ExoPlanet News
An Electronic Newsletter

No. 195, 9 September 2025

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https://nccr-planets.ch/exoplanetnews

Contents

1 Editorial

Welcome to Edition 194 of ExoPlanet News!

This month, as usual, we bring you abstracts of scientific papers, job ads, conference announcements, and an overview of exoplanet-related articles on astro-ph. Thanks a lot to all of you who contributed to this issue of the newsletter!

For next month, we look forward to continuing receiving your submissions of paper abstracts, job ads, or meeting announcements. Special announcements are also welcome. As always, we would also be happy to receive feedback concerning the newsletter. The LaTeX template (v2.0) for submitting contributions, as well as all previous editions of ExoPlanet News, can be found on the ExoPlanet News webpage (`https://nccr-planets.ch/exoplanetnews/`).

The next issue will appear on Tuesday, September 9th (with a submission deadline ending on Sun September 7th, 2025 CEST).

Thanks again for your support, and best wishes from the editorial team.

Leander Schlarmann
Haiyang Wang
Jeanne Davoult
Timm-Emanuel Riesen

2 Abstracts of refereed papers

The changing transit shape of TOI-3884 b

H. Chakraborty[1] , *J.M. Almenara*[1,2] , *M. Lendl*[1] , *D. Ehrenreich*[1] , *F. Bouchy*[1] , *X. Bonfils*[2] , *R. Dancikova*[3] , *A. Deline*[1] , *S. Khan*[3] , *H. Netzel*[3,4] , *M. Shinde*[1] , *A. Verdier*[3]

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Astronomy & Astrophysics, Accepted (arXiv:2509.04297),

TOI-3884 b is a sub-Saturn transiting a fully convective M-dwarf. Observations indicate that the transit shape is chromatic and asymmetric as a result of persistent starspot crossings. This, along with the lack of photometric variability of the host star, indicates that the rotational axis of the star is tilted along our line of sight and the planet-occulted starspot is located close to the stellar pole. We acquired photometric transits over a period of three years with the Swiss 1.2-meter Euler telescope to track changes in the starspot configuration and detect any signs of decay or growth. The shape of the transit changes over time, and so far no two observations match perfectly. We conclude that the observed variability is likely not caused by changes in the temperature and size of the spot, but due to a slight ($5.64 \pm 0.64^{\circ}$) misalignment between the spot center and the stellar pole, i.e., a small spin-spot angle (Θ). In addition, we were able to obtain precise measurements of the sky-projected spin-orbit angle (λ) of $37.3 \pm 1.5^{\circ}$, and the true spin-orbit angle (ψ) of 54.3 $pm1.4^{\circ}$. The precise alignment measurements along with future atmospheric characterisation with the James Webb Space Telescope will be vital for understanding the formation and evolution of close-in, massive planets around fully convective stars.

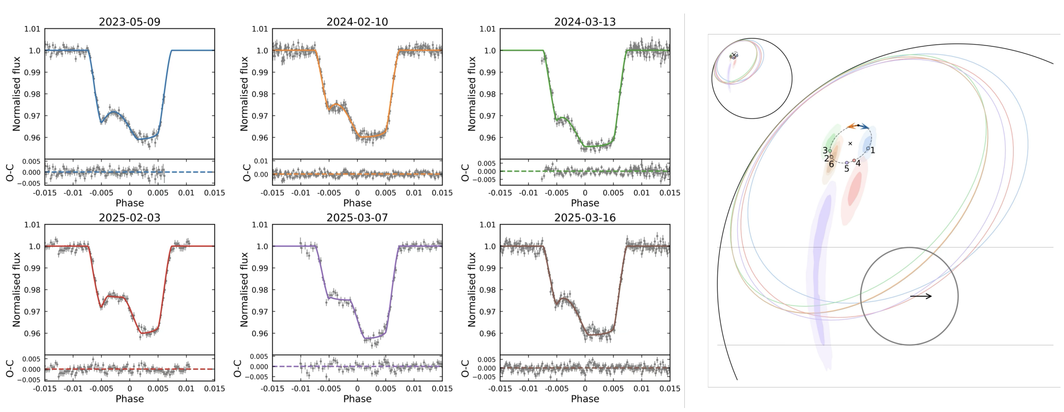

Figure 1: *Left:* Phase-folded EulerCam light curves of TOI-3884 b. The best-fit `PyTranSpot` models accounting for the misalignment between stellar spin-axis and spot center are overlaid. *Right:* Posterior positions of the spot center on the stellar surface, along with spot sizes (solid lines), as constrained from individual EulerCam transits. The transit path is shown as horizontal lines, while the planet, depicted as a circle, contains an arrow indicating its direction of the movement. The stellar spin axis is marked as a black cross.

Download/Website: `https://arxiv.org/abs/2509.04297`

Contact: `Hritam.Chakraborty@unige.ch`

On inertial forces (indirect terms) in problems with a central body

A. Crida[1], C. Baruteau[2], P. Griveaud[1], E. Lega[1], F. Masset[3], W. Béthune[4,5], J.-F. Gonzalez[6], H. Méheut[1], A. Morbidelli[1,7], F. Gerosa[1], D. Kloster[1], L. Marques[8,9,10], A. Miniussi[11], K. Minker[8,1], G. Pichierri[12,13], P. Segrétain[1]

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The Open Journal of Astrophysics, published, Vol. 8, July 2025 (2025OJAp....8E..84C)

Gravitational systems in astrophysics often comprise a body – the primary – that far outweights the others, and which is taken as the centre of the reference frame. A fictitious acceleration, also known as the indirect term, must therefore be added to all other bodies in the system to compensate for the absence of motion of the primary. In this paper, we first stress that there is not *one* indirect term but as many indirect terms as there are bodies in the system that exert a gravitational pull on the primary. For instance, in the case of a protoplanetary disc with two planets, there are three indirect terms: one arising from the whole disc, and one per planet. We also highlight that the direct and indirect gravitational accelerations should be treated in a balanced way: the indirect term from one body should be applied to the other bodies in the system that feel its direct gravitational acceleration, and only to them. We point to situations where one of those terms is usually neglected however, which may lead to spurious results. These ideas are developed here for star-disc-planets interactions, for which we propose a recipe for the force to be applied onto a migrating planet, but they can easily be generalized to other astrophysical systems.

Download/Website: `https://astro.theoj.org/article/141682-on-inertial-forces-indirect-terms-in-problems-with-a-central-body`

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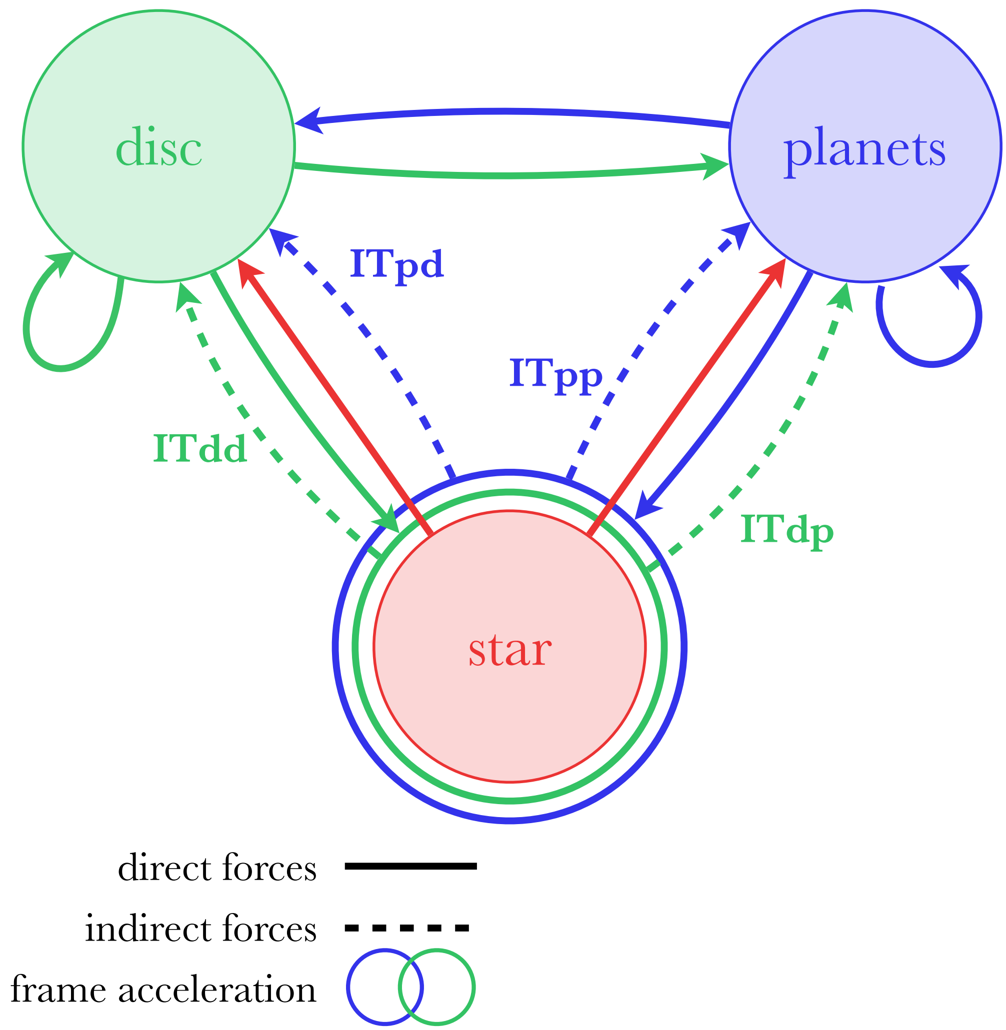

Figure 2: Summary of all forces applied in a gravitational system comprised of a star, a protoplanetary disc and a planet, in a frame centred on the star. Solid arrows show direct gravitational forces, while dashed arrows show the corresponding indirect forces. Two circles, blue and green, surround the star that symbolise the acceleration felt by the star from the gravitational pull of the corresponding objects (blue for the planet and green for the disc). This acceleration is the driver of the indirect terms felt by each object. One can see 4 different indirect terms, arising from the disc or the planets, and applied to the disc or the planets (labeled ITdd, ITdp, ITpd and ITpp).

The reflex instability: exponential growth of a large-scale $m = 1$ mode in astrophysical discs

A. Crida[1], C. Baruteau[2], J.-F. Gonzalez[3], F. Masset[4], P. Segrétain[1], P. Griveaud[1,5], H. Méheut[1], E. Lega[1]

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The Open Journal of Astrophysics, published, Vol. 8, August 2025 (2025OJAp....8E.115C)

We report the finding of a linear, non-axisymmetric, global instability in gas discs around stars, which may be relevant to other astrophysical discs. It takes the form of an $m = 1$ mode that grows in the disc density distribution while the star-barycentre distance rises exponentially with a characteristic timescale that is orders of magnitude longer than the orbital period. We present results of hydrodynamical simulations with various codes and numerical methods, using either barycentric or stellocentric reference frames, with or without the disc's self gravity: all simulations consistently show an unstable mode growing exponentially.

The instability disappears if, and only if, the reflex motion of the star due to the disc's asymmetry is not taken into account in the simulations. For this reason we refer to this instability as the *reflex instability*. We identify a feedback loop as a possible origin, whereby the acceleration of the star excites the eccentricity of the disc, yielding an $m = 1$ mode in the density distribution which, in turn, pulls the star. The growth timescale of the instability decreases with increasing disc mass and is a few hundred orbits for disc-to-star mass ratios of a few percent.

If truly physical, and not due to a numerical artifact that would be common to all the codes we have employed, the reflex instability could have a dramatic impact on protoplanetary discs evolution and planetary formation.

Download/Website: https://astro.theoj.org/article/143230-the-reflex-instability-exponential-growth-of-a-large-scale-m-1-mode-in-astrophysical-discs

Contact: crida@oca.eu

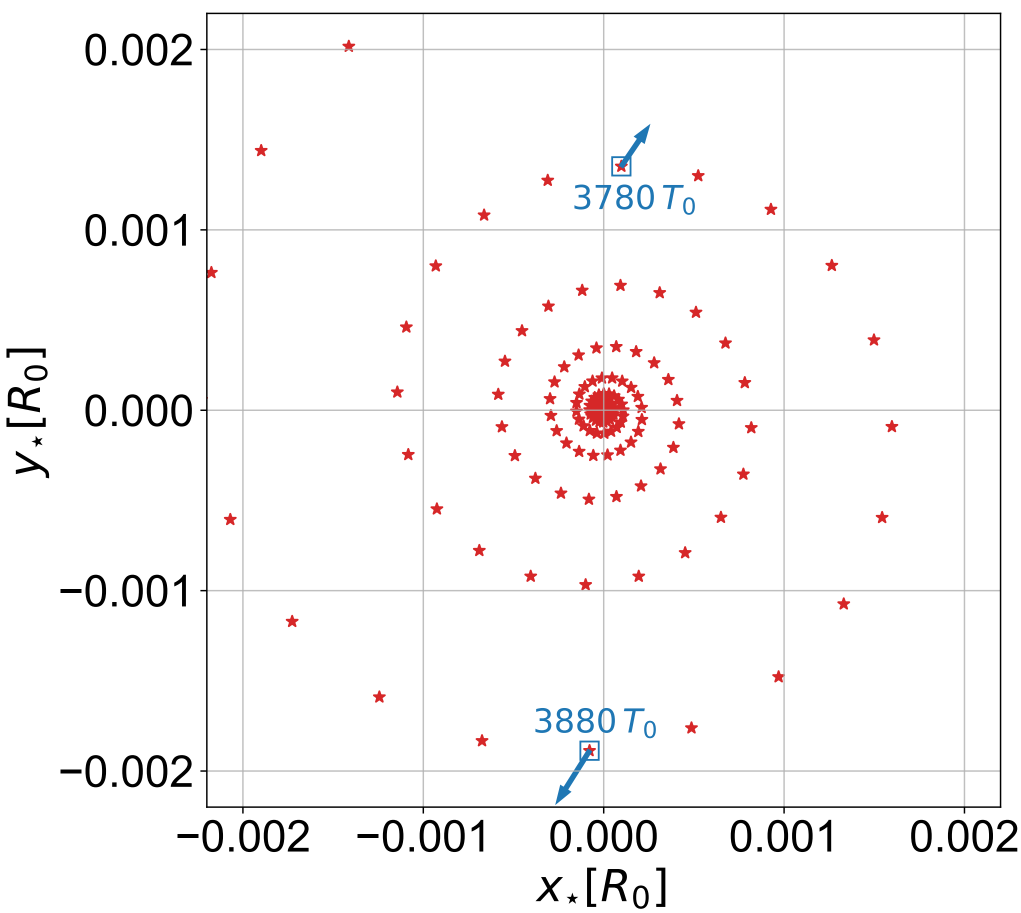

Figure 3: Position of the star in the barycentric frame, in a numerical simulation using FARGO-2D1D, starting from an axisymmetric gas disc, without planet. The star exponentially runs away from the centre-of-mass, following a logarithmic spiral. The acceleration exerted by the disc on the star is shown at two different times (arrows).

TOI-2322: two transiting rocky planets close to the stellar rotation period and its first harmonic

M. J. Hobson (1), A. Suárez Mascareño (2, 3), C. Lovis (1), F. Bouchy (1), B. Lavie (1), M. Cretignier (4), A. M. Silva (5, 6), S. G. Sousa (5, 6), H. M. Tabernero (7, 8), et al. (a complete list of authors can be found on the publication)

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Astronomy & Astrophysics, in press (arXiv:2508.18094)

Context: Active regions on the stellar surface can induce quasi-periodic radial velocity (RV) variations that can mimic planets and mask true planetary signals. These spurious signals can be problematic for RV surveys such as those carried out by the ESPRESSO consortium.
Aims: Using ESPRESSO and HARPS RVs and activity indicators, we aim to confirm and characterise two candidate transiting planets from TESS orbiting a K4 star with strong activity signals.
Methods: From the ESPRESSO FWHM, TESS photometry, and ASAS-SN photometry, we measure a stellar rotation period of $21.28 \pm 0.08\,\mathrm{d}$. We jointly model the TESS photometry, ESPRESSO and HARPS RVs, and activity indicators, applying a multivariate Gaussian process (GP) framework to the spectroscopic data.
Results: We are able to disentangle the planetary and activity components, finding that TOI-2322 b has a $11.307170^{+0.000085}_{-0.000079}$ d period, close to the first harmonic of the rotation period, a $\leq\ 2.03 M_{\oplus}$ mass upper limit and a $0.994^{+0.057}_{-0.059}\,\mathrm{R}_{\oplus}$ radius. TOI-2322 c orbits close to the stellar rotation period, with a $20.225528^{+0.000039}_{-0.000044}$ d period; it has a $18.10^{+4.34}_{-5.36}\,\mathrm{M}_{\oplus}$ mass and a $1.874^{+0.066}_{-0.057}\,\mathrm{R}_{\oplus}$ radius.
Conclusions: The multivariate GP framework is crucial to separating the stellar and planetary signals, significantly outperforming a one-dimensional GP. Likewise, the transit data is fundamental to constraining the periods and epochs, enabling the retrieval of the planetary signals in the RVs. The internal structure of TOI-2322 c is very similar to that of Earth, making it one of the most massive planets with an Earth-like composition known.

Download/Website: `https://arxiv.org/abs/2508.18094`

Contact: `melissa.hobson@unige.ch`

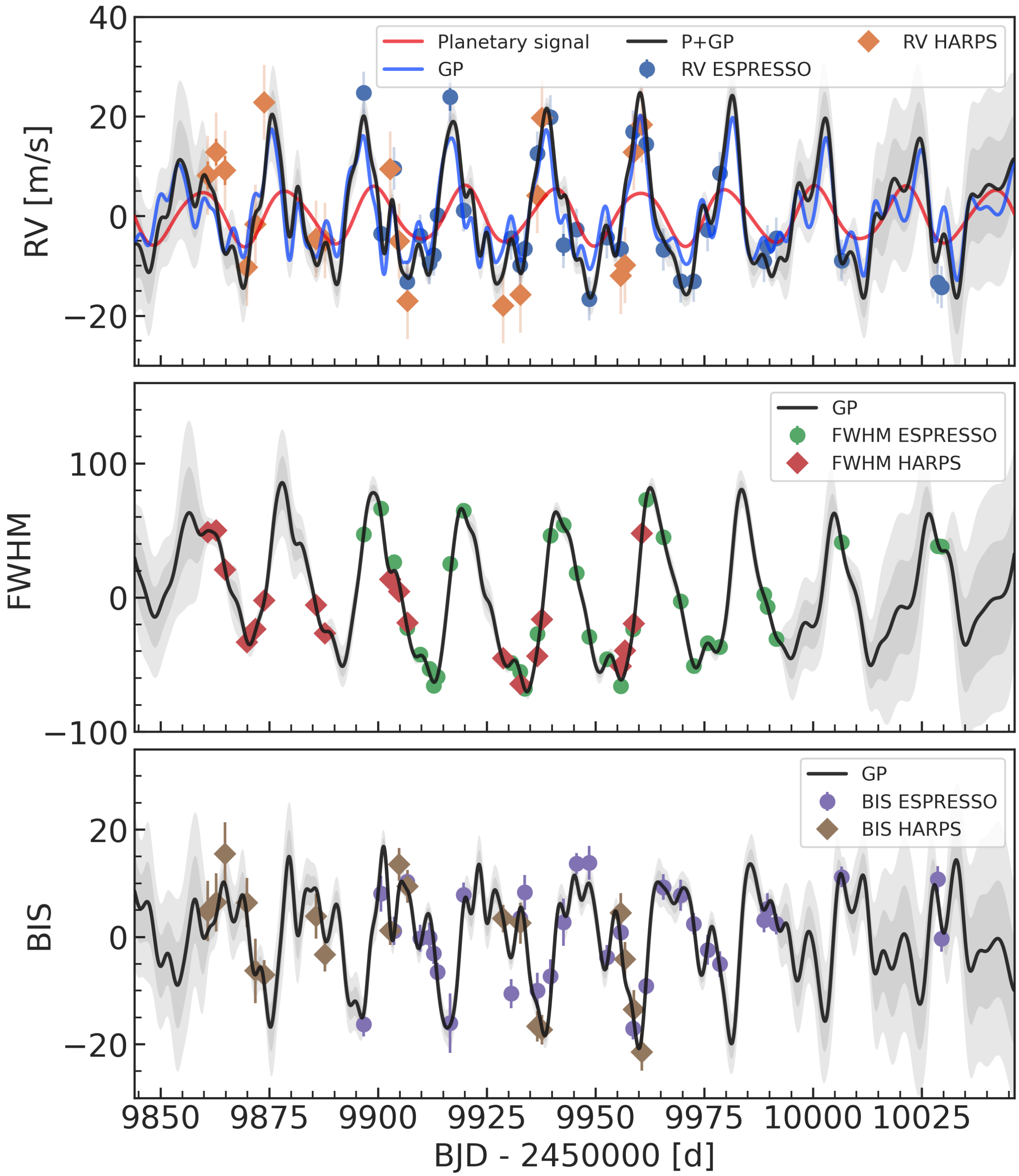

Figure 4: Top: ESPRESSO RVs (blue dots), HARPS RVs (orange diamonds), model components (GP: blue, Keplerian: red), and median model (black) for the `pyaneti` 2c model. Centre: ESPRESSO (green dots) and HARPS (and red diamonds) FWHM values and joint GP model (black). Bottom: ESPRESSO (purple dots) and HARPS (brown diamonds) BIS values and joint GP model (black). In all panels, solid error bars show the pipeline errors, semi-transparent error bars the added jitter, and dark and light grey regions the 1σ and 2σ confidence intervals. The systemic offsets have been subtracted.

Proto-planetary disk composition-dependent element volatility in the context of rocky planet formation

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The Astrophysical Journal, in press (arXiv:2509.03724)

The inferred compositions of the Solar System terrestrial (rocky) bodies are fractionated from that of the Sun, where elemental depletions in the bulk rocky bodies correlate with element volatility, expressed in its 50% condensation temperature. However, because element volatility depends on disk gas composition, it is not mandated that elemental fractionation trends derived from the solar-terrestrial scenario apply to other planetary systems. Here, we expand upon previous efforts to quantify element volatility during disk condensation, and how this affects rocky planet compositional diversity. We simulate condensation sequences for a sample of 1,000 initial disk compositions based on observed stellar abundances. Based on these simulations, we present parametrisations of how element 50% condensation temperatures depend on disk composition, and apply element fractionation trends with appropriate element volatilty to stellar abundances to simulate compositions of rocky exoplanets with the same volatile depletion pattern as the Earth, providing a robust and conservative lower limit to the compositional diversity of rocky exoplanets. Here we show that Earth-like planets emerge from low-C/O disks ($\mathrm{C/O} \leq 0.75$) and graphite-bearing planets from medium-to-high-C/O disks ($\mathrm{C/O} > 0.75$). Furthermore, we identify an intermediate-C/O (0.84–1.04) class of planets characterized by Mg and Si depletion, leading to relatively high abundances of Fe, Ca, and Al. We show that devolatilisation patterns could be adapted potentially with disk composition-dependent condensation temperatures to make predictions of rocky planet bulk compositions within individual systems, although such patterns could be further modified by the dynamics of planetary accretion that remains under-constrained for most of exoplanetary systems. The outcomes of our analysis suggest that accounting for disk composition-dependent condensation temperatures means that we can expect an even broader range of possible rocky planet compositions than has previously been considered.

Download/Website: `http://arxiv.org/pdf/2509.03724`

Contact: `spaargaren@astro.rug.nl`

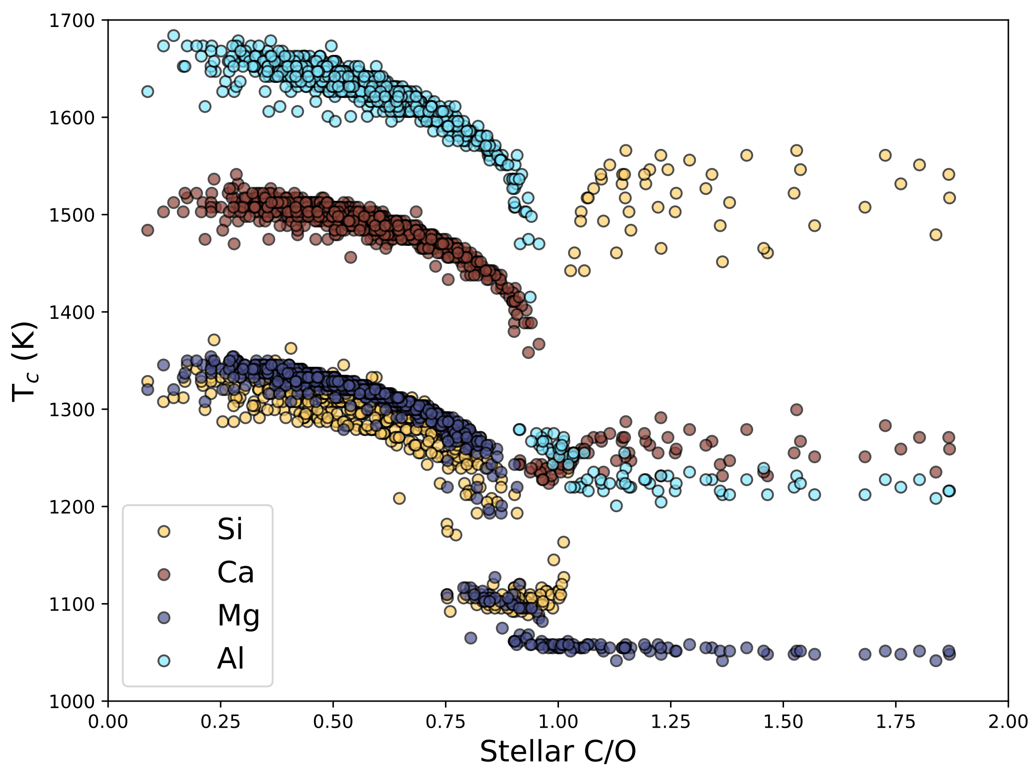

Figure 5: Condensation temperatures (T_c) of the rock-forming elements Mg, Si, Ca, and Al, plotted against the molar C/O ratio in disks, based on stellar $\epsilon_{\mathrm{C}}/\epsilon_{\mathrm{O}}$ values (top).

3 Jobs and Positions

Courtois Scientific Vanguard Fund UdeM FAS Postdoctoral Fellowship at the Trottier Institute for Research on Exoplanets (IREx)

Prof. René Doyon

Montréal, Canada, Starting date: January to September 2026

The Trottier Institute for Research on Exoplanets (IREx) at the Université de Montréal invites applications for the **Courtois Scientific Vanguard Fund of the Faculty of Arts and Sciences Postdoctoral Competition**. Candidates in experimental, observational, or theoretical astrophysics related to exoplanets or astronomical instrumentation are encouraged to apply.

Six (6) fellowships are available in the natural and formal sciences (including, but not limited to, astrophysics), for **3 years**, offering a salary of up to **CAD$76,000/year** and research funds up to **CAD$30,000/year**, subject to justification.

Deadline: September 23, 2025, 11:59 p.m. (ET)

Applicants must have obtained their Ph.D. within the last 5 years (6 with justification) and hold **Canadian citizenship**, **permanent residency**, or a **valid (or pending) work permit**. Please note it is possible to apply without any of these, but they will need to apply and obtain a work permit before the start date (between Jan. and Sept. 2026).

The research proposal must be original and integrated with a Faculty of Arts and Science researcher in natural/formal sciences. A faculty member must confirm their willingness to supervise. **For that matter, astrophysicists working in exoplanet science should contact IREx director René Doyon at `irex-applications@umontreal.ca` as soon as possible.**

See full details online: `https://exoplanetes.umontreal.ca/en/job/courtois/`.

IREx (`https://exoplanetes.umontreal.ca/en/`) is a dynamic team of over 60 researchers across Quebec, Canada (UdeM, McGill, Bishop's, Université Laval, Montreal Planetarium) working on cutting-edge observational, theoretical, and instrumental projects related to exoplanets. The team is deeply involved in major international efforts, including the *James Webb Space Telescope*, SPIRou, and NIRPS, with privileged access to data from these instruments.

IREx also leads a strong science communication and outreach program, training researchers who excel both scientifically and as communicators.

We value diversity, equity, and inclusion, and strongly encourage applications from underrepresented groups in physics. Our EDI committee supports the integration of these individuals into our research environment.

Download/Website: `https://exoplanetes.umontreal.ca/en/job/courtois/\`

Contact: `irex-applications@umontreal.ca`

ESA Research Fellowship in Space Science (Postdoctoral Fellowships)

European Space Agency (ESA)

We are pleased to announce the 2025 Call for Applications for the European Space Agency's Research Fellowships in Space Science. We expect to hire 5 to 6 postdoctoral fellows who will start their fellowship in fall 2026.

The deadline for applications is 22 September 2025.

ESA's postdoctoral Research Fellowship programme offers early-career researchers the possibility to carry out independent research in a variety of disciplines. Research Fellowships in Space Science offer the opportunity to contribute to ESA's endeavour to explore our Solar System and the Universe in the fields of heliophysics, planetary science, astrophysics, and fundamental physics.

ESA Research Fellow contracts have a maximum duration of three years. Projects initially last two years and are frequently extended to a third year upon submission of a dedicated proposal.

Research Fellowships in Space Science can be located at any of the following institutes:

- European Space Astronomy Centre (ESAC) in Villafranca del Castillo near Madrid, Spain
- European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands
- ESA Office at Space Telescope Science Institute (STScI) in Baltimore, Maryland, USA

Detailed information and a link to the application portal can be found on the fellowship webpage.

Download/Website: `https://www.cosmos.esa.int/fellowship`
Contact: `victoria.grinberg@esa.int`

PhD Position in "ML-tools for Cloud Formation in Exoplanetary Atmospheres"

Prof. Dr. Christiane Helling

Space Research Institute (IWF) of the Austrian Academy of Sciences, Graz, Austria, Jan 1, 2026

As part of its Young Researcher Programme YRP@Graz, the Space Research Institute (IWF) of the Austrian Academy of Sciences (OeAW) and the Graz University of Technology jointly invite applications for a PhD position.

This FWF funded project, aims to understand cloud formation in exoplanets and specifically the formation of molecular cluster as pre-coursers of cloud formation in the diversity of extrasolar planets. The project explores advanced neural network architectures, particularly Graph Neural Networks (GNNs) and generative models, to predict thermo-chemical properties of large molecular clusters. These data will be applied to support physical data interpretation of observations with CHEOPS, JWST, and other space missions, like PLATO, in the future.

We seek excellent candidates with a strong background in natural sciences. Successful candidates must hold a Master's degree in physics, astrophysics or equivalent at the latest by the starting date of the position but preferably at the time of application. Previous experience on aspects of computational chemistry, machine learning and related fields, and a track record of team work will be beneficial for the selection, as will experience in scientific coding and scientific publishing.

The application process has two stages: Stage 1 is anonymised, stage 2 takes the form of an interview.

Application Deadline: October 10, 2025

Download/Website: `https://www.oeaw.ac.at/en/iwf/research/young-researcher-program/phd-students`

Contact: `ruth-sophie.taubner@oeaw.ac.at`

4 Conferences and Workshops

On the shoulders of giants: cold Jupiters and their role in the formation of inner low-mass planets. From theory to observations

SOC: Eleonora Alei (NASA Goddard Space Flight Center, USA), Domenico Barbato (INAF-Padova, Italy), Aldo S. Bonomo (INAF-Torino, Italy; Chair), Silvano Desidera (INAF-Padova, Italy), Rachel Fernandes (Penn State University, USA), Benjamin Fulton (California Institute of Technology, USA), Heather Knutson (California Institute of Technology, USA), Anne-Marie Lagrange (LESIA, France), Michiel Lambrechts (University of Copenhagen, Denmark), Yamila Miguel (Leiden Observatory & SRON, the Netherlands), Alessandro Morbidelli (Observatoire de la Côte d'Azur, France), Damien Ségransan (University of Geneva, Switzerland), Alessandro Sozzetti (INAF-Torino, Italy), Robert Wittenmyer (University of Southern Queensland, Australia)

VENUE: Archivio di Stato, Piazza Castello 209 Torino, Italy, 25-27 March 2026

Although gas giants were the first exoplanets to be discovered in close orbits, only in the last five years has it been possible to make detailed statistical studies of cold Jupiters, i.e., gaseous giant planets with orbital separation between 1 and 10 au like Jupiter. These studies were mainly based on high precision radial-velocity measurements over several years. A key contribution is expected soon from high-precision Gaia astrometry (Gaia DR4).

The properties of cold Jupiters (eccentricity, multiplicity, occurrence rates as a function of stellar metallicity and mass) provide fundamental information on the formation and evolution of planetary systems and their possible terrestrial planets. Interactions among giant planets after the dissipation of the protoplanetary disk (planet-planet scattering) may strongly influence the formation of terrestrial planets in the habitable zone and/or inner regions. On the other hand, some studies pointed to the possible beneficial role of Jupiter in protecting our Earth from potentially life-destroying asteroids and/or short-period comet impacts.

The study of the relation between cold Jupiters and inner small planets, i.e., sub-Neptunes and super-Earths in short period orbits ($P < 100$ d), is a frontier topic for today's exoplanetary science. Planet formation simulations obtained discordant results, predicting negative, null or positive correlations between the two planetary populations, depending on the different formation models and/or model parameters adopted. Some disagreement is also present in observational results from different radial velocity surveys.

Crucial questions on the relation between cold Jupiters and small and terrestrial planets still remain unanswered: do outer gaseous giants promote or inhibit the formation of inner low-mass close-in planets, or do they have a substantially negligible impact on it? Can the absence of sub-Neptunes and super-Earths in the Solar System be attributed to the presence of Jupiter and Saturn? To what extent does the emergence of life depend on the presence of a Jupiter analogue?

The proposed international workshop aims to bring together leaders in both the observational and theoretical fields to discuss all of these issues, leading to fundamental advances in the field while charting new directions for future research and observational campaigns.

Workshop sessions: i) Formation of gaseous giant planets and their impact on short-period low-mass planets: from Solar System to exoplanetary systems; ii) Formation of gaseous giant planets and their impact on inner low-mass planets in the habitable zone: from Solar System to exoplanetary systems; iii) Cold Jupiters: statistical properties; iv) Inner low-mass planets, even in the habitable zone: statistical properties; v) Cold Jupiters and inner low-mass planets (individual systems and statistical analyses) - inside-out; vi) Cold Jupiters and inner low-mass planets (individual systems and statistical analyses) - outside-in; vii) Future prospects and instruments (PLATO, Gaia DR4, new high-resolution spectrographs, new imaging instruments).

Contact: `aldo.bonomo@inaf.it`

Rogue Worlds 2: Rogue Worlds Strike Back

Institut d'Astrophysique de Paris, Dec 15-17, 2025

Dear Colleagues,

This December 15-17 (2025), you are cordially invited to Paris for Rogue Worlds 2, the second in the Rogue Worlds series of meetings (talks from the first meeting available here). It will be a 3-day workshop focusing on the detection, dynamics, and astrophysical interpretation of free-floating planetary mass objects.

Scientific rationale

Free-floating, or "rogue", planetary-mass objects have been discovered wandering through the Galaxy unbound to any star. The origins of these objects remain poorly understood, and likely involve a combination of many different processes relevant to star and planet formation. Direct imaging surveys of young star-forming regions have already found hundreds of high-mass rogue planets, though it remains an ongoing theoretical challenge to determine what fraction represent ejected planets as opposed to aborted stellar embryos. Meanwhile, upcoming microlensing missions such as the Nancy Grace Roman telescope are poised to vastly increase our sample of free-floating planets at masses extending to Earth-mass and below, opening a new window into their origin and demographics.

Rogue Worlds 2 is a 3-day workshop designed to bring together researchers at the forefront of different aspects of the study of free-floating planets, including microlensing (ground- and space-based), direct imaging, and modeling of stellar and planetary dynamics. The format of the workshop is designed to promote discussion and foster collaboration, bringing together researchers across a wide array of fields to make new progress on our understanding of rogue worlds and the systems they leave behind.

Invited speakers

Takahiro Sumi (Microlensing detection of free-floating planets)
Scott Gaudi (Update on the Nancy Grace Roman space telescope)
Nuria Miret-Roig (Direct imaging of free-floating planets)
Malena Rice (Dynamics of planetary ejection)
Amaya Moro-Martin (Connecting free-floating planets and interstellar objects)
Ruth Murray-Clay (Connecting free-floating planets with the tail end of the stellar IMF)

Scientific organizing committee

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Clément Ranc (IAP/Sorbonne Université)
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5 As seen on astro-ph

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astro-ph/2508.00177: **Reliability of 1D radiative-convective photochemical-equilibrium retrievals on transit spectra of WASP-107b** *by Thomas Konings et al.*
astro-ph/2508.00369: **Formation of Planetesimals in the Outer Solar System** *by Anders Johansen et al.*
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astro-ph/2508.01267: **Corotating Interaction Regions (CIRs): impacts with exoplanets** *by Rose Waugh, Moira Jardine*
astro-ph/2508.01233: **Detailed radial scale height profile of dust grains as probed by dust self-scattering in HL Tau** *by Haifeng Yang et al.*
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astro-ph/2508.03812: **Worlds Next Door: A Candidate Giant Planet Imaged in the Habitable Zone of α Cen A. II. Binary Star Modeling, Planet and Exozodi Search, and Sensitivity Analysis** *by Aniket Sanghi et al.*
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