ExoPlanet News
An Electronic Newsletter

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1 Editorial

Welcome to edition 115 of the ExoPlanet News!

We are pleased to distribute the first edition of the ExoPlanet newsletter in 2019 and we are happy that we have again a great collection of paper abstracts, conference announcements and job ads. Have a look and share with anyone who might be interested! Of course we also have the monthly update from the NASA exoplanet archive and an overview of new exoplanet related articles from astro-ph.

We are particular excited that ESA announced a launch window for the CHEOPS mission, which is 15 October to 14 November 2019:

`http://sci.esa.int/cheops/60949-exoplanet-mission-launch-slot-announced/`

This would mean that in addition to TESS we will have a second exoplanet-focused mission in space later this year with quite complementary scientific objectives!

In addition to receiving your contributions for future newsletter we would also be happy to receive feedback concerning the content and scope of the newsletter. Are we missing something? How could we further improve the reader experience and make it more interesting? 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 February 18, 2019.

Thanks for all your support and best regards from Switzerland,

Sascha P. Quanz
Christoph Mordasini
Yann Alibert
Adrien Leleu

2 Abstracts of refereed papers

Hubble PanCET: An extended upper atmosphere of neutral hydrogen around the warm Neptune GJ 3470 b

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Astronomy & Astrophysics, published (2018A&A...620A.147B)

GJ 3470b is a warm Neptune transiting an M-dwarf star at the edge of the evaporation desert. It offers the possibility of investigating how low-mass, close-in exoplanets evolve under the irradiation from their host stars. We observed three transits of GJ 3470b in the Lyman-α line with the Hubble Space Telescope (HST) as part of the Panchromatic Comparative Exoplanet Treasury (PanCET) program. Absorption signatures are detected with similar properties in all three independent epochs, with absorption depths of $35\pm7\%$ in the blue wing of the line, and $23\pm5\%$ in the red wing. The repeatability of these signatures, their phasing with the planet transit, and the radial velocity of the absorbing gas allow us to conclude that there is an extended upper atmosphere of neutral hydrogen around GJ 3470 b. We determine from our observations the stellar radiation pressure and XUV irradiation from GJ 3470 and use them to perform numerical simulations of the upper atmosphere of GJ 3470b with the EVaporating Exoplanets (EVE) code. The unusual redshifted signature can be explained by the damping wings of dense layers of neutral hydrogen that extend beyond the Roche lobe and are elongated in the direction of the planet motion. This structure could correspond to a shocked layer of planetary material formed by the collision of the expanding thermosphere with the wind of the star. The blueshifted signature is well explained by neutral hydrogen atoms escaping at rates of about 10^{10} g s^{-1} that are blown away from the star by its strong radiation pressure and are quickly photoionized, resulting in a smaller exosphere than that of the warm Neptune GJ 436b. The stronger escape from GJ 3470b, however, may have led to the loss of about 4–35% of its current mass over its $\sim$2 Gyr lifetime.

Download/Website: `https://www.aanda.org/articles/aa/abs/2018/12/aa33675-18/aa33675-18.html`

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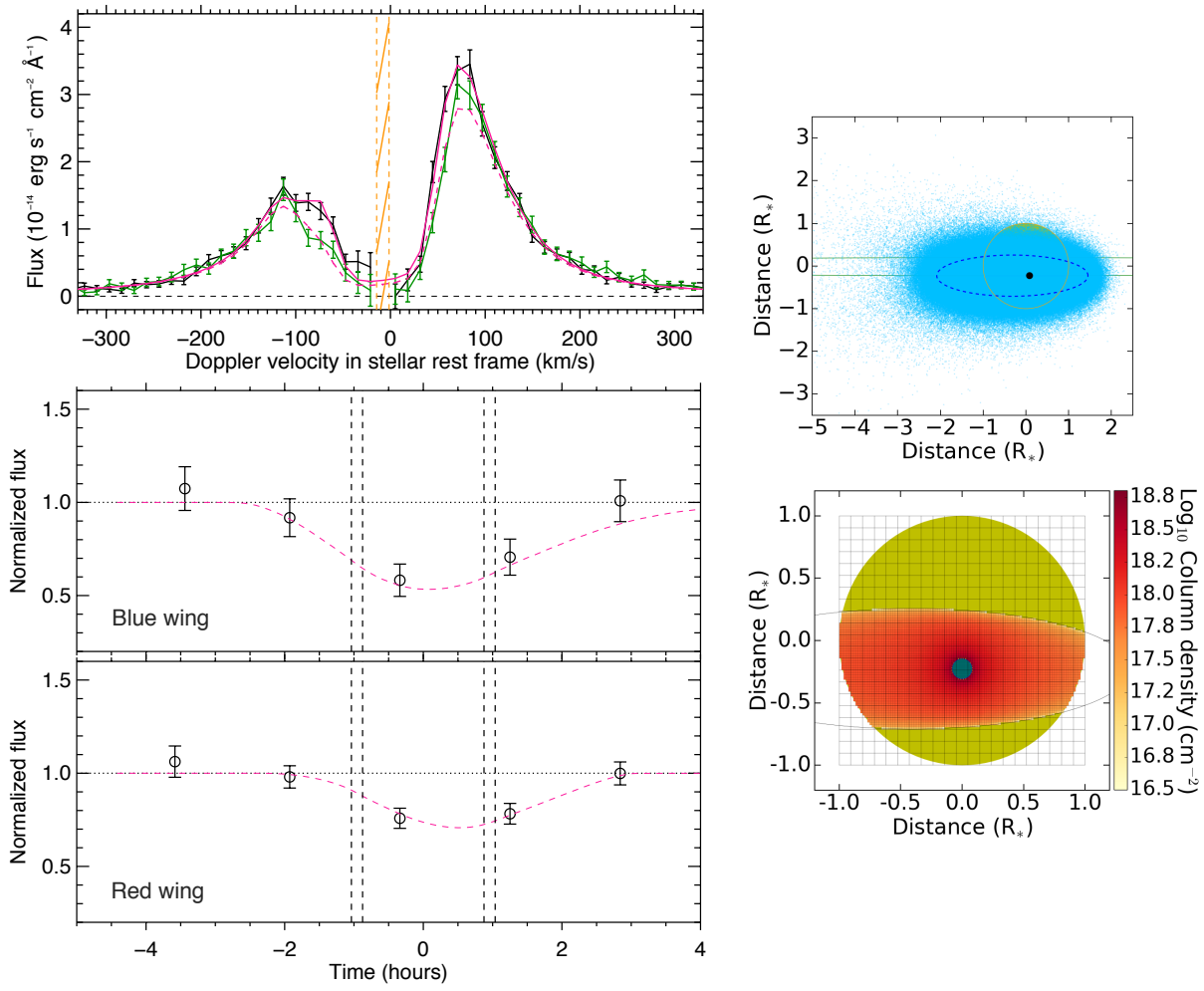

Figure 1: Best-fit simulation to GJ 3470b Lyman-α spectra (top left panel) and corresponding light curves (bottom left panels). The solid magenta spectrum, which corresponds to the reconstructed intrinsic stellar spectrum, yields the dashed spectrum and light curves after absorption by the simulated upper atmosphere. Right panels show a transit view of the simulated exosphere (top) and of the dense hydrogen layers closer to the planet, best-fitted with an ellipsoidal shape (bottom, boundary shown as a dashed blue line in the top subpanel).

The independent discovery of planet candidates around low mass stars and astrophysical false positives from the first two TESS sectors

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The Astronomical Journal, submitted

Continuous data releases throughout the TESS primary mission will provide unique opportunities for the exoplanet community at large to contribute to maximizing TESS's scientific return via the discovery and validation of transiting planets. This paper introduces our independent detection pipeline of periodic transit events along with the results of its inaugural application to the recently released 2 minute light curves of low mass stars from the first two TESS sectors. The stellar parameters within our sample are refined using precise parallax measurements from the GAIA DR2 which reduces the number of low mass stars in our sample relative to those listed in the TESS Input Catalog. In lieu of the follow-up observations required to confirm or refute the planetary nature of transit-like signals, a validation of transit-like events flagged by our pipeline is performed statistically. The resulting vetted catalog contains seven probable blended eclipsing binaries, eight known TOIs, plus eight new planet candidates smaller than 4 Earth radii. This work demonstrates the ability of our pipeline to detect sub-Neptune-sized planet candidates which to-date, represent some of the most attractive targets for future atmospheric characterization via transmission or thermal emission spectroscopy and for radial velocity efforts aimed at the completion of the TESS level one requirement to deliver 50 planets smaller than 4 Earth radii with measured masses.

Download/Website: `https://arxiv.org/abs/1812.08145`

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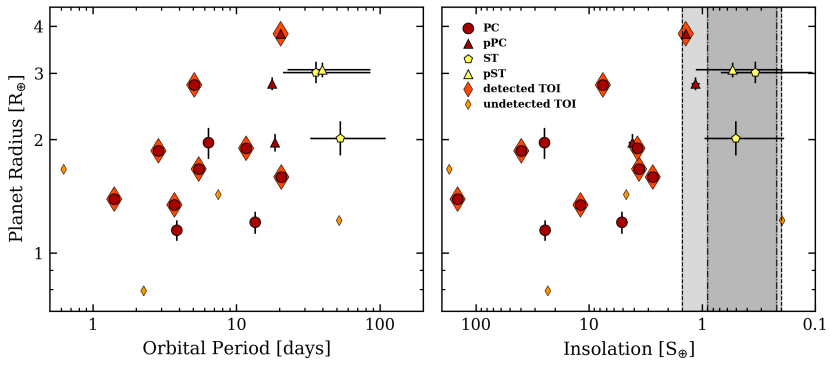

Figure 2: The resulting planet candidates from running our transiting planet detection pipeline on the 2 minute extracted light curves from the first two TESS sectors in the period/radius and insolation/radius parameter spaces. The legend labels are planet candidates (PC), putative planet candidates (pPC), single transit events (ST), and putative single transit events (pST). TOIs which we also detect are highlighted with orange diamonds surrounding the associated candidate's marker. TOIs which we do not detect are depicted as small orange diamonds. The outer shaded region in the insolation panel marks the 'recent-Venus' and 'earlyMars' limits of the habitable zone around low mass stars from Kopparapu et al. (2013). The inner shaded region marks the more conservative 'water-loss' and 'maximum-greenhouse' habitable zone limits.

A search for accreting young companions embedded in circumstellar disks: High-contrast Hα imaging with VLT/SPHERE

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Astronomy & Astrophysics, in press (arXiv:1812.06993)

In recent years, our understanding of giant planet formation progressed substantially. Even the detections of a few young protoplanet candidates still embedded in the circumstellar disks of their host stars have been made. The exact physics that describes the accretion of material from the circumstellar disk onto the suspected circumplanetary disk and eventually onto the young, forming planet is still an open question. We want to detect and quantify observables related to accretion processes occurring locally in circumstellar disks, which could be attributed to young forming planets. We focus on objects known to host protoplanet candidates and/or disk structures thought to be the result of interactions with planets. We analyzed observations of 6 young stars (age $3.5 - 10$ Myr) and their surrounding environments with the SPHERE/ZIMPOL instrument on the VLT in the Hα filter (656 nm) and a nearby continuum filter (644.9 nm). We applied several PSF subtraction techniques to reach the highest possible contrast near the primary star, specifically investigating regions where forming companions were claimed or have been suggested based on observed disk morphology. We re-detect the known accreting M-star companion HD142527 B with the highest published signal to noise to date in both Hα and the continuum. We derive new astrometry ($r = 62.8^{+2.1}_{-2.7}$ mas and PA $= (98.7 \pm 1.8)^\circ$) and photometry (ΔN_Ha=$6.3^{+0.2}_{-0.3}$ mag, ΔB_Ha=6.7 ± 0.2 mag and ΔCnt_Ha=$7.3^{+0.3}_{-0.2}$ mag) for the companion in agreement with previous studies, and estimate its mass accretion rate ($\dot{M} \approx 1 - 2 \times 10^{-10}\,M_\odot$ yr^{-1}). A faint point-like source around HD135344 B (SAO206462) is also investigated, but a second deeper observation is required to reveal its nature. No other companions are detected. In the framework of our assumptions we estimate detection limits at the locations of companion candidates around HD100546, HD169142 and MWC 758 and calculate that processes involving Hα fluxes larger than $\sim 8 \times 10^{-14} - 10^{-15}$ erg/s/cm^2 ($\dot{M} > 10^{-10} - 10^{-12}\,M_\odot$ yr^{-1}) can be excluded. Furthermore, flux upper limits of $\sim 10^{-14} - 10^{-15}$ erg/s/cm^2 ($\dot{M} < 10^{-11} - 10^{-12}\,M_\odot$ yr^{-1}) are estimated within the gaps identified in the disks surrounding HD135344 B and TW

Hya. The derived luminosity limits exclude Hα signatures at levels similar to those previously detected for the accreting planet candidate LkCa15 b.

Download/Website: `https://arxiv.org/abs/1812.06993`

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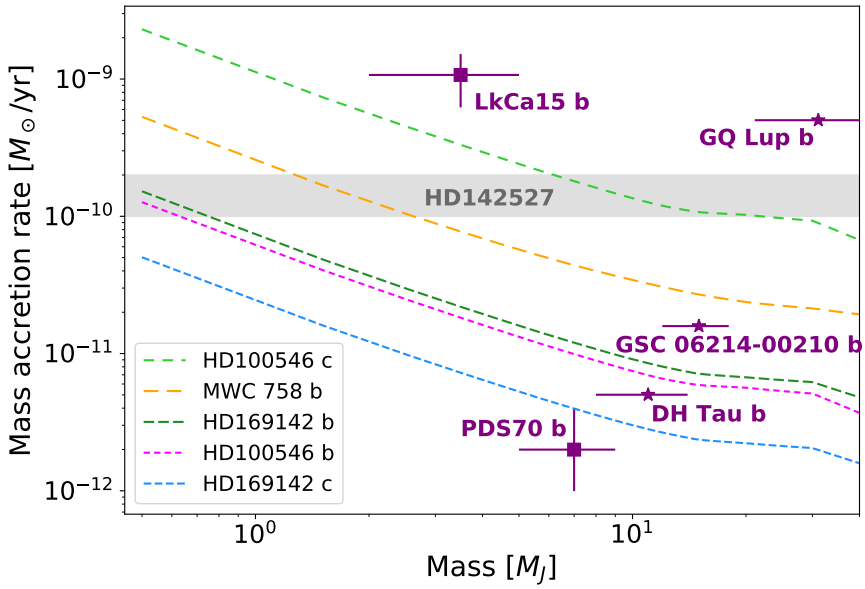

Figure 3: Mass accretion rate upper limits as a function of the planetary mass for all the candidate forming planets investigated in this work. The violet stars represent the values of the accreting objects presented in Zhou et al., 2014, while the violet squares indicate PDS70 b (Wagner et al., 2018) and LkCa15 b (Sallum et al., 2015). The grey shaded area represents the mass accretion rate of HD142527 B and is shown for mass accretion rate comparison purposes only. Indeed, the mass of the object is much larger than what is reported on the x-axis of the plot.

Star-disc (mis-)alignment in Rho Oph and Upper Sco: insights from spatially resolved disc systems with K2 rotation periods

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1901.01929)

The discovery of close in, giant planets (hot Jupiters) with orbital angular momentum vectors misaligned with respect to the rotation axis of their host stars presents problems for planet formation theories in which planets form in discs with angular momentum vectors aligned with that of the star. Violent, high eccentricity migration mechanisms purported to elevate planetary orbits above the natal disc plane predict populations of proto-hot Jupiters which have not been observed with Kepler. Alternative theories invoking primordial star-disc misalignments have recently received more attention. Here, the relative alignment between stars and their protoplanetary discs is assessed for the first time for a sample of 20 pre-main-sequence stars. Recently published rotation periods derived from high quality, long duration, high cadence K2 light curves for members of the ρ Ophiuchus and Upper Scorpius star forming regions are matched with high angular resolution observations of spatially resolved discs and projected rotational

velocities to determine stellar rotation axis inclination angles which are then compared to the disc inclinations. Ten of the fifteen systems for which the stellar inclination could be estimated are consistent with star-disc alignment while five systems indicate potential misalignments between the star and its disc. The potential for chance misalignment of aligned systems due to projection effects and characteristic measurement uncertainties is also investigated. While the observed frequency of apparent star-disc misalignments could be reproduced by a simulated test population in which 100% of systems are truly aligned, the distribution of the scale of inferred misalignment angles could not.

Download/Website: `https://arxiv.org/abs/1901.01929`

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The atmospheric circulation and climate of terrestrial planets orbiting Sun-like and M-dwarf stars over a broad range of planetary parameters

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The Astrophysical Journal, in press (arxiv:1901.00567)

The recent detections of temperate terrestrial planets orbiting nearby stars and the promise of characterizing their atmospheres motivates a need to understand how the diversity of possible planetary parameters affects the climate of terrestrial planets. In this work, we investigate the atmospheric circulation and climate of terrestrial exoplanets orbiting both Sun-like and M-dwarf stars over a wide swath of possible planetary parameters, including the planetary rotation period, surface pressure, incident stellar flux, surface gravity, planetary radius, and cloud particle size. We do so using a general circulation model (GCM) that includes non-grey radiative transfer and the effects of clouds. The results from this suite of simulations generally show qualitatively similar dependencies of circulation and climate on planetary parameters as idealized GCMs, with quantitative differences due to the inclusion of additional model physics. Notably, we find that the effective cloud particle size is a key unknown parameter that can greatly affect the climate of terrestrial exoplanets. We confirm a transition between low and high dayside cloud coverage of synchronously rotating terrestrial planets with increasing rotation period. We determine that this cloud transition is due to eddy-driven convergence near the substellar point and should not be parameterization-dependent. Finally, we compute full-phase light curves from our simulations of planets orbiting M-dwarf stars, finding that changing incident stellar flux and rotation period affect observable properties of terrestrial exoplanets. Our GCM results can guide expectations for planetary climate over the broad range of possible terrestrial exoplanets that will be observed with future space telescopes.

Download/Website: `https://arxiv.org/abs/1901.00567`

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Analytic solutions to the maximum and average exoplanet transit depth for common stellar limb darkening laws

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Astronomy & Astrophysics, submitted (arXiv:1901.01730)

The depth of an exoplanetary transit in the light curve of a distant star is commonly approximated as the squared planet-to-star radius ratio, $(R_\mathrm{p}/R_\mathrm{s})^2$. Stellar limb darkening, however, results in significantly deeper transits. Here we calculate the overshoot of the mid-transit depth caused by stellar limb darkening compared to the $(R_\mathrm{p}/R_\mathrm{s})^2$ estimate for arbitrary transit impact parameters. In turn, this allows us to compute the true planet-to-star radius ratio from the transit depth for a given parameterization of a limb darkening law and for a known transit impact parameter. We calculate the maximum emerging specific stellar intensity covered by the planet in transit and derive analytic

solutions for the transit depth overshoot. Solutions are presented for the linear, quadratic, square-root, logarithmic, and non-linear stellar limb darkening with arbitrary transit impact parameters. We also derive formulae to calculate the average intensity along the transit chord, which allows us to estimate the actual transit depth (and therefore $R_{\rm p}/R_{\rm s}$) from the mean in-transit flux. The transit depth overshoot of exoplanets compared to the $(R_{\rm p}/R_{\rm s})^2$ estimate increases from about 15 % for A main-sequence stars to roughly 20 % for sun-like stars and some 30 % for K and M stars. The error in our analytical solutions for $R_{\rm p}/R_{\rm s}$ from the small planet approximation is orders of magnitude smaller than the uncertainties arising from typical noise in real light curves and from the uncertain limb darkening. Our equations can be used to predict with high accuracy the expected transit depth of extrasolar planets. The actual planet radius can be calculated from the measured transit depth or from the mean in-transit flux if the stellar limb darkening can be properly parameterized and if the transit impact parameter is known. Light curve fitting is not required.

Download/Website: `https://arxiv.org/abs/1901.01730`

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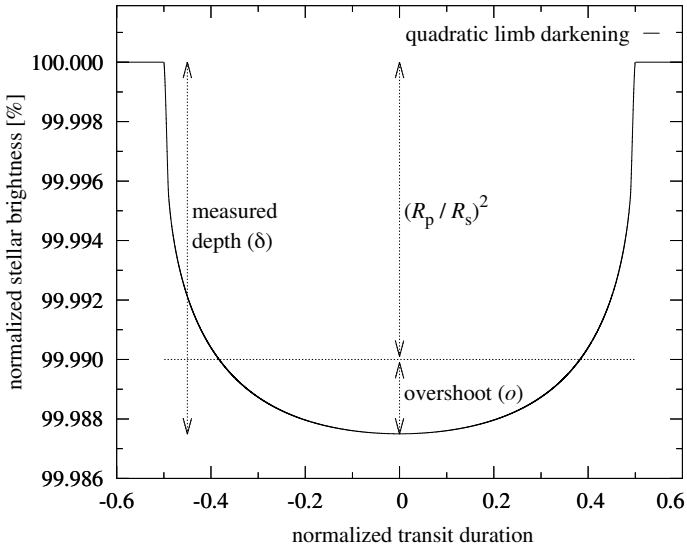

Figure 4: Comparison of a simulated transit light curve with quadratic limb darkening (Mandel & Agol 2002) (solid curve) with the $(R_{\rm p}/R_{\rm s})^2$ approximation (dashed line). The planet is assumed to have a radius of 1 % the stellar radius, roughly corresponding to an Earth-sized planet around a sun-like star. The stellar limb darkening parameters are arbitrarily set to $a = 0.4$ and $b = 0.4$ and the transit impact parameter is set to $p = 0$. The overshoot indicated by the arrow refers to $o_{\rm LC}$ as defined in Eq. (1) of the paper.

Magma ascent in planetesimals: control by grain size

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Earth and Planetary Science Letters, published (2019E&PSL.507..154L)

Rocky planetesimals in the early solar system melted internally and evolved chemically due to radiogenic heating from ^{26}Al. Here we quantify the parametric controls on magma genesis and transport using a coupled petrological and fluid mechanical model of reactive two-phase flow. We find the mean grain size of silicate minerals to be a key control on magma ascent. For grain sizes larger than ≈ 1 mm, melt segregation produces distinct radial structure and chemical stratification. This stratification is most pronounced for bodies formed at around 1 Myr after formation of Ca,Al-rich inclusions. These findings suggest a link between the time and orbital location of planetesimal formation and their subsequent structural and chemical evolution. According to our models, the evolution of partially molten planetesimal interiors falls into two categories. In the *magma ocean* scenario, the whole interior of a planetesimal experiences nearly complete melting, which would result in turbulent convection and core-mantle differentiation by the rainfall mechanism. In the *magma sill* scenario, segregating melts gradually deplete the deep interior of the radiogenic heat source. In this case, magma may form melt-rich layers beneath a cool and stable lid, while core formation would proceed by percolation. Our findings suggest that grain sizes prevalent during the internal heating stage governed magma ascent in planetesimals. Regardless of whether evolution progresses toward a *magma ocean* or *magma sill* structure, our models predict that temperature inversions due to rapid ^{26}Al redistribution are limited to bodies formed earlier than ≈ 1 Myr after CAIs. We find that if grain size was smaller than ≈ 1 mm during peak internal melting, only elevated solid–melt density contrasts (such as found for the reducing conditions in enstatite chondrite compositions) would allow substantial melt segregation to occur.

Download/Website: `https://arxiv.org/abs/1802.02157`; *blog post:* `http://bit.ly/2GZZ0e9`

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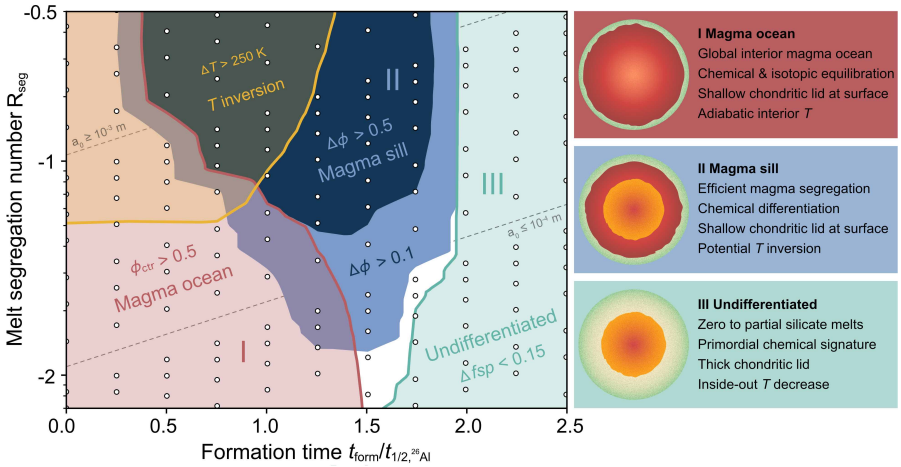

Figure 5: Regime diagram of planetesimal melt ascent and chemical segregation with the primary identified interior evolutionary regimes.

Detecting isotopologues in exoplanet atmospheres using ground-based high-dispersion spectroscopy

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Astronomy & Astrophysics, in press (arXiv:1809.01156)

Cross-correlation is a well-tested method for exoplanet characterization. A new, potentially powerful application is the measurement of atmospheric isotope ratios. In particular D/H can give unique insights into a planet's formation and evolution. Here we aim to study the detectability of isotopologues in the high-dispersion spectra of exoplanets, to identify the optimal wavelengths ranges, and to predict the required observational efforts with current and future ground-based instruments. High-dispersion (R=10^5) thermal emission (and sometimes reflection) spectra were simulated by self-consistent modeling exoplanet atmospheres over a wide range of temperatures. These were synthetically observed with telescopes equivalent to the VLT or ELT, and analysed with cross-correlation, resulting in S/N predictions for the detection of ^{13}CO, HDO, and CH_3D. For the best observable exoplanets, ^{13}CO is in range of current telescopes. It will be most favorably detected at 2.4 microns, just longward of the spectral range probed by several high-dispersion observations in the literature. CH_3D can best be seen at 4.7 microns, using 40m-class telescopes for planets with $T_{\rm equ}$ below 600 K. In this case, sky emission is often dominating the noise. HDO can be targeted at 3.7 microns, where sky emission is smaller. 40m-class telescopes may detect it in planets with $T_{\rm equ}$ below 900 K, potentially even 8m-class telescopes in the case of methane quenching. If Proxima Cen b is water-rich, HDO could be detected with the ELT in 1 night in reflected light. Isotopologues will soon belong to the exoplanet characterisation tools. Measuring D/H, and ratios of other isotopes, could be a prime science case for the METIS instrument on the ELT, especially for nearby rocky and ice giant planets. This can give unique insights in their history of ice enrichment and atmospheric evaporation.

Download/Website: `https://arxiv.org/abs/1809.01156`

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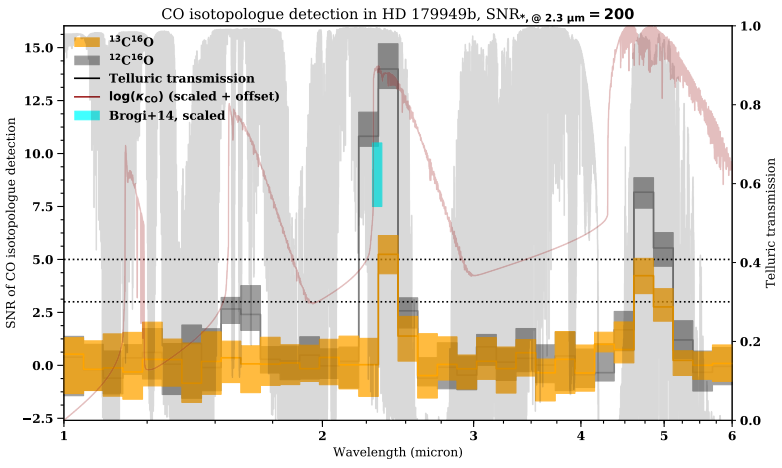

Figure 6: Mollière & Snellen

Predicted wavelength-dependent detection SNR for the secondary $^{13}C^{16}O$ (orange boxes) and the main $^{12}C^{16}O$ isotopologue (gray boxes), for the hot Jupiter HD 179949b. The box widths correspond to the wavelength range of the synthetic observations, while the height corresponds to the 16 and 84 percentiles of the measured SNRs, as derived by running the simulations multiple times. We assumed 100 observations with $\mathrm{SNR}_*(2.3\ \mu\mathrm{m}) = 200$, used to calculate the stellar SNR as function of wavelength. In the background, we show the telluric transmission model (gray solid line), as well as the scaled and offset logarithm of the CO opacity at $T = 1200$ K and $P = 10^{-4}$ bar (light red solid line). The CO detection by Brogi et al (2014) is shown in cyan. The actual SNR value of the CO detection in Brogi et al (2014) is 5.8, but due to the larger wavelength coverage of our bins one has to scale this value up to a SNR of 9. This is somewhat lower than our prediction for $^{12}C^{16}O$, but the SNR of their observations is also smaller.

The imprint of X-ray photoevaporation of planet-forming discs on the orbital distribution of giant planets

K. Monsch[1], *B. Ercolano*[1,2], *G. Picogna*[1], *T. Preibisch*[1], *M. M. Rau*[3]

[1] Universitäts-Sternwarte, Ludwig-Maximilians-Universität München, Scheinerstr. 1, 81679 München, Germany
[2] Excellence Cluster Origin and Structure of the Universe, Boltzmannstr.2, 85748 Garching, Germany
[3] McWilliams Center for Cosmology, Department of Physics, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Monthly Notices of the Royal Astronomical Society, published (arXiv:1812.02173)

High energy radiation from a planet host star can have strong influence on the final habitability of a system through several mechanisms. In this context we have constructed a catalogue containing the X-ray luminosities, as well as basic stellar and planetary properties of all known stars hosting giant planets ($> 0.1\ M_{\rm J}$) that have been observed by the *Chandra* X-ray Observatory, *XMM-Newton* and/or ROSAT. Specifically in this paper we present a first application of this catalogue to search for a possible imprint of X-ray photoevaporation of planet-forming discs on the present-day orbital distribution of the observed giant planets. We found a suggestive void in the semi-major axis, a, versus X-ray luminosity, $L_{\rm x}$, plane, roughly located between $a \sim 0.05$–1 au and $L_{\rm x} \sim 10^{27}$–10^{29} erg s^{-1}, which would be expected if photoevaporation played a dominant role in the migration history of these systems. However, due to the small observational sample size, the statistical significance of this feature cannot be proven at this point.

Download/Website: `The catalog is available for download on Harvard Dataverse (https://doi.org/10.7910/DVN/FPXFA5)`

Contact: `monsch@usm.lmu.de`

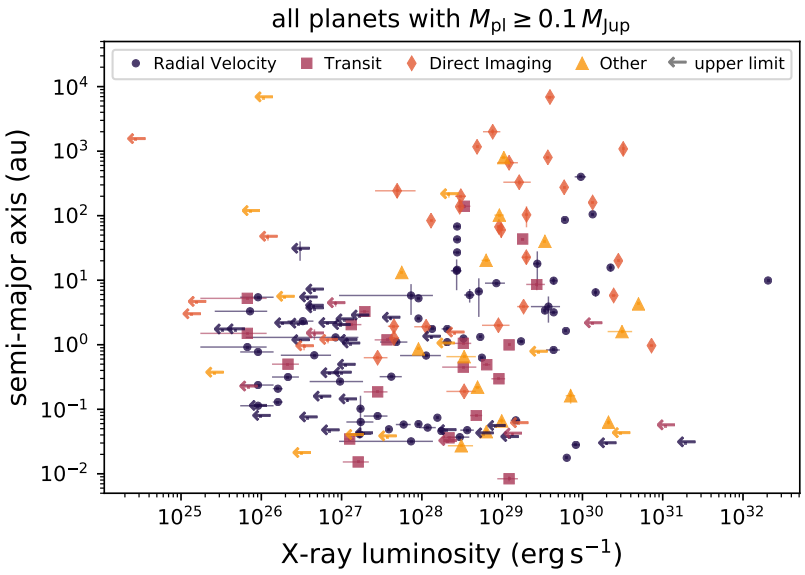

Figure 7: Observed semi-major axis vs. X-ray luminosity distribution of stars hosting giant planets with masses above $0.1\ M_{\rm J}$. For multi-planet systems all planets with a mass of $0.1\ M_{\rm J}$ are plotted. The colours highlight the different exoplanet detection methods for each system. Techniques that result in only very few detections (like astrometry or transit timing variation (TTV)) in our catalogue are summarised as 'Other'. Upper limits on X-ray luminosities are shown as arrows.

TESS exoplanet candidates validated with HARPS archival data. A massive Neptune around GJ 143 and two Neptunes around HD 23472

Trifon Trifonov[1], *Jan Rybizki*[1], *Martin Kürster*[1]

[1] Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany

Astronomy & Astrophysics, submitted on 10 Dec 2018 (arXiv:1812.04501)

We aim at the discovery of new planetary systems by exploiting the transit light curve results from TESS orbital observatory's Sector 1 and 2 observations and validating them with precise Doppler measurements obtained from archival HARPS data. Taking advantage of the reported TESS transit events around GJ 143 (TOI 186) and HD 23472 (TOI 174) we model their HARPS precise Doppler measurements and derive orbital parameters for these two systems. For the GJ 143 system TESS has reported only a single transit, and thus its period is unconstrained from photometry. Our RV analysis of GJ 143 reveal the full Keplerian solution of the system, which is consistent with an eccentric planet with a mass almost twice that of Neptune and a period of $P_{\rm b}$ = $35.59^{+0.01}_{-0.01}$ days. Our estimates of the GJ 143 b planet are fully consistent with the transit timing from TESS. We confirm the two-planet system around HD 23472, which according to our analysis is composed of two Neptune mass planets in a possible 5:3 MMR.

Download/Website: `https://arxiv.org/abs/1812.04501`

Contact: `trifonov@mpia.de`

Two Jovian planets around the giant star HD 202696. A growing population of packed massive planetary pairs around massive stars?

Trifon Trifonov[1], *Stephan Stock*[2], *Thomas Henning*[1], *Sabine Reffert*[2], *Martin Kürster*[1], *Man Hoi Lee*[3,4], *Bertram Bitsch*[1] *R. Paul Butler*[5], *Steven S. Vogt*[6]

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[5] Department of Terrestrial Magnetism, Carnegie Institution for Science, Washington, DC 20015, USA
[6] UCO/Lick Observatory, Department of Astronomy and Astrophysics, University of California at Santa Cruz, Santa Cruz, CA 95064, USA

The Astronomical Journal, accepted on 18 Dec 2018 (arXiv:1901.01935)

We present evidence for a new two-planet system around the giant star HD 202696 (= HIP 105056, BD +26 4118). The discovery is based on public HIRES radial velocity measurements taken at Keck Observatory between July 2007 and September 2014. We estimate a stellar mass of $1.91^{+0.09}_{-0.14} M_{\odot}$ for HD 202696, which is located close to the base of the red giant branch. A two-planet self-consistent dynamical modeling MCMC scheme of the radial velocity data followed by a long-term stability test suggests planetary orbital periods of $P_{\rm b}$ = $517.8^{+8.9}_{-3.9}$ days and $P_{\rm c}$ = $946.6^{+20.7}_{-20.9}$ days, eccentricities of $e_{\rm b}$ = $0.011^{+0.078}_{-0.011}$ and $e_{\rm c}$ = $0.028^{+0.065}_{-0.012}$, and minimum dynamical masses of $m_{\rm b}$ = $2.00^{+0.22}_{-0.10}$ $M_{\rm Jup}$ and $m_{\rm c}$ = $1.86^{+0.18}_{-0.23}$,$M_{\rm Jup}$, respectively. Our stable MCMC samples are consistent with orbital configurations predominantly in a mean period ratio of 11:6 and its close-by high order mean-motion commensurabilities with low eccentricities. For the majority of the stable configurations we find an aligned or anti-aligned apsidal libration (i.e. $\Delta\omega$ librating around 0° or 180°), suggesting that the HD 202696 system is likely dominated by secular perturbations near the high-order 11:6 mean-motion resonance. The HD 202696 system is yet another Jovian mass pair around an intermediate mass star with a period ratio below the 2:1 mean motion resonance. Therefore, the HD 202696 system is an important discovery, which may shed light on the primordial disk-planet properties needed for giant planets to break the strong 2:1 mean motion resonance and settle in more compact orbits.

Download/Website: `https://arxiv.org/abs/1901.01935`

Contact: `trifonov@mpia.de`

Precovery of TESS Single Transits with KELT

X. Yao[1], J. Pepper[1], B. S. Gaudi[2], J. Labadie-Bartz[1,3], T. G. Beatty[4,5], K. D. Colón[6], D. J. James[7], R. B. Kuhn[8,9], M. B. Lund[10], J. E. Rodriguez[7], R. J. Siverd[11], K. G. Stassun[10,12], D. J. Stevens[2], S. Villanueva, Jr.[2], D. Bayliss[13]

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[6] NASA Goddard Space Flight Center, Exoplanets and Stellar Astrophysics Laboratory (Code 667), Greenbelt, MD 20771, USA
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[8] South African Astronomical Observatory, P.O. Box 9, Observatory 7935, South Africa
[9] South African Large Telescope, P.O. Box 9, Observatory 7935, South Africa
[10] Department of Physics and Astronomy, Vanderbilt University, 6301 Stevenson Center, Nashville, TN 37235, USA
[11] Las Cumbres Observatory Global Telescope Network, 6740 Cortona Dr., Suite 102, Santa Barbara, CA 93117, USA
[12] Department of Physics, Fisk University, 1000 17th Avenue North, Nashville, TN 37208, USA
[13] Department of Physics, University of Warwick, Gibbet Hill Road, Coventry CV4 7AL, UK

The Astronomical Journal, published (arXiv:1807.11922)

During the Transiting Exoplanet Survey Satellite (TESS) prime mission, 74% of the sky area will have an observational baseline of only 27 days. For planets with orbital periods longer than 13.5 days, TESS can capture only one or two transits, and the planet ephemerides will be difficult to determine from TESS data alone. Follow-up observations of transits of these candidates will require precise ephemerides. We explore the use of existing ground-based wide-field photometric surveys to constrain the ephemerides of the TESS single-transit candidates, with a focus on the Kilodegree Extremely Little Telescope (KELT) survey. We insert simulated TESS-detected single transits into KELT light curves and evaluate how well their orbital periods can be recovered. We find that KELT photometry can be used to confirm ephemerides with high accuracy for planets of Saturn size or larger, with orbital periods as long as a year, and therefore span a wide range of planet equilibrium temperatures. In a large fraction of the sky, we recover 30% to 50% of warm Jupiter systems (planet radius of 0.9 to 1.1 R_J and $13.5 < P < 50$ days), 5% to 20% of temperate Jupiters ($50 < P < 300$ days), and 10% to 30% of warm Saturns (planet radius of 0.5 to 0.9 R_J and $13.5 < P < 50$ days). The resulting ephemerides can be used for follow-up observations to confirm candidates as planets, eclipsing binaries, or other false positives, as well as to conduct detailed transit observations with facilities like James Webb Space Telescope or Hubble Space Telescope.

Download/Website: `https://arxiv.org/abs/1807.11922`

Contact: `xiy515@lehigh.edu`

3 Jobs and Positions

PhD positions in Astrochemistry and Exoplanet Atmospheres

Dr Catherine Walsh and Prof Dan Marsh
School of Physics and Astronomy, University of Leeds, Leeds, UK

University of Leeds, 09/2019

The School of Physics and Astronomy at the University of Leeds is pleased to announce two PhD projects in (exo)planetary science, now accepting applications, and with anticipated start dates in September/October 2019. Ongoing review of submitted applications will continue until the end of March 2019.

The first project, supervised by Dr Catherine Walsh is titled **"Probing the molecular composition of planet-forming regions with ALMA"** and will involve data analysis and chemical modelling support for a current ALMA Large Program (130 hours) titled "The Chemistry of Planet Formation". This project would be particularly suited to a candidate interested in conducting a computational project in astrochemistry and planet formation, and who would enjoy the challenge of working with state-of-the-art data from ALMA (the Atacama Large Millimeter/submillimeter Array).

The second project, supervised by Prof Dan Marsh and co-supervised by Dr Catherine Walsh, is titled **"Simulating the atmospheres of rocky planets"**. This will involve using state-of-the art coupled chemistry global circulation models to simulate the atmospheric structure and dynamics of rocky (exo)planet atmospheres. This project is suited to a candidate who is interested in conducting a computational project using high-performance computing facilities in a high-impact research area.

For more information on the proposed projects please visit the project pages:

- `https://physicalsciences.leeds.ac.uk/research-opportunity/40/research-degrees/721/probing-the-molecular-composition-of-planet-forming-regions-with-alma`

  and

- `https://physicalsciences.leeds.ac.uk/research-opportunity/40/research-degrees/735/simulating-the-atmospheres-of-rocky-exoplanets`.

Please contact the supervisors directly using the e-mail addresses below for additional information.

The Astrophysics Group at the University of Leeds consists of eight members of academic staff active in the research fields of observational and theoretical star and planet formation, astrochemistry, magnetohydrodynamics, and atmospheric science. Information on research profile of the School of Physics and Astronomy can be found here: `https://physicalsciences.leeds.ac.uk/info/37/school_of_physics_and_astronomy`. Information on how to apply can be found here: `http://www.leeds.ac.uk/info/130206/applying/91/applying_for_research_degrees`.

Contact: `c.walsh1@leeds.ac.uk, d.marsh@leeds.ac.uk`

Tenure track position at Lund University in observations and characterisation of exoplanets

Lund Observatory at Lund University is recruiting a person into a tenure-track faculty position in observational studies of exoplanets. The Associate Senior Lecturer will conduct research on the detection of exoplanets, in studies of exoplanet atmospheres or in the characterization of exoplanet host stars, with the purpose of understanding the planetary system.

The new Associate Senior Lecturer will join a vibrant scientific environment at Lund Observatory. Research work at Lund Observatory has as a common focus the formation and evolution of the Milky Way and its constituents. Our work combines theory with observations and science support for space missions. Data from ESA's Gaia satellite gives information about the Milky Way and will find some several thousand exoplanetary systems. Astronomers in Lund are involved in programmes for processing and exploitation of Gaia data, and for the acquisition of complementary data from ground-based telescopes (e.g., Gaia-ESO Survey). Theoretical work concerns the formation and dynamics of exoplanetary systems, the growth of black holes, and the progenitors of the brightest explosions in the Universe (supernovae and gamma-ray bursts). Observational as well as theoretical work benefits from our participation in development and preparation of next-generation instrumentation (e.g., 4MOST and PLATO).

All employees in Sweden and at Lund University enjoy full access to the national health care system. The position includes 5 weeks paid annual leave. For employees with small children there are extra possibilities of leave and there are state provided daycare facilities.

Last day of applying: 28 February 2019

Full job announcement (apply here):
`http://www.astro.lu.se/Staff/staff_vacancies.html`

Information about Lund Observatory:
`http://www.astro.lu.se/`
`http://www.astro.lu.se/Research/`

Inquiries about position: Professor Anders Johansen (anders@astro.lu.se)

PhD and Postdoctoral Positions in Star and Exoplanet Research

Prof. Ansgar Reiners
Institute for Astrophysics, Friedrich-Hund-Platz 1, 37077 Göttingen

Göttingen, August 1, 2019

The stellar and exoplanetary physics group at the Institute for Astrophysics (IAG) at the Georg-August-University, Göttingen invites applications for:

2 Research Assistants
and
2 PhD Students

We are looking for highly motivated researchers to strengthen our stellar and planetary physics group in the fields of astrophysical observations and theory, and instrument development. Possible research topics include all fields mentioned.

IAG covers research in the fields of extrasolar planets, solar and stellar physics, galactic and extragalactic astrophysics, and cosmology. With an instrument engineering group and qualified workshops, IAG participates in the development of modern astronomical instrumentation, e.g., for ESO's VLT and ELT. The institute operates local facilities for hardware development, as well as telescopes in Texas and South Africa. The stellar and planetary physics group covers a broad range of research, e.g., stellar activity, low-mass stars, the search for extrasolar planets, and exoplanet atmospheres. We are members of the CARMENES and CRIRES+ consortia with privileged access, and of the ELT instrument HIRES. From Göttingen, our group is carrying out benchmark observations of the Sun.

The University of Göttingen is an internationally renowned research university founded in 1737. Göttingen is situated in the geographical center of Germany, between the Harz Mountains and the Weser River. It offers a broad range of subjects across 13 university faculties, five Max Planck Institutes, and other scientific institutions. With over 30,000 students, the University is one of the largest in Germany.

Positions should be filled by Aug 1, 2019. Pay grade 13 TV-L. The University of Göttingen is an equal opportunities employer with particular emphasis on fostering career opportunities for women. Qualified women are strongly encouraged to apply. See full ad for more info.

Download/Website: `http://www.uni-goettingen.de/en/305402.html?cid=14006`
Contact: `sekr@astro.physik.uni-goettingen.de`

PostDoctoral Research on exoplanets with CHEOPS

Sérgio Sousa[1,2]*, Susana Barros*[1,2]
[1] Instituto de Astrofísica e Ciências do Espaço, Universidade do Porto, CAUP, Rua das Estrelas, 4150-762 Porto, Portugal
[2] https://www.astro.up.pt/exoearths/

Porto, Portugal, Starting date: from 1st February to 1st May 2019

Centro de Investigação em Astronomia/Astrofísica da Universidade do Porto (CAUP) is advertising a postdoctoral position in the field of exoplanets. The position has duration of 25 months and cannot exceed the end date of the project, 21st of May 2021. The starting date of the position is negotiable, but not later than 1st May 2019. The gross monthly remuneration is 2128.34 EUR.

The researcher is expected to give support to the participation of the team in CHEOPS satellite data exploitation. Within the scientific themes of CHEOPS, the candidate should be involved in the search of transits of already known exoplanets, the characterization of its radius and composition. It is also expected for the researcher to work on the study of the exoplanet's atmosphere by using observations of the transit occultation and/or the observed phase curves. The team has already most of the tools for these analysis in place, but it is expected that the researcher participate on their optimization and in the development of new tools.

The call will be open until 21st January 2019. Candidates shall submit their application through the form available online (link bellow), including all supporting documentation, namely: motivation letter; certificate or PhD diploma copy; Curriculum Vitae, detailed and structured according to section 8 of this announcement; other documentation relevant for the evaluation of qualifications in a related scientific area; and a brief description of the most relevant scientific activities of the last 5 years;

IA assembles more than two-thirds of all active researchers working in Space Sciences in Portugal. The research and development effort at the IA includes most of the topics at the forefront of research in Astrophysics and Space Sciences, complemented by work on instrumentation and systems with potential use in Astronomy and Astrophysics. IA provides all necessary research conditions in a friendly and scientifically active environment.

Full details of this call is presented in the online announcement: `www.iastro.pt/jobs/IA2018-41-CTTI`

Please contact us if you need further information.

Download/Website: `www.iastro.pt/jobs/IA2018-41-CTTI`
Contact: `sergio.sousa@astro.up.pt, susana.barros@astro.up.pt`

4 Conferences & Workshops

From Stars to Planets II - Connecting our understanding of star & planet formation

SOC Chair: Jonathan C. Tan

Gothenburg, Sweden, 17th - 20th June 2019

Second Announcement: Abstract submission by 28th February 2019
Star formation, planet formation, astrochemistry and exoplanet studies are undergoing rapid, revolutionary advances and this conference aims to bring together researchers in these fields, especially to explore and develop new connections. The scientific scope of the meeting will include:
- Molecular Clouds and Star Formation in the Milky Way
- Star Cluster Formation and Evolution
- Pre-stellar and Protostellar Cores
- Protostellar and Protoplanetary Disks
- Planet Formation
- Astrochemistry of Star and Planet Forming Regions and Exoplanets
- Exoplanet Properties and Evolution
- Formation and Evolution of the Solar System

Meeting schedule and preliminary logistics:
Sunday 16th June 2019, 6pm Welcome reception
Monday 17th - Thur. 20th June 2019, 3.5 days of science sessions, 0.5 day excursion
Friday 21st June 2019, Midsummer celebration (optional post-conference activity)

Confirmed Invited Speakers:

- Viviana Guzman
- Christoph Mordasini
- Richard Nelson
- Stella Offner
- Leonardo Testi
- Catherine Walsh
- Anders Johansen
- Gijs Mulders
- David Nesvorny
- Nami Sakai
- Ewine van Dishoeck
- Zhaohuan Zhu

SOC: Jonathan Tan (Chair, Chalmers/UVa), Ilse Cleeves (UVa), Maria Drozdovskaya (Bern), Eric Herbst (UVa), Jouni Kainulainen (Chalmers), Zhi-Yun Li (UVa), Yamila Miguel (Leiden), Darin Ragozinne (BYU), John Tobin (NRAO), Jonathan Williams (UH), Andrew Youdin (UA)
LOC Contact: Jonathan Tan (jonathan.tan@chalmers.se)

ABSTRACT SUBMISSION: If you are interested in attending the conference, please submit an abstract by 28th February 2019 via the link from this page: `http://cosmicorigins.space/fstpii/`
We expect decisions on abstracts to be made by mid March. Note, it is possible that we will receive more submissions than can be accepted given the size of the venue. Registration and logistics information, including hotel room blocks, for attendees will be sent out by the end of March.

Download/Website: `http://cosmicorigins.space/fstpii/`

Contact: `jonathan.tan@chalmers.se`

PLATO Atmospheres Workshop

SOC: J. L. Grenfell, M. Güdel, H. Lammer, A. García Muñoz, S. Gebauer, M. Godolt, H. Rauer
LOC: C. Dreyer, J.L. Grenfell, B. Stracke, R. Schubert, R. Titz-Weider

DLR Institute for Planetary Research, Berlin, 4–5 February 2019

SCIENCE CONTRIBUTION
Workshop contributions on hot and cool terrestrial planetary atmospheres relevant to the PLATO Mission are welcome. This includes data analyses and modeling studies on atmospheric composition, climate, escape, clouds, retrieval and evolution of hot and temperate rocky exoplanets. The organizers particularly welcome a clear demonstrable link with the PLATO mission science goals.

LOCATION AND TIMES
The workshop will be held in the Rotunde room in the Institute for Planetary Research at the German Aerospace Centre (DLR), Rutherfordstr. 2, 12489 Berlin, Germany, from Monday 4th February starting at 13:30 and ending on Tuesday 5th February 2019 at 16:00.

REGISTRATION
Registration will be possible until January 15th 2018. There is no registration fee. Further details can be found at the Website.

Download/Website: `https://www.dlr.de/pf/en/desktopdefault.aspx/tabid-13166/23008_read-53371/`

Contact: `PLATO-Workshop@dlr.de`

Planetary Dynamics Conference

Debra Fischer, Thomas Henning, Hubert Klahr, Gregory Laughlin, Man Hoi Lee, Rosemary Mardling, Ruth Murray-Clay, Alice Quillen, Trifon Trifonov, Yanqin Wu

Heidelberg, Germany, at the Max Planck Institute for Astronomy (MPIA), 3 – 7 June 2019

The conference aims to bring together experts and students working in the field of extrasolar planets and planetary dynamics. We hope to discuss variety of dynamical problems such as: Resonant and near-resonant pairs and chains, Secular dynamics, Chaos, Three-dimensional structure and Lidov-Kozai mechanisms, Formation and stability of S- and P- type planets in binaries, Post-MS evolution of multiple planet systems, Solar system dynamics, etc.

Download/Website: `http://mpia.de/homes/dynamics2019`

Contact: `trifonov@mpia.de`

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 and information on financial assistance to attend the workshop will be available in early February.

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

Exoplanets III - save the date

Cornelis Dullemond

Heidelberg, Germany, July 27-31, 2020

Save the date for the next conference in the "Exoplanets" series. Exoplanets III will take place in Heidelberg, Germany, July 27-31, 2020. More information will follow soon.

Download/Website: `www.exoplanets.world`
Contact: `#ExoConf`

5 Exoplanet Archive Updates

December 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, January 14, 2019

December 21, 2018

We have an #Exoplanets2018 Winner! No new planets were added this week, so the final #Exoplanets2018 planet count is the same as last week's: **3,869 planets**! Congratulations to our winner, Jake Taylor (a.k.a. @AstroJake), who guessed there would be 3,852 at the end of 2018. It was the closest entry we received without surpassing the final planet count. In case you're wondering, there were 297 confirmed exoplanets added to the NASA Exoplanet Archive this year, including the first TESS confirmed planet that was announced in October.

We would like to extend a big thank you to everyone who played along this year, and congratulations again to Jake!

See you in 2019! The NASA Exoplanet Archive staff is on a winter break from Dec. 22 through Jan. 1, during which there will be no data or software updates. Responses to Helpdesk tickets and social media may also be delayed. We wish everyone a cozy and relaxing holiday season, full of earthly and astronomical surprises. If you are attending the American Astronomical Society (AAS) winter meeting in Seattle, Washington, stop by the NExScI booth and say hello!

December 13, 2018

Seven Transiting Planets: This week we have seven new planets, including a four-planet system discovered by the K2 mission and three WASP planets: K2-285 b, c, d, & e, and WASP-161 b, WASP-163 b, and WASP-170 b. This brings our total confirmed planet count to 3,869. View the data in the Confirmed Planets (`http://bit.ly/2MqFnub`), Composite Planet Data (), and Extended Planet Data (`http://bit.ly/2NLy1Ci`) tables.

#Exoplanets2018 Update: We are getting very close to announcing the winner of our #Exoplanets2018 contest!

December 6, 2018

New Planets: We've added 14 new planets this week from various papers: HD 4917 b, HD 180053 b, HD 94834 b, HD 72490 b, HD 18015 b, HD 14787 b, HD 13167 b, CoRoT-21 b, LHS 1140 c, GJ 1265 b, GJ 3779 b, HATS-59 b & c, and KOI-3680 b. View the data in the Confirmed Planets, Composite Planet Data, and Extended Planet Data tables.

ExoFOP TESS Public Data: With the end of the beta-test validation period, TESS planetary candidates are now available to the community through NExScI's Exoplanet Community Follow-up Program (ExoFOP) TESS site (`http://bit.ly/2E5vFMf`). There are currently 164 Tess Objects of Interest (TOIs) identified by the TESS Project. TESS Project follow-up priorities and dispositions, as well as summaries of what has been followed up from the ground, are also available to the community.

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

Contact: `mharbut@caltech.edu`

6 As seen on astro-ph

The following list contains all entries relating to (exo-)planetary science we spotted on astro-ph in December 2018.

December 2018

astro-ph/1812.00466: **A near-Sun Solar System Twilight Survey with LSST** by *Rob Seaman et al.*
astro-ph/1812.00607: **Simultaneous LSST and Euclid observations - advantages for Solar System Objects** by *C. Snodgrass et al.*
astro-ph/1812.00665: **Hot Jupiter accretion: 3D MHD simulations of star-planet wind interaction** by *Simon Daley-Yates, Ian R. Stevens*
astro-ph/1812.00908: **Propagation of Transient Perturbations into a Planet's Exosphere: Molecular Kinetic Simulations** by *Ludivine Leclercq et al.*
astro-ph/1812.00937: **The Effects of Filter Choice on Outer Solar System Science with LSST** by *Kathryn Volk et al.*
astro-ph/1812.00961: **Flybys in protoplanetary discs: I. Gas and dust dynamics** by *Nicolás Cuello et al.*
astro-ph/1812.01033: **Solar System Formation in the Context of Extra-Solar Planets** by *Sean N. Raymond, Andre Izidoro, Alessandro Morbidelli*
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