ExoPlanet News
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1 Editorial

Welcome to Edition 131 of the ExoPlanet News!

We hope this newsletter finds you well in these challenging times. It is great to see that some of you could still contribute to this newsletter. Thank you for that. In this May-issue you can find, as usual, abstracts of scientific papers, conference announcements/updates, Exoplanet Archive updates, and an overview of exoplanet-related articles on astro-ph.

For next month we look forward to your paper abstract, job ad or meeting announcement. Also special announcements 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 on 16. June 2020.

Thanks again for your support.
Best healthy wishes from the editorial team,

Daniel Angerhausen
Julia Venturini
Lokesh Mishra
Holly Capelo
Timm-Emanuel Riesen

2 Abstracts of refereed papers

Mass-loss rate and local thermodynamic state of the KELT-9 b thermosphere from the hydrogen Balmer series

A. Wyttenbach[1,2], P. Mollière[1,3], D. Ehrenreich[4], H. M. Cegla[4], V. Bourrier[4], C. Lovis[4], L. Pino[5], R. Allart[4], J. V. Seidel[4], H. J. Hoeijmakers[4,6], L. D. Nielsen[4], B. Lavie[4], F. Pepe[4], and X. Bonfils[2], and I. A. G. Snellen[1]

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Astronomy & Astrophysics, in press (arXiv:2004.13733)

KELT-9 b, the hottest known exoplanet, with $\mathrm{T_{eq}} \sim 4400$ K, is the archetype of a new planet class known as ultra-hot Jupiters. These exoplanets are presumed to have an atmosphere dominated by neutral and ionized atomic species. In particular, Hα and Hβ Balmer lines have been detected in the KELT-9 b upper atmosphere, suggesting that hydrogen is filling the planetary Roche lobe and escaping from the planet. In this work, we detected δ Scuti-type stellar pulsation (with a period $P_{\rm puls} = 7.54 \pm 0.12$ h) and studied the Rossiter-McLaughlin effect (finding a spin-orbit angle $\lambda = -85.01° \pm 0.23°$) prior to focussing on the Balmer lines (Hα to Hζ) in the optical transmission spectrum of KELT-9 b. Our HARPS-N data show significant absorption for Hα to Hδ. The precise line shapes of the Hα, Hβ, and Hγ absorptions allow us to put constraints on the thermospheric temperature. Moreover, the mass loss rate, and the excited hydrogen population of KELT-9 b are also constrained, thanks to a retrieval analysis performed with a new atmospheric model. We retrieved a thermospheric temperature of $T = 13\,200^{+800}_{-720}$ K and a mass loss rate of $\dot{\mathrm{M}} = 10^{12.8 \pm 0.3}$ g s^{-1} when the atmosphere was assumed to be in hydrodynamical expansion and in local thermodynamic equilibrium (LTE). Since the thermospheres of hot Jupiters are not expected to be in LTE, we explored atmospheric structures with non-Boltzmann equilibrium for the population of the excited hydrogen. We do not find strong statistical evidence in favor of a departure from LTE. However, our non-LTE scenario suggests that a departure from the Boltzmann equilibrium may not be sufficient to explain the retrieved low number densities of the excited hydrogen. In non-LTE, Saha equilibrium departure via photo-ionization, is also likely to be necessary to explain the data.

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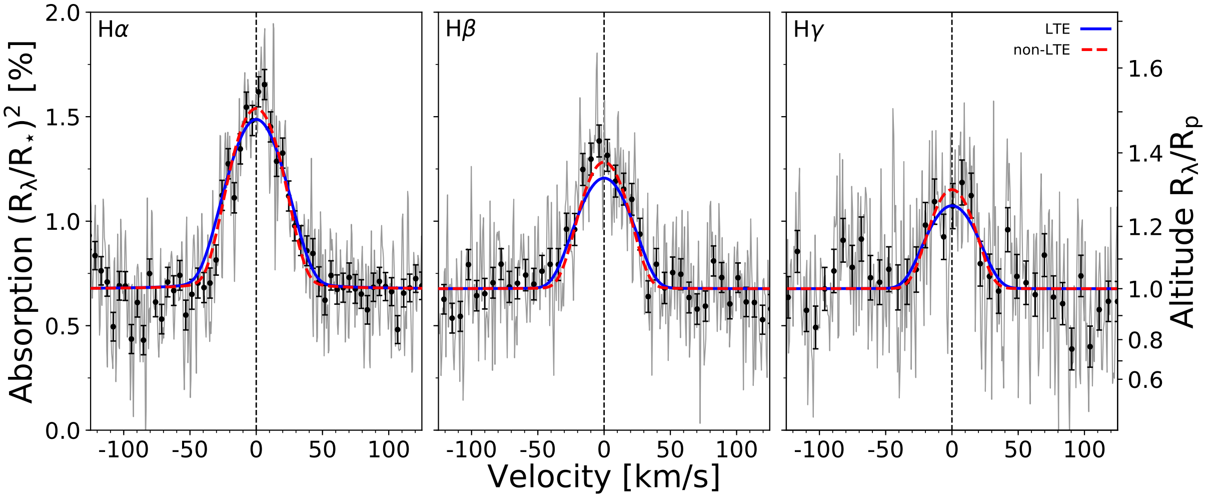

Figure 1: Wyttenbach et al.:Hα, Hβ, and Hγ transmission spectra (light gray, and binned by $10\times$ in black circles) in the planet rest frame and in velocity space (the continuums are set to the white light transit depth $\delta = 0.00677$). The best PAWN models, in the case of a hydrodynamically expanding thermosphere, and in the Boltzmann equilibrium, are shown in blue. The retrieved temperature is $T = 13\,200^{+800}_{-720}$ K, and the mass loss rate is $\dot{\mathrm{M}}_{\mathrm{PW}} = 10^{12.8\pm0.3}$ g s^{-1}. The best PAWN models, in the case of a hydrodynamically expanding thermosphere, with a LTE departure, are shown in dashed red. The retrieved temperature is $T = 9\,600^{+1210}_{-1180}$ K, the mass loss rate is $\dot{\mathrm{M}}_{\mathrm{PW}} = 10^{14.3^{+1.2}_{-1.4}}$ g s^{-1}, and the common LTE departure coefficient is $\beta = 10^{-6.1^{+1.3}_{-1.1}}$.

TESS Reveals HD 118203 b to be a Transiting Planet

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The Astronomical Journal, published (2020AJ....159..243P)

The exoplanet HD 118203b, orbiting a bright ($V = 8.05$) host star, was discovered using the radial velocity method by da Silva et al. (2006), but was not previously known to transit. *TESS* photometry has revealed that this planet transits its host star. Nine planetary transits were observed by *TESS*, allowing us to measure the radius of the planet to be $1.136^{+0.029}_{-0.028} R_J$, and to calculate the planet mass to be $2.166^{+0.074}_{-0.079} M_J$. The host star is slightly evolved with an effective temperature of $T_{eff} = 5683^{+84}_{-85}$ K and a surface gravity of $logg = 3.889^{+0.017}_{-0.018}$. With an orbital period of $6.134985^{+0.000029}_{-0.000030}$ days and an eccentricity of 0.314 ± 0.017, the planet occupies a transitional regime between circularized hot Jupiters and more dynamically active planets at longer orbital periods. The host star is among the ten brightest known to have transiting giant planets, providing opportunities for both planetary atmospheric and asteroseismic studies.

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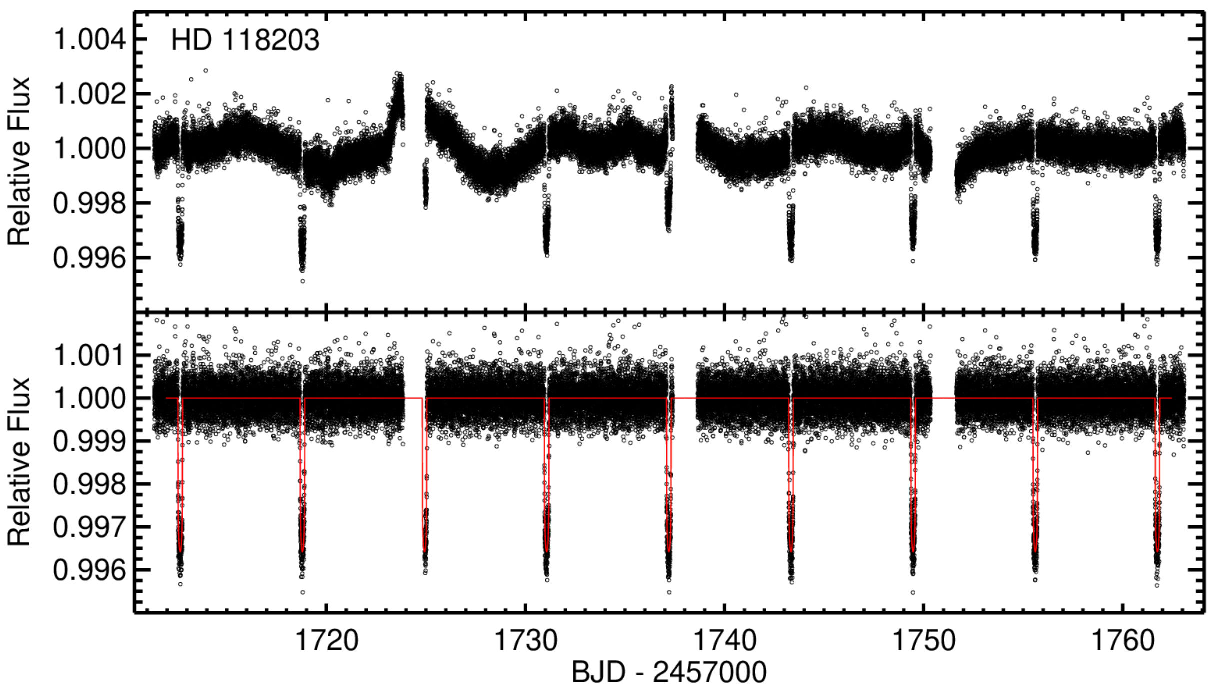

Figure 2: Pepper et al.:Top: TESS PDCSAP 2-minute cadence light curve of HD 18203 from Sectors 15 and 16. Bottom: the flattened TESS light curve used in the EXOFASTv2 fit. The observations are plotted in open black circles, and the best-fit model from EXOFASTv2 is plotted in red.

Atmospheric convection plays a key role in the climate of tidally-locked terrestrial exoplanets: insights from high-resolution simulations

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The Astrophysical Journal, published (arXiv:2004.03007)

Using a 3D general circulation model (GCM), we investigate the sensitivity of the climate of tidally-locked Earth-like exoplanets, Trappist-1e and Proxima Centauri b, to the choice of a convection parameterization. Compared to a mass-flux convection parameterization, a simplified convection adjustment parameterization leads to a $> 60\,\%$ decrease of the cloud albedo, increasing the mean day-side temperature by $\approx\ 10\,K$. The representation of convection also affects the atmospheric conditions of the night side, via a change in planetary-scale wave patterns. As a result, using the convection adjustment scheme makes the night-side cold traps warmer by 17–$36\,K$ for the planets in our simulations. The day-night thermal contrast is sensitive to the representation of convection in 3D GCM simulations, so caution should be taken when interpreting emission phase curves. The choice of convection treatment, however, does not alter the simulated climate enough to result in a departure from habitable conditions, at least for the atmospheric composition and planetary parameters used in our study. The near-surface conditions both in the Trappist-1e and Proxima b cases remain temperate, allowing for an active water cycle.
We further advance our analysis using high-resolution model experiments, in which atmospheric convection is simulated explicitly. Our results suggest that in a hypothetical global convection-permitting simulation the surface temperature contrast would be higher than in the coarse-resolution simulations with parameterized convection. In other words, models with parameterized convection may overestimate the inter-hemispheric heat redistribution efficiency.

Download/Website: `https://doi.org/10.3847/1538-4357/ab8882`

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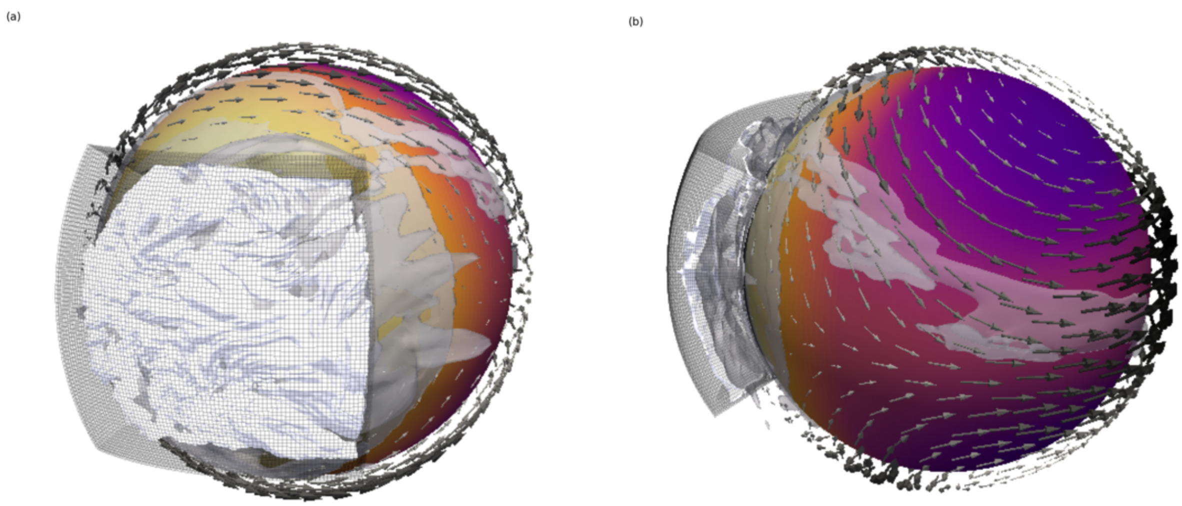

Figure 3: Sergeev et al.: Cloud condensate, surface temperature, and the free troposphere wind vectors in the Trappist-1e simulation: (a) day side with the nested model domain and (b) night side of the planet. The cloud condensate is shown using a threshold of $10^{-5}\,kg\,kg^{-1}$ of total cloud condensate (liquid water plus ice). Interactive version of this figure is available at `https://dennissergeev.github.io/exoconvection-apj-2020`.

Photoevaporation of the Jovian circumplanetary disk I. Explaining the orbit of Callisto and the lack of outer regular satellites

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Astronomy & Astrophysics, in press (arXiv:2005.05132)

Context. The Galilean satellites are thought to have formed from a circumplanetary disk (CPD) surrounding Jupiter. When it reached a critical mass, Jupiter opened an annular gap in the solar protoplanetary disk (PPD) that might have exposed the CPD to radiation from the young Sun or from the stellar cluster in which the Solar System formed.
Aims. We investigate the radiation field to which the Jovian CPD was exposed during the process of satellite formation. The resulting photoevaporation of the CPD is studied in this context to constrain possible formation scenarios for the Galilean satellites and explain architectural features of the Galilean system.
Methods. We constructed a model for the stellar birth cluster to determine the intracluster far-ultraviolet (FUV) radiation field. We employed analytical annular gap profiles informed by hydrodynamical simulations to investigate a range of plausible geometries for the Jovian gap. We used the radiation thermochemical code ProDiMo to evaluate the incident radiation field in the Jovian gap and the photoevaporation of an embedded 2D axisymmetric CPD.
Results. We derive the time-dependent intracluster FUV radiation field for the solar birth cluster over 10 Myr. We find that intracluster photoevaporation can cause significant truncation of the Jovian CPD. We determine steady-state truncation radii for possible CPDs, finding that the outer radius is proportional to the accretion rate $\dot{M}^{0.4}$. For CPD accretion rates $\dot{M} < 10^{-12} M_{\odot}$ yr^{-1}, photoevaporative truncation explains the lack of additional satellites outside the orbit of Callisto. For CPDs of mass $M_{\rm CPD} < 10^{-6.2} M_{\odot}$, photoevaporation can disperse the disk before Callisto is able to migrate into the Laplace resonance. This explains why Callisto is the only massive satellite that is excluded from the resonance.

Download/Website: `https://arxiv.org/abs/2005.05132`

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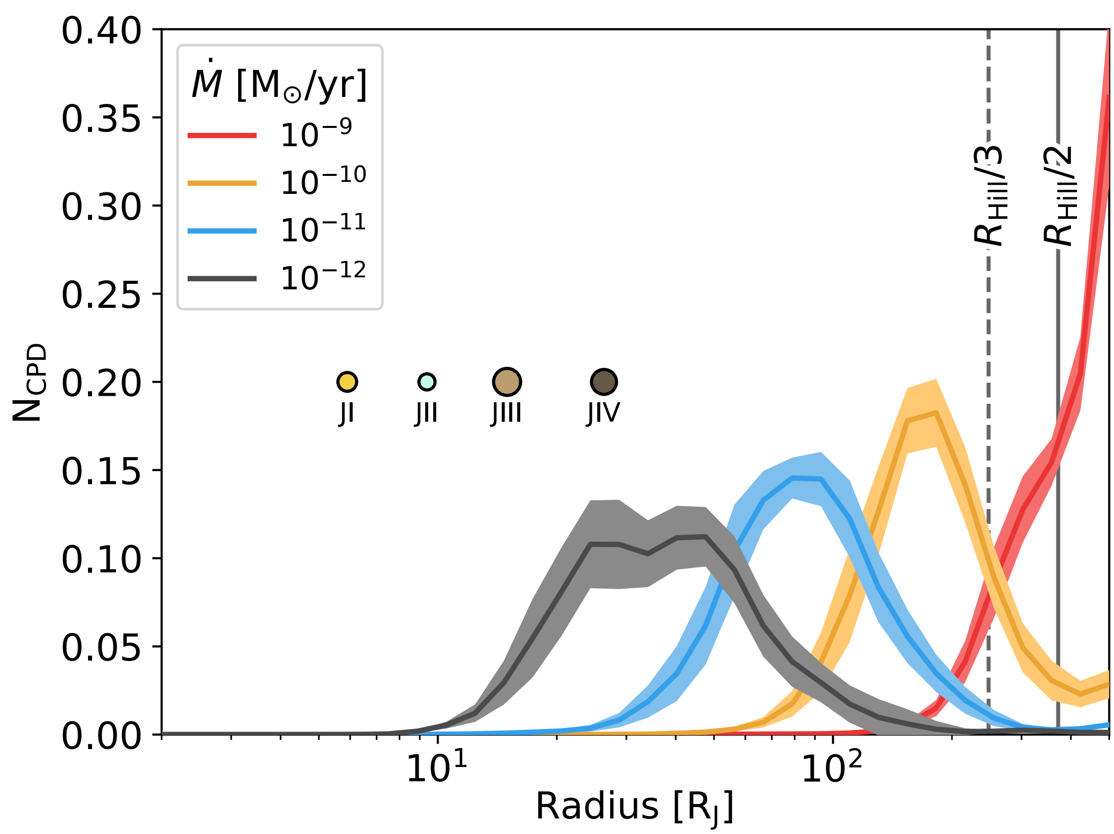

Figure 4: Oberg et al.: Distribution of steady-state truncation radii for the grid of CPD models in the case of intra-cluster FUV irradiation at $t = 5$ Myr. Each colored line represents the instantaneous distribution of the outer radii of 2500 Jovian CPD analogs within the stellar cluster for a given mass accretion rate. The shaded region bracketing each distribution indicates the standard deviation of the scatter produced by the different CPD mass models. The four colored circles indicate the radial location of the Galilean satellites JI (Io), JII (Europa), JIII (Ganymede), and JIV (Callisto). The vertical dashed black lines indicate theoretical limits on the CPD outer radius based on gravitational perturbations as fractions of the Hill radius.

Mineral snowflakes on exoplanets and brown dwarfs: Effects of micro-porosity, size distributions, and particle shape

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Astronomy & Astrophysics, in press (arXiv:2004.13502)

Context. Exoplanet atmosphere characterisation has become an important tool in understanding exoplanet formation, evolution, and it also is a window into potential habitability. However, clouds remain a key challenge for characterisation: upcoming space telescopes (e.g. the James Webb Space Telescope, JWST, and the Atmospheric Remote-sensing Infrared Exoplanet Large-survey, ARIEL) and ground-based high-resolution spectrographs (e.g. the next-generation CRyogenic high-resolution InfraRed Echelle Spectrograph, CRIRES+) will produce data requiring detailed understanding of cloud formation and cloud effects for a variety of exoplanets and brown dwarfs.
Aims. We aim to understand how the micro-porosity of cloud particles affects the cloud structure, particle size, and material composition on exoplanets and brown dwarfs. We further examine the spectroscopic effects of micro-porous particles, the particle size distribution, and non-spherical cloud particles.
Methods. We expanded our kinetic non-equilibrium cloud formation model to study the effect of micro-porosity on the cloud structure using prescribed 1D ($T_{\rm gas}$-$p_{\rm gas}$) profiles from the DRIFT-PHOENIX model atmosphere grid. We applied the effective medium theory and the Mie theory to model the spectroscopic properties of cloud particles with micro-porosity and a derived particle size distribution. In addition, we used a statistical distribution of hollow spheres to represent the effects of non-spherical cloud particles.
Results. Highly micro-porous cloud particles (90% vacuum) have a larger surface area, enabling efficient bulk growth higher in the atmosphere than for compact particles. Increases in single scattering albedo and cross-sectional area for these mineral snowflakes cause the cloud deck to become optically thin only at a wavelength of $\sim 100\,\mu{\rm m}$ instead of at the $\sim 20\,\mu{\rm m}$ for compact cloud particles. A significant enhancement in albedo is also seen when cloud particles occur with a locally changing Gaussian size distribution. Non-spherical particles increase the opacity of silicate spectral features, which further increases the wavelength at which the clouds become optically thin.
Conclusions. Retrievals of cloud properties, particularly particle size and mass of clouds, are biased by the assumption of compact spherical particles. The JWST mid-infrared instrument (MIRI) will be sensitive to signatures of micro-porous and non-spherical cloud particles based on the wavelength at which clouds are optically thin. Details of spectral features are also dependent on particle shape, and greater care must be taken in modelling clouds as observational data improves.

Download/Website: `https://arxiv.org/abs/2004.13502`

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Optical phase curve of the ultra-hot Jupiter WASP-121b

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Astronomy & Astrophysics, published (A&A 637, A36 (2020) / arXiv:1909.03010)

We present the analysis of TESS optical photometry of WASP-121b, which reveals the phase curve of this transiting ultra-hot Jupiter. Its hotspot is located at the sub-stellar point, showing inefficient heat transport from the dayside (2870±50 K) to the nightside (< 2500 K at 3σ) at the altitudes probed by TESS. The TESS eclipse depth, measured at the shortest wavelength to date for WASP-121b, confirms the strong deviation from blackbody planetary emission. Our atmospheric retrieval on the complete emission spectrum supports the presence of a temperature inversion, which can be explained by the presence of VO and possibly TiO and FeH. The strong planetary emission at short wavelengths could arise from an H^- continuum.

Download/Website: `https://doi.org/10.1051/0004-6361/201936647`

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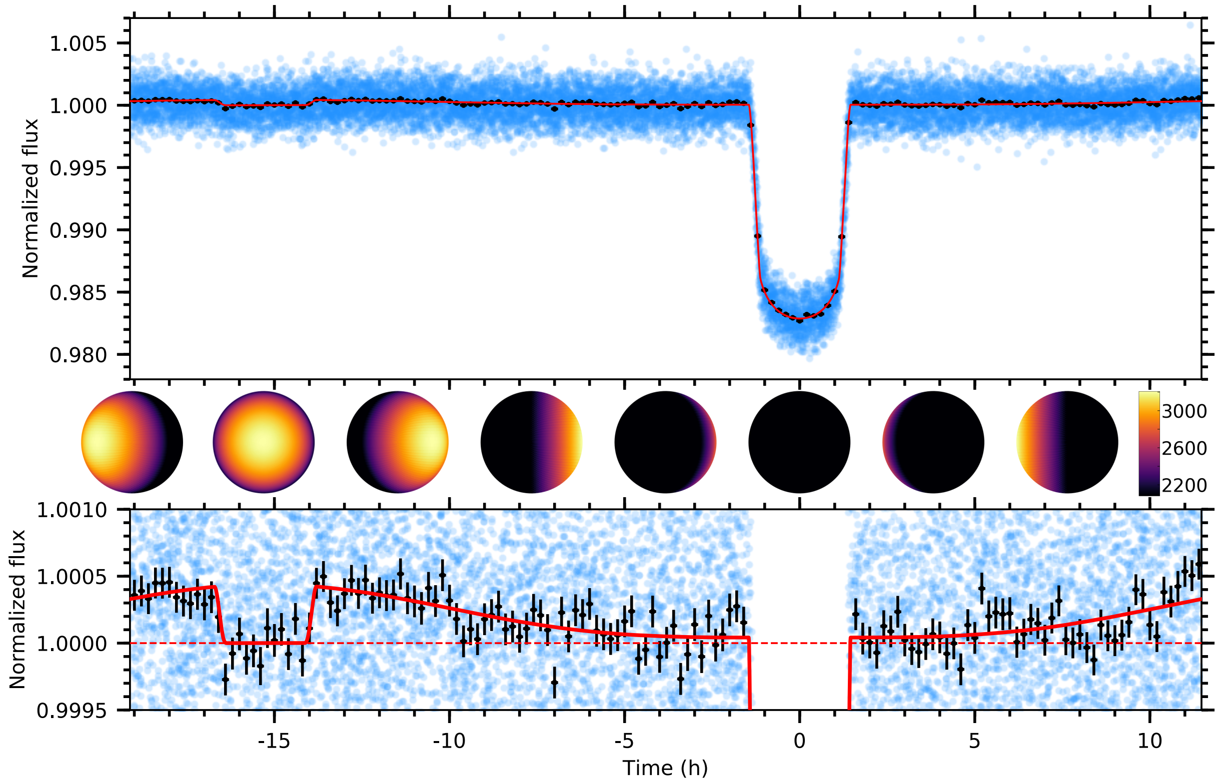

Figure 5: Bourrier et al.: TESS light curve of WASP-121b. *Upper panel*: Photometric data (blue points) phase-folded at the orbital period of the planet. The lower sub-panel zooms in on the planetary phase curve, clearly visible in the binned exposures (black points). Our best-fit model to the complete light curve is plotted as a solid red line. The corresponding temperature distribution of the planet is shown at regular phase intervals. The flux is normalized to unity during the secondary eclipse, when the stellar light alone is measured.

Survival of Primordial Planetary Atmospheres: Mass Loss from Temperate Terrestrial Planets

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The Astrophysical Journal, in press (arXiv:1912.08820v4)

The most widely-studied mechanism of mass loss from extrasolar planets is photoevaporation via XUV ionization, primarily in the context of highly irradiated planets. However, the EUV dissociation of hydrogen molecules can also theoretically drive atmospheric evaporation on low-mass planets. For temperate planets such as the early Earth, impact erosion is expected to dominate in the traditional planetesimal accretion model, but it would be greatly reduced in pebble accretion scenarios, allowing other mass loss processes to be major contributors. We apply the same prescription for photoionization to this photodissociation mechanism and compare it to an analysis of other possible sources of mass loss in pebble accretion scenarios. We find that there is not a clear path to evaporating the primordial atmosphere accreted by an early Earth analog in a pebble accretion scenario. Impact erosion could remove $\sim$2,300 bars of hydrogen if 1% of the planet's mass is accreted as planetesimals, while the combined photoevaporation processes could evaporate $\sim$750 bars of hydrogen. Photodissociation is likely a subdominant, but significant component of mass loss. Similar results apply to super-Earths and mini-Neptunes. This mechanism could also preferentially remove hydrogen from a planet's primordial atmosphere, thereby leaving a larger abundance of primordial water compared to standard dry formation models. We discuss the implications of these results for models of rocky planet formation including Earth's formation and the possible application of this analysis to mass loss from observed exoplanets.

Download/Website: `https://arxiv.org/abs/1912.08820v4`

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Planet-star interactions with precise transit timing. II. The radial-velocity tides and a tighter constraint on the orbital decay rate in the WASP-18 system

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Acta Astronomica, published

From its discovery, the WASP-18 system with its massive transiting planet on a tight orbit was identified as a unique laboratory for studies on tidal planet-star interactions. In an analysis of Doppler data, which include five new measurements obtained with the HIRES/Keck-I instrument between 2012 and 2018, we show that the radial velocity signal of the photosphere following the planetary tidal potential can be distilled for the host star. Its amplitude is in agreement with both theoretical predictions of the equilibrium tide approximation and an ellipsoidal modulation observed in an orbital phase curve. Assuming a circular orbit, we refine system parameters using photometric time series from TESS. With a new ground-based photometric observation, we extend the span of transit timing observations to 28 years in order to probe the rate of the orbital period shortening. Since we found no departure from a constant-period model, we conclude that the modified tidal quality parameter of the host star must be greater than 3.9×10^6 with 95% confidence. This result is in line with conclusions drawn from studies of the population of hot Jupiters, predicting that the efficiency of tidal dissipation is 1 or 2 orders of magnitude weaker. As the WASP-18 system is one of the prime candidates for detection of orbital decay, further timing observations are expected to push the boundaries of our knowledge on stellar interiors.

Contact: gmac@umk.pl

Stellar impact on disequilibrium chemistry and observed spectra of hot Jupiter atmospheres

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A&A, accepted (https://ui.adsabs.harvard.edu/abs/2020arXiv200501470S/abstract)

We study the effect of disequilibrium processes (photochemistry and vertical transport) on mixing ratio profiles of neutral species and on the simulated spectra of a hot Jupiter exoplanet that orbits stars of various spectral types. We additionally address the impact of stellar activity that should be present, to various degrees, in all stars with convective envelopes. We used the VULCAN chemical kinetic code to compute number densities of species in irradiated planetary atmospheres. The temperature-pressure profile of the atmosphere was computed with the HELIOS code. We also utilized the τ-REx forward model to predict the spectra of planets in primary and secondary eclipses. In order to account for the stellar activity, we made use of the observed solar extreme ultraviolet (XUV) spectrum taken from Virtual Planetary Laboratory (VPL) as a proxy for an active sun-like star. We find large changes in the mixing ratios of most chemical species in planets orbiting A-type stars, which radiate strong XUV flux thereby inducing a very effective photodissociation. For some species, these changes can propagate very deep into the planetary atmosphere to pressures of around 1 bar. To observe disequilibrium chemistry we favor hot Jupiters with temperatures $T_{\rm eq} = 1000$ K and ultra-hot Jupiters, with $T_{\rm eq} \approx 3000$ K, which also have temperature inversion in their atmospheres. On the other hand, disequilibrium calculations predict no noticeable changes in spectra of planets with intermediate temperatures. We also show that stellar activity similar to that of the modern Sun drives important changes in mixing ratio profiles of atmospheric species. However, these changes take place at very high atmospheric altitudes and thus do not affect predicted spectra. Finally, we estimate that the effect of disequilibrium chemistry in planets orbiting nearby bright stars could be robustly detected and studied with future missions with spectroscopic capabilities in infrared such as JWST and ARIEL.

Download/Website: `https://www.aanda.org/articles/aa/pdf/forth/aa37210-19.pdf`

Contact: `shulyak@mps.mpg.de`

Formation of secondary atmospheres on terrestrial planets by late disk accretion

Q. Kral, J. Davoult, B.Charnay
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Nature Astronomy, published (2020NatAs.tmp...66K/2004.02496)

Recently, gas disks have been discovered around main sequence stars well beyond the usual protoplanetary disk lifetimes (i.e., $>$ 10 Myrs), when planets have already formed. These gas disks, mainly composed of CO, carbon, and oxygen seem to be ubiquitous in systems with planetesimal belts (similar to our Kuiper belt), and can last for hundreds of millions of years. Planets orbiting in these gas disks will accrete a large quantity of gas that will transform their primordial atmospheres into new secondary atmospheres with compositions similar to that of the parent gas disk. Here, we quantify how large a secondary atmosphere can be created for a variety of observed gas disks and for a wide range of planet types. We find that gas accretion in this late phase is very significant and an Earth's atmospheric mass of gas is readily accreted on terrestrial planets in very tenuous gas disks. In slightly more massive disks, we show that massive CO atmospheres can be accreted, forming planets with up to sub-Neptune-like pressures. Our new results demonstrate that new secondary atmospheres with high metallicities and high C/O ratios will be created in these late gas disks, resetting their primordial compositions inherited from the protoplanetary disk phase, and providing a new birth to planets that lost their atmosphere to photoevaporation or giant impacts. We therefore propose a new paradigm for the formation of atmospheres on low-mass planets, which can be tested with future observations (JWST, ELT, ARIEL). We also show that this late accretion would show a very clear signature in Sub-Neptunes or cold exo-Jupiters. Finally, we find that accretion creates cavities in late gas disks, which could be used as a new planet detection method, for low mass planets a few au to a few tens of au from their host stars.

Download/Website: `https://rdcu.be/b3qqh`

Contact: `quentin.kral@obspm.fr`

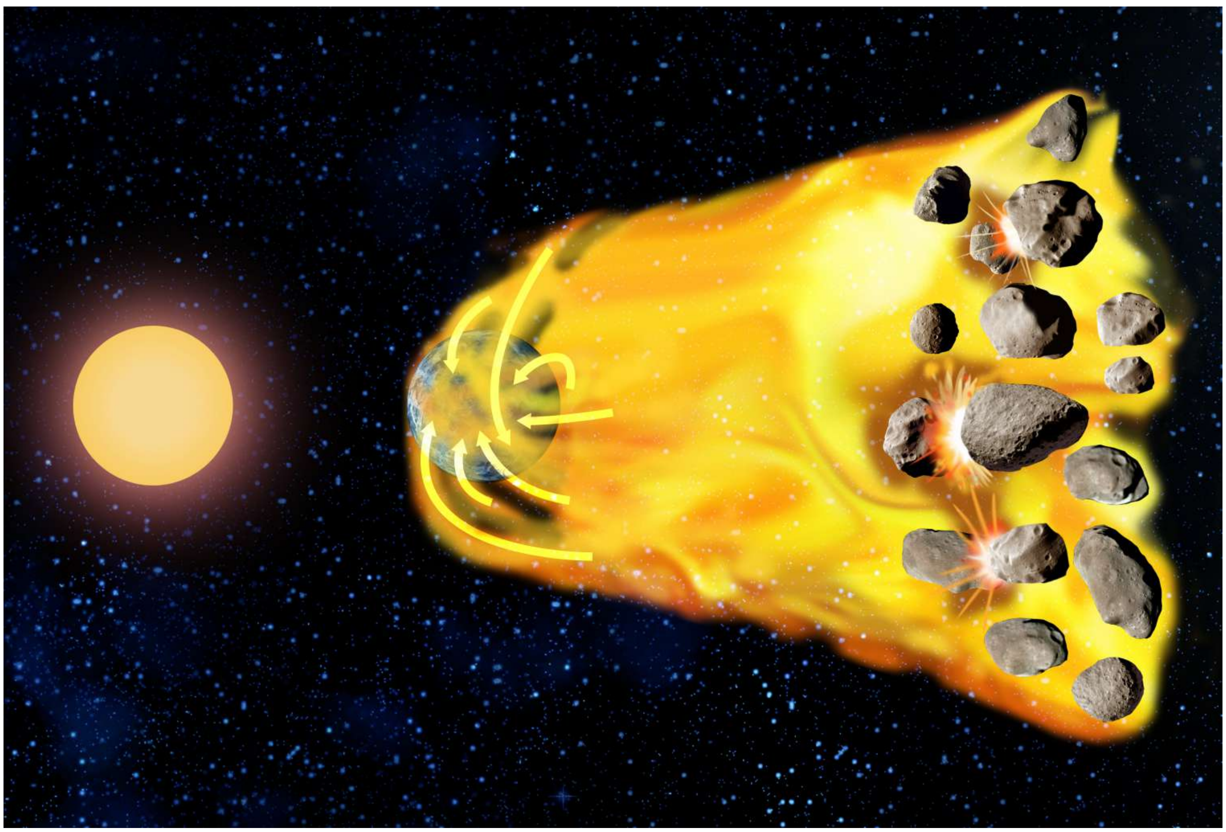

Figure 6: Kral et al.: The gas is released into a planetesimal disk further away than the planet and migrates inward until it is captured by the planet, creating a new atmosphere on the planet, which may have a mass similar to the Earth's atmosphere or even become much more massive than the Venusian atmosphere. © Sylvain Cnudde / Observatoire de Paris - PSL

Neutral Iron Emission Lines from the Day-side of KELT-9b: The GAPS Program with HARPS-N at TNG XX

L. Pino[1], J. M. Désert[1], M. Brogi[2,3,4], L. Malavolta[5,6], A. Wyttenbach[7], M. Line[8], J. Hoeijmakers[9,10] , L. Fossati[11], A. S. Bonomo[3], V. Nascimbeni[12], V. Panwar[1], L. Affer[13], S. Benatti[13], K. Biazzo[6], A. Bignamini[14], F. Borsa[15], I. Carleo[16,12], R. Claudi[12], R. Cosentino[17], E. Covino[18], M. Damasso[3], S. Desidera[12], P. Giacobbe[3], A. Harutyunyan[17], A. F. Lanza[6], G. Leto[6], A. Maggio[13], J. Maldonado[13], L. Mancini[19,3,20], G. Micela[13], E. Molinari[21], I. Pagano[6], G. Piotto[5], E. Poretti[17,15], M. Rainer[22], G. Scandariato[6], A. Sozzetti[3], R. Allart[10], L. Borsato[5], G. Bruno[6], L. Di Fabrizio[17], D. Ehrenreich[10], A. Fiorenzano[17], G. Frustagli[15,23], B. Lavie[10], C. Lovis[10], A. Magazzù[17], D. Nardiello[5], M. Pedani[17], R. Smareglia[14]

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The Astrophysical Journal Letters, published (2020arXiv200411335P)

We present the first detection of atomic emission lines from the atmosphere of an exoplanet. We detect neutral iron lines from the day-side of KELT-9b ($T_{\rm eq} \sim 4,000$ K). We combined thousands of spectrally resolved lines observed during one night with the HARPS-N spectrograph ($R \sim 115,000$), mounted at the Telescopio Nazionale Galileo. We introduce a novel statistical approach to extract the planetary parameters from the binary mask cross-correlation analysis. We also adapt the concept of contribution function to the context of high spectral resolution observations, to identify the location in the planetary atmosphere where the detected emission originates. The average planetary line profile intersected by a stellar G2 binary mask was found in emission with a contrast of 84 ± 14 ppm relative to the planetary plus stellar continuum ($40 \pm 5\%$ relative to the planetary continuum only). This result unambiguously indicates the presence of an atmospheric thermal inversion. Finally, assuming a modelled temperature profile previously published (Lothringer et al., 2018), we show that an iron abundance consistent with a few times the stellar value explains the data well. In this scenario, the iron emission originates at the 10^{-3}–10^{-5} bar level.

Download/Website: `https://doi.org/10.3847/2041-8213/ab8c44`

Contact: `l.pino@uva.nl`

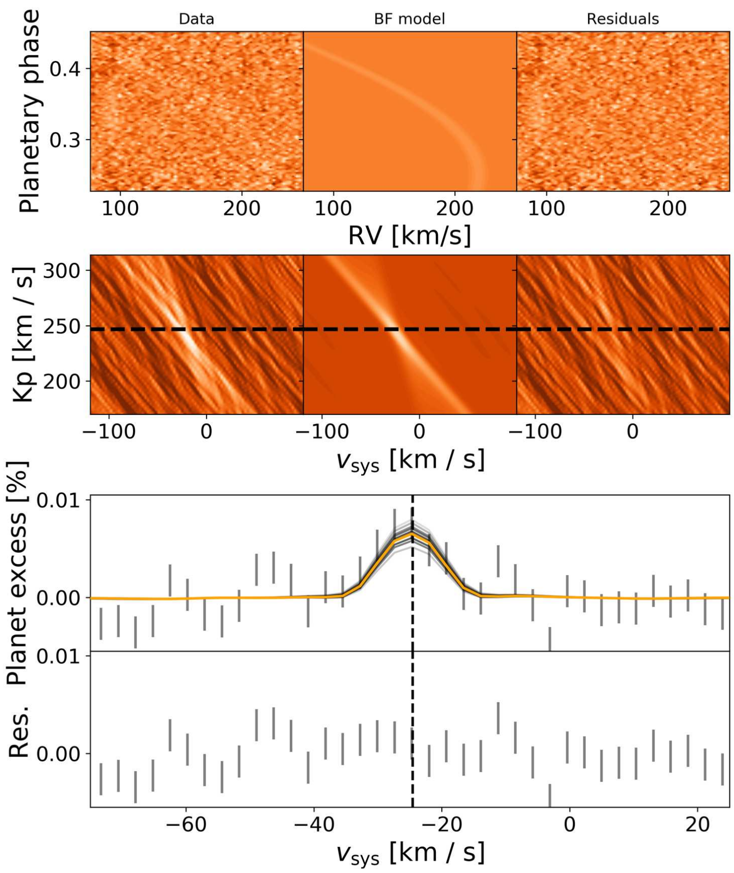

Figure 7: Pino et al.: Observed and modelled average planet emission line intersected by the G2 mask, and residuals between data and best fit model. *Upper panel:* The exposure matrix in the region where we performed the fit. The curvature of the planetary trace is due to its overnight change in radial velocity compared to its host star. Middle panel: Kp–$\mathrm{v}_{\mathrm{sys}}$ diagram for data, best fit model and residuals. The color scale is the same across the three panels, showing that the residuals map is clean in the region where the planet excess is localized. A horizontal, black, dashed line indicates the best fit value for Kp. *Lower panel:* The average data, model and residuals in the best fit planetary rest frame Kp. Gray vertical bars are the data, with their uncertainties at 1 standard deviation, while the orange line is the model shown in the middle panel. Black lines are models deviating by less than 2σ from the best fit, while varying the iron abundance, with transparency proportional to their deviation. The bottom half of the panel shows the residuals from the best fit with the same y–axis. A black dashed vertical line shows the best fit systemic velocity. The average planetary line is in emission, and has a contrast of 84 ppm compared to the continuum.

3 Jobs and Positions

Research Fellow in Exoplanets & Stellar Physics

Dr H. M. Cegla
Department of Physics, University of Warwick, Coventry, CV4 7AL, UK

University of Warwick, Application deadline: 3 July 2020

The University of Warwick seeks to appoint a motivated and driven Research Fellow within the Astronomy and Astrophysics Group. The initial appointment will be for 3 years, with the possibility for extension.

The successful candidate will work with Dr Cegla on the 'Pathway to the Confirmation and Characterisation of Habitable Alien Worlds,' supported by the UK Research and Innovation Future Leaders Fellowship programme. They will characterise stellar surface variability and measure the alignment between exoplanetary orbits and their host stars' rotational spin-axis. The candidate will utilise the 'reloaded RM' approach to determine such alignments and probe planet migration and evolution. In doing so, they will also spatially resolve distant stars, investigate stellar surface variability and determine stellar differential rotation across main sequence stars.

The Astrophysics group at Warwick is one of the UK's leading exoplanet research groups, and provides an excellent environment for a motivated Research Fellow to further their scientific career. Some of the post holder's time may be available for their own independent research, preferably in the area of exoplanets or stellar/solar physics within the Physics Department at Warwick.

Applications should include:

- a completed application form (including contact details for three references),
- a brief statement of research interests,
- CV including publications,
- a statement on commitment to equality, diversity and inclusion.

The anticipated start date is September/October 2020, but this is flexible.

At the University of Warwick, we strongly value equity, diversity and inclusion, and the Physics Department will provide a healthy working environment, dedicated to outstanding scientific guidance, mentorship and personal development (for details, including Warwick's Benefits Programme, see www.warwick.ac.uk/physics/staff/working). We are committed to individuals with care giving duties and can offer flexible working hours. Applications for a part-time position will be considered.

For more details on candidate requirements, duties, and responsibilities, please see the link below.

Download/Website: `https://bit.ly/WarwickResearchFellow`
Contact: `h.cegla@warwick.ac.uk`

Postdoctoral Researcher in Exoplanets & Binary Stars

Amaury Triaud

Sun, Stars, and Exoplanet Group, University of Birmingham, Sep-Oct 2020

Location - University of Birmingham, Edgbaston, Birmingham UK
Salary - Starting salary between £30,942 and £33,797, with usual progression once in post to £40,322
Duration - Three years.
Starting date - September - October 2020.

The successful applicant will work 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 seek applicants with expertise related with at least one of the following: n-body numerical integration, advanced statistical data analysis methods, high-resolution spectroscopy, Doppler imaging, photometric time series analysis, data mining, algorithm development and machine learning. Knowledge and expertise related to exoplanets and binary stars is also welcome. Expertise with fitting astrometric orbits is a plus.
The successful applicant is expected to create and contribute to the creation of scientific knowledge by undertaking a range of activities within the BEBOP search for circumbinary planets. **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.

The successful candidate will join a vibrant group of astronomers. The Sun, Stars, and Exoplanets 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. Birmingham is part of the Russell Group of British Universities. Members of the group have responsibilities in ASTEP, SPECULOOS, TESS, Kepler and the PLATO 2.0 Mission.
Applications should include a CV, a list of 5 publications of your most appropriate work, a research statement describing how your expertise would fit within the project, and the names, addresses and emails of three reviewers to be contacted.

Included Benefits. A list of benefits can be found in the link below
Application link. can be found below, or from the jobregister advert.

Download/Website: `https://jobregister.aas.org/ad/a41357c2`

Download/Website: `https://www.birmingham.ac.uk/staff/employeebenefits/index.aspx`

Contact: `a.triaud@bham.ac.uk`

4 Conferences

Exoplanet Demographics I Conference

J. Christiansen
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, November 9-12, 2020

Registration is available for the first Exoplanet Demographics conference, hosted by the NASA Exoplanet Science Institute. It will be held November 9-12, 2020, and there is no registration fee.

Although we don't know what November will look like in terms of travel and safety, we are still planning to hold the Exoplanet Demographics Conference in November 2020. At minimum we will support virtual attendance and presentations, so that people can make their own decisions about the form of attendance which is most appropriate for their needs. The final conference format will either be a hybrid of in-person and virtual presentations, if the organizing committees deem that a safe possibility, or fully virtual.

This conference will bring together community members working both theoretically and observationally on understanding exoplanet demographics focusing on the following themes.

- What are the current limitations on our ability to discern the true underlying planet population from the observed distribution?
- What can the size and/or mass distribution of exoplanets teach us about the dominant planet formation, migration, and evolution pathways?
- What properties of stars affect the types of planets that form, and how can we use the properties of stars to study planet formation?
- What can we learn from planetary systems or disks around stellar remnants and substellar objects?
- How will upcoming missions advance our understanding of exoplanet demographics?

You can still submit abstracts for Contributed Talks and Posters (the deadline for Review Talks has passed with notifications by May 22). If you want to submit more than one abstract, please re-register separately for each submission.

Contributed Talks and Poster Presentations: abstract submission by July 9 with notifications by August 6

Contributed talks are shorter (~ 15 minute) presentations. We hope to accommodate as many requests as possible. We are also accepting abstracts for poster presentations and are still deciding how a virtual poster session would work.
Selection criteria:
The SOC is committed to building an inclusive conference agenda, and is looking for ways to facilitate vibrant, thoughtful, and respectful discussions between all participants. Submissions are widely solicited and encouraged. Abstracts will be anonymously ranked in three career stage categories (student, postdoc, and staff) using three criteria: originality of the work, relevance to the conference themes, and results.

Download/Website: `http://nexsci.caltech.edu/workshop/2020`

Contact: `exodem@ipac.caltech.edu`

2020 Sagan Summer Virtual Workshop: Extreme Precision Radial Velocity

E. Furlan, D. Gelino
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Virtual, July 20-24, 2020

Please join us for the first virtual Sagan Summer Workshop! This workshop will provide an introduction to the basics of the PRV technique, a summary of planet demographics from PRV surveys, and an evaluation of the importance of planet masses and orbits to imaging missions and of the challenges in advancing PRV precision by the factor of 10-30 needed to detect terrestrial analogs in orbit around nearby solar type stars.

The workshop will take place via Zoom Webinar from July 20-24, with most of the presentations on July 20-23, earlier in the day Pacific time. The revised agenda for the virtual meeting is available on the workshop website. Some of the talks will be pre-recorded so attendees can become familiar with material ahead of the live meeting. We will also using Jupyter notebooks for the modified hands-on sessions and are planning to host virtual "lunch with the speakers."

As in previous years, we will record all talks for posting on the Sagan Summer Workshop YouTube channel: `https://www.youtube.com/channel/UCytsRiMvdj5VTZWfj6dBadQ/`. Please complete the free registration so that we can plan for our online attendance and communicate information for the workshop with attendees ahead of time and the receive the remote access information.

Download/Website: `http://nexsci.caltech.edu/workshop/2020`

Contact: `sagan_workshop@ipac.caltech.edu`

5 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 15, 2020

Note: All new planetary data 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`).

Also, the new alpha release of the Planetary Systems table allows you to browse ALL the planet and host star solutions (`http://bit.ly/2Pt0tM1`), and clicking on a planet name in the table takes you to the planet's redesigned System Overview page.

April 22, 2020

We've added the published data for Kepler-1649 c, an exoplanet similar to Earth in size and estimated temperature that was resurrected from the bin of false positives in the Kepler sample. The Kepler data keep on giving, long after the mission's end!

View the system's Overview page (https://bit.ly/2YIcpib) or read the media release (https://go.nasa.gov/2SHhjIk).

April 16, 2020

Seven New Planets

Data from the decommissioned Convection, Rotation and planetary Transits (CoRoT) telescope revealed two new systems: CoRoT-30 b (https://bit.ly/3bepVNd) and CoRoT-31 b (https://bit.ly/2WBmQkL). We've also added a five-planet system, HD 158259 b, c, d, e, & f (https://bit.ly/3cgFZz9), that was detected and confirmed with SOPHIE and TESS data.

Fun Fact: The NASA Exoplanet Archive partnered with the CoRoT mission to serve the stellar and light curve data from the astero-seismology and exoplanet channels. More information about our CoRoT holdings, as well as links to the data, are provided on our CoRoT summary page (https://bit.ly/3fwVpRI).

Direct Imaging Data

We've also added more parameter sets for 51 Eri b, TYC 8998-760-1 b, and 2MASS J01225093-2439505 b to our newest table, the Direct Imaging table (http://bit.ly/3ayD185).

April 2, 2020

This week, we added three confirmed planets, including two TESS planets and one discovered by direct imaging. These bring our total confirmed planet count to 4,144. The new planets are TYC 8998-760-1 b and TOI-1130 b and c.

We've also added new WASP-79 b transmission spectra, viewable in the Transmission Spectroscopy table (http://bit.ly/2B54JfR), and 16 solutions for three planets to the Microlensing table (http://bit.ly/2JQr180).

More Improvements to the NASA Exoplanet Archive Coming Soon

The NASA Exoplanet Archive team's efforts to provide a more integrated and streamlined user experience is still underway. Here is a quick update on our progress:

Last December, we announced the alpha release of the Planetary Systems Table (http://bit.ly/2Pt0tM1), which combines data from the Confirmed Planets and Extended Planet Data tables. This new table is also connected to a new Table Access Protocol (TAP) service (https://bit.ly/2Tajkgk).

Based on user feedback during this alpha period, we're planning to roll out an update to the Planetary Systems (PS) table, as well as a new table, called the Planetary Systems Composite Parameters Table (PSCP), in the coming weeks. The PSCP table's purpose is similar to our existing Composite Parameters Table: it's a more complete table of planet parameters drawn from multiple references and calculations. The new Planetary Systems Composite table will be built from the new Planetary Systems table. Data from both the PS and PSCP tables will be available through our TAP service.

More details will be released in the coming weeks. In the meantime, you are welcome to contact us through social media or our Helpdesk ticketing system (`http://bit.ly/2uP9N1b`).

Download/Website: `https://exoplanetarchive.ipac.caltech.edu`
Contact: `mharbut@caltech.edu`

6 Announcements

NOMINATIONS REQUESTED BY JUNE 1ST FOR THE 10TH PAOLO FARINELLA PRIZE

Full call for nominations:
`https://lagrange.oca.eu/images/CALL_Paolo_Farinella_Prize_2020.pdf`

The tenth Paolo Farinella Prize will be awarded to a young scientist with outstanding contributions in the field of planetary science concerning "Structure, Physics and Dynamics of Giant Planets", including work on the composition, atmospheric dynamics, and interior structure of giant planets inside or outside of our solar system. The award ceremony will be hosted by the European Planetary Science Congress (EPSC) meeting in Granada, Spain (27th of September to the 3rd of October 2020). It will also honor the outstanding scientific contributions of Adam Showman (1968-2020) who had accepted to be a member of this prize committee and passed away unexpectedly twenty years after Paolo Farinella.

Nominations must be sent by email not later than June 1st (extended from May 15 previously) to the following addresses: tristan.guillot@oca.eu, acb@ua.es and david.lucchesi@inaf.it, using the form downloadable from `https://lagrange.oca.eu/images/FORM_Paolo_Farinella_Prize_2020.docx`

The nominations for the "Paolo Farinella" Prize can be made by any researcher that works in the field of planetary sciences following the indications in the attached form. Self nominations are acceptable. The candidates should have international and interdisciplinary collaborations and should be not older than the age of Paolo when he passed away, 47 years, on May 15, 2020.

Tristan Guillot for the 10th Paolo Farinella Prize Committee

7 As seen on astro-ph

The following list contains the entries relating to exoplanets that we spotted on astro-ph during April 2020.

March 2020

astro-ph/2004.00014: **Smaller than expected bright-spot offsets in Spitzer phase curves of the hot Jupiter Qatar-1b** by *Dylan Keating et al.*

astro-ph/2004.00037: **Giant Planet Influence on the Collective Gravity of a Primordial Scattered Disk** by *Alexander Zderic, Ann-Marie Madigan*

astro-ph/2004.00072: **Jupiter's Equatorial Plumes and Hot Spots: Spectral Mapping from Gemini/TEXES and Juno/MWR** by *L.N. Fletcher et al.*

astro-ph/2004.00126: **Gravitoviscous protoplanetary disks with a dust component. III. Evolution of gas, dust, and pebbles** by *Vardan G. Elbakyan et al.*

astro-ph/2004.00229: **The effect of high nitrogen pressures on the habitable zone and an appraisal of greenhouse states** by *Ramses M. Ramirez*

astro-ph/2004.00242: **Cassini states of a rigid body with a liquid core** by *Gwenaël Boué*

astro-ph/2004.00637: **WASP-4 is Accelerating Toward the Earth** by *L. G. Bouma et al.*

astro-ph/2004.00874: **Influence of migration models and thermal torque on planetary growth in the pebble accretion scenario** by *Thomas Baumann, Bertram Bitsch*

astro-ph/2004.01063: **Radial migration of gap-opening planets in protoplanetary disks. II. The case of a planet pair** by *Kazuhiro D. Kanagawa, Ewa Szuszkiewicz*

astro-ph/2004.01109: **Tidal friction in satellites and planets. The new version of the creep tide theory** by *Sylvio Ferraz-Mello et al.*

astro-ph/2004.01198: **Apsidal Clustering following the Inclination Instability** by *Alexander Zderic et al.*

astro-ph/2004.01745: **Solid accretion onto planetary cores in radiative disks** by *Apostolos Zormpas et al.*

astro-ph/2004.01756: **Thermal Evolution of Uranus with a Frozen Interior** by *Lars Stixrude, Stefano Baroni, Federico Grasselli*

astro-ph/2004.01829: **Extremely long convergence times in a 3D GCM simulation of the sub-Neptune Gliese 1214b** by *Huize Wang, Robin Wordsworth*

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