ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to edition 119 of the ExoPlanet News!

A big "Thank You" to all of you who sent input for this edition of the newsletter! Please keep sending contributions in the form of accepted papers covering all fields related to (exo)planet research, conference or workshop announcements, job ads or any other information relevant to the wider exoplanet community. The current Latex template for submitting contributions of any kind, as well as all previous editions of ExoPlanet News, can be found at http://nccr-planets.ch/exoplanetnews/.

The next issue will appear 17 June 2019.

Thanks for all your support and best regards from Switzerland

Yann Alibert
Sascha P. Quanz
Adrien Leleu
Christoph Mordasini

2 Abstracts of refereed papers

The EBLM Project V. Physical properties of ten fully convective, very-low-mass stars

A. von Boetticher[1,2], A. Triaud[3], D. Queloz[2], S. Gill[4], P. Maxted[4], and the EBLM team

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A&A, in press (arXiv:1903.10808)

Measurements of the physical properties of stars at the lower end of the main sequence are scarce. In this context we report masses, radii and surface gravities of ten very-low-mass stars in eclipsing binary systems, with orbital periods of the order of several days. The objects probe the stellar mass-radius relation in the fully convective regime, $M_\star \leq 0.35\ \mathrm{M}_\odot$, down to the hydrogen burning mass-limit, $M_{\mathrm{HB}} \sim 0.07\ \mathrm{M}_\odot$. The stars were detected by the WASP survey for transiting extra-solar planets, as low-mass, eclipsing companions orbiting more massive, F- and G-type host stars. We use eclipse observations of the host stars (TRAPPIST, Leonhard Euler, SPECULOOS telescopes), and radial velocities of the host stars (CORALIE spectrograph), to determine physical properties of the low-mass companions. Companion surface gravities are derived from the eclipse and orbital parameters of each system. Spectroscopic measurements of the host star effective temperature and metallicity are used to infer the host star mass and age from stellar evolution models. Masses and radii of the low-mass companions are then derived from the eclipse and orbital parameters of each system. The objects are compared to stellar evolution models for low-mass stars, to test for an effect of the stellar metallicity and orbital period on the radius of low-mass stars in close binary systems. Measurements are in good agreement with stellar models; an inflation of the radii of low-mass stars with respect to model predictions is limited to $1.6 \pm 1.2\%$ in the fully convective regime. The sample of ten objects indicates a scaling of the radius of low-mass stars with the host star metallicity. No correlation between stellar radii and orbital periods of the binary systems is determined. A combined analysis with comparable objects from the literature is consistent with this result.

Download/Website: `https://arxiv.org/abs/1903.10808`

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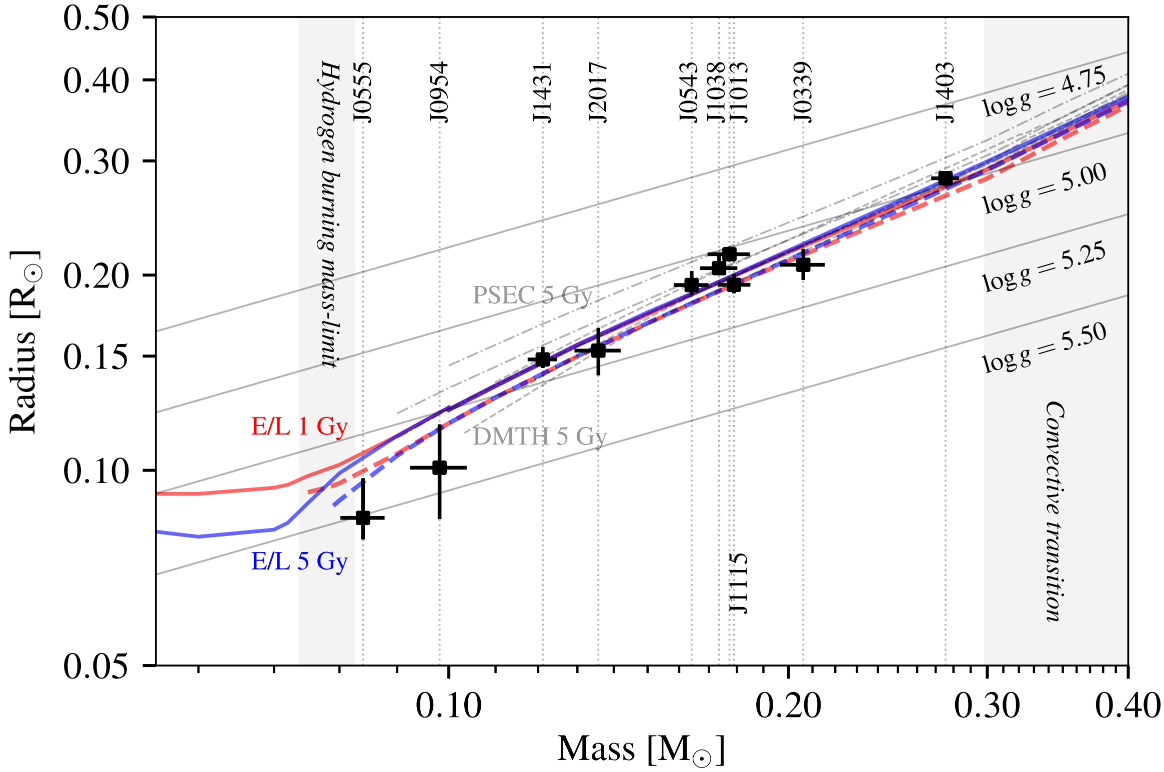

Figure 1: Plot showing the masses and radii of our 10 low mass eclipsing binaries (EBLM). They broadly compatible with the Exeter/Lyon models over the fully convective range.

Is there more than meets the eye? Presence and role of submicron grains in debris discs

P. Thebault[1], *Q. Kral*[1]
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Astronomy & Astrophysics, in press

The presence of sub-micron grains has been inferred in several debris discs, usually because of a blue colour of the spectrum in scattered light or a pronounced silicate band around 10μm, even though these particles should be blown out by stellar radiation pressure on very short timescales. So far, no fully satisfying explanation has been found for this apparent paradox. We investigate the possibility that the observed abundances of sub-micron grains could be naturally produced in bright debris discs, where the high collisional activity produces them at a rate high enough to partially compensate for their rapid removal. We also investigate to what extent this potential presence of small grains can affect our understanding of some debris disc characteristics. We used a numerical collisional code to follow the collisional evolution of a debris disc down to sub-micron grains far below the limiting blow-out size $s_{\rm blow}$. We considered compact astrosilicates and explored different configurations: A and G stars, cold and warm discs, bright and very bright systems. We then produced synthetic spectra and spectral energy distributions, where we identified and quantified the signature of unbound sub-micron grains. We find that in bright discs (fractional luminosity $\geq 10^{-3}$) around A stars, the number of sub-micron grains is always high enough to leave detectable signatures in scattered light where the disc colour becomes blue, and also in the mid-IR ($10 \leq \lambda \leq 20\mu$m), where they boost the disc luminosity by at least a factor of 2 and induce a pronounced silicate solid-state band around 10μm. We also show that with this additional contribution of sub-micron grains, the spectral energy distribution can mimic that of two debris belts separated by a factor of $\sim$ 2 in radial distance. For G stars, the effect of $s \leq s_{\rm blow}$ grains remains limited in the spectra although they dominate the geometrical cross section of the system. We also find that for all considered cases, the halo of small (bound and unbound) grains that extends far beyond the main disc contributes to $\sim$ 50% of the flux up to $\lambda \sim 50\mu$m wavelengths

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The tidal parameters of TRAPPIST-1 b and c

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1905.00512)

The TRAPPIST-1 planetary system consists of seven approximately Venus- to Earth-sized planets that revolve around a cool M-dwarf star within 0.05 AU of each other. Five of the planets are situated in a multi-resonant chain; in addition, the system appears to exhibit up to five three-body resonances, although it is uncertain if all of these are stable on long timescales. The resonant nature of the system suggests a particular formation mechanism that involved planet migration, and that tidal evolution has damped away most of the initial eccentricities of the planets. This can be used to determine the tidal parameters of the innermost planets. We aim to constrain the tidal parameters of the innermost two planets, where most of the tidal dissipation is expected to occur. We have used a combination of dynamical N-body simulations, secular theory and interior modelling. Specifically, we run dynamical simulations of the system for 100 Myr with initial conditions that are expected from formation and migration into a multi-resonant system, from which we estimate the timescale to when the multi-resonant configuration breaks. This timescale sets the tidal damping rate in planets b and c. We further construct multi-layered interior models from which the tidal

parameters can be computed independently. The dynamical simulations suggest that the system tends to go unstable roughly 30 Myr after its formation unless there is strong tidal damping. This upper time limit implies that for TRAPPIST-1 b $k_2/Q > 2 \times 10^{-4}$ and for TRAPPIST-1 c we find that $k_2/Q > 10^{-3}$, with large uncertainties due to uncertainties in the instability timescale. Interior models yield estimates that are generally lower: $(0.075–0.37)\times10^{-4}$ for TRAPPIST-1 b and $(0.4 - 2) \times 10^{-4}$ for TRAPPIST-1 c. The agreement between the tidal dissipation parameters for TRAPPIST-1b and -1c determined from numerical simulations and interior models is not too strong, but is still useful to constrain the dynamical history of the system. We suggest that this two-pronged approach could be of further use in other multi-resonant systems if the planet's orbital and interior parameters are sufficiently well known.

Download/Website: `https://arxiv.org/abs/1905.00512`

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Effects of Radius and Gravity on the Inner Edge of the Habitable Zone

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Astrophysical Journal Letters, in press (1904.12267)

A rigorous definition of the habitable zone and its dependence on planetary properties is part of the search for habitable exoplanets. In this work, we use the general circulation model `ExoCAM` to determine how the inner edge of the habitable zone of tidally locked planets orbiting M dwarf stars depends on planetary radius, surface gravity, and surface pressure. We find that the inner edge of the habitable zone for more massive planets occurs at higher stellar irradiation, as found in previous one-dimensional simulations. We also determine the relative effects of varying planetary radius and surface gravity. Increasing the planetary radius leads to a lower planetary albedo and warmer climate, pushing the inner edge of the habitable zone to lower stellar irradiation. This results from a change in circulation regime that leads to the disruption of the thick, reflective cloud deck around the substellar point. Increasing gravity increases the outgoing longwave radiation, which moves the inner edge of the habitable zone to higher stellar irradiation. This is because the column mass of water vapor decreases with increasing gravity, leading to a reduction in the greenhouse effect. The effect of gravity on the outgoing longwave radiation is stronger than the effect of radius on the planetary albedo, so that increasing gravity and radius together causes the inner edge of the habitable zone to move to higher stellar irradiation. Our results show that the inner edge of the habitable zone for more massive terrestrial planets occurs at a larger stellar irradiation.

Download/Website: `https://arxiv.org/abs/1904.12267`

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The Ability of Significant Tidal Stress to Initiate Plate Tectonics

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Icarus, published (2019Icar..325...55Z)

Plate tectonics is a geophysical process currently unique to Earth, has an important role in regulating the Earth's climate, and may be better understood by identifying rocky planets outside our solar system with tectonic activity. The key criterion for whether or not plate tectonics may occur on a terrestrial planet is if the stress on a planet's lithosphere from mantle convection may overcome the lithosphere's yield stress. Although many rocky exoplanets closely orbiting their host stars have been detected, all studies to date of plate tectonics on exoplanets have neglected tidal stresses in the planet's lithosphere. Modeling a rocky exoplanet as a constant density, homogeneous, incompressible sphere, we show the tidal stress from the host star acting on close-in planets may become comparable to the stress on the lithosphere from mantle convection. Tidal stress of this magnitude may aid mantle convection stress in subduction of plates, or drive the subduction of plates without the need for mantle convective stresses. We also show that tidal stresses from planet-planet interactions are unlikely to be significant for plate tectonics, but may be strong enough to trigger Earthquakes. Our work may imply planets orbiting close to their host stars are more likely to experience plate tectonics, with implications for exoplanetary geophysics and habitability. We produce a list of detected rocky exoplanets under the most intense stresses. Atmospheric and topographic observations may confirm our predictions in the near future. Investigations of planets with significant tidal stress can not only lead to observable parameters linked to the presence of active plate tectonics, but may also be used as a tool to test theories on the main driving force behind tectonic activity.

Download/Website: `https://arxiv.org/pdf/1711.09898.pdf`

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Stellar and substellar companions of nearby stars from Gaia DR2 - Binarity from proper motion anomaly

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Astronomy & Astrophysics, 2019A&A...623A..72K

The census of stellar and substellar companions of nearby stars is largely incomplete, in particular toward the low-mass brown dwarf and long-period exoplanets. It is, however, fundamentally important in the understanding of the stellar and planetary formation and evolution mechanisms. Nearby stars are particularly favorable targets for high precision astrometry. We aim to characterize the presence of physical companions of stellar and substellar mass in orbit around nearby stars. Orbiting secondary bodies influence the proper motion of their parent star through their gravitational reflex motion. Using the Hipparcos and Gaia's second data release (GDR2) catalogs, we determined the long-term proper motion of the stars common to these two catalogs. We then searched for a proper motion anomaly (PMa) between the long-term proper motion vector and the GDR2 (or Hipparcos) measurements, indicative of the presence of a perturbing secondary object. We focussed our analysis on the 6741 nearby stars located within 50 pc, and we also present a catalog of the PMa for > 99% of the Hipparcos catalog (≈ 117 000 stars). 30% of the stars studied present a PMa greater than 3σ. The PMa allows us to detect orbiting companions, or set stringent limits on their presence. We present a few illustrations of the PMa analysis to interesting targets. We set upper limits of $0.1 - 0.3\,M_J$ to potential planets orbiting Proxima between 1 and 10 au ($P_{\rm orb} = 3$ to 100 years). We confirm that Proxima is gravitationally bound to α Cen. We recover the masses of the known companions of ϵ Eri, ϵ Ind, Ross 614 and β Pic. We also detect the signature of a possible planet of a few Jovian masses orbiting τ Ceti. Based on only 22 months of data, the GDR2 has limitations. But its combination with the Hipparcos catalog results in very high accuracy PMa vectors, that already enable us to set valuable constraints on the binarity of nearby objects. The detection of tangential velocity anomalies at a median accuracy of $\sigma(\Delta v_{\rm T}) = 1.0\,{\rm m\,s^{-1}}$ per parsec of distance is already possible with the GDR2. This type of analysis opens the possibility to identify long period orbital companions otherwise inaccessible. For long orbital periods, Gaia's complementarity to radial velocity and transit techniques (that are more sensitive to short orbital periods) already appears to be remarkably powerful.

Download/Website: `https://www.aanda.org/articles/aa/abs/2019/03/aa34371-18`

Download/Website: `http://cdsarc.u-strasbg.fr/viz-bin/qcat?J/A+A/623/A72`

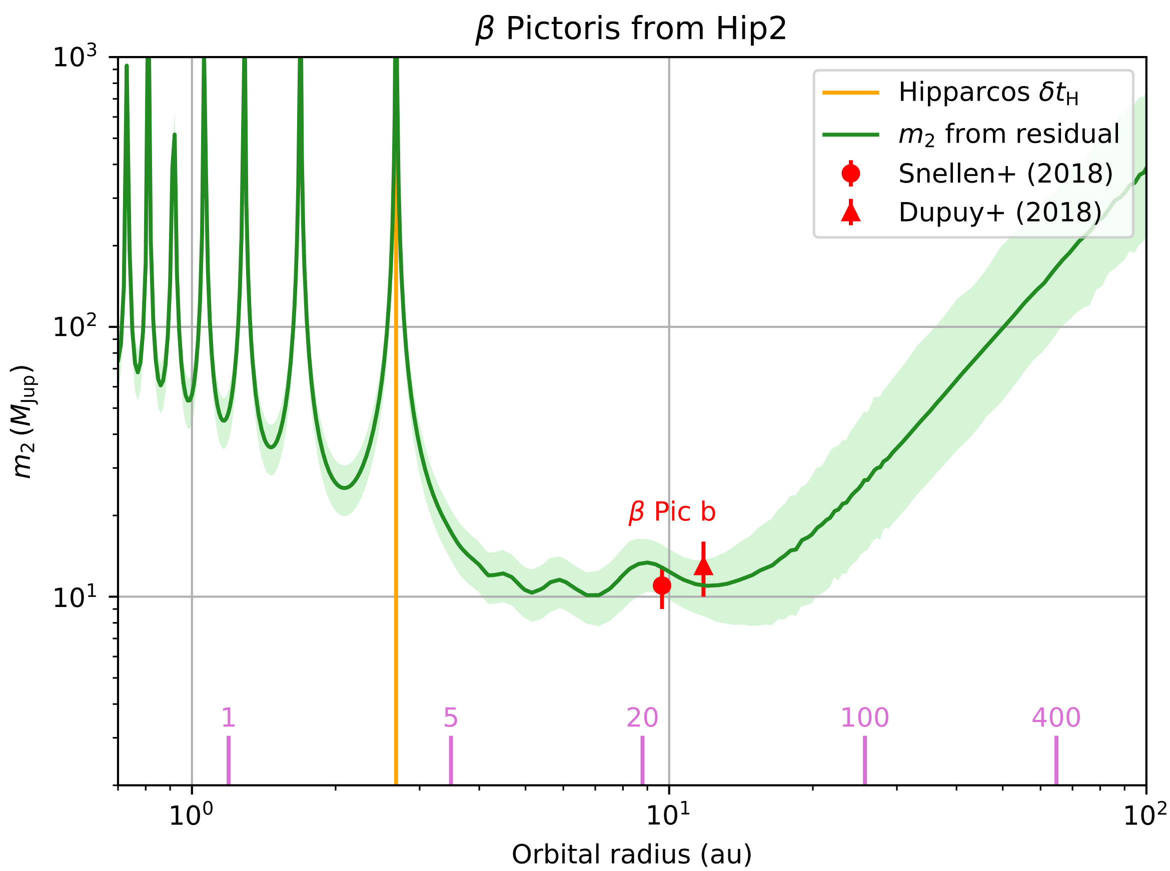

Figure 2: Possible mass and orbital radius combinations for companions of β Pictoris from its Hipparcos proper motion anomaly, compared to the properties of the known exoplanet β Pic b from Snellen et al. (2018) and Dupuy et al. (2019) (red symbols).

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The BEBOP radial-velocity survey for circumbinary planets I. Eight years of CORALIE observations of 47 single-line eclipsing binaries and abundance constraints on the masses of circumbinary planets

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Astronomy & Astrophysics, Published: Year 2019, Volume 624, Article A68

We introduce the BEBOP radial velocity survey for circumbinary planets. We initiated this survey using the CORALIE spectrograph on the Swiss Euler Telescope at La Silla, Chile. An intensive four year observing campaign commenced in 2013, targeting 47 single-lined eclipsing binaries drawn from the EBLM survey for low mass eclipsing binaries. Our specific use of binaries with faint M dwarf companions avoids spectral contamination, providing observing conditions akin to single stars. By combining new BEBOP observations with existing ones from the EBLM programme, we report on the results of 1519 radial velocity measurements over timespans as long as eight years. For the best targets we are sensitive to planets down to $0.1M_{\rm Jup}$, and our median sensitivity is $0.4M_{\rm Jup}$. In this initial survey we do not detect any planetary mass companions. Nonetheless, we present the first constraints on the abundance of circumbinary companions, as a function of mass and period. A comparison of our results to *Kepler*'s detections indicates a dispersion of planetary orbital inclinations less than $\sim 10°$.

Download/Website: `http://www.amaurytriaud.net/Main/BEBOP`

Contact: `davidmartin@uchicago.edu`

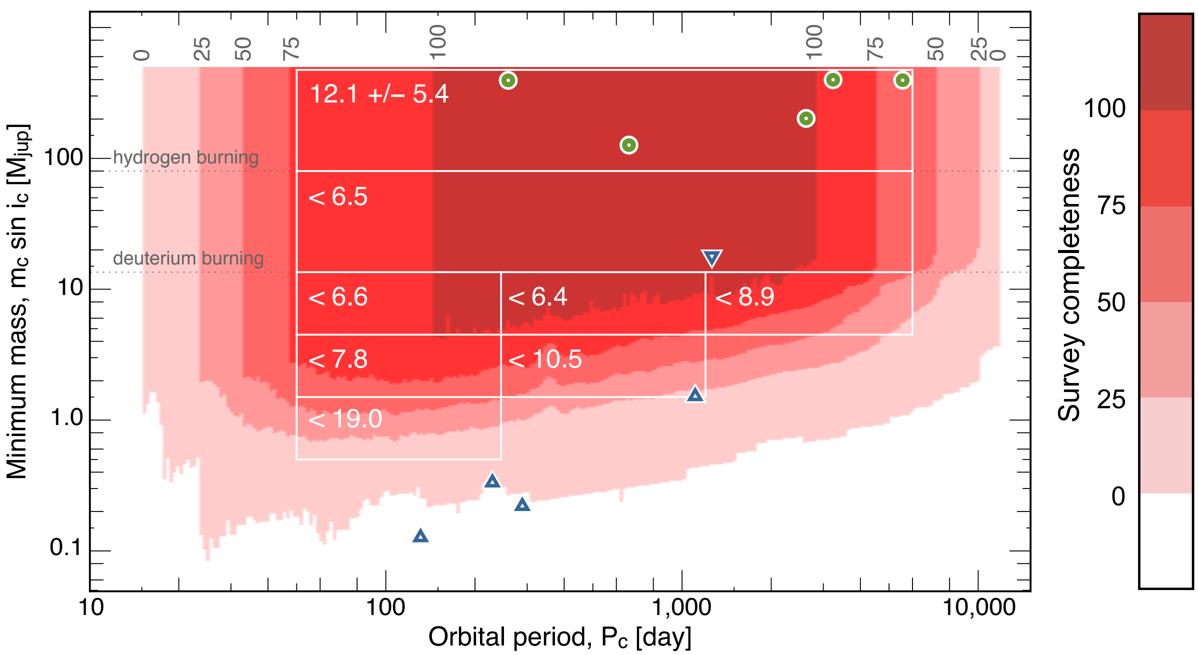

Figure 3: Completeness of the BEBOP radial velocity survey of 47 low-mass eclipsing binaries, as a function of the circumbinary minimum mass and period. Six different colour contours indicate the programme completeness between 0% (white) and 100% (dark red). The green circles near the top of the plot correspond to the five BEBOP triples, i.e. binaries with well-characterised tertiary stellar companions. The upright blue triangles in the bottom half of the plot represent the four Kepler transiting circumbinary planets with published masses: Kepler-16, -34, -35 and -1647. The inverted blue triangle represents the circumbinary brown dwarf HD 202206 ($m_{\rm c}$ = $17.9M_{\rm Jup}$, $P_{\rm c}$ = 1261 days) discovered using a combination of RVs and astrometry (Correia et al. 2005; Benedict & Harrison 2017). There are eight white boxes covering different parameter spaces within which we constrain the abundance of tertiary objects. The number in each box is the 2σ upper limit to the circumbinary abundance, given as a per cent. An exception is the top box which covers triple star systems. Since we have detections in this box, we derive an actual value for the abundance and its 1σ uncertainty.

Using deep neural networks to compute the mass of forming planets

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Astronomy & Astrophysics, in press, astroph:1903.00320

Computing the mass of planetary envelopes and the critical mass beyond which planets accrete gas in a runaway fashion is important for studying planet formation, in particular, for planets up to the Neptune-mass range. This computation in principle requires solving a set of differential equations, the internal structure equations, for some boundary conditions (pressure, temperature in the protoplanetary disc where a planet forms, core mass, and the rate of accretion of solids by the planet). Solving these equations in turn proves to be time-consuming and sometimes numerically unstable. The aim is to provide a way to approximate the result of integrating the internal structure equations for a variety of boundary conditions. We computed a set of internal planetary structures for a very large number (millions) of boundary conditions, considering two opacities: that of the interstellar medium, and a reduced opacity. This database was then used to train deep neural networks (DNN) in order to predict the critical core mass and the mass of planetary envelopes as a function of the boundary conditions. We show that our neural networks provide a very good approximation (at the percent level) of the result obtained by solving interior structure equations, but the rquired computer time is much shorter. The difference to with the real solution is much smaller than the difference that is obtained with some analytical formulas that are available in the literature, which only provide the correct order of magnitude at best. We compare the results of the DNN with other popular machine-learning methods (random forest, gradient boost, support vector regression) and show that the DNN outperforms these methods by a factor of at least two. We show that some analytical formulas that can be found in various papers can severely overestimate the mass of planets and therefore predict the formation of planets in the Jupiter-mass regime instead of the Neptune-mass regime. The python tools that we provide allow computing the critical mass and the mass of planetary envelopes in a variety of cases, without the requirement of solving the internal structure equations. These tools can easily replace previous analytical formulas and provide far more accurate results.

Download/Website: https://github.com/yalibert/DNN_internal_structure/

Contact: alibert@space.unibe.ch

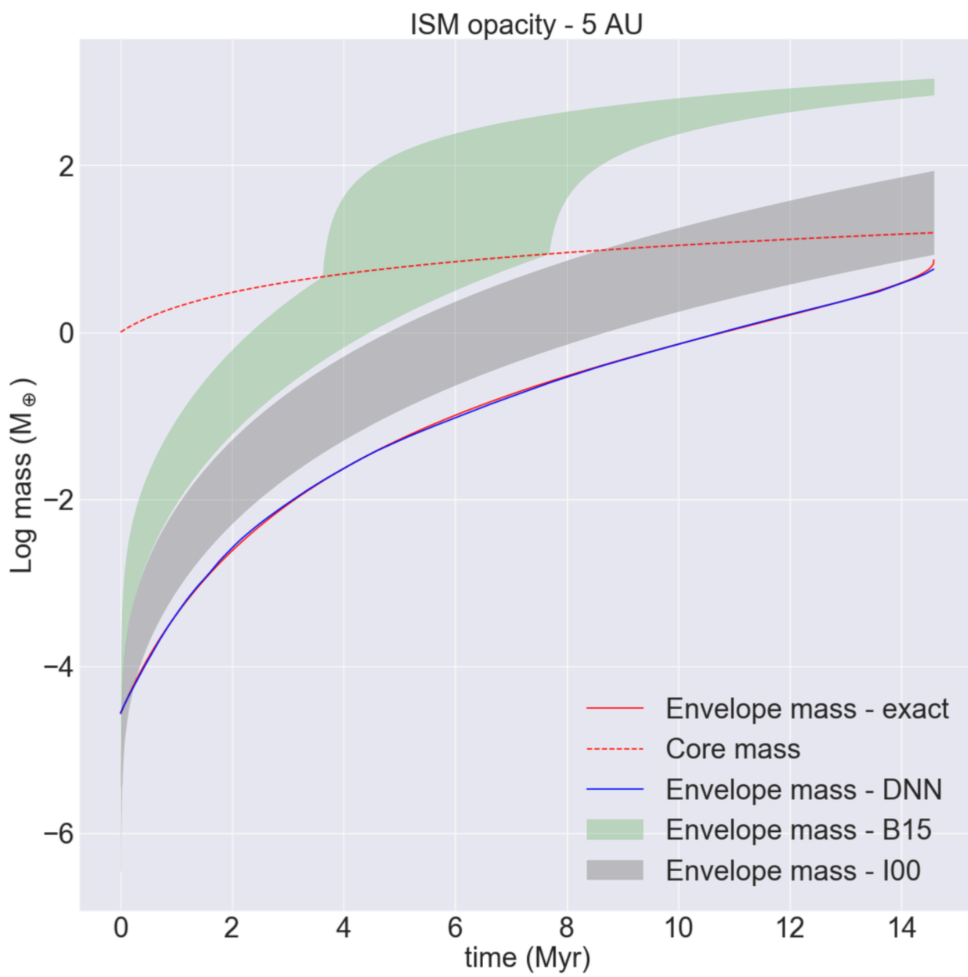

Figure 4: Exemple comparison between results of the DNN (blue line) and analytical formulas by Ikoma et al. (2000 - gray region) and Bitsch et al. (2015 - green region). The grey and green regions corresponds to the values of the envelope mass for different possible opacities. The red dashed line shows the core mass as as function of time which is the same in all the cases, and the red solid line shows the planetary mass obtained by solving internal structure equations.

3 Jobs and Positions

Exoplanet Postdoctoral Position about circumbinary planets

Amaury Triaud
School of Physics & Astronomy, University of Birmingham, UK

Flexible start, between 01 September 2019 and 01 May 2019

We invite inventive and talented individuals to apply for a postdoctoral research position and join the Sun, Stars and Exoplanet research group, at the University of Birmingham.

The successful candidate will join a vibrant group of astronomers. The Sun, Stars, and Exoplanet group consist of four permanent researchers: Amaury Triaud, Guy Davies, Andrea Miglio and Bill Chaplin, along two main research themes: exoplanets and asteroseismology. Three of us hold ERC grants. The group benefits from newly refurbished offices at the heart of a beautiful campus.

Members of the group have responsibilities in SPECULOOS, TESS, Kepler and the PLATO 2.0 Mission.

The successful applicant will work primarily with Dr Amaury Triaud as part of the BEBOP radial-velocity survey for circumbinary planets, an ERC and Leverhulme Trust funded project with large observing allocations on HARPS (ESO) and SOPHIE (OHP). We particularly welcome applicants with expertise related with high-resolution spectroscopy, various statistical data analysis methods, data mining, algorithm development and machine learning. The position comes with a generous allowance to cover international travel and computing.

Mirroring the fact that exoplanets are diverse, we welcome applications from all backgrounds to enrich our research group.

Salary: £30,395 to £39,609 depending on experience. With potential progression once in post to £42,036 a year.
Duration: 36 months
Start date: between 01 October 2019 and 01 June 2020.
Application deadline: 15 June 2019 for full consideration.

The application form will need:
1) A CV & list of publications, highlighting up to five most relevant works.
2) A research statement (up to 1000 words). This should describe your previous research experience, your skill set, and your future professional plans.
3) Contact information for up to three academic references who can provide letters in support of your application. Please provide for each referee their name and title, institution, e-mail address and telephone number.

Link to further information below.

Download/Website: `http://www.download.bham.ac.uk/vacancies/jd/81193.pdf/`

Contact: `A.Triaud@bham.ac.uk`

Post Doctoral Research Fellow (REF: R61860)

Nathan Mayne

University of Exeter, On or after 29th June 2019

We seek to recruit a full-time Research Fellow starting on or after the 29th June 2019 with a fixed end date of 1st April 2022. The position is funded by the UK Science and Technology Facilities Council, and is working with Nathan Mayne.

The project will primarily involve application and continued development of a three dimensional atmospheric model of Brown Dwarfs and Gas Giant exoplanets, focusing on the cloud or condensate aspects. The model development will be performed within the framework of the state-of-the art global circulation model (GCM) of the UK Met Office, adapted by researchers at the University of Exeter.

The project also benefits from access to high quality observations provided by collaboration with, for example, Prof. Sasha Hinkley (Exeter) and Prof. David Sing (Johns Hopkins). Our work at Exeter University also includes research in to terrestrial planets, and the applicant will have opportunities to become involved in this aspect of the research programme.

We are particularly interested in applicants with direct experience in modeling aspects of stellar/sub-stellar/planetary atmospheres, especially clouds, and of working with large code bases.

You will be able to develop research objectives, projects and proposals, identify sources of research funding and contribute to the process of securing funds and make presentations at conferences and other events.

The research will be supported by Met Office staff, and connect to the work of several PhD and postdoctoral researchers. Extensive super-computing resources will be available as well as funds to support international travel.

Applications are made online through the University of Exeter application system (link below), and informal enquiries can be directed to Nathan Mayne (n.j.mayne@exeter.ac.uk).

Download/Website: tiny.cc/watb6y

Contact: n.j.mayne@exeter.ac.uk

4 Conference announcements

Rocky Exoplanets in the Era of JWST: Theory and Observation

Avi Mandell, Eliza Kempton, and the Symposium SOC and LOC

NASA Goddard in Greenbelt, MD, November 4 - 8, 2019

We are excited to announce the 2nd Annual NASA Goddard SEEC Symposium, which will be hosted by the GSFC Sellers Exoplanet Environments Collaboration (SEEC) and co-supported by the University of Maryland Astronomy Department.

The goal of this meeting is to bring together theorists and observers interested in rocky exoplanets from across the exoplanet community and related fields, to help us all prepare for the first light of the James Webb Space Telescope era by framing the key questions about these worlds and the exciting new observations that will help us characterize them.

General topics include:
- What are the general capabilities of the JWST instrumentation in terms of rocky exoplanets?
- How will the JWST Early Release Science program inform us on the actual capabilities for transit science?
- What other observational capabilities will come online during the era of JWST, and what can they contribute to the study of rocky worlds?
- What observing and analysis strategies will help us to extract constraints on rocky exoplanet characteristics, based on the quality of data in the JWST era?
- What should we expect for the composition and structure of rocky planet atmospheres around low-mass and ultra-low-mass stars?
- How do we better model the impact of interactions between exoplanets and their parent star, including UV and particle fluxes?
- How do we model the impact of atmospheric dynamics for thin atmospheres, especially in the tidally locked spin-orbit state?
- What are the volatile inventories for rocky planets in different environments, and how we can constrain these inventories through observations?
- How do we model internal geodynamics, including magnetic fields and internal dynamos, and what are the impacts on the observable atmosphere?
- How can we use JWST observations to constrain the surface properties and conditions on rocky exoplanets?
- What are the biosignatures and false positives for habitable planets that may be observed in the JWST era, and how do we confirm their biologic origin?

The workshop will include invited overview talks combined with short research presentations, as well as ample time for group discussion and collaborative work sessions. Abstracts for combined poster+flash talks will be due at the beginning of the summer (date TBD, to be announced later). Attendance will be limited by space, so please check out the meeting's webpage and pre-register now. We will alert you when the full registration and abstract submission pages are available.

Download/Website: `https://rebrand.ly/SEEC_Symposium_2019`

Planet^2/RESCEU Symposium: From Protoplanetary Disks through Planetary System Architecture to Planetary Atmosphere and Habitability

Y. Alibert
NCCR PlanetS, Switzerland

Okinawa, Japan, October 14-18, 2019

The space telescope TESS was launched last year to conduct an extensive survey of exoplanets orbiting nearby bright stars, which will be followed by precise measurements with CHEOPS launched this autumn. Furthermore, spectroscopic observations of those transiting planets will be extensively conducted by scheduled missions such as JWST, ARIEL, and WSO-UV. We are about to enter the age of characterization of exoplanet atmospheres, which is a crucial milestone also in habitable planet science. Also recent solar-system missions have brought much new knowledge of the solar-system planets and small bodies. Against this background, we will held a symposium that brings together scientists from a broad range of research topics such as planetary atmospheres, habitability, and planet formation and evolution, aiming for the participants to share current understanding regarding such important topics for the extra-solar and solar-system planets. We hope that you will actively join this exciting symposium and look forward very much to seeing you in Okinawa.

Sessions include

- Exoplanet atmospheres
- Solar system planet atmospheres
- Climate and habitability
- Evolution of planetary atmosphere and interior
- Protoplanetary disks
- Volatile delivery
- Planetary system formation and evolution
- Future Prospects

Download/Website: `http://www.resceu.s.u-tokyo.ac.jp/symposium/resceu_sympo2019/`

5 Announcements

2019 Sagan Summer Workshop: Astrobiology for Astronomers

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NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, July 15-19, 2019

The 2019 Sagan Summer Workshop will focus on astrobiology and will feature introductions on the formation of Earth and terrestrial planets, their evolution over time, current geochemical cycles on Earth, and the emergence of life on Earth. Our knowledge of Exo-Earths will be reviewed, including demographics, composition, atmospheric signatures, and comparison with Earth. Detection of biosignatures, with an emphasis on false positives and false negatives, will also be discussed. Attendees will participate in hands-on group projects related to astrobiology and will have the opportunity to present their own work through short presentations (research POPs) and posters.

The Sagan Summer Workshops are aimed at graduate and post doctoral level students, however anyone who is interested in learning more about the field is welcome to attend.

Registration to attend the workshop are now available along with the complete agenda. The hotel reservation link is also posted on the workshop website.

Important Dates

- May 9: POP/Poster/Talk submission link available
- early June: food ordering site open
- June 13: Hotel Reservation Deadline for workshop hotel
- June 28: Deadline to submit POP and poster presentations
- July 5: Final agenda posted with POP schedule
- July 15-19: Sagan Exoplanet Summer Workshop

Download/Website: `http://nexsci.caltech.edu/workshop/2019`
Contact: `sagan_workshop@ipac.caltech.edu`

6 Exoplanet Archive Updates

April Updates at the NASA Exoplanet Archive

The NASA Exoplanet Archive team
Caltech/IPAC-NASA Exoplanet Science Institute, MC 100-22 Pasadena CA 91125

Pasadena CA USA, May 13, 2019

Note: Data for all new planets can be viewed in the Confirmed Planets (`http://bit.ly/2MqFnub`), Composite Planet Data (`http://bit.ly/2l84Qw9`), and Extended Planet Data (`http://bit.ly/2NLy1Ci`) tables. New microlensing solutions are in the Microlensing Data table (`http://bit.ly/2JQr180`).

April 25, 2019

There are two new planets this week, both very newsworthy in their own way:

- **HD 21749 c** is the first Earth-sized planet discovered by TESS! Read about it in the press release (`https://go.nasa.gov/2LvCTP2`).
- **Kepler-47 d** is a third, transiting planet in a circumbinary system. Its orbit is located in between the orbits of the b and c planets that were previously known. See the press release for details (`https://go.nasa.gov/302uSEg`).

Also, our Exoplanet Community Follow-up Program (ExoFOP) community has grown to 800 users, who use the site to download and share their Kepler, K2 and TESS data! ExoFOP-TESS already has 93 unique users sharing content after just one year of the telescope's space operations (`http://bit.ly/2PVFbVX`).

April 18, 2019

Four newly confirmed transiting planets are in the archive this week, as well as 1977 updated ephemerides for Kepler confirmed planets—65 of which have also been identified to have possible transit timing variations. The new planets are: HD 221416 b, WASP-177 b, WASP-181 b, and WASP-183 b.

The new planet data (including the updated TTV flags) can be found in the Confirmed Planets, Composite Planet Data, and Extended Planet Data tables. The updated ephemerides can be accessed from each planet's overview page, as well as our Transit and Ephemeris Service (`http://bit.ly/2DnAv6c`). The list of 1977 Kepler planets is published in Gajdoš, Vaňko, & Parimucha 2019 (`http://bit.ly/2DkgY6A`).

April 11, 2019

We've added seven new planets, all detected using the radial velocity method, many of which have some of the longest-measured orbital periods, including one extending beyond 40 years! The new planets are: GJ 685 b, HD 13724 b, HD 181234 b, HD 25015 b, HD 92987 b, HD 50499 c, and HD 92788 c. Also added: new sets of planet parameters for three known exoplanets: HD 50499 b, HD 92788 b, and HD 98649 b.

April 5, 2019

New MOA Light Curves! The Microlensing Observations in Astrophysics (MOA) collaboration has contributed a new data set to the archive consisting of approximately 6000 light curves (22 GB) acquired from 2006 to 2014.

These data can be downloaded in bulk from our MOA page, which also contains the observational coverage map (`http://bit.ly/2Vdyvnr`).

April 4, 2019

New Planets: This week we've added seven new confirmed planets, including K2-293 b and K2-294 b, the first K2 exoplanets found using machine-learning algorithms. *Fun Fact:* NExScI scientist Jessie Christiansen was quoted in an NPR story on these discoveries. The other new planets are: Qatar-7 b, K2-63 c, TOI 172 b, KOI-1599.02, and KOI-1599.01.

Download/Website: `https://exoplanetarchive.ipac.caltech.edu`

Contact: `mharbut@caltech.edu`

7 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during April 2019.

April 2019

astro-ph/1904.00025: **Exploring A Photospheric Radius Correction to Model Secondary Eclipse Spectra for Transiting Exoplanets** by *Jonathan J. Fortney et al.*
astro-ph/1904.00027: **The Mass of Stirring Bodies in the AU Mic Debris Disk Inferred from Resolved Vertical Structure** by *Cail Daley et al.*
astro-ph/1904.00054: **Comparing key compositional indicators in Jupiter with those in extra-solar giant planets** by *J.I. Lunine et al.*
astro-ph/1904.00094: **Data-Driven Spectroscopy of Cool Stars at High Spectral Resolution** by *Aida Behmard, Erik A. Petigura, Andrew W. Howard*
astro-ph/1904.00651: **The Transit Least Squares Survey - I. Discovery and validation of an Earth-sized planet in the four-planet system K2-32 near the 1:2:5:7 resonance** by *René Heller et al.*
astro-ph/1904.00985: **Alignment of a circumbinary disc around an eccentric binary with application to KH 15D** by *Jeremy L. Smallwood et al.*
astro-ph/1904.01019: **Theoretical Reflectance Spectra of Earth-Like Planets through Their Evolutions: Impact of Clouds on the Detectability of Oxygen, Water, and Methane with Future Direct Imaging Missions** by *Yui Kawashima, Sarah Rugheimer*
astro-ph/1904.01063: **Extreme hydrodynamic losses of Earth-like atmospheres in the habitable zones of very active stars** by *C. P. Johnstone et al.*
astro-ph/1904.01089: **Stellar Characterization Necessary to Define Holistic Planetary Habitability** by *Natalie Hinkel et al.*
astro-ph/1904.01092: **An Interdisciplinary Perspective on Elements in Astrobiology: From Stars to Planets to Life** by *Natalie Hinkel et al.*
astro-ph/1904.01420: **The influence of general-relativity effects, dynamical tides and collisions on planet-planet scattering close to the star** by *F. Marzari, M. Nagasawa*
astro-ph/1904.01573: **The CORALIE survey for southern extrasolar planets XVIII. Three new massive planets and two low mass brown dwarfs at separation larger than 5 AU** by *E. L. Rickman et al.*
astro-ph/1904.01973: **Storms or Systematics? The changing secondary eclipse depth of WASP-12b** by *Matthew J. Hooton et al.*
astro-ph/1904.01992: **On the origin of 7Be isotopic records in a Calcium, Aluminium, -rich inclusion** by *Ritesh Kumar Mishra, Kuljeet Kaur Marhas*
astro-ph/1904.02069: **Climate of an Ultra hot Jupiter: Spectroscopic phase curve of WASP-18b with HST/WFC3** by *Jacob Arcangeli et al.*
astro-ph/1904.02105: **Impact Dynamics of Moons Within a Planetary Potential** by *Raluca Rufu, Oded Aharonson*
astro-ph/1904.02127: **One Solution to the Mass Budget Problem for Planet Formation: Optically Thick Disks with Dust Scattering** by *Zhaohuan Zhu et al.*
astro-ph/1904.02163: **A planetesimal orbiting within the debris disc around a white dwarf star** by *Christopher J. Manser et al.*
astro-ph/1904.02173: **Dynamical Constraints on Mercury's Collisional Origin** by *Matthew S. Clement, Nathan A. Kaib, John E. Chambers*
astro-ph/1904.02218: **Evidence against non-gravitational acceleration of 1I/2017 U1 'Oumuamua** by *J. I. Katz*
astro-ph/1904.02253: **Tidal evolution of the Keplerian elements** by *Gwenaël Boué, Michael Efroimsky*
astro-ph/1904.02290: **Exciting mutual inclination in planetary systems with a distant stellar companion: the case of Kepler-108** by *Wenrui Xu, Daniel Fabrycky*

astro-ph/1904.02294: **Evaluating Climate Variability Of The Canonical Hot Jupiters Hd 189733b & Hd 209458b Through Multi-epoch Eclipse Observations** by *Brian M. Kilpatrick et al.*
astro-ph/1904.02407: **Primordial Earth mantle heterogeneity caused by the Moon-forming giant impact** by *Hongping Deng et al.*
astro-ph/1904.02409: **ALMA survey of Class II protoplanetary disks in Corona Australis: a young region with low disk masses** by *P. Cazzoletti et al.*
astro-ph/1904.02636: **Spectroscopic line parameters of NO, NO2, and N2O for the HITEMP database** by *Robert J. Hargreaves et al.*
astro-ph/1904.02715: **Exocometary Science** by *Luca Matrà et al.*
astro-ph/1904.02726: **Identifying Exoplanets with Deep Learning III: Automated Triage and Vetting of TESS Candidates** by *Liang Yu et al.*
astro-ph/1904.02733: **MASCARA-4 b/bRing-1b - A retrograde hot Jupiter around the bright A3V star HD 85628** by *P. Dorval et al.*
astro-ph/1904.02746: **Two cold belts in the debris disk around the G-type star NZ Lup** by *A. Boccaletti et al.*
astro-ph/1904.02752: **The dispersal of protoplanetary discs I: A new generation of X-ray photoevaporation models** by *Giovanni Picogna et al.*
astro-ph/1904.02980: **Kuiper belt: formation and evolution** by *Alessandro Morbidelli, David Nesvorny*
astro-ph/1904.03190: **Exoplanetary Atmospheres: Key Insights, Challenges and Prospects** by *Nikku Madhusudhan*
astro-ph/1904.03195: **Orbital relaxation and excitation of planets tidally interacting with white dwarfs** by *Dimitri Veras et al.*
astro-ph/1904.03200: **The Impact of Stellar Surface Magnetoconvection and Oscillations on the Detection of Temperate, Earth-Mass Planets Around Sun-Like Stars** by *H. M. Cegla*
astro-ph/1904.03364: **Significant improvement in the accuracy of simulated chaotic N-body orbits by using smoothness** by *David M. Hernandez*
astro-ph/1904.03480: **The Western Bulge of 162173 Ryugu Formed as a Result of a Rotationally Driven Deformation Process** by *Masatoshi Hirabayashi et al.*
astro-ph/1904.03869: **Nonsticky Ice at the Origin of the Uniformly Polarized Submillimeter Emission from the HL Tau Disk** by *Satoshi Okuzumi, Ryo Tazaki*
astro-ph/1904.03919: **The paradoxes of the Late Hesperian Mars ocean** by *Martin Turbet, Francois Forget*
astro-ph/1904.03956: **Lessons from early Earth: UV surface radiation should not limit the habitability of active M star systems** by *Jack T. O'Malley-James, Lisa Kaltenegger*
astro-ph/1904.04146: **Normalization of the Levi-Civita Hamiltonian at a collinear Lagrange point** by *Rocio Isabel Paez et al.*
astro-ph/1904.04170: **Exoplanet atmospheres with GIANO II. Detection of molecular absorption in the dayside spectrum of HD 102195b** by *G. Guilluy et al.*
astro-ph/1904.04284: **Modelling H+3 in planetary atmospheres: effects of vertical gradients on observed quantities** by *L. Moore et al.*
astro-ph/1904.04320: **X-ray Studies of Exoplanets: A 2020 Decadal Survey White Paper** by *Scott J. Wolk et al.*
astro-ph/1904.04407: **Decomposition of Amino Acids in Water with Application to In-Situ Measurements of Enceladus, Europa and Other Hydrothermally Active Icy Ocean Worlds** by *Ngoc Truong et al.*
astro-ph/1904.04740: **Wetter Stratospheres on High Obliquity Planets** by *Wanying Kang*
astro-ph/1904.04832: **The binary mass ratios of circumbinary planet hosts** by *David V. Martin*
astro-ph/1904.04839: **Astro 2020 Science White Paper: Evolved Planetary Systems around White Dwarfs** by *Boris Gaensicke et al.*
astro-ph/1904.04980: **Transiting Planets near the Snow Line from Kepler. I. Catalog** by *Hajime Kawahara, Kento Masuda*
astro-ph/1904.05356: **On degeneracies in retrievals of exoplanetary transmission spectra** by *Luis Welbanks, Nikku Madhusudhan*

astro-ph/1904.05358: **The Gemini Planet Imager Exoplanet Survey: Giant Planet and Brown Dwarf Demographics From 10-100 AU** by *Eric L. Nielsen et al.*

astro-ph/1904.05362: **First Light of Engineered Diffusers at the Nordic Optical Telescope Reveal Time Variability in the Optical Eclipse Depth of WASP-12b** by *C. von Essen et al.*

astro-ph/1904.05395: **Is there more than meets the eye? Presence and role of submicron grains in debris discs** by *Philippe Thebault, Quentin Kral*

astro-ph/1904.05669: **Medium Earth Orbit dynamical survey and its use in passive debris removal** by *Despoina K. Skoulidou et al.*

astro-ph/1904.05891: **The unbiased frequency of planetary signatures around single and binary white dwarfs using Spitzer and Hubble** by *Thomas G. Wilson et al.*

astro-ph/1904.05990: **Tiny Grains Shining Bright in the Gaps of Herbig Ae Transitional Discs** by *Eloise K. Birchall et al.*

astro-ph/1904.06155: **Pushing the Limits of Exoplanet Discovery via Direct Imaging with Deep Learning** by *Kai Hou Yip et al.*

astro-ph/1904.06360: **Indications for transit timing variations in the exo-Neptune HAT-P-26b** by *C. von Essen et al.*

astro-ph/1904.06379: **Multiband photometry of a Patroclus-Menoetius mutual event: Constraints on surface heterogeneity** by *Ian Wong, Michael E. Brown*

astro-ph/1904.06438: **On the Mass Function, Multiplicity, and Origins of Wide-Orbit Giant Planets** by *Kevin Wagner, Dániel Apai, Kaitlin M. Kratter*

astro-ph/1904.07047: **Accurate modelling of the low-order secondary resonances in the spin-orbit problem** by *Ioannis Gkolias et al.*

astro-ph/1904.07064: **Cooling in the shade of warped transition disks** by *Simon Casassus et al.*

astro-ph/1904.07161: **Impacts of Quantum Chemistry Calculations on Exoplanetary Science, Planetary Astronomy, and Astrophysics** by *Der-you Kao et al.*

astro-ph/1904.07215: **The surprisingly low carbon mass in the debris disk around HD 32297** by *Gianni Cataldi et al.*

astro-ph/1904.07224: **Discovery of a Meteor of Interstellar Origin** by *Amir Siraj, Abraham Loeb*

astro-ph/1904.07255: **Discovery of a Third Transiting Planet in the Kepler-47 Circumbinary System** by *Jerome A. Orosz et al.*

astro-ph/1904.07269: **APEX Observations of the CO Envelope around the Young FUor-type Star V883 Ori** by *Jacob Aaron White et al.*

astro-ph/1904.07338: **Excitation of Planetary Obliquities Through Planet-Disk Interactions** by *Sarah Millholland, Konstantin Batygin*

astro-ph/1904.07552: **Long-term Hydrodynamic Simulations on the Planetesimals Trapped in the First-order Mean Motion Resonances** by *He-Feng Hsieh, Ing-Guey Jiang*

astro-ph/1904.07592: **Potential softening and eccentricity dynamics in razor-thin, nearly-Keplerian discs** by *Antranik A. Sefilian, Roman R. Rafikov*

astro-ph/1904.07596: **Orbital decay of short-period gas giants under evolving tides** by *Jaime A. Alvarado, Carolina García-Carmona*

astro-ph/1904.07910: **Spontaneous ring formation in wind-emitting accretion discs** by *A. Riols, G. Lesur*

astro-ph/1904.07929: **Could there be an undetected inner planet near the stability limit in Kepler-1647?** by *Ziqian Hong et al.*

astro-ph/1904.07997: **NGTS-6b: An Ultra Hot-Jupiter Orbiting a Metal-rich star** by *Jose I. Vines et al.*

astro-ph/1904.08300: **Linking the evolution of terrestrial interiors and an early outgassed atmosphere to astrophysical observations** by *Dan J. Bower et al.*

astro-ph/1904.08446: **Mars Obliquity History Constrained by Elliptic Crater Orientations** by *Samuel J. Holo , Edwin S. Kite , Stuart J. Robbins*

astro-ph/1904.08567: **Search for nearby Earth analogs I. 15 planet candidates found in PFS data** by *Fabo Feng* *et al.*

astro-ph/1904.08797: **Debris Disk Composition: A Diagnostic Tool for Planet Formation and Migration** by *Christine Chen et al.*

astro-ph/1904.08899: **Non-ideal MHD simulation of HL Tau disk: formation of rings** by *Xiao Hu et al.*

astro-ph/1904.08922: **Blue, white, and red ocean planets - Simulations of orbital variations in flux and polarization colors** by *Victor J.H. Trees, Daphne M. Stam*

astro-ph/1904.09089: **Unexpectedly strong effect of supergranulation on the detectability of Earth twins orbiting Sun-like stars with radial velocities** by *N. Meunier, A.-M. Lagrange*

astro-ph/1904.09303: **Line Ratios Reveal N2H+ Emission Originates Above the Midplane in TW Hydrae** by *Kamber R. Schwarz , Richard Teague , Edwin A. Bergin*

astro-ph/1904.09315: **A survey of C2H, HCN, and C18O in protoplanetary disks** by *Jennifer B. Bergner et al.*

astro-ph/1904.09355: **Exoplanet Reflected Light Spectroscopy with PICASO** by *Natasha E. Batalha et al.*

astro-ph/1904.09419: **Identification of organic molecules with a laboratory prototype based on the Laser Ablation-CosmOrbitrap** by *L. Selliez et al.*

astro-ph/1904.09580: **Compound chondrule formation in optically thin shock waves** by *Sota Arakawa, Taishi Nakamoto*

astro-ph/1904.09676: **Vertical Tracer Mixing in Hot Jupiter Atmospheres** by *Thaddeus D. Komacek, Adam P. Showman, Vivien Parmentier*

astro-ph/1904.09866: **Constraints on a Putative Planet Sculpting the V4046 Sagittarii Circumbinary Disk** by *Dary Ruiz-Rodriguez et al.*

astro-ph/1904.09986: **Theoretical Transmission Spectra of Exoplanet Atmospheres with Hydrocarbon Haze. II. Dependence on UV Irradiation Intensity, Metallicity, C/O Ratio, Eddy Diffusion Coefficient, and Temperature** by *Yui Kawashima, Masahiro Ikoma*

astro-ph/1904.10288: **The Heavy-element Content Trend of Planets: A Tracer of their Formation Sites** by *Yasuhiro Hasegawa, Bradley M. S. Hansen, Gautam Vasisht*

astro-ph/1904.10388: **WASP-169, WASP-171, WASP-175 and WASP-182: One bloated sub-Saturn and three hot Jupiters discovered by WASP-south** by *L. D. Nielsen et al.*

astro-ph/1904.10422: **Unlocking CO Depletion in Protoplanetary Disks II. Primordial C/H Predictions Inside the CO Snowline** by *Kamber R. Schwarz et al.*

astro-ph/1904.10458: **Internal Structure and CO2 Reservoirs of Habitable Water-Worlds** by *Nadejda Marounina, Leslie A. Rogers*

astro-ph/1904.10470: **The Boundary Between Gas-rich and Gas-poor Planets** by *Eve J. Lee*

astro-ph/1904.10474: **Atmospheres and UV Environments of Earth-like Planets Throughout Post-Main Sequence Evolution** by *Thea Kozakis, Lisa Kaltenegger*

astro-ph/1904.10618: **No Evidence for Lunar Transit in New Analysis of HST Observations of the Kepler-1625 System** by *Laura Kreidberg, Rodrigo Luger, Megan Bedell*

astro-ph/1904.10793: **CoRoT: The First Space-Based Transit Survey to Explore the Close-in Planet Population** by *Magali Deleuil, Malcolm Fridlund*

astro-ph/1904.10896: **Shallow Ultraviolet Transits of WD 1145+017** by *Siyi Xu et al.*

astro-ph/1904.11047: **Thermal torque effects on the migration of growing low-mass planets** by *O. M. Guilera et al.*

astro-ph/1904.11504: **petitRADTRANS: a Python radiative transfer package for exoplanet characterization and retrieval** by *P. Mollière et al.*

astro-ph/1904.11517: **An Inner Disk in the Large Gap of the Transition Disk SR 24S** by *Paola Pinilla et al.*

astro-ph/1904.11631: **Polar alignment of a protoplanetary disc around an eccentric binary III: Effect of disc mass** by *Rebecca G. Martin, Stephen H. Lubow*

astro-ph/1904.11716: **The Role of N2 as a Geo-Biosignature for the Detection and Characterization of Earth-like Habitats** by *Helmut Lammer et al.*

astro-ph/1904.11837: **The coupling between inertial and rotational eigenmodes in planets with liquid cores** by

Santiago Andres Triana et al.

astro-ph/1904.11852: **TOI-216b and TOI-216c: Two warm, large exoplanets in or slightly wide of the 2:1 orbital resonance** by *Rebekah I. Dawson et al.*

astro-ph/1904.11896: **Loose Ends for the Exomoon Candidate Host Kepler-1625b** by *Alex Teachey et al.*

astro-ph/1904.11988: **The ExoEarth Yield Landscape for Future Direct Imaging Space Telescopes** by *Christopher C. Stark et al.*

astro-ph/1904.12062: **The inverse Lidov-Kozai resonance for an outer test particle due to an eccentric perturber** by *Gonzalo Carlos de Elía et al.*

astro-ph/1904.12267: **Effects of Radius and Gravity on the Inner Edge of the Habitable Zone** by *Huanzhou Yang, Thaddeus D. Komacek, Dorian S. Abbot*

astro-ph/1904.12404: **Co-orbital Asteroids as the Source of Venus's Zodiacal Dust Ring** by *Petr Pokorný, Marc J. Kuchner*

astro-ph/1904.12419: **Detecting Exoplanet Transits through Machine Learning Techniques with Convolutional Neural Networks** by *Pattana Chintarungruangchai et al.*

astro-ph/1904.12497: **Oscillatory migration of accreting protoplanets driven by a 3D distortion of the gas flow** by *Ondřej Chrenko, Michiel Lambrechts*

astro-ph/1904.12781: **A Tight Relation between Spiral Arm Pitch Angle and Protoplanetary Disk Mass** by *Si-Yue Yu, Luis C. Ho, Zhaohuan Zhu*

astro-ph/1904.12790: **Astro 2020: Astromineralogy of interstellar dust with X-ray spectroscopy** by *Lia Corrales et al.*

astro-ph/1904.12818: **A planetary system around the nearby M dwarf Gl 357 including a transiting hot Earth-sized planet optimal for atmospheric characterisation** by *R. Luque et al.*

astro-ph/1904.12854: **Collisional formation of detectable exomoons of super-terrestrial exoplanets** by *Uri Malamud et al.*

astro-ph/1904.12931: **Detection of Planetary and Stellar Companions to Neighboring Stars via a Combination of Radial Velocity and Direct Imaging Techniques** by *Stephen R. Kane et al.*

astro-ph/1904.13120: **The Formation of Habitable Planets in the Four-Planet System HD 141399** by *R. Dvorak et al.*

astro-ph/1904.13334: **Equatorial anti-rotating day side wind flow in WASP-43b elicited by deep wind jets?** by *Ludmila Carone et al.*

astro-ph/1904.00142: **Do Kepler superflare stars really include slowly-rotating Sun-like stars ? - Results using APO 3.5m telescope spectroscopic observations and Gaia-DR2 data -** by *Yuta Notsu et al.*

astro-ph/1904.00225: **Rossby and Magnetic Prandtl Number Scaling of Stellar Dynamos** by *K. C. Augustson, A. S. Brun, J. Toomre*

astro-ph/1904.01239: **Detecting exoplanets with FAST?** by *Philippe Zarka et al.*

astro-ph/1904.01437: **Activity time series of old stars from late F to early K. I. Simulating radial velocity, astrometry, photometry, and chromospheric emission** by *N. Meunier et al.*

astro-ph/1904.01591: **A possibly inflated planet around the bright, young star DS Tuc A** by *S. Benatti et al.*

astro-ph/1904.03231: **The CARMENES search for exoplanets around M dwarfs: Different roads to radii and masses of the target stars** by *Andreas Schweitzer et al.*

astro-ph/1904.03557: **Precise radial velocities of giant stars. XI. Two brown dwarfs in 6:1 mean motion resonance around the K giant star ν Ophiuchi** by *Andreas Quirrenbach et al.*

astro-ph/1904.03939: **How stars and planets interact: a look through the high-energy window** by *Katja Poppenhaeger*

astro-ph/1904.04489: **Stellar activity and rotation of the planet host Kepler-17 from long-term space-borne photometry** by *A. F. Lanza et al.*

astro-ph/1904.05032: **Magnetohydrodynamics in a Cylindrical Shearing Box** by *Takeru K. Suzuki, Tetsuo Taki, Scott S. Suriano*

astro-ph/1904.05608: **Reducing activity-induced variations in a radial-velocity time series of the Sun as a**

star by *A. F. Lanza, A. Collier Cameron, R. D. Haywood*

astro-ph/1904.05976: **Developing a vision for exoplanetary transit spectroscopy: a shared window on the analysis of planetary atmospheres and of stellar magnetic structure** by *Adam F. Kowalski et al.*

astro-ph/1904.06471: **The Ophiuchus DIsk Survey Employing ALMA (ODISEA): Disk Dust Mass Distributions across Protostellar Evolutionary Classes** by *Jonathan P. Williams et al.*

astro-ph/1904.07008: **Evolution of three-dimensional Relativistic Ion Weibel Instability: Competition with Kink Instability** by *Makoto Takamoto, Yosuke Matsumoto, Tsunehiko N. Kato*

astro-ph/1904.07323: **Causation of Late Quaternary Rapid-increase Radiocarbon Anomalies** by *G. Robert Brakenridge*

astro-ph/1904.07718: **OGLE-2017-BLG-1186: first application of asteroseismology and Gaussian processes to microlensing** by *Shun-Sheng Li et al.*

astro-ph/1904.07879: **The Keplerian three-body encounter II. Comparisons with isolated encounters and impact on gravitational wave merger timescales** by *Alessandro A. Trani et al.*

astro-ph/1904.08295: **Stellar activity and planetary atmosphere evolution in tight binary star systems** by *C. P. Johnstone et al.*

astro-ph/1904.09624: **Analytic computation of the secular effects of encounters on a binary: features arising from second-order perturbation theory** by *Adrian S. Hamers, Johan Samsing*

astro-ph/1904.09991: **First radial velocity results from the MINiature Exoplanet Radial Velocity Array (MINERVA)** by *Maurice L. Wilson et al.*

astro-ph/1904.10421: **EvryFlare I: Long-term Evryscope Monitoring of Flares from the Cool Stars Across Half the Southern Sky** by *Ward S. Howard et al.*

astro-ph/1904.11494: **Simulating the Diverse Instabilities of Dust in Magnetized Gas** by *Philip F. Hopkins , Jonathan Squire , Darryl Seligman*

astro-ph/1904.11664: **A Close-in Substellar Object Orbiting the sdOB-type Eclipsing-Binary System NSVS14256825** by *Zhu L.-Y. et al.*

astro-ph/1904.12155: **ExoMol line lists - XXXII. The rovibronic spectrum of MgO** by *Heng Ying Li, Jonathan Tennyson, Sergei N. Yurchenko*

astro-ph/1904.12186: **Three years of Sun-as-a-star radial-velocity observations on the approach to solar minimum** by *A. Collier Cameron et al.*

astro-ph/1904.00436: **Attitude and orbit coupling of planar helio-stable solar sails** by *Narcis Miguel, Camilla Colombo*

astro-ph/1904.01062: **Advanced Aspects of the Galactic Habitability** by *Vladimir Đošović, Branislav Vukotić, Milan M. Ćirković*

astro-ph/1904.01929: **Validation of the neutron monitor yield function using data from AMS-02 experiment, 2011–2017** by *Sergey A. Koldobskiy et al.*

astro-ph/1904.05221: **Inertial Modes in Near-Spherical Geometries** by *J. Rekier et al.*