplus}$. Other planet properties were also explored as, for instance, the increase of the average planet radius with the metallicity of the host star.

Finally, the future updates of this catalogue thanks to the Gaia/DR4 data will be discussed, including present works on the chemical properties of the host stars.

*Speaker

Author Index

- Al, Et, 32
Albert, Damien, 48
Alecian, Evelyne, 48
Allart, Romain, 2, 4
Almenara Villa, Jose, 11, 28
Aramanekoppa, Aniruddha, 5
- Babusiaux, Carine, 6
Bali, Komal, 12
Baruteau, Clément, 26
Baudoz, Pierre, 7
Bazinet, Luc, 4
Benilan, Yves, 20
Bergeon, Stephane, 48
Beust, Hervé, 60
Bhat, Junaid Ramzan, 8
Bigot, Lionel, 49
Boccaletti, Anthony, 9, 60, 65
Boisse, Isabelle, 44
Bonduelle, Myriam, 10
Bonfils, Xavier, 11, 28
Bonnefoy, Mickaël, 16
Bouchy, François, 4
Boukaré, Charles-Edouard, 38
Bourrier, Vincent, 2
Brogi, Matteo, 23
Burn, Remo, 12
- Caracas, Razvan, 13
Carteret, Yann, 2
Chabrol, Estelle, 14
Changeat, Quentin, 62
Charnay, Benjamin, 16, 42, 47, 54
charnoz, sebastien, 23, 47, 67
Chauvin, Gaël, 16
Chaverot, Guillaume, 17, 44
Chebly, Judy, 18
Chiavassa, Andrea, 19
Chomez, Antoine, 48
Clément, Noé, 42
Collado, Alexandro, 20
Coulombe, Louis-Philippe, 2
Courtoux, Margot, 21
- Daban, Jean-Baptiste, 11, 28
- Damonte, Andrea, 22
Dang, Lisa, 2
Dash, Spandan, 23, 47
de Laverny, Patrick, 68
De Regt, Sam, 16
Debras, Florian, 14
Delfosse, Xavier, 4, 17
Delorme, Philippe, 48, 60
Denis, Allan, 16
Destriez, Florian, 25
Dorn, Caroline, 12
Doyon, René, 4
Drant, Thomas, 36
Duchêne, Quentin, 66
Ducrot, Elsa, 14, 47
- Estève, Pacôme, 59
Evelain, Siméo, 26
- Falco, Aurélien, 23, 47
Feingesicht, Maxime, 20
Ferraina, Clément, 38
Flasseur, Olivier, 48
Fleury, Benjamin, 20
Fray, Nicolas, 20
- García Muñoz, Antonio, 8, 22, 27
Gauvrit, Luke, 28
Girard, Julien, 66
Gourvès, Clémence, 29
Gressier, Amélie, 30
Griessmeier, Jean-Mathias, 66
Grouffal, Salomé, 31
Guerlet, Sandrine, 42
Guillot, Tristan, 11, 28
Guyon, Olivier, 34
- Habart, Emilie, 59
Heidari, Neda, 32
Henning, Thomas, 59
Houllé, Mathis, 33
Huby, Elsa, 34
Huet, Paul, 35
HÉBRARD, Guillaume, 25, 32

Jaziri, Adam Yassin, 36
 JOLLY, Antoine, 20

 Kiefer, Flavien, 16, 25, 37, 48, 50, 54, 60
 Kral, Quentin, 35

 Lacour, Sylvestre, 34
 Lafrenière, David, 2
 Lagage, Pierre-Olivier, 23
 Lagrange, Anne-Marie, 25, 40, 48, 50, 54, 60, 65
 Lallement, Manon, 34
 Lamy, Laurent, 66
 Landsheere, Xavier, 20
 Lavail, Alexis, 14, 41
 LE LOSQ, Charles, 38
 Leboulleux, Lucie, 44
 Lecavelier, Alain, 63
 Leconte, Jeremy, 42, 47
 Loh, Alan, 66
 Lopez, Bruno, 33, 55
 Louis, Corentin, 66
 Luo, Yangcheng, 47
 Luque, Rafael, 12

 Markovitch, Cyril, 45
 Masson, Adrien, 14
 Matrà, Luca, 60
 Mauduit, Emilie, 66
 Maurel, Alice, 47
 Maurice, Maxime, 47
 Mazoyer, Johan, 48
 Meunier, Nadège, 48, 49
 Micela, Giuseppina, 22
 MIGNON, Lucile, 4, 17, 44
 Milcareck, Gwenaël, 42
 Milli, Julien, 10, 60
 Millour, Ehouarn, 42
 Millour, Florentin, 33, 55
 Moutou, Claire, 53
 Mâlin, Mathilde, 60, 65
 Méheut, Héloïse, 26

 Nguyen, Tung Lam, 50
 Nowak, Mathias, 34

 O'Sullivan, Niamh, 49

 Padois, Chloé, 52
 Palma-Bifani, Paulina, 16
 PARC, Léna, 44
 Parmentier, Vivien, 56
 PAUL, Arghyadeep, 51

 Paul, Arghyadeep, 29
 Paul, Charpentier, 53
 Pelletier, Stefan, 4
 Perrin, Zoé, 20
 Perrot, Clément, 60, 65
 Poch, Olivier, 10
 Poux-Bouret, Benjamin, 66

 Radcliffe, Alice, 16, 48, 54
 Ravet, Mathieu, 16
 Roudier, Thierry, 49
 Rubini, Pascal, 60

 Santerne, Alexandre, 31
 Sarrazin, Jehanne, 34
 Scigliuto, Jules, 33, 55
 Seidel, Julia, 56
 Seidler, Fabian, 23
 Selsis, Franck, 42
 Sivkova, Katia, 57
 Sossi, Paolo, 58
 Sossi, Paolo A., 23, 38
 Spiga, Aymeric, 42
 Splinter, Jared, 2
 Squicciarini, Vito, 48
 Strugarek, Antoine, 29, 51
 Sulis, Sophia, 49

 Tabone, Benoît, 59
 Tasse, Cyril, 66
 Team, ASTEP, 28
 Team, SOPHIE, 32
 Teinturier, Lucas, 16
 Toucheboeuf, Sven, 60
 Tremblin, Pascal, 23
 Triquet, Sylvain, 20
 turbet, martin, 47
 Turner, Jake, 66

 Valencia, Diana, 8
 van Dishoeck, Ewine, 59
 Vaulato, Valentina, 4
 Veillet, Roméo, 20
 Venot, Olivia, 20, 42
 Vievard, Sebastien, 34
 Vigan, Arthur, 16
 Villenave, Marion, 61
 Vinatier, Sandrine, 14
 Voyer, Maël, 62
 Vrignaud, Théo, 63

 Wafflard-Fernandez, Gaylor, 64
 Wehrung-Montpezat, Jonas, 65

Wilkinson, Christian, 48, 60, 65

Yoo Jung, Kim, 34

Zapf, Pascal, 20

Zarka, Philippe, 66

Zhang, Xiang, 66