ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to Edition 118 of the ExoPlanet News!

We are pleased to send you the next ExoPlanet newsletter in 2019 with numerous abstracts of new scientific papers, job ads, conference and school announcements, the monthly updates from the NASA exoplanet archive, and the overview of the new exoplanet-related articles on astro-ph. The first call for proposals for the CHEOPS guest observers programme is also included. Thanks a lot to all of you who contributed to this extensive issue of the newsletter!

The big astronomy headline of the month was certainly the spectacular announcement that the Event Horizon Telescope has succeeded to unveil the first direct visual evidence of a supermassive black hole. But there were also other events, like for example the celebration of the 50th anniversary of the inauguration of ESO's La Silla Observatory. Construction of La Silla began three years earlier, in 1965, which was in turn three years after the foundation of ESO, and La Silla has - especially since the installation of the HARPS spectrograph - played a major role also in exoplanet science.

Looking ahead to edition 119, we are again looking forward to your paper abstract, job ad or meeting announcement. Also special announcements of all kinds are welcome. As always, we would also be happy to receive feedback concerning the newsletter. The Latex template for submitting contributions, as well as all previous editions of ExoPlanet News, can be found on the ExoPlanet News webpage (http://nccr-planets.ch/exoplanetnews/).

The next issue will appear 13 May 2019.

Thanks for all your support and best regards from Switzerland,

Christoph Mordasini
Yann Alibert
Adrien Leleu
Sascha P. Quanz

2 Abstracts of refereed papers

The Impact of Stellar Surface Magnetoconvection and Oscillations on the Detection of Temperate, Earth-Mass Planets Around Sun-Like Stars

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Geosciences, published (2019Geosc...9..114C)

Detecting and confirming terrestrial planets is incredibly difficult due to their tiny size and mass relative to Sun-like host stars. However, recent instrumental advancements are making the detection of Earth-like exoplanets technologically feasible. For example, Kepler and TESS photometric precision means we can identify Earth-sized candidates (and PLATO in the future will add many long-period candidates to the list), while spectrographs such as ESPRESSO and EXPRES (with an aimed radial velocity precision [RV] near 10 cm s^{-1}) mean we will soon reach the instrumental precision required to confirm Earth-mass planets in the habitable zones of Sun-like stars. However, many astrophysical phenomena on the surfaces of these host stars can imprint signatures on the stellar absorption lines used to detect the Doppler wobble induced by planetary companions. The result is stellar-induced spurious RV shifts that can mask or mimic planet signals. This review provides a brief overview of how stellar surface magnetoconvection and oscillations can impact low-mass planet confirmation and the best-tested strategies to overcome this astrophysical noise. These noise reduction strategies originate from a combination of empirical motivation and a theoretical understanding of the underlying physics. The most recent predications indicate that stellar oscillations for Sun-like stars may be averaged out with tailored exposure times, while granulation may need to be disentangled by inspecting its imprint on the stellar line profile shapes. Overall, the literature suggests that Earth-analog detection should be possible, with the correct observing strategy and sufficient data collection.

Download/Website: `https://www.mdpi.com/2076-3263/9/3/114`

Download/Website: `https://arxiv.org/abs/1904.03200`

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Stellar Surface Magneto-Convection as a Source of Astrophysical Noise III. Sun-as-a-star Simulations and Optimal Noise Diagnostics

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The Astrophysical Journal, in press (arXiv:1903.08446)

Stellar surface magnetoconvection (granulation) creates asymmetries in the observed stellar absorption lines that can subsequently manifest themselves as spurious radial velocities shifts. In turn, this can then mask the Doppler-reflex motion induced by orbiting planets on their host stars, and represents a particular challenge for determining the masses of low-mass, long-period planets. Herein, we study this impact by creating Sun-as-a-star observations that encapsulate the granulation variability expected from 3D magnetohydrodynamic simulations. These Sun-as-a-star model observations are in good agreement with empirical observations of the Sun, but may underestimate the total variability relative to the quiet Sun due to the increased magnetic field strength in our models. We find numerous line profile characteristics linearly correlate with the disc-integrated convection-induced velocities. Removing the various correlations with the line bisector, equivalent width, and the V_{asy} indicator may reduce ~50-60% of the

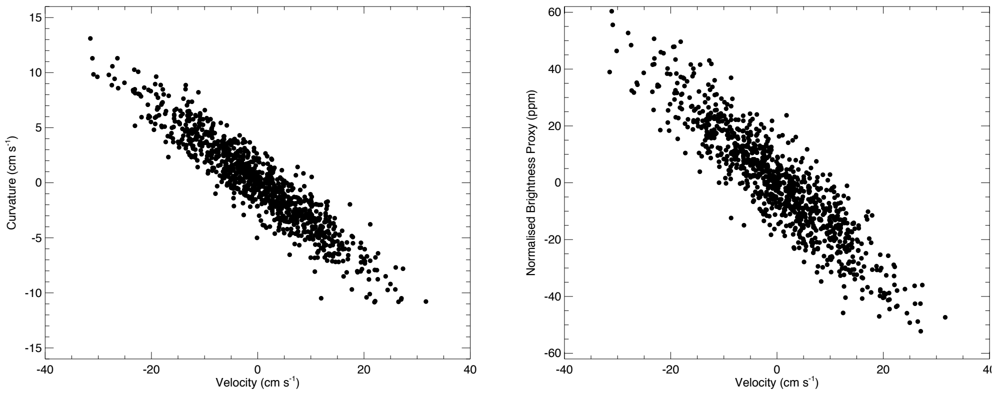

Figure 1: Cegla et al.: The (mean-subtracted) bisector curvature (**left**) and normalized brightness proxy (**right**) as a function of the granulation-induced velocity shifts from our Sun-as-a-star simulations; the brightness was approximated by integrating the area under the Fe I 6302 $\AA$ line profile. A strong linear correlation is clearly discernible, which may be observable with the next generation of spectrographs and space-based photometric missions, e.g. ESPRESSO and TESS/CHEOPS/PLATO. By removing such correlations, we may be able to disentangle and mitigate the granulation-induced velocity variability by $\sim$50% or more.

granulation noise in the measured velocities. We also find that simultaneous photometry may be a key diagnostic, as our proxy for photometric brightness also allowed us to remove $\sim$50% of the granulation-induced radial velocity noise. These correlations and granulation-noise mitigations breakdown in the presence of low instrumental resolution and/or increased stellar rotation, as both act to smooth the observed line profile asymmetries.

Download/Website: `https://arxiv.org/abs/1903.08446`

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Filtering Solar-like Oscillations for Exoplanet Detection in Radial Velocity Observations

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The Astronomical Journal, in press (arXiv:1903.00657)

Cool main-sequence, subgiant and red giant stars all show solar-like oscillations, pulsations that are excited and intrinsically damped by near-surface convection. Many overtones are typically excited to observable amplitudes, giving a rich spectrum of detectable modes. These modes provide a wealth of information on fundamental stellar properties. However, the radial velocity shifts induced by these oscillations can also be problematic when searching for low-mass, long-period planets; this is because their amplitudes are large enough to completely mask such minute planetary signals. Here we show how fine-tuning exposure times to the stellar parameters can help efficiently average out the solar-like, oscillation-induced shifts. To reduce the oscillation signal to the radial velocity precision commensurate with an Earth-analogue, we find that for cool, low-mass stars (near spectral type K) the necessary exposure times may be as short as 4 minutes, while for hotter, higher-mass stars (near spectral type F, or slightly

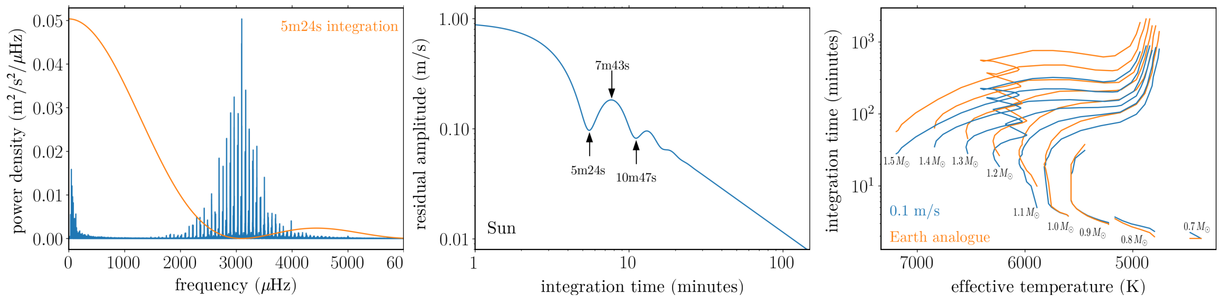

Figure 2: Chaplin et al.: **Left:** Model oscillation spectrum, constructed to mimic Sun-as-a-star observations (blue), with the filter response function for a 5.4 minute exposure time (orange). **Middle:** Residual oscillation mode amplitude versus integration duration, i.e. the exposure time, for a solar-twin. **Right:** Exposure duration, for stellar evolutionary tracks corresponding to stars with masses ranging from M = 0.7 - 1.5 $M_{\odot}$, necessary to reach either a residual amplitude of 0.1 m s^{-1} (blue) or the equivalent of an Earth-analogue (orange).

evolved), the required exposure times can be longer than 100 minutes. We provide guideline exposure durations required to suppress the total observed amplitude due to oscillations to a level of $0.1\,\mathrm{m\,s^{-1}}$, and a level corresponding to the Earth-analogue reflex amplitude for the star. Owing to the intrinsic stochastic variability of the oscillations, we recommend in practice choosing short exposure durations at the telescope and then averaging over those exposures later, as guided by our predictions. To summarise, as we enter an era of $0.1\,\mathrm{m\,s^{-1}}$ instrumental precision, it is critical to tailor our observing strategies to the stellar properties.

Download/Website: `https://arxiv.org/abs/1903.00657`

Download/Website: `https://github.com/grd349/ChaplinFilter`

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The Mass of Stirring Bodies in the AU Mic Debris Disk Inferred from Resolved Vertical Structure

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The Astrophysical Journal, in press (arXiv:1904.00027)

The vertical distribution of dust in debris disks is sensitive to the number and size of large planetesimals dynamically stirring the disk, and is therefore well-suited for constraining the prevalence of otherwise unobservable Uranus and Neptune analogs. Information regarding stirring bodies has previously been inferred from infrared and optical observations of debris disk vertical structure, but theoretical works predict that the small particles traced by short-wavelength observations will be 'puffed up' by radiation pressure, yielding only upper limits. The large grains that dominate the disk emission at millimeter wavelengths are much less sensitive to the effects of stellar radiation or stellar winds, and therefore trace the underlying mass distribution more directly. Here we present ALMA 1.3 mm dust continuum observations of the debris disk around the nearby M star AU Mic. The 3 au spatial resolution of the observations, combined with the favorable edge-on geometry of the system, allows us to measure the vertical thickness of the disk. We report a scale height-to-radius aspect ratio of $h = 0.031^{+0.005}_{-0.004}$ between radii of ~ 23 au and ~ 41 au. Comparing this aspect ratio to a theoretical model of size-dependent velocity distributions in the collisional cascade, we find that the perturbing bodies embedded in the local disk must be larger than about 400 km, and the largest perturbing body must be smaller than roughly 1.8 $M_\odot$. These measurements rule out the presence of a gas giant or Neptune analog near the ~ 40 au outer edge of the debris ring, but are suggestive of large planetesimals or an Earth-sized planet stirring the dust distribution.

Download/Website: `https://arxiv.org/abs/1904.00027`

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The SOPHIE search for northern extrasolar planets XIV. A temperate ($T_{\rm eq} \sim 300$ K) super-earth around the nearby star Gliese 411

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Astronomy & Astrophysics, in press (arXiv:1902.06004)

Periodic radial velocity variations in the nearby M-dwarf star Gl411 are reported, based on measurements with the SOPHIE spectrograph. Current data do not allow us to distinguish between a 12.95-day period and its one-day alias at 1.08 days, but favour the former slightly. The velocity variation has an amplitude of 1.6 $\mathrm{m\,s^{-1}}$, making this the lowest-amplitude signal detected with SOPHIE up to now. We have performed a detailed analysis of the significance of the signal and its origin, including extensive simulations with both uncorrelated and correlated noise, representing the signal induced by stellar activity. The signal is significantly detected, and the results from all tests point to its planetary origin. Additionally, the presence of an additional acceleration in the velocity time series is suggested by the current data. On the other hand, a previously reported signal with a period of 9.9 days, detected in HIRES velocities of this star, is not recovered in the SOPHIE data. An independent analysis of the HIRES dataset also fails to unveil the 9.9-day signal.
If the 12.95-day period is the real one, the amplitude of the signal detected with SOPHIE implies the presence of a planet, called Gl411 b, with a minimum mass of around three Earth masses, orbiting its star at a distance of 0.079 AU. The planet receives about 3.5 times the insolation received by Earth, which implies an equilibrium temperature between 256 K and 350 K, and makes it too hot to be in the habitable zone. At a distance of only 2.5 pc, Gl411 b,

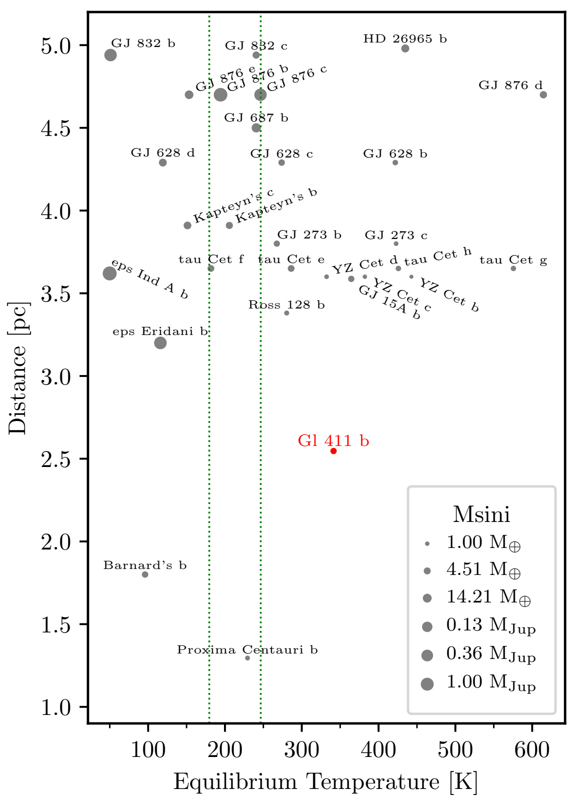

Figure 3: Diaz et al.: Equilibrium temperature and distance to the Sun for planets currently known within 5 pc from the Solar System. Equilibrium temperatures were computed assuming circular orbits for all objects, and a Bond albedo of 0.3. The limits of the habitable zone for a star like Gl411 are indicated by green dotted lines. The symbol sizes are proportional to the natural logarithm of the minimum mass.

is the third closest low-mass planet detected to date. Its proximity to Earth will permit probing its atmosphere with a combination of high-contrast imaging and high-dispersion spectroscopy in the next decade.

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The carbon-to-oxygen ratio: implications for the spectra of hydrogen-dominated exoplanet atmospheres

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1903.10997)

We present results from one-dimensional atmospheric simulations investigating the effect of varying the carbon-to-oxygen (C/O) ratio on the thermal structure, chemical composition and transmission and emission spectra, for irradiated hydrogen-dominated atmospheres. We find that each of these properties of the atmosphere are strongly dependent on the individual abundances (relative to hydrogen) of carbon and oxygen. We confirm previous findings that different chemical equilibrium compositions result from different sets of element abundances but with the same C/O ratio. We investigate the effect of this difference in composition on the thermal structure and simulated spectra. We also simulate observations using the PandExo tool and show that these differences are observationally significant with current (i.e. Hubble Space Telescope) and future (i.e. James Webb Space Telescope) instruments. We conclude

that it is important to consider the full set of individual element abundances, with respect to hydrogen, rather than the ratios of only two elements, such as the C/O ratio, particularly when comparing model predictions with observed transmission and emission spectra.

Download/Website: `http://adsabs.harvard.edu/doi/10.1093/mnras/stz909`

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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

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Astronomy & Astrophysics, accepted (arXiv:1904.00651)

We apply for the first time the transit least-squares (`TLS`) algorithm to search for new transiting exoplanets. `TLS` has been developed as a successor to the box least-squares (`BLS`) algorithm, which has served as a standard tool for the detection of periodic transits. In this proof-of-concept paper, we demonstrate that `TLS` finds small planets that have previously been missed. We show the capabilities of `TLS` using the K2 `EVEREST`-detrended light curve of the star K2-32 (EPIC 205071984), which has been known to have three transiting planets. `TLS` detects these known Neptune-sized planets K2-32 b, d, and c in an iterative search and finds an additional transit signal with a high signal detection efficiency (SDE_{TLS}) of 26.1 at a period of $4.34882^{+0.00069}_{-0.00075}$ d. We show that this additional signal remains detectable (SDE_{TLS} = 13.2) with `TLS` in the `K2SFF` light curve of K2-32, which includes a less optimal detrending of the systematic trends. The signal is below common detection thresholds if searched with `BLS` in the `K2SFF` light curve (SDE_{BLS} = 8.9), however, as in previous searches. Markov chain Monte Carlo sampling with the `emcee` software shows that the radius of this candidate is $1.01^{+0.10}_{-0.09}\,R_{\oplus}$. We analyzed its phase-folded transit light curve using the `vespa` software and calculated a false-positive probability $\mathrm{FPP} = 3.1 \times 10^{-3}$. Taking into account the multiplicity boost of the system, we estimate an $\mathrm{FPP} < 3.1 \times 10^{-4}$, which formally validates K2-32 e as a planet. K2-32 now hosts at least four planets that are very close to a 1:2:5:7 mean motion resonance chain. The offset of the orbital periods of K2-32 e and b from a 1:2 mean motion resonance agrees very well with the sample of transiting multiplanet systems from *Kepler*, lending further credence to the planetary nature of K2-32 e. We expect that `TLS` can find many more transits of Earth-sized and even smaller planets in the *Kepler* and *K2* data that have so far remained undetected with algorithms that search for box-like signals.

Download/Website: `https://arxiv.org/abs/1904.00651`

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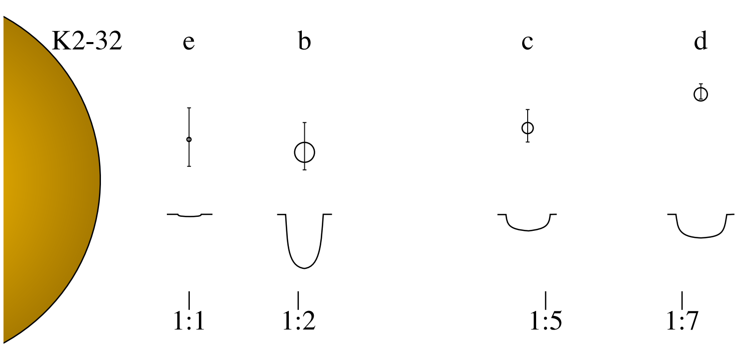

Figure 4: Heller et al.: System architecture. Stellar and planetary radii are to scale. Planetary distances to the star are mutually to scale, but not with respect to the radii. The shapes of the transit light curves are to scale as well. Orbital resonances are indicated with respect to the innermost planet K2-32 e. The error bars denote our uncertainties in the transit impact parameter.

Storms or systematics? The changing secondary eclipse depth of WASP-12b

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1904.01973)

WASP-12b is one of the most well-studied transiting exoplanets, as its highly inflated radius and its 1.1 d orbit around a G0-type star make it an excellent target for atmospheric categorisation through observation during its secondary eclipse. We present two new secondary eclipse observations of WASP-12b, acquired a year apart with the Wide Field Camera on the Isaac Newton Telescope (INT) and the IO:O instrument on the Liverpool Telescope (LT). These observations were conducted in the i'-band, a window expected to be dominated by titanium oxide features if present in appreciable quantities in the upper atmosphere. We measured eclipse depths that disagree with each other by $\sim 3\sigma$ (0.97 $\pm$ 0.14 mmag on the INT and 0.44 $\pm$ 0.21 mmag on the LT), a result that is mirrored in previous z'-band secondary eclipse measurements for WASP-12b. We explore explanations for these disagreements, including systematic errors and variable thermal emission in the dayside atmosphere of WASP-12b caused by temperature changes of a few hundred Kelvin: a possibility we cannot rule out from our analysis. Full-phase curves observed with *TESS* and *CHEOPS* have the potential to detect similar atmospheric variability for WASP-12b and other optimal targets, and a strategic, multi-telescope approach to future ground-based secondary eclipse observations is required to discriminate between explanations involving storms and systematics.

Download/Website: `https://arxiv.org/abs/1904.01973`

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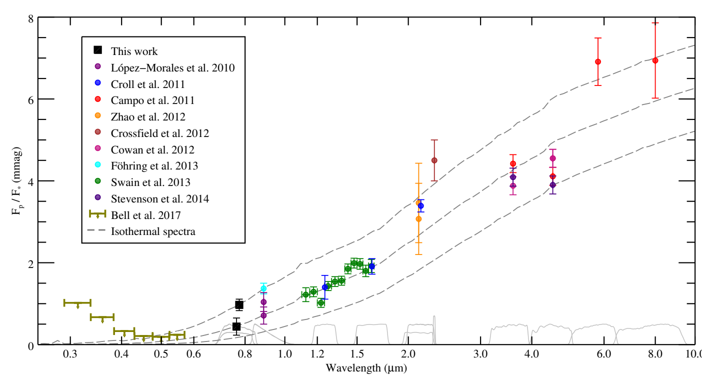

Figure 5: Hooton et al.: A comparison of all WASP-12b secondary eclipse observations. Data points show reported eclipse depths of WASP-12b across the NUV, optical and NIR. The depths displayed from López-Morales et al. (2010) and Zhao et al. (2012) are the depths associated with each of their individual eclipse observations, not the combined depths that are more commonly used. For the *HST* spectrophotometry from Bell et al. (2017) and Swain et al. (2013), the horizontal bars denote the width of the bins. The solid grey lines show response functions associated with each of the photometric eclipse measurements. Points marked with a downward arrow denote 2σ upper limits on the eclipse depth from Bell et al. (2017). Grey dashed lines show the eclipse depths associated with WASP-12b dayside emission modelled by blackbody spectra with T_{B} = 2600 K, 3000 K and 3400 K.

Co-orbital exoplanets from close-period candidates: The TOI-178 case

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Astronomy & Astrophysics, published (arXiv:1901.07250)

Despite the existence of co-orbital bodies in the solar system, and the prediction of the formation of co-orbital planets by planetary system formation models, no co-orbital exoplanets (also called trojans) have been detected thus far. Here we study the signature of co-orbital exoplanets in transit surveys when two planet candidates in the system orbit the star with similar periods. Such a pair of candidates could be discarded as false positives because they are not Hill-stable. However, horseshoe or long-libration-period tadpole co-orbital configurations can explain such period similarity. This degeneracy can be solved by considering the transit timing variations (TTVs) of each planet. We subsequently focus on the three-planet-candidate system TOI-178: the two outer candidates of that system have similar orbital periods and were found to have an angular separation close to $\pi/3$ during the TESS observation of sector 2. Based on the announced orbits, the long-term stability of the system requires the two close-period planets to be co-orbital. Our independent detrending and transit search recover and slightly favour the three orbits close to a 3:2:2 resonant chain found by the TESS pipeline, although we cannot exclude an alias that would put the system close to a 4:3:2 configuration. We then analyse the co-orbital scenario in more detail, and show that despite the influence of an inner planet just outside the 2:3 MMR, this potential co-orbital system could be stable on a gigayear time-scale for a variety of planetary masses, either on a trojan or a horseshoe orbit. We predict that large TTVs should arise in such a configuration with a period of several hundred days. We then show how the mass of each planet can be retrieved from these TTVs.

Download/Website: `https://www.aanda.org/articles/aa/pdf/2019/04/aa34901-18.pdf`

Contact: `adrien.leleu@space.unibe.ch`

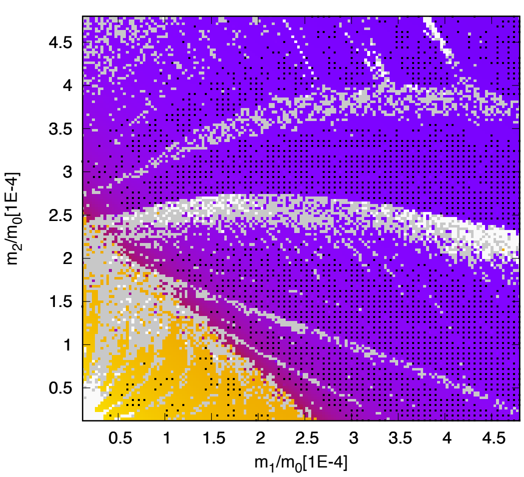

Figure 6: Leleu et al.: Stability domains for the co-orbital candidates of the TOI-178 system as a function of the mass of the two co-orbitals m_1 and m_2 with respect to the mass of the star m_0, fixing the mass of the 6.5 day planet at $m_3 = 2.5 \times 10^{-5} m_0$. Black dots represent orbits that are stable over 10^{10} orbital periods, while white and grey pixels represent orbits that are unstable over 10^6 orbital periods, mainly due to the perturbations from the 3rd planet. In the orange area the planets 1 and 2 are in a horseshoe configuration, while in the purple area they are in a tadpole configuration, librating around the equilateral Lagrangian equilibria.

Photo-evaporation of close-in gas giants orbiting around G and M stars

D. Locci[1], *C. Cecchi-Pestellini*[1], *G. Micela*[1]
INAF – Osservatorio Astronomico di Palermo, Piazza del Parlamento 1, I-90134 Palermo, Italy

Astronomy & Astrophysics, in press (arXiv:1903.10911)

X-rays and extreme ultraviolet radiation impacting a gas produce a variety of effects that, depending on the electron content, may provide significant heating of the illuminated region. In a planetary atmosphere of solar composition, stellar high energy radiation can heat the gas to very high temperatures and this could affect the stability of planetary atmospheres, in particular for close-in planets. We investigate the variations with stellar age in the occurring frequency of gas giant planets orbiting G and M stars, taking into account that the high energy luminosity of a low mass star evolves in time, both in intensity and hardness. Using the energy-limited escape approach we investigated the effects induced by the atmospheric mass loss on giant exoplanet distribution that is initially flat, at several distances from the parent star. We followed the dynamical evolution of the planet atmosphere, tracking the departures from the initial profile due to the atmospheric escape, until it reaches the final mass-radius configuration. We find that a significant fraction of low mass Jupiter-like planets orbiting with periods lower than ~ 3.5 days either vaporize during the first billion years or lose a relevant part of their atmospheres. The planetary initial mass profile is significantly distorted; in particular, the frequency of occurrence of gas giants, less massive than 2 M_J, around young stars can be considerably greater than their occurrence around older stellar counterparts.

Download/Website: `https://doi.org/10.1051/0004-6361/201834491`

Contact: `daniele.locci@inaf.it`

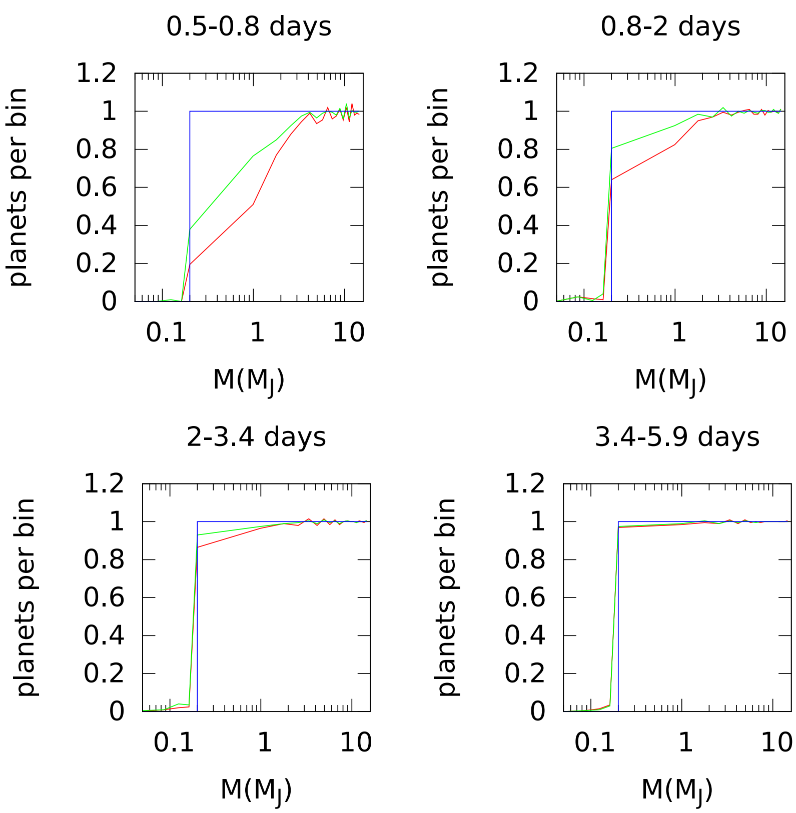

Figure 7: Locci et al.: Normalized number of planets per mass bin. Each panel corresponds to an orbital period interval. The initial (flat) mass distribution: blue line; final mass distribution for planets around dG stars: red line; and final mass distribution for planet around dM stars: green line. Since radiative effects are negligible, orbital periods longer than ~ 6 days have not been shown.

Orbital relaxation and excitation of planets tidally interacting with white dwarfs

Dimitri Veras[1,2], *Michael Efroimsky*[3], *Valeri V. Makarov*[3], *Gwenaël Boué*[4], *Vera Wolthoff*[5], *Sabine Reffert*[5], *Andreas Quirrenbach*[5], *Pier-Emmanuel Tremblay*[2], *Boris T. Gänsicke*[1,2]

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[2] Department of Physics, University of Warwick, Coventry, CV4 7AL, UK
[3] US Naval Observatory, Washington DC 20392, USA
[4] IMCCE, Observatoire de Paris, UPMC Univ. Paris 6, PSL Research University, Paris, France
[5] Landessternwarte, Zentrum für Astronomie der Universität Heidelberg, Königstuhl 12, 69117 Heidelberg, Germany

MNRAS, In Press, arXiv:1904.03195

Observational evidence of white dwarf planetary systems is dominated by the remains of exo-asteroids through accreted metals, debris discs, and orbiting planetesimals. However, exo-planets in these systems play crucial roles as perturbing agents, and can themselves be perturbed close to the white dwarf Roche radius. Here, we illustrate a procedure for computing the tidal interaction between a white dwarf and a near-spherical solid planet. This method determines the planet's inward and/or outward drift, and whether the planet will reach the Roche radius and be destroyed. We avoid constant tidal lag formulations and instead employ the self-consistent secular Darwin-Kaula expansions from Boué & Efroimsky (2019), which feature an arbitrary frequency dependence on the quality functions. We adopt wide ranges of dynamic viscosities and spin rates for the planet in order to straddle many possible outcomes, and provide a foundation for the future study of individual systems with known or assumed rheologies. We find that: (i) massive Super-Earths are destroyed more readily than minor planets (such as the ones orbiting WD 1145+017 and SDSS J1228+1040), (ii) low-viscosity planets are destroyed more easily than high-viscosity planets, and (iii) the boundary between survival and destruction is likely to be fractal and chaotic.

Download/Website: `https://arxiv.org/abs/1904.03195`

Contact: `d.veras@warwick.ac.uk`

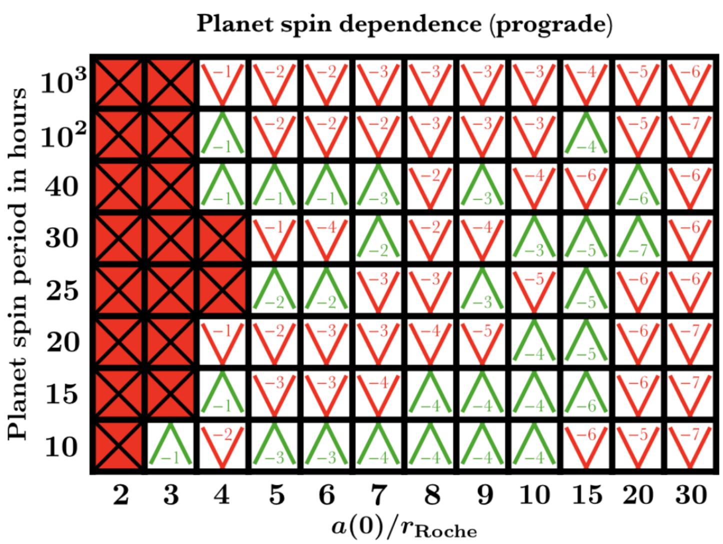

Figure 8: Veras et al. (tides): Situations which destroy the planet (red crosses) and those in which the planet survives, after 1 Gyr of evolution around a white dwarf. Green arrows indicate outward migration and red arrows indicate inward migration.

Speeding past planets? Asteroids radiatively propelled by giant branch Yarkovsky effects

Dimitri Veras[1,2], *Arika Higuchi*[3], *Shigeru Ida*[4]

[1] Centre for Exoplanets and Habitability, University of Warwick, Coventry, CV4 7AL, UK
[2] Department of Physics, University of Warwick, Coventry, CV4 7AL, UK
[3] RISE Project Office, National Astronomical Observatory of Japan, Osawa, Mitaka, Tokyo 181-8588, Japan
[4] Earth-Life Science Institute, Tokyo Institute of Technology, Meguro, Tokyo 152-8550, Japan

MNRAS, In Press, arXiv:1902.02795

Understanding the fate of planetary systems through white dwarfs which accrete debris crucially relies on tracing the orbital and physical properties of exo-asteroids during the giant branch phase of stellar evolution. Giant branch luminosities exceed the Sun's by over three orders of magnitude, leading to significantly enhanced Yarkovsky and YORP effects on minor planets. Here, we place bounds on Yarkovsky-induced differential migration between asteroids and planets during giant branch mass loss by modelling one exo-Neptune with inner and outer exo-Kuiper belts. In our bounding models, the asteroids move too quickly past the planet to be diverted from their eventual fate, which can range from: (i) populating the outer regions of systems out to 10^4-10^5 au, (ii) being engulfed within the host star, or (iii) experiencing Yarkovsky-induced orbital inclination flipping without any Yarkovsky-induced semimajor axis drift. In these violent limiting cases, temporary resonant trapping of asteroids with radii of under about 10 km by the planet is insignificant, and capture within the planet's Hill sphere requires fine-tuned dissipation. The wide variety of outcomes presented here demonstrates the need to employ sophisticated structure and radiative exo-asteroid models in future studies. Determining where metal-polluting asteroids reside around a white dwarf depends on understanding extreme Yarkovsky physics.

Download/Website: `https://arxiv.org/abs/1902.02795`

Contact: `d.veras@warwick.ac.uk`

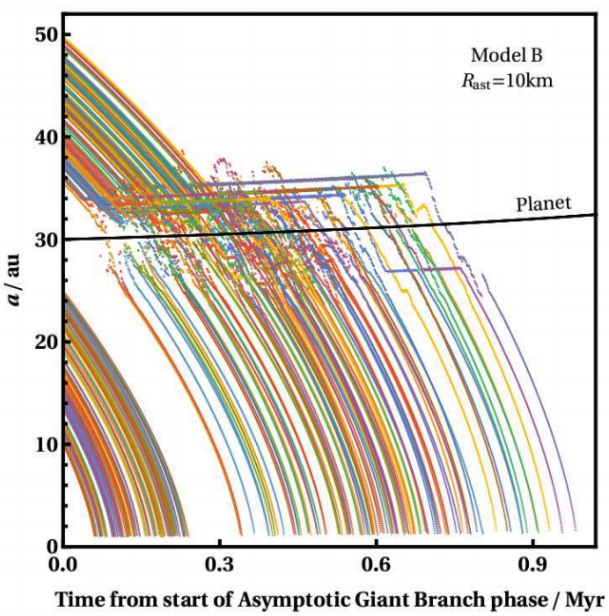

Figure 9: Veras et al. (Yarkovsky): Asteroids being radiatively flung into the star, with only a minor delay due to a planet.

3 Jobs and Positions

Postdoctoral Position in High-Contrast Imaging

Olivier Absil
STAR Institute, University of Liège, Liège, Belgium

University of Liège, Sept. 2019

The Space Sciences, Technologies, and Astrophysics Research (STAR) Institute of the University of Liège (ULiège) is inviting applications for a postdoctoral research position in the field of exoplanet imaging. This position is open within the framework of the ERC Consolidator Grant EPIC, which aims to advance high-contrast imaging techniques with the help of machine learning, and to contribute to the development of the ELT/METIS instrument. The postdoc will work within the Planetary System Imaging Laboratory (PSILab) of the STAR Institute under the supervision of Dr Olivier Absil, in close collaboration with Prof Gilles Louppe (Montefiore Institute, ULiège) and with the rest of the PSILab team, which currently comprises 3 postdocs and 4 PhD students.

The successful applicant will work on the development of new algorithms for focal-plane wavefront sensing, building upon our recent efforts to leverage the power of machine learning techniques. He/she will validate these new algorithms on an infrared coronagraphic test bench already available at PSILab. The postdoc will also be responsible for the development of the focal-plane wavefront sensing solution to be implemented in the METIS high-contrast imager. This part of the work will be carried out in collaboration with Prof Matthew Kenworthy (Leiden). The postdoc is expected to spend about 70% of his/her time on this project, while the rest of the time can be spent on a personal research subject, which should preferably be related to the PSILab activities (extrasolar planetary systems, high-contrast imaging, adaptive optics, stellar interferometry).

A successful candidate must hold a PhD in astronomy, physics (optics/instrumentation), or a related field by the starting date of the position. A good experience in programming is required. Some experience in machine learning and/or computer vision would be an asset. Applications should include:

- a cover letter,
- a curriculum vitae and a list of publications,
- a statement of current and future research interests (up to 3 pages).

The application, merged into one single pdf file, should be sent by email to Olivier Absil (`olivier.absil@uliege.be`). The applicants should also provide the names and contact details of three referees who could be contacted for reference letters.

Complete applications received by **10 May 2019** will receive full consideration. The preferred starting date of the appointment is September 2019, although we would accept starting dates up to early 2020. The appointment is initially for two years, with renewal for a third year contingent upon satisfactory progress.

The position comes with full benefits and a competitive salary. Informal enquiries are welcome and should be sent to the address provided above.

Download/Website: `https://jobregister.aas.org/ad/c066b0e1`

Contact: `olivier.absil@uliege.be`

Two exoplanets postdoctoral research positions

X. Delfosse & G. Hébrard

Grenoble or Paris (France), between July and October 2019

As part of a research project funded by the ANR (Agence Nationale de la Recherche), the SPIRou Legacy Survey team invites applications for two postdoctoral research positions in the field of exoplanets detections and characterization. The positions will be hosted respectively at the Institut de Planetologie et d'Astrophysique de Grenoble (IPAG) and at the Institut d'Astrophysique de Paris (IAP), France, with a preferred starting date between July and October 2019. Both postdocs will be expected to carry out original research in using SPIRou data of the Radial Velocity (RV) survey dedicated to search and characterize exoplanets. The postdoc at IPAG will have to play an important role in the organization and the exploitation of the systematic RV monitoring of nearby M-dwarfs (under the supervision of X. Delfosse); the postdoc at IAP will have to play an important role to exploit the SPIRou RV monitoring of transiting planet candidates (under the supervision of G. Hebrard).
Interested candidates should contact Xavier Delfosse (xavier.delfosse@univ-grenoble-alpes.fr) at IPAG and/or Guillaume Hebrard (hebrard@iap.fr) at IAP, and send (in a singe pdf file) a CV, a publication list, a motivation letter, a short research statement describing past achievements and future projects, and arrange for up to two letters of recommendation to be sent before 15 th May 2019.

Download/Website: `http://www.iap.fr/users/hebrard/postdocANR.pdf`

Contact: `xavier.delfosse@univ-grenoble-alpes.fr, hebrard@iap.fr`

Two Postdoctoral Positions on Debris Disks

Alexander Krivov

Friedrich Schiller University, Jena, Start date: Summer/Autumn 2019

The Astrophysical Institute and University Observatory (AIU) of the Friedrich Schiller University, Jena, Germany, is seeking two postdoctoral researchers.

The positions are to work in the Research Unit FOR 2285 "Debris Disks in Planetary Systems", funded by the German Research Foundation (DFG). The successful candidates will join the theory group at the AIU. The researchers will benefit from close collaboration with other observational, theory, and laboratory projects of the Research Unit running in Jena, Braunschweig, and Kiel.

One position is part of the Research Unit's project P1 **"Masses and stirring of debris disks."** The main goal of this project is to develop a detailed understanding of the origins of debris disks. The researcher is expected to tackle a challenging "mass problem" identified recently for both debris disks and their protoplanetary disk progenitors. They will also address a related question of what excites the planetesimals in debris disks and when, activating the dust production. Both problems should be investigated by means of analytic work and/or numerical simulations, taking into account a wealth of available observational constraints.

The second position is part of project P3 **"Origin of the warm and hot dust and planetary system architecture."** The successful candidate will work to constrain the occurrence rate and parameters of warm and hot dust disks commonly observed in planetary systems, set up and run simulations for plausible cometary and asteroidal scenarios of dust production, transport and removal, consider implications for the overall architecture of the systems, and make suggestions for future observational tests.

The positions are for three years and can start at any time in the summer or fall 2019. The salary is standard for postdoc positions in Germany (TV-L E13/3–E14/2 of the German federal public service scale) and includes a number of social and family-related benefits. Funding is available for travel, computational resources and relocation expenses.

The applicants should have a strong educational record and hold a doctoral degree or equivalent in physics or astronomy. Previous experience of astronomical research, preferably on debris or protoplanetary disks, exoplanets or planet formation, is required. Proficiency in English is also required.

Applications as a single document in the PDF format should include a CV, a statement of research interests (4 pages max), and the names and contact details of three referees. Please quote "FOR2285/P1" or "FOR2285/P3" in the subject depending on which project is preferred. All applications received by **May 27, 2019** will be given full consideration.

The Friedrich Schiller University is an equal opportunity employer and explicitly encourages women to apply. Disabled persons with equal aptitude, competence and qualification will be given preference.

Download/Website: `http://www.astro.uni-jena.de/FOR2285`

Contact: `krivov@astro.uni-jena.de`

PhD Position on Debris Disks

Torsten Löhne

Friedrich Schiller University, Jena, Start date: Summer/Autumn 2019

The Astrophysical Institute and University Observatory (AIU) of the Friedrich Schiller University, Jena, Germany, invites applications for a graduate student position.

The position is to work in the Research Unit FOR 2285 "Debris Disks in Planetary Systems", funded by the German Research Foundation (DFG). The successful candidate will join the theory group at the AIU and will work for the Research Unit's project P2 **"Sculpturing of debris disks by planets and companions."** The project aims at understanding the origin of the observed features in debris disks, such as sharp edges, eccentric offsets, or azimuthal asymmetries. Many of these can be attributed to the gravitational influence of alleged but yet unseen planets and companions. The graduate student is expected to utilize a model devised earlier in our group to investigate the disk evolution under the action of secular gravitational perturbations combined with a full collisional cascade and drag forces. The model should be applied to infer possible dynamical histories of the systems, to explore how the parameter variation affects the predicted structure, and to test the predictions against the structure actually observed in selected disks. The researcher will benefit from close collaboration with other observational, theory, and laboratory projects of the Research Unit.

The position is for three years and can start at any time in the summer or fall 2019. The salary is standard for doctoral positions in Germany (1/2 TV-L E13 of the German federal public service scale) and includes a number of social and family-related benefits. Travel funding for short-term visits to collaborators or to attend conferences will be provided. Funding is available for computational resources and the group already has a set of 8 multi-core servers for running simulations. Reimbursement of relocation costs is possible.

The applicant should have a strong educational record and hold a Masters' degree or equivalent in physics or astronomy. Previous experience with numerics and astronomical research, preferably with debris disks and/or orbital dynamics, would be a strong advantage. Proficiency in English is required.

Applications as a single PDF document should include a CV, a brief statement of research interests (1 page max), and the names and contact details of two referees. Please quote "FOR2285/P2" in the subject. All applications received by **June 17, 2019** will be given full consideration.

The Friedrich Schiller University is an equal opportunity employer and explicitly encourages women to apply. Disabled persons with equal aptitude, competence and qualification will be given preference.

Download/Website: `http://www.astro.uni-jena.de/FOR2285`

Contact: `tloehne@astro.uni-jena.de`

18 Post-doctoral Fellowships on the Origin and Evolution of Life

Floris van der Tak[1,2] *& Wouter Roos*[3]
[1] Kapteyn Astronomical Institute, University of Groningen, The Netherlands
[2] SRON Netherlands Institute for Space Research
[3] Zernike Institute for Advanced Materials, University of Groningen, The Netherlands

Groningen / Leiden / Eindhoven, January–March 2020

The origin and nature of life and its distribution in the universe are fundamental questions for humanity. How did biomolecules form? How did life emerge? How did cellular functions evolve? Is there life elsewhere? Will life cope with human-induced challenges?

You:

- are an ambitious scientist fascinated by very fundamental questions about life, and you are ready for the next research career step.
- have research experience in (bio)chemistry, (bio)physics, molecular biology, computational science, systems biology, evolutionary biology, ecology, astrophysics or geoscience.
- can develop an original and innovative idea for an interdisciplinary research project on the origins and evolution of life.
- are curious to learn new scientific languages to make the necessary crossovers between your field and other fields.

Then apply for a position in our exciting interdisciplinary oLife Fellowship Programme.

The oLife Fellowship Programme is a joint initiative by seven world-leading research institutes of three universities in The Netherlands (University of Groningen, Leiden University, Eindhoven University of Technology). Supported by funding from the Horizon 2020 Framework Programme of the European Union, we offer 18 post-doctoral fellowships for interdisciplinary research on fundamental questions concerning the origin, evolution and distribution of life in the universe.

Using a collaborative, interdisciplinary approach, we aim to break new grounds in four scientific areas:

1. Planetary preconditions and boundary conditions of Life, and its origins here on Earth
2. Defining properties and synthesis of Life, from the molecular to the biosphere level
3. Modelling, predicting and steering of Life
4. Distribution of Life across the universe

Job Description
As a fellow in the oLife Fellowship Programme you are given the opportunity to work on your own interdisciplinary research project with advisors and research institutes of your own choice.
Together with 17 other fellows, you will follow a joint research and training programme, consisting of scientific lectures, academic and professional skills training, and career guidance.
In the Netherlands, teaching and supervising students is an integral part of a researcher's position. Therefore, you will be expected to prepare and teach your own lecture series on your field(s) of expertise and to supervise student research projects. Also, you are offered the opportunity to go on secondments with our leading industrial, academic or non-profit partner organizations.
For more detailed information about the research, the involved research institutes, prospective supervisors and the training programme, please visit our website.

Download/Website: `www.olife-programme.eu`

Contact: `olife@rug.nl`

4 Conferences

EPSC-DPS MIT10: Machine learning and deep learning for planetary sciences

Organizers: Yann Alibert, Mario D'Amore & Jörn Helbert

EPSC-DPS, Geneva, Switzerland, September 15-20, 2019

Abstracts are welcome to the EPSC-DPS 2019 session MIT10 on Machine Learning and Deep Learning for planetary sciences. Machine Learning is the subfield of computer science that gives ”computers the ability to learn without being explicitly programmed.” As tactical and strategic planning timelines compress and increasingly large nonlinear datasets are acquired, autonomy and machine intelligence has to play a more critical role in the interpretation of data from planetary exploration missions and laboratory measurements. There is a need for capable systems that can rapidly and intelligently extract information from these datasets in a manner useful for scientific analysis. The community is starting to respond to this need by applying machine learning and deep learning approaches on various levels. This session will explore research that leverages machine learning methods to enhance our scientific understanding of planetary data, from astronomical observations, planetary exploration missions, as well as numerical simulations. Science objectives as diverse as image recognition, atmospheric retrieval, analysis of observed time series and of numerical simulation addressed through a variety of machine and deep learning tools will be considered. We invite abstracts for oral and poster contributions from all areas related to machine learning and deep learning applied to planetary sciences.
Abstract deadline: May 8, 2019

https://meetingorganizer.copernicus.org/EPSC-DPS2019/session/34102

Contact: alibert@space.unibe.ch

Europlanet Lunchtime Session on Exoplanetary Magnetism

M. N. Gorman

National Astronomy Meeting, Lancaster, UK, Thursday 4th July 2019

As part of the Europlanet NA1 scheme, Aberystwyth University will be hosting a lunchtime session as part of the National Astronomy Meeting on “Exoplanetary Magnetism” on Thursday 4th July 2019.

The aim of this panel and networking session is to bring together expertise in solar magnetospheres and the exoplanet community to explore potential future collaborations. With the advent of new instrumentation (both space based and ground based) the routine detection of exoplanets using radio waves emitted when a stellar wind interacts with an intrinsic planetary magnetic field is becoming an increasing possibility.

To assist those whom plan to attend this session and the conference in general we are able to offer bursaries of a flat rate of 100 euros. If you wish to apply for a bursary please fill out the application form from here *https://nam2019.org/nam2019/grants* and email to Dr Maire N. Gorman (mng2@aber.ac.uk) by Sunday 5th May. Outcomes will be communicated by Monday 13th May. Priority will be given to early career researchers and those from under-represented research communities and stakeholders, including new EU Member States. The bursary will be reimbursed by Aberystwyth University to recipients after the event whom will be required to fill out a short feedback form.

Download/Website: https://nam2019.org/science/special-lunches

Contact: mng2@aber.ac.uk

EPSC-DPS EXO7: Planetary Aeronomy – Near and Afar

A. García Muñoz, T. Koskinen, P. Lavvas

Geneva, Switzerland, 15–20 September 2019

Aims and scope

Space missions, ground-based observations and theory allow for detailed characterization of planetary upper atmospheres in the solar system that provides novel insights into the physical mechanisms at play. At the same time, the detection of short-period extrasolar planets has inspired numerous studies of chemistry, dynamics, and escape of the upper atmospheres of these planets, at more extreme conditions than those found in the solar system. More than ever, it is critical to foster the communication between the communities working on the theoretical and observational aspects of both solar system and exoplanet upper atmospheres. This communication will secure a solid progress in the interpretation of new atmospheric observables and in the implications for e.g. planet demographics.

This session brings together researchers from the solar system and exoplanet communities in an attempt to exchange knowledge and ideas. We welcome papers on all aspects of planetary aeronomy i.e., the science of the upper atmosphere, either in the solar system or exoplanet systems. Suitable papers include results on photochemistry and ionization, magnetosphere-ionosphere coupling, energy balance and circulation, atmospheric escape and evolution as well as new observations and novel observational techniques.
Deadline for abstract submission: 08/05/2019
`https://meetingorganizer.copernicus.org/EPSC-DPS2019/session/34017`

Contact: `garciamunoz@astro.physik.tu-berlin.de`

EPSC-DPS EXO10/TP11: Advances in developing quantitative and realistic models of terrestrial planet formation and their chemical compositions

Organizers: Nader Haghighipour & Thomas Maindl

EPSC-DPS, Geneva, Switzerland, September 15-20, 2019

Abstracts are welcome to the EPSC-DPS 2019 session EXO10/TP11 on the formation of terrestrial planets in our solar system and extrasolar planets. The past few years have witnessed great advances in the theories of planet formation and computational simulations of impacts in planetary systems. These advances have played fundamental roles in reshaping models of terrestrial planet formation and have placed them on the path to becoming quantitative (and, therefore, predictive). They have also paved the way for more realistic extension of these models to other planetary systems. We invite abstracts for oral and poster contributions from all areas related to theoretical, observational and experimental studies of terrestrial planet formation in our solar system and extrasolar planets.
Abstract deadline: May 8, 2019
`https://meetingorganizer.copernicus.org/EPSC-DPS2019/session/34023`

Contact: `nader@ifa.hawaii.edu`

5 Exoplanet Archive Updates

March 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, April 15, 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`).

March 21, 2019
Here are the archive's updates this week:
Microlensing Planets Table: With 33 microlensing solutions added this week, the archive's Microlensing Planets Table is now the first public and comprehensive database of published microlensing planet models.
One Planet and a Plethora of Planet Parameters: New planet Gl 686 b is in the archive, as well as 233 new sets of planet parameters.

March 14, 2019
There are two new microlensing planets this week, KMT-2017-BLG-1038L b and KMT-2017-BLG-1146L b. Also, we've added new planet parameter sets for nine exoplanets.

March 5, 2019
Kepler-1658 b: The first Kepler planetary candidate, KOI-4.01, confirmed as a true planetary system!
KOI-4.01 was identified by the Kepler Spacecraft 10 years ago. This week it was announced at the Kepler & K2 Science Conference V that KOI-4.01 is confirmed as exoplanet Kepler-1658 b. We've already added it to the archive; see its Confirmed Planet Overview page (`http://bit.ly/2NIEGO4`), press release (`http://bit.ly/2VDTGiY`), and the discovery paper (Chontos et al. 2019 `http://bit.ly/2UOBRB4`).
Six other planets added this week are: PDS 70 b, HD 219666 b, GJ 378 b, GJ 411 b, HD 1397 b, and WASP-190 b. We've also added new microlensing solutions for OGLE-2012-BLG-0950L b and MOA-2013-BLG-605L b.

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

Contact: `mharbut@caltech.edu`

6 Announcements

Fizeau exchange visitors program in optical interferometry - call for applications

European Interferometry Initiative

www.european-interferometry.eu, application deadline: May. 15

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff), with priority given to PhD students and young postdocs. Non-EU based missions will only be funded if considered

essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.
The deadline for applications is May 15 for visits to be carried out between mid July 2019 and December 2019. Further informations and application forms can be found at: www.european-interferometry.eu. The program is funded by OPTICON/H2020. Please distribute this message also to potentially interested colleagues outside of your community!
Looking forward to your applications,
Josef Hron & Péter Ábrahám (for the European Interferometry Initiative)

Download/Website: `http://www.european-interferometry.eu`

Contact: `fizeau@european-interferometry.eu`

First Call for Proposals for the CHEOPS Guest Observers Programme

Kate Isaak
CHEOPS ESA Project Scientist, ESTEC, Noordwijk, NL

Call closes on 16 May 2019 at midday GMT/14:00 CEST,

CHEOPS (Characterising Exoplanet Satellite) is an s-(small) class ESA science mission implemented in partnership with Switzerland, with important contributions from 10 other ESA member states. It is the first mission dedicated to the search for exoplanetary transits by means of ultrahigh precision photometry on bright stars already known to host planets. CHEOPS will be launched from Kourou, French Guiana, in the timeframe of 15 October to 14 November 2019.
ESA is soliciting proposals in response to the first Announcement of Opportunity (AO-1) for observing time in the CHEOPS Guest Observers Programme, which covers the period February 2020 to January 2021. Full details. including all relevant documentation and tools with which to prepare proposals, can be found at the link below.
Note: the call closes on 16 May 2019 at midday GMT/14:00 CEST

`https://www.cosmos.esa.int/web/cheops-guest-observers-programme/ao-1`

Contact: `cheops-support@cosmos.esa.int`

2019 Sagan Summer Workshop: Astrobiology for Astronomers

E. Furlan, D. Gelino
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`

7 As seen on astro-ph

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

astro-ph/1903.00031: **KELT-23b: A Hot Jupiter Transiting a Near-Solar Twin Close to the TESS and JWST Continuous Viewing Zones** by *Daniel Johns et al.*
astro-ph/1903.00042: **Mass-Radius relationship for M dwarf exoplanets: Comparing nonparametric and parametric methods** by *Shubham Kanodia et al.*
astro-ph/1903.00174: **A Spectroscopic Analysis of the California-Kepler Survey Sample: I. Stellar Parameters, Planetary Radii and a Slope in the Radius Gap** by *Cintia F. Martinez et al.*
astro-ph/1903.00234: **Exoplanet host-star properties: the active environment of exoplanets** by *John P. Pye et al.*
astro-ph/1903.00320: **Using Deep Neural Networks to compute the mass of forming planets** by *Yann Alibert, Julia Venturini*
astro-ph/1903.00474: **Catalog of New K2 Exoplanet Candidates from Citizen Scientists** by *Jon K. Zink et al.*
astro-ph/1903.00907: **Atmospheres on Nonsynchronized Eccentric-tilted Exoplanets I: Dynamical Regimes** by *Kazumasa Ohno, Xi Zhang*
astro-ph/1903.00908: **Atmospheres on Nonsynchronized Eccentric-tilted Exoplanets II: Thermal Light Curves** by *Kazumasa Ohno, Xi Zhang*
astro-ph/1903.01019: **Theoretical model of HD 163296 presently forming in-situ planets and comparison with the models of AS 209, HL Tau, and TW Hya** by *Dimitris M. Christodoulou, Demosthenes Kazanas*
astro-ph/1903.01386: **Obliquity-Driven Sculpting of Exoplanetary Systems** by *Sarah Millholland, Gregory Laughlin*
astro-ph/1903.01478: **Spitzer Detection of the Transiting Jupiter-analog Exoplanet Kepler-167e** by *Paul A. Dalba, Patrick Tamburo*
astro-ph/1903.01591: **The Curious Case of KOI 4: Confirming Kepler's First Exoplanet** by *Ashley Chontos et al.*
astro-ph/1903.01873: **Planet migration in wind-fed accretion disks in binaries** by *O. Kulikova et al.*
astro-ph/1903.01890: **Effect of dust size and structure on scattered light images of protoplanetary discs** by *Ryo Tazaki et al.*
astro-ph/1903.01995: **Enlarging habitable zones around binary stars in hostile environments** by *Bethany A. Wootton, Richard J. Parker*
astro-ph/1903.02004: **Formation of short-period planets by disk migration** by *Daniel Carrera, Eric B. Ford, Andre Izidoro*

astro-ph/1903.02303: **Transit Ly-α signatures of terrestrial planets in the habitable zones of M dwarfs** by *K.G. Kislyakova et al.*

astro-ph/1903.02316: **On the survivability of planets in young massive clusters** by *Maxwell Xu Cai et al.*

astro-ph/1903.02332: **A high binary fraction for the most massive close-in giant planets and brown dwarf desert members** by *C. Fontanive et al.*

astro-ph/1903.02336: **Visual Analysis and Demographics of Kepler Transit Timing Variations** by *Mackenzie Kane et al.*

astro-ph/1903.02488: **Rocky super-Earths or waterworlds: the interplay of planet migration, pebble accretion and disc evolution** by *Bertram Bitsch, Sean N. Raymond, Andre Izidoro*

astro-ph/1903.02564: **Planet-planet scattering as the source of the highest eccentricity exoplanets** by *Daniel Carrera, Sean R. Raymond, Melvyn B. Davies*

astro-ph/1903.02573: **WASP-4b Arrived Early for the TESS Mission** by *L. G. Bouma et al.*

astro-ph/1903.02576: **Helium Absorption at 1083 nm from Extended Exoplanet Atmospheres: Dependence on Stellar Radiation** by *Antonija Oklopčić*

astro-ph/1903.02800: **Physical properties and transmission spectrum of the WASP-74 planetary system from multi-band photometry** by *L. Mancini et al.*

astro-ph/1903.02804: **WASP-92, WASP-93 and WASP-118: Transit timing variations and long-term stability of the systems** by *Pavol Gajdoš et al.*

astro-ph/1903.03108: **On beryllium-10 production in gaseous protoplanetary disks and implications on the astrophysical setting of refractory inclusions** by *Emmanuel Jacquet*

astro-ph/1903.03114: **Revealing signatures of planets migrating in protoplanetary discs with ALMA multi-wavelength observations** by *Pooneh Nazari et al.*

astro-ph/1903.03118: **New substellar discoveries from Kepler and K2: Is there a brown dwarf desert?** by *Theron Carmichael, David Latham, Andrew Vanderburg*

astro-ph/1903.03123: **Planetary Magnetism as a Parameter in Exoplanet Habitability** by *Sarah R.N. McIntyre, Charles H. Lineweaver, Michael J. Ireland*

astro-ph/1903.03529: **Millimeter-wave polarization due to grain alignment by the gas flow in protoplanetary disks** by *Akimasa Kataoka, Satoshi Okuzumi, Ryo Tazaki*

astro-ph/1903.03540: **Building protoplanetary disks from the molecular cloud: redefining the disk timeline** by *Kevin Baillié, Joao Marques, Laurent Piau*

astro-ph/1903.03620: **Dust settling against hydrodynamic turbulence in protoplanetary discs** by *Min-Kai Lin*

astro-ph/1903.03644: **The first multi-dimensional view of mass loss from externally FUV irradiated protoplanetary discs** by *Thomas J. Haworth, Cathie J. Clarke*

astro-ph/1903.03706: **Habitable zone predictions and how to test them** by *Ramses M. Ramirez et al.*

astro-ph/1903.03726: **Mechanisms leading to a warmer climate on high obliquity planets** by *Wanying Kang*

astro-ph/1903.03997: **Effectively Calculating Gaseous Absorption in Radiative Transfer Models of Exoplanetary and Brown Dwarf Atmospheres** by *R. Garland, P. G. J. Irwin*

astro-ph/1903.04451: **A hypothesis for the rapid formation of planets** by *Susanne Pfalzner, Michele T. Bannister*

astro-ph/1903.04470: **Impact of thermal effects on the evolution of eccentricity and inclination of low-mass planets** by *Sebastien Fromenteau, Frederic Masset*

astro-ph/1903.04482: **Tracing the Origins and Evolution of Small Planets using Their Orbital Obliquities** by *Marshall C. Johnson et al.*

astro-ph/1903.04501: **Tides between the TRAPPIST-1 planets** by *Hamish Hay, Isamu Matsuyama*

astro-ph/1903.04507: **Realistic On-The-Fly Outcomes of Planetary Collisions: Machine Learning Applied to Simulations of Giant Impacts** by *Saverio Cambioni et al.*

astro-ph/1903.04508: **Fate of the runner in hit-and-run collisions** by *Alexandre Emsenhuber, Erik Asphaug*

astro-ph/1903.04546: **Planet formation: The case for large efforts on the computational side** by *Wladimir Lyra et al.*

astro-ph/1903.04559: **Identification and characterization of the host stars in planetary microlensing with**

ELTs by *Chien-Hsiu Lee et al.*

astro-ph/1903.04565: **Lightning and charge processes in brown dwarf and exoplanet atmospheres** by *Christiane Helling et al.*

astro-ph/1903.04669: **Asteroseismic determination of the stellar rotation period of the Kepler transiting planetary systems and its implications for the spin-orbit architecture** by *Yasushi Suto, Shoya Kamiaka, Othman Benomar*

astro-ph/1903.04675: **Fates of hydrous materials during planetesimal collisions** by *Shigeru Wakita, Hidenori Genda*

astro-ph/1903.04723: **On the Anomalous Acceleration of 1I/2017 U1 'Oumuamua** by *Darryl Seligman, Gregory Laughlin, Konstantin Batygin*

astro-ph/1903.04808: **Gliese 49: Activity evolution and detection of a super-Earth** by *M Perger et al.*

astro-ph/1903.04817: **The sub-Jovian desert of exoplanets: parameter dependent boundaries and implications on planet formation** by *Gyula M. Szabó, Szilárd Kálmán*

astro-ph/1903.04937: **The Metallicity-Period-Mass Diagram of low-mass exoplanets** by *S. G. Sousa et al.*

astro-ph/1903.04960: **Emissivity of Ammonia Ice** by *S. Wang, J. I. Katz*

astro-ph/1903.04972: **Hybrid Symplectic Integrators for Planetary Dynamics** by *Hanno Rein et al.*

astro-ph/1903.05012: **The Importance of 3D General Circulation Models for Characterizing the Climate and Habitability of Terrestrial Extrasolar Planets** by *Eric T. Wolf et al.*

astro-ph/1903.05077: **Protoplanetary Disk Science Enabled by Extremely Large Telescopes** by *Hannah Jang-Condell et al.*

astro-ph/1903.05211: **A Statistical Comparative Planetology Approach to Maximize the Scientific Return of Future Exoplanet Characterization Efforts** by *Jade H. Checlair et al.*

astro-ph/1903.05258: **The Super-Earth Opportunity - Search for Habitable Exoplanets in the 2020s** by *Renyu Hu et al.*

astro-ph/1903.05317: **Multiple Populations of Extrasolar Gas Giants** by *Shohei Goda, Taro Matsuo*

astro-ph/1903.05319: **Imaging Giant Protoplanets with the ELTs** by *Steph Sallum et al.*

astro-ph/1903.05419: **A hot rocky and a warm puffy super-Earth orbiting TOI-402 (HD 15337)** by *X. Dumusque et al.*

astro-ph/1903.05439: **The mass and density of the dwarf planet (225088) 2007 OR10** by *Csaba Kiss et al.*

astro-ph/1903.05468: **The Critical, Strategic Importance of Adaptive Optics-Assisted Ground-Based Telescopes for the Success of Future NASA Exoplanet Direct Imaging Missions** by *Thayne Currie, et al.*

astro-ph/1903.05544: **The radio search for technosignatures in the decade 2020-2030** by *Jean-Luc Margot et al.*

astro-ph/1903.05563: **The ground-based optical transmission spectrum of hot Jupiter HAT-P-1b** by *Kamen O. Todorov et al.*

astro-ph/1903.05623: **The transiting system HD 15337: a pair of nearly equal-mass sub-Neptunes on opposite sides of the radius gap** by *Davide Gandolfi et al.*

astro-ph/1903.05624: **Exoplanet Exergy: Why useful work matters for planetary habitabilty** by *Caleb Scharf*

astro-ph/1903.05649: **Stellar Influence on Heavy Ion Escape from Unmagnetized Exoplanets** by *Hilary Egan, Riku Jarvinen, David Brain*

astro-ph/1903.05665: **Astro2020 Science White Paper: Toward Finding Earth 2.0: Masses and Orbits of Small Planets with Extreme Radial Velocity Precision** by *David R. Ciardi, et al.*

astro-ph/1903.05718: **EUV influences on exoplanet atmospheric stability and evolution** by *Allison Youngblood et al.*

astro-ph/1903.05834: **Ultraviolet Spectropolarimetry as a Tool for Understanding the Diversity of Exoplanetary Atmospheres** by *L. Fossati et al.*

astro-ph/1903.05839: **A Shiny New Method for SETI: Specular Reflections from Interplanetary Artifacts** by *Brian C. Lacki*

astro-ph/1903.06107: **A Super-Earth and two sub-Neptunes transiting the bright, nearby, and quiet M-dwarf TOI-270** by *Maximilian N. Günther et al.*

astro-ph/1903.06130: **Hot exozodiacal dust: an exocometary origin?** by *Élie Sezestre, Jean-Charles Augereau, Philippe Thébault*

astro-ph/1903.06184: **Three direct imaging epochs could constrain the orbit of Earth 2.0 inside the habitable zone** by *Claire Marie Guimond, Nicolas B. Cowan*

astro-ph/1903.06190: **Gas vs dust sizes of protoplanetary disks: effects of dust evolution** by *L. Trapman et al.*

astro-ph/1903.06216: **Aquaplanet Models on Eccentric Orbits: Effects of Rotation Rate on Observables** by *Arthur D. Adams, William R. Boos, Eric T. Wolf*

astro-ph/1903.06217: **Monitoring of the D Doublet of Neutral Sodium during Transits of Two "Evaporating" Planets** by *Eric Gaidos, Teruyuki Hirano, Megan Ansdell*

astro-ph/1903.06283: **Multiverse Predictions for Habitability: Fraction of Planets that Develop Life** by *Mc-Cullen Sandora*

astro-ph/1903.06299: **The Demographics and Atmospheres of Giant Planets with the ELTs** by *Brendan Bowler et al.*

astro-ph/1903.06300: **1I/'Oumuamua and the Problem of Survival of Oort Cloud Comets Near the Sun** by *Zdenek Sekanina*

astro-ph/1903.06373: **Collisional Elongation: Possible Origin of Extremely Elongated Shape of 1I/'Oumuamua** by *Keisuke Sugiura, Hiroshi Kobayashi, Shu-ichiro Inutsuka*

astro-ph/1903.06537: **Dust traps in the protoplanetary disc MWC 758: two vortices produced by two giant planets?** by *Clément Baruteau et al.*

astro-ph/1903.06550: **Searching for Technosignatures: Implications of Detection and Non-Detection** by *Jacob Haqq-Misra et al.*

astro-ph/1903.06587: **The trail of water and the delivery of volatiles to habitable planets** by *Klaus M. Pontoppidan et al.*

astro-ph/1903.06622: **Three Hot-Jupiters on the upper edge of the mass-radius distribution: WASP-177, WASP-181 and WASP-183** by *Oliver D. Turner et al.*

astro-ph/1903.06746: **Effect of Different Angular Momentum Transport mechanisms on the Distribution of Water in Protoplanetary Disks** by *Anusha Kalyaan, Steven J. Desch*

astro-ph/1903.06794: **Self-luminous and irradiated exoplanetary atmospheres explored with HELIOS** by *Matej Malik et al.*

astro-ph/1903.06853: **Reconstructing Extreme Space Weather from Planet Hosting Stars** by *V. S. Airapetian et al.*

astro-ph/1903.06910: **On the Dynamics of Comets in Extrasolar Planetary Systems** by *Rudolf Dvorak, Birgit Loibnegger, Manfred Cuntz*

astro-ph/1903.07152: **Characterizing Transiting Exoplanets with JWST Guaranteed Time and ERS Observations** by *Thomas Greene et al.*

astro-ph/1903.07186: **Long-Period Giant Companions to Three Compact, Multiplanet Systems** by *Sean M. Mills et al.*

astro-ph/1903.07298: **The habitability of stagnant-lid Earths around dwarf stars** by *Mareike Godolt et al.*

astro-ph/1903.07556: **New Frontiers for Terrestrial-sized to Neptune-sized Exoplanets In the Era of Extremely Large Telescopes** by *Ji Wang et al.*

astro-ph/1903.07620: **Hint of curvature in the orbital motion of the exoplanet 51 Eridani b using 3 years of VLT/SPHERE monitoring** by *A.-L. Maire et al.*

astro-ph/1903.07661: **Rethinking CO Antibiosignatures in the Search for Life Beyond the Solar System** by *Edward W. Schwieterman et al.*

astro-ph/1903.07694: **HD 213885b: A transiting 1-day-period super-Earth with an Earth-like composition around a bright (V=7.9) star unveiled by TESS** by *Néstor Espinoza et al.*

astro-ph/1903.08002: **WASP-180Ab: Doppler tomography of an hot Jupiter orbiting the primary star in a visual binary** by *L.Y. Temple et al.*

astro-ph/1903.08017: **The L 98-59 System: Three Transiting, Terrestrial-Sized Planets Orbiting a Nearby M-**

dwarf by *Veselin B. Kostov et al.*

astro-ph/1903.08090: **Searching for Exosatellites Orbiting L and T Dwarfs: Connecting Planet Formation to Moon Formation and Finding New Temperate Worlds** by *Philip S. Muirhead et al.*

astro-ph/1903.08180: **Measurement of the Free-Floating Planet Mass Function with Simultaneous Euclid and WFIRST Microlensing Parallax Observations** by *Matthew T. Penny et al.*

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astro-ph/1903.08446: **Stellar Surface Magneto-Convection as a Source of Astrophysical Noise III. Sun-as-a-star Simulations and Optimal Noise Diagnostics** by *H. M. Cegla et al.*

astro-ph/1903.08733: **OGLE-2018-BLG-0022: A Nearby M-dwarf Binary** by *R.A. Street et al.*

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astro-ph/1903.08825: **Onset of giant planet migration before 4480 million years ago** by *Stephen J. Mojzsis et al.*

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astro-ph/1903.09173: **Characterizing the Atmospheres of Irradiated Exoplanets at High Spectral Resolution** by *Diana Dragomir et al.*

astro-ph/1903.09213: **The Weird Detector: Flagging periodic, coherent signals of arbitrary shape in time series photometry** by *Adam Wheeler, David Kipping*

astro-ph/1903.09258: **Qatar Exoplanet Survey: Qatar-8b, 9b and 10b — A Hot Saturn and Two Hot Jupiters** by *Khalid Alsubai et al.*

astro-ph/1903.09322: **Imaging Cool Giant Planets in Reflected Light: Science Investigations and Synergy with Habitable Planets** by *Mark Marley et al.*

astro-ph/1903.09459: **On possible types of magnetospheres of hot Jupiters** by *A.G. Zhilkin, D.V. Bisikalo*

astro-ph/1903.09474: **The role of dissipative evolution for three-planet, near-resonant extrasolar systems** by *Gabriele Pichierri, Konstantin Batygin, Alessandro Morbidelli*

astro-ph/1903.09496: **High-Drag Interstellar Objects And Galactic Dynamical Streams** by *T. Marshall Eubanks*

astro-ph/1903.09523: **Detecting Earth-like Biosignatures on Rocky Exoplanets around Nearby Stars with Ground-based Extremely Large Telescopes** by *Mercedes López-Morales et al.*

astro-ph/1903.09640: **Phase space description of the dynamics due to the coupled effect of the planetary oblateness and the solar radiation pressure perturbations** by *Elisa Maria Alessi, Camilla Colombo, Alessandro Rossi*

astro-ph/1903.09720: **Desorption Kinetics and Binding Energies of Small Hydrocarbons** by *Aida Behmard et al.*

astro-ph/1903.09768: **Active Galactic Nuclei: Boon or Bane for Biota?** by *Manasvi Lingam, Idan Ginsburg, Shmuel Bialy*

astro-ph/1903.09842: **Remote-sensing Characterisation of Major Solar System Bodies with the Twinkle Space**

Telescope by *Billy Edwards et al.*

astro-ph/1903.10017: **Ground-Based Radial Velocity as Critical Support for Future NASA Earth-Finding Missions** by *Courtney D. Dressing et al.*

astro-ph/1903.10507: **Identifying Exoplanets with Deep Learning II: Two New Super-Earths Uncovered by a Neural Network in K2 Data** by *Anne Dattilo et al.*

astro-ph/1903.10616: **Probing Unseen Planet Populations with Resolved Debris Disk Structures** by *Kate Su et al.*

astro-ph/1903.10627: **Extreme Debris Disk Variability – Exploring the Diverse Outcomes of Large Asteroid Impacts During the Era of Terrestrial Planet Formation** by *Kate Y. L. Su et al.*

astro-ph/1903.10669: **Understanding Exoplanet Atmospheres with UV Observations II: The Far UV and Atmospheric Escape** by *Eric D. Lopez et al.*

astro-ph/1903.10772: **Modeling the Lyα transit absorption of the hot Jupiter HD 189733b** by *P. Odert et al.*

astro-ph/1903.10880: **The visible and near-infrared spectra of asteroids in cometary orbits** by *J. Licandro et al.*

astro-ph/1903.10897: **Transit observations of the exoplanet WASP-2b** by *V.K. Ignatov, M.A. Gorbachev, A.A Shlyapnikov*

astro-ph/1903.10911: **Photo-evaporation of close-in gas giants orbiting around G and M stars** by *Daniele Locci, Cesare Cecchi Pestellini, Giuseppina Micela*

astro-ph/1903.10997: **The carbon-to-oxygen ratio: implications for the spectra of hydrogen-dominated exoplanet atmospheres** by *Benjamin Drummond et al.*

astro-ph/1903.11078: **Efficient Follow-Up of Exoplanet Transits Using Small Telescopes** by *Peter Beck et al.*

astro-ph/1903.11180: **Towards a more complex description of chemical profiles in exoplanets retrievals: A 2-layer parameterisation** by *Quentin Changeat et al.*

astro-ph/1903.11252: **Kernel phase imaging with VLT/NACO: high-contrast detection of new candidate low-mass stellar companions at the diffraction limit** by *Jens Kammerer et al.*

astro-ph/1903.11533: **Ohmic heating of asteroids around magnetic stars** by *Benjamin C. Bromley, Scott J. Kenyon*

astro-ph/1903.11539: **TESS Habitable Zone Star Catalog** by *L. Kaltenegger et al.*

astro-ph/1903.11603: **New Avenues for Thermal Inversions in hot Jupiters** by *Siddharth Gandhi, Nikku Madhusudhan*

astro-ph/1903.11853: **The HADES RV Programme with HARPS-N at TNG XI. GJ 685 b: a warm super-Earth around an active M dwarf** by *M. Pinamonti et al.*

astro-ph/1903.11903: **First direct detection of an exoplanet by optical interferometry; Astrometry and K-band spectroscopy of HR8799 e** by *S. Lacour et al.*

astro-ph/1903.11906: **13CO and 13CO2 ice mixtures with N2 in photon energy transfer studies** by *H. Carrascosa et al.*

astro-ph/1903.12111: **Habitability of Earth-like stagnant lid planets: Climate evolution and recovery from snowball states** by *Bradford J. Foley*

astro-ph/1903.12182: **TESS Photometric Mapping of a Terrestrial Planet in the Habitable Zone: Detection of Clouds, Oceans, and Continents** by *Rodrigo Luger et al.*

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astro-ph/1903.12274: **Probing the protosolar disk using dust filtering at gaps in the early Solar System** by *Troels Haugbølle et al.*

astro-ph/1903.12288: **Planetesimal fragmentation and giant planet formation II: dependencies with planetesimal relative velocities and compositions** by *I. L. San Sebastián, O. M. Guilera, M. G. Parisi*

astro-ph/1903.12492: **Interpretation of the resonant drag instability of dust settling in protoplanetary disc** by *V.V. Zhuravlev*

astro-ph/1903.12649: **The effects of dust evolution on disks in the mid-IR** by *A.J. Greenwood et al.*

astro-ph/1903.00657: **Filtering solar-like oscillations for exoplanet detection in radial velocity observations** by *William J. Chaplin et al.*
astro-ph/1903.01141: **Connecting substellar and stellar formation. The role of the host star's metallicity** by *J. Maldonado et al.*
astro-ph/1903.01809: **MOVES II. Tuning in to the radio environment of HD189733b** by *R. D. Kavanagh et al.*
astro-ph/1903.02192: **ALMA observations of layered structures due to CO selective dissociation in the ρ Ophiuchi A plane-parallel PDR** by *M. Yamagishi et al.*
astro-ph/1903.02277: **Theory of Stochastic Shock Drift Acceleration for Electrons in the Shock Transition Region** by *T. Katou, T. Amano*
astro-ph/1903.03157: **Stellar Astrophysics and Exoplanet Science with the Maunakea Spectroscopic Explorer (MSE)** by *Maria Bergemann et al.*
astro-ph/1903.03481: **The MESAS Project: Long wavelength follow-up observations of Sirius A** by *Jacob Aaron White et al.*
astro-ph/1903.04529: **Discovery of a Compact Companion to a Nearby Star** by *Stephen R. Kane et al.*
astro-ph/1903.04664: **Astro2020 Science White Paper: High-Resolution Spectroscopic Surveys of Ultracool Dwarf Stars & Brown Dwarfs** by *Adam Burgasser et al.*
astro-ph/1903.04667: **Astro2020 Science White Paper: Fundamental Physics with Brown Dwarfs: The Mass-Radius Relation** by *Adam Burgasser et al.*
astro-ph/1903.04686: **Discovery of Cold Brown Dwarfs or Free-Floating Giant Planets Close to the Sun** by *Sandy K. Leggett et al.*
astro-ph/1903.04759: **A high-order weighted finite difference scheme with a multi-state approximate Riemann solver for divergence-free magnetohydrodynamic simulations** by *Takashi Minoshima, Takahiro Miyoshi, Yosuke Matsumoto*
astro-ph/1903.05478: **Polarization in Disks** by *Ian Stephens et al.*
astro-ph/1903.05656: **Direct Acceleration: Cosmic and Exoplanet Synergies** by *David Erskine et al.*
astro-ph/1903.05686: **Rotation Period Evolution in Low-Mass Binary Stars: The Impact of Tidal Torques and Magnetic Braking** by *David P. Fleming et al.*
astro-ph/1903.06152: **Constraining Stellar Photospheres as an Essential Step for Transmission Spectroscopy of Small Exoplanets** by *Benjamin V. Rackham et al.*
astro-ph/1903.06242: **The Early Evolution of Stars and Exoplanet Systems: Exploring and Exploiting Nearby, Young Stars (an Astro2020 Science White Paper)** by *Joel H. Kastner*
astro-ph/1903.06623: **A method to deconvolve stellar rotational velocities III. The probability distribution function via Maximum Likelihood utilizing Finite Distribution Mixtures** by *Rafael Orellana et al.*
astro-ph/1903.06634: **Increasing the Discovery Space in Astrophysics - A Collation of Six Submitted White Papers** by *G. Fabbiano et al.*
astro-ph/1903.06691: **Astro2020 White Paper: The L/T Transition** by *Johanna M. Vos et al.*
astro-ph/1903.06699: **Substellar Multiplicity Throughout the Ages** by *Daniella Bardalez Gagliuffi et al.*
astro-ph/1903.06703: **Brown Dwarfs and Directly Imaged Exoplanets in Young Associations** by *Jacqueline K. Faherty et al.*
astro-ph/1903.07611: **Total Power Map to Visibilities (TP2VIS): Joint Deconvolution of ALMA 12m, 7m, and Total Power Array Data** by *Jin Koda et al.*
astro-ph/1903.07716: **Engaging Citizen Scientists to Keep Transit Times Fresh and Ensure the Efficient Use of Transiting Exoplanet Characterization Missions** by *Robert T. Zellem et al.*
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