ExoPlanet News
An Electronic Newsletter

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## Contents

# 1 Editorial

Welcome to the 87th edition of Exoplanet News.

After taking a break for a month, the newsletter is back with a larger than normal selection of abstracts plus a selection of upcoming conferences and meetings.
Both the field of exoplanet research and the ways of disseminating information about it have changed so much since I started the newsletter back in 2007, so I hope it still occupies a useful niche for its subscribers. Be sure to let me know any suggestions for ways it might improve. I can't promise to implement any or all ideas, as I'm only ever compiling this in my spare time, but I'm keen to keep the newsletter relevant for the community.
Remember that past editions of this newsletter, submission templates and other information can be found at the ExoPlanet News website: http://exoplanet.open.ac.uk. Although note that my updates to the website only become live over-night. So if you want to get the newsletter as soon as it is ready, please subscribe and get it by email on the day it's released.

Best wishes
Andrew Norton
The Open University

# 2 Abstracts of refereed papers

## Resolving the Planetesimal Belt of HR 8799 with ALMA

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*Monthly Notices of the Royal Astronomical Society, in press (2016MNRAS.tmpL..24B)*

The star HR 8799 hosts one of the largest known debris discs and at least four giant planets. Previous observations have found evidence for a warm belt within the orbits of the planets, a cold planetesimal belt beyond their orbits and a halo of small grains. With the infrared data, it is hard to distinguish the planetesimal belt emission from that of the grains in the halo. With this in mind, the system has been observed with ALMA in band 6 (1.34 mm) using a compact array format. These observations allow the inner edge of the planetesimal belt to be resolved for the first time. A radial distribution of dust grains is fitted to the data using an MCMC method. The disc is best fit by a broad ring between $145^{+12}_{-12}$ AU and $429^{+37}_{-32}$ AU at an inclination of $40^{+5\circ}_{-6}$ and a position angle of $51^{+8\circ}_{-8}$. A disc edge at $\sim$145 AU is too far out to be explained simply by interactions with planet b, requiring either a more complicated dynamical history or an extra planet beyond the orbit of planet b.

*Download/Website:* http://dx.doi.org/10.1093/mnrasl/slw040

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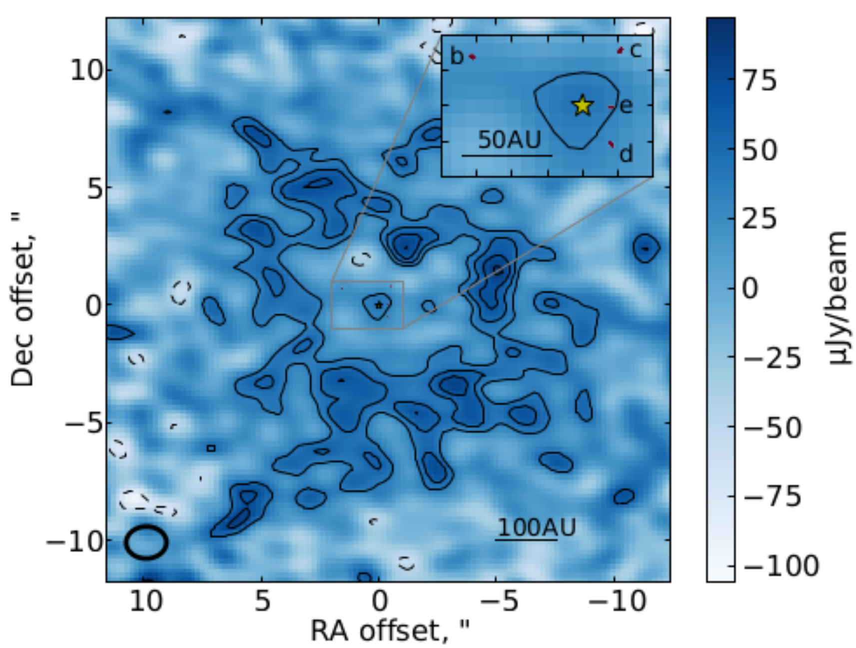


Figure 1: (Booth et al.) Restored image using the best fitting model (i.e the primary beam attenuated model convolved with a beam of size $1.7'' \times 1.3''$ – shown by the black ellipse – added to the residuals and primary beam corrected). Contours start at $2\sigma$ and increase in increments of $1\sigma$. This also shows the planets as seen in the K2 band with SPHERE-IRDIS on the VLT (Zurlo et al. 2016).

## A map of the large day-night temperature gradient of a super-Earth exoplanet

*Brice-Olivier Demory*[1], *Michael Gillon*[2], *Julien de Wit*[3], *Nikku Madhusudhan*[4], *Emeline Bolmont*[5], *Kevin Heng*[6], *Tiffany Kataria*[7], *Nikole Lewis*[8], *Renyu Hu*[9,10], *Jessica Krick*[11], *Vlada Stamenković*[9,10], *Björn Benneke*[10], *Stephen Kane*[12] *& Didier Queloz*[1]

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*Nature, 532, 207-209 (2016) (arXiv:1604.05725)*

Over the past decade, observations of giant exoplanets (Jupiter-size) have provided key insights into their atmospheres, but the properties of lower-mass exoplanets (sub-Neptune) remain largely unconstrained because of the challenges of observing small planets. Numerous efforts to observe the spectra of super-Earths–exoplanets with masses of one to ten times that of Earth–have so far revealed only featureless spectra. Here we report a longitudinal thermal brightness map of the nearby transiting super-Earth 55 Cancri e revealing highly asymmetric dayside thermal emission and a strong day-night temperature contrast. Dedicated space-based monitoring of the planet in the infrared revealed a modulation of the thermal flux as 55 Cancri e revolves around its star in a tidally locked configuration. These observations reveal a hot spot that is located $41 \pm 12$ degrees east of the substellar point (the point at which incident light from the star is perpendicular to the surface of the planet). From the orbital phase curve, we also constrain the nightside brightness temperature of the planet to $1380 \pm 400$ kelvin and the temperature of the warmest hemisphere (centred on the hot spot) to be about 1300 kelvin hotter ($2700 \pm 270$ kelvin) at a wavelength of 4.5 microns, which indicates inefficient heat redistribution from the dayside to the nightside. Our observations are consistent with either an optically thick atmosphere with heat recirculation confined to the planetary dayside, or a planet devoid of atmosphere with low-viscosity magma flows at the surface.

*Download/Website:* `http://www.nature.com/nature/journal/v532/n7598/full/nature17169.html`

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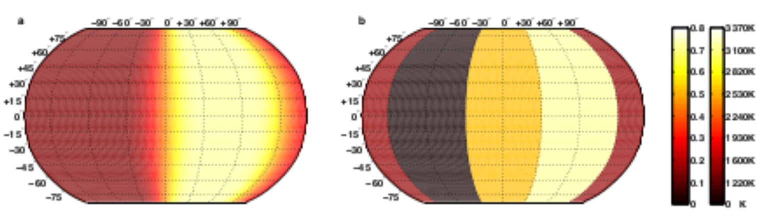

Figure 2: (Demory et al.) Longitudinal brightness maps of 55 Cancri e. Longitudinal brightness distributions as retrieved from the Spitzer/IRAC 4.5$\mu$m phase-curve. The planetary dayside is modelled using two prescriptions. Left: single-band model whose longitude, width and brightness is adjusted in the fit. Right: model including three longitudinal bands whose positions and widths are fixed, but their relative brightness being adjustable. The color-scales indicate the planetary brightness normalised to the stellar average brightness (left) and the corresponding brightness temperature (right) for each longitudinal band.

## Transit timing variations for planets near eccentricity-type mean motion resonances

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*The Astrophysical Journal, published (2016ApJ...821...96D/arXiv:1509.08460)*

We derive the transit timing variations (TTVs) of two planets near a second order mean motion resonance on nearly circular orbits. We show that the TTVs of each planet are given by sinusoids with a frequency of $jn_2 - (j-2)n_1$, where $j \geq 3$ is an integer characterizing the resonance and $n_2$ and $n_1$ are the mean motions of the outer and inner planets, respectively. The amplitude of the TTV depends on the mass of the perturbing planet, relative to the mass of the star, and on both the eccentricities and longitudes of pericenter of each planet. The TTVs of the two planets are approximated anti-correlated, with phases of $\phi$ and $\approx \phi + \pi$, where the phase $\phi$ also depends on the eccentricities and longitudes of pericenter. Therefore, the TTVs caused by proximity to a second order mean motion resonance do not in general uniquely determine both planet masses, eccentricities, and pericenters. This is completely analogous to the case of TTVs induced by two planets near a first order mean motion resonance. We explore how other TTV signals, such as the short-period synodic TTV or a first order resonant TTV, in combination with the second order resonant TTV, can break degeneracies. Lastly, we derive approximate formulae for the TTVs of planets near any order eccentricity-type mean motion resonance; this shows that the same basic sinusoidal TTV structure holds for all eccentricity-type resonances. Our general formula reduces to previously derived results near first order mean motion resonances.

*Download/Website:* `http://adsabs.harvard.edu/abs/2016ApJ...821...96D`

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## The SOPHIE search for northern extrasolar planets. XI. Three new companions and an orbit update: Giant planets in the habitable zone.

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*Astronomy & Astrophysics, in press (arXiv:1604.07610)*

We report the discovery of three new substellar companions to solar-type stars, HD191806, HD214823, and HD221585, based on radial velocity measurements obtained at the Haute-Provence Observatory. Data from the SOPHIE spectrograph are combined with observations acquired with its predecessor, ELODIE, to detect and characterise the orbital parameters of three new gaseous giant and brown dwarf candidates. Additionally, we combine SOPHIE data with velocities obtained at the Lick Observatory to improve the parameters of an already known giant planet companion, HD16175 b. Thanks to the use of different instruments, the data sets of all four targets span

more than ten years. Zero-point offsets between instruments are dealt with using Bayesian priors to incorporate the information we possess on the SOPHIE/ELODIE offset based on previous studies. The reported companions have orbital periods between three and five years and minimum masses between 1.6 Mjup and 19 Mjup. Additionally, we find that the star HD191806 is experiencing a secular acceleration of over 11 $\mathrm{ms}^{-1}$ per year, potentially due to an additional stellar or substellar companion. A search for the astrometric signature of these companions was carried out using Hipparcos data. No orbit was detected, but a significant upper limit to the companion mass can be set for HD221585, whose companion must be substellar. With the exception of HD191806 b, the companions are located within the habitable zone of their host star. Therefore, satellites orbiting these objects could be a propitious place for life to develop.

*Download/Website:* `http://arxiv.org/abs/1604.07610`

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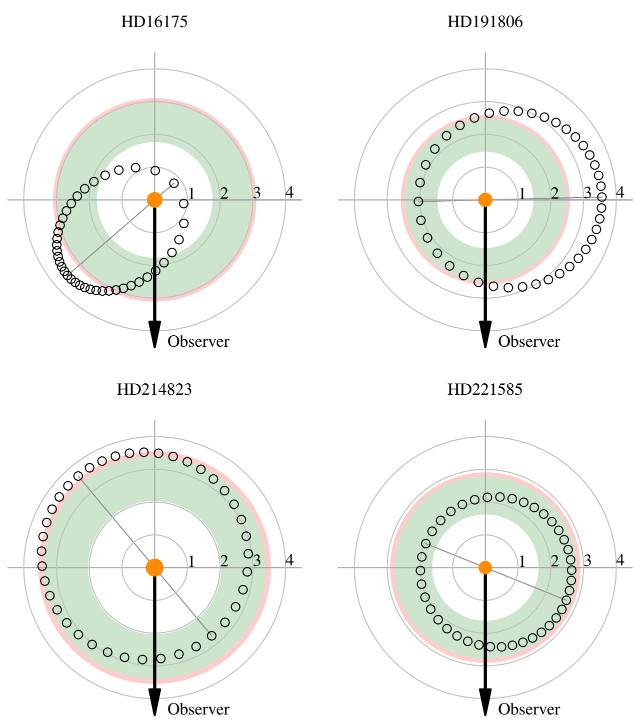


Figure 3: (Diaz et al.) Schematic view of the systems. The orbital plane is represented. The maximum a posteriori companion orbits are indicated with the empty black points that are equally spaced in time over the orbit. The orbital movement is counter-clockwise and angles are measured counter-clockwise from the negative x-axis. The semi-major axis of the orbit is shown as a thin grey line. The host star is at the centre and the area of the orange circle is proportional to its luminosity. The concentric circles are labelled in astronomical units and the black thick arrow points towards the observer. The filled green area is the habitable zone comprised between the "runaway greenhouse" limit and the "maximum greenhouse" limit, according to the model of Kopparapu et al. (2013). The red area corresponds to the increased habitable zone if the outer edge is defined by the "early Mars" limit.

## The HARPS search for southern extra-solar planets. XXXVIII. Bayesian re-analysis of three systems. New super-Earths, unconfirmed signals, and magnetic cycles.

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We present the analysis of the entire HARPS observations of three stars that host planetary systems: HD1461, HD40307, and HD204313. The data set spans eight years and contains more than 200 nightly averaged velocity measurements for each star. This means that it is sensitive to both long-period and low-mass planets and also to the effects induced by stellar activity cycles.
We modelled the data using Keplerian functions that correspond to planetary candidates and included the short- and long-term effects of magnetic activity. A Bayesian approach was taken both for the data modelling, which allowed us to include information from activity proxies such as $\log{(R'_{\rm HK})}$ in the velocity modelling, and for the model selection, which permitted determining the number of significant signals in the system. The Bayesian model comparison overcomes the limitations inherent to the traditional periodogram analysis. We report an additional super-Earth planet in the HD1461 system. Four out of the six planets previously reported for HD40307 are confirmed and characterised. We discuss the remaining two proposed signals. In particular, we show that when the systematic uncertainty associated with the techniques for estimating model probabilities are taken into account, the current data are not conclusive concerning the existence of the habitable-zone candidate HD40307 g.
We also fully characterise the Neptune-mass planet that orbits HD204313 in 34.9 days.

*Download/Website:* http://arxiv.org/abs/1510.06446

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## High Contrast Imaging with Spitzer : Constraining the Frequency of Giant Planets out to 1000 AU separations

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*The Astrophysical Journal, in press (arXiv:1604.00859)*

We report results of a re-analysis of archival Spitzer IRAC direct imaging surveys encompassing a variety of nearby stars. Our sample is generated from the combined observations of 73 young stars (median age, distance, spectral type = 85 Myr, 23.3 pc, G5) and 48 known exoplanet host stars with unconstrained ages (median distance, spectral type = 22.6 pc, G5). While the small size of Spitzer provides a lower resolution than 8m-class AO-assisted ground based telescopes, which have been used for constraining the frequency of 0.5 - 13 $M_J$ planets at separations of $10 - 10^2$ AU, its exquisite infrared sensitivity provides the ability to place unmatched constraints on the planetary populations at wider separations. Here we apply sophisticated high-contrast techniques to our sample in order to remove the stellar PSF and open up sensitivity to planetary mass companions down to 5 arcsecond separations. This enables sensitivity to 0.5 - 13 $M_J$ planets at physical separations on the order of $10^2 - 10^3$ AU , allowing us to probe a parameter space which has not previously been systematically explored to any similar degree of sensitivity. Based on a colour and proper motion analysis we do not record any planetary detections. Exploiting this enhanced survey sensitivity, employing Monte Carlo simulations with a Bayesian approach, and assuming a mass distribution of $dn/dm \propto m^{-1.31}$, we constrain (at 95% confidence) a population of 0.5 - 13 $M_J$ planets at separations of 100 - 1000 AU with an upper frequency limit of 9%.

*Download/Website:* `http://arxiv.org/abs/1604.00859`

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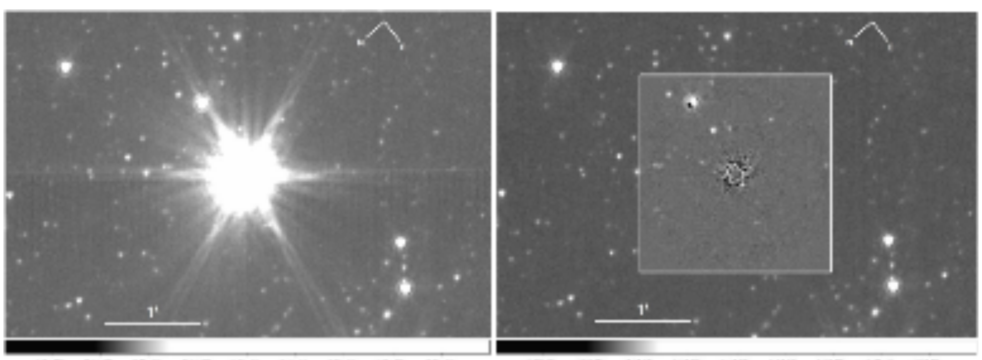


Figure 4: (Durkan et al.) LHS displays example of a composite PBCD / BCD 4.5 micron image of typical target HD 217813. RHS displays final reduced image of HD 217813 depicting the same FOV. The white box highlights the 2.01 x 2.01 arcsecond PCA optimization region. Regular PSF subtraction of a mean stack image has been performed outside the optimisation region.

## High-resolution Imaging of Transiting Extrasolar Planetary systems (HITEP). I. Lucky imaging observations of 101 systems in the southern hemisphere

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*Astronomy & Astrophysics, published (2016A&A...589A..58E)*

*Context*. Wide binaries are a potential pathway for the formation of hot Jupiters. The binary fraction among host stars is an important discriminator between competing formation theories, but has not been well characterised. Additionally, contaminating light from unresolved stars can significantly affect the accuracy of photometric and spectroscopic measurements in studies of transiting exoplanets.
*Aims*. We observed 101 transiting exoplanet host systems in the Southern hemisphere in order to create a homogeneous catalogue of both bound companion stars and contaminating background stars, in an area of the sky where transiting exoplanetary systems have not been systematically searched for stellar companions. We investigate the binary fraction among the host stars in order to test theories for the formation of hot Jupiters.
*Methods*. Lucky imaging observations from the Two Colour Instrument on the Danish 1.54m telescope at La Silla were used to search for previously unresolved stars at small angular separations. The separations and relative magnitudes of all detected stars were measured. For 12 candidate companions to 10 host stars, previous astrometric measurements were used to evaluate how likely the companions are to be physically associated.
*Results*. We provide measurementsof 499 candidate companions within 20 arcseconds of our sample of 101 planet host stars. 51 candidates are located within 5 arcseconds of a host star, and we provide the first published measurements for 27 of these. Calibrations for the plate scale and colour performance of the Two Colour Instrument are presented.
*Conclusions*. We find that the overall multiplicity rate of the host stars is $38^{+17}_{-13}\%$, consistent with the rate among solar-type stars in our sensitivity range, suggesting that planet formation does not preferentially occur in long period binaries compared to a random sample of field stars. Long period stellar companions ($P > 10$ yr) appear to occur

independently of short period companions, and so the population of close-in stellar companions is unconstrained by our study.

*Download/Website:* http://arxiv.org/abs/1603.03274

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## Galactic cosmic rays on extrasolar Earth-like planets: II. Atmospheric implications

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*Astronomy & Astrophysics, published (ADS: 2016A&A...587A.159G, arXiv:1603.06500)*

Context: Theoretical arguments indicate that close-in terrestial exoplanets may have weak magnetic fields. As described in the companion article (Paper I), a weak magnetic field results in a high flux of galactic cosmic rays to the top of the planetary atmosphere. Aims. We investigate effects that may result from a high flux of galactic cosmic rays both throughout the atmosphere and at the planetary surface.
Aims: We wish to quantify the flux of Galactic cosmic rays to an exoplanetary atmosphere as a function of the particle energy and of the planetary magnetic moment.
Methods: Using an air shower approach, we calculate how the atmospheric chemistry and temperature change under the influence of galactic cosmic rays for Earth-like (N2-O2 dominated) atmospheres. We evaluate the production and destruction rate of atmospheric biosignature molecules. We derive planetary emission and transmission spectra to study the influence of galactic cosmic rays on biosignature detectability. We then calculate the resulting surface UV flux, the surface particle flux, and the associated equivalent biological dose rates.
Results: We find that up to 20% of stratospheric ozone is destroyed by cosmic-ray protons. The effect on the planetary spectra, however, is negligible. The reduction of the planetary ozone layer leads to an increase in the weighted surface UV flux by two orders of magnitude under stellar UV flare conditions. The resulting biological effective dose rate is, however, too low to strongly affect surface life. We also examine the surface particle flux: For a planet with a terrestrial atmosphere (with a surface pressure of 1033 hPa), a reduction of the magnetic shielding effciency can increase the biological radiation dose rate by a factor of two, which is non-critical for biological systems. For a planet with a weaker atmosphere (with a surface pressure of 97.8 hPa), the planetary magnetic field has a much stronger influence on the biological radiation dose, changing it by up to two orders of magnitude.
Conclusions: For a planet with an Earth-like atmospheric pressure, weak or absent magnetospheric shielding against galactic cosmic rays has little effect on the planet. It has a modest effect on atmospheric ozone, a weak effect on the atmospheric spectra, and a noncritical effect on biological dose rates. For planets with a thin atmosphere, however, magnetospheric shielding controls the surface radiation dose and can prevent it from increasing to several hundred times the background level.

*Download/Website:* http://www.aanda.org/articles/aa/abs/2016/01/aa25602-14/aa25602-14.html

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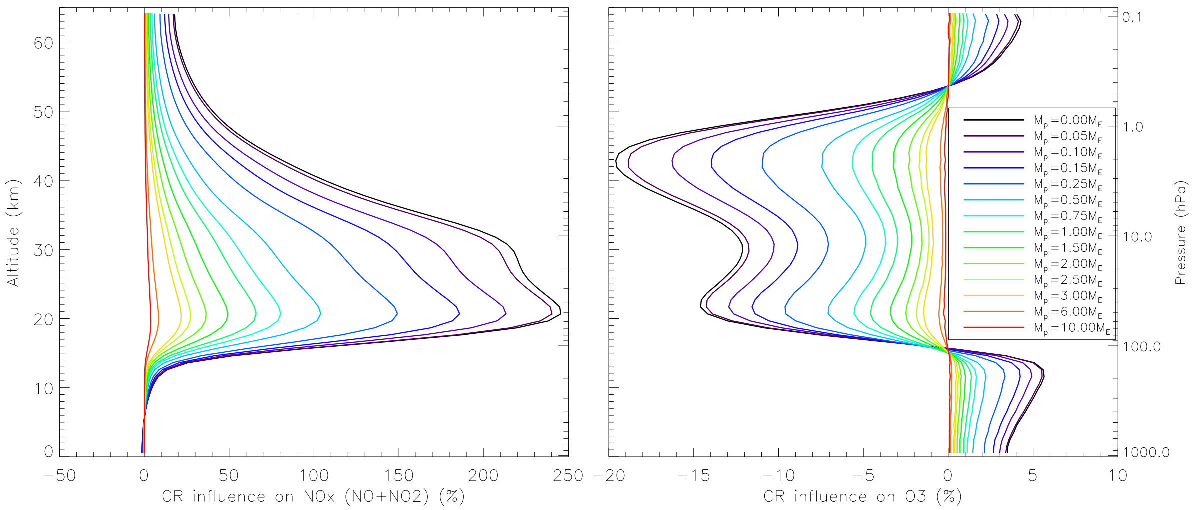


Figure 5: (Griessmeier et al.) Altitude-dependent change of the volume mixing ratio of $NO_x$ (i.e. NO + $NO_2$) (left) and $O_3$ (right) for exoplanets with a magnetic moment of $\mathcal{M}$ = 0.0, 0.05, 0.1, 0.15, 0.25, 0.5, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0, 6.0 and 10.0 $\mathcal{M}_{oplus}$, relative to a case without cosmic rays.

## Lightning as a possible source of the radio emission on HAT-P-11b

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*Monthly Notices of the Royal Astronomical Society, accepted (ADS-Bibcode: 2016arXiv160407406H)*

Lightning induced radio emission has been observed on Solar System planets. There have been many attempts to observe exoplanets in the radio wavelength, however, no unequivocal detection has been reported. Lecavelier des Etangs et al. (2013, A&A, 552, A65) carried out radio transit observations of the exoplanet HAT-P-11b, and suggested that a small part of the radio flux can be attributed to the planet. In the current letter, we assume that this signal is real, and study if this radio emission could be caused by lightning in the atmosphere of the planet. We find that a lightning storm with 530 times larger flash densities than the Earth-storms with the largest lightning activity is needed to produce the observed signal from HAT-P-11b. The optical counterpart would nevertheless be undetectable with current technology. We show that HCN produced by lightning chemistry of such thunderstorms is observable 2-3 years after the storm, which produces signatures in the L ($3.0\mu\mathrm{m} - 4.0\mu\mathrm{m}$) and N ($7.5\mu\mathrm{m} - 14.5\mu\mathrm{m}$) infrared bands. We conclude that future, combined radio and infrared observations may lead to lightning detection on planets outside the Solar System.

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## Transits of extrasolar moons around luminous giant planets

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*Astronomy & Astrophysics, published (2016A&A...588A..34H)*

Beyond Earth-like planets, moons can be habitable, too. No exomoons have been securely detected, but they could be extremely abundant. Young Jovian planets can be as hot as late M stars, with effective temperatures of up to 2000 K. Transits of their moons might be detectable in their infrared photometric light curves if the planets are sufficiently separated ($\gtrsim$ 10 AU) from the stars to be directly imaged. The moons will be heated by radiation from their young planets and potentially by tidal friction. Although stellar illumination will be weak beyond 5 AU, these alternative energy sources could liquify surface water on exomoons for hundreds of Myr. A Mars-mass $H_2O$-rich moon around $\beta$ Pic b would have a transit depth of $1.5 \times 10^{-3}$, in reach of near-future technology.

*Download/Website:* `http://arxiv.org/abs/1603.00174`

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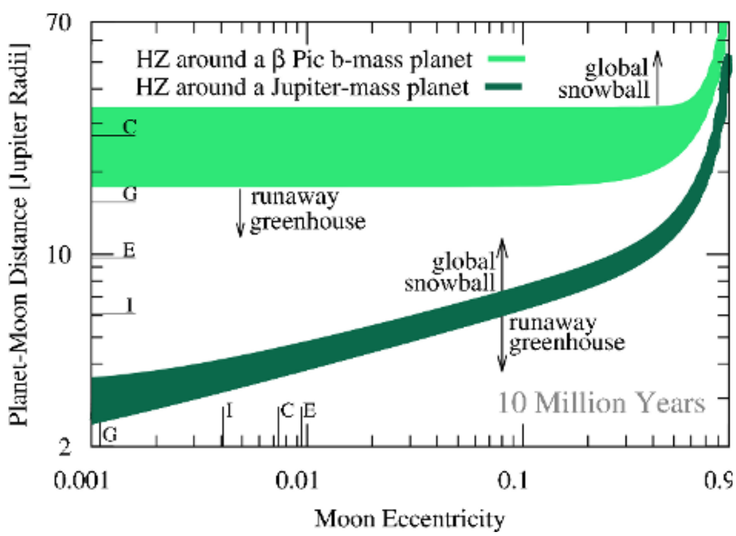


Figure 6: (Heller) Habitable zone (HZ) of a Mars-sized moon around a Jupiter-mass (light green) and a $\beta$ Pic b-like 11 $M_J$-mass (dark green) planet > 5 AU from a Sun-like star. Inside the green areas, tidal heating plus planetary illumination can liquify water on the moon surface. Values of the Galilean moons are denoted by their initials. Both HZs refer to a planet at an age of 10 Myr, where planetary illumination is significant.

## Modeling the Orbital Sampling Effect of Extrasolar Moons

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*The Astrophysical Journal, published (2016ApJ...820...88H)*

The orbital sampling effect (OSE) appears in phase-folded transit light curves of extrasolar planets with moons. Analytical OSE models have hitherto neglected stellar limb darkening and non-zero transit impact parameters and assumed that the moon is on a circular, co-planar orbit around the planet. Here, we present an analytical OSE model for eccentric moon orbits, which we implement in a numerical simulator with stellar limb darkening that allows for arbitrary transit impact parameters. We also describe and publicly release a fully numerical OSE simulator (`PyOSE`) that can model arbitrary inclinations of the transiting moon orbit. Both our analytical solution for the OSE and `PyOSE` can be used to search for exomoons in long-term stellar light curves such as those by *Kepler* and the upcoming *PLATO* mission. Our updated OSE model offers an independent method for the verification of possible future exomoon claims via transit timing variations and transit duration variations. Photometrically quiet K and M dwarf stars are particularly promising targets for an exomoon discovery using the OSE.

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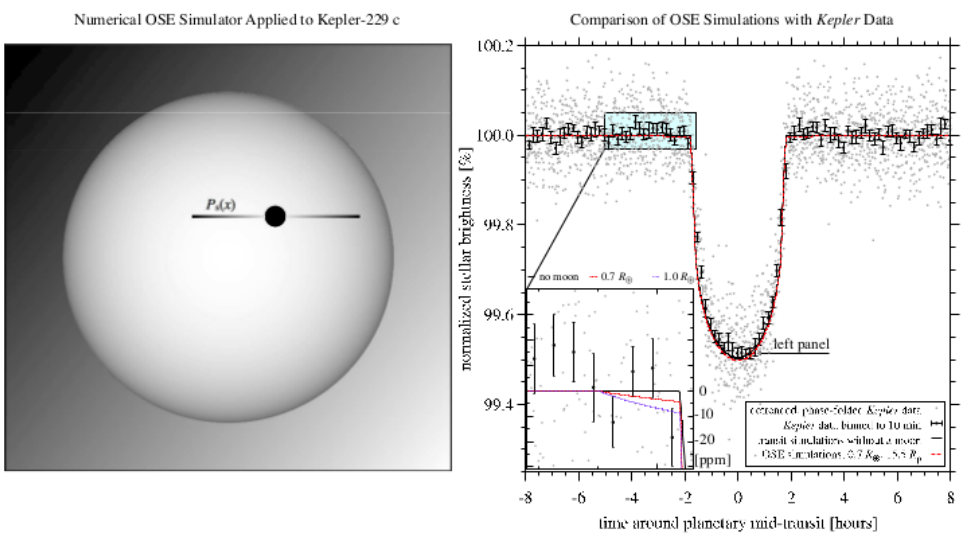


Figure 7: (Heller, Hippke & Jackson) Visualization of our dynamical photometric OSE transit model. This example shows the transit of Kepler-229 c, a $4.8\,R_\oplus$ planet orbiting a $0.7\,R_\odot$ star every $\approx 17$ d with a transit impact parameter $b = 0.25$. *Left:* The planet (black circle) and the probability function (shaded horizontal strip) of a hypothetical $0.7\,R_\oplus$ moon with an orbital semimajor axis of $8\,R_\mathrm{p}$ transit the limb-darkened star (large bright circle). *Right:* The red cross on the OSE curve at 0.5 hr refers to the moment shown in the left panel. The inset zooms into the wings of the transit ingress. Three models are shown: no moon (black solid), a $0.7\,R_\oplus$ moon (red dashed), and a $1\,R_\oplus$ moon (blue dotted), all moons with a semimajor axis of $8\,R_\mathrm{p}$ around the planet.

## Predictable patterns in planetary transit timing variations and transit duration variations due to exomoons

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*Astronomy & Astrophysics, accepted (arXiv:1604.05094)*

We present new ways to identify single and multiple moons around extrasolar planets using planetary transit timing variations (TTVs) and transit duration variations (TDVs). For planets with one moon, measurements from successive transits exhibit a hitherto undescribed pattern in the TTV-TDV diagram, originating from the stroboscopic sampling of the planet's orbit around the planet–moon barycenter. This pattern is fully determined and analytically predictable after three consecutive transits. The more measurements become available, the more the TTV-TDV diagram approaches an ellipse. For planets with multiple moons in orbital mean motion resonance (MMR), like the Galilean moon system, the pattern is much more complex and addressed numerically in this report. Exomoons in MMR can also form closed, predictable TTV-TDV figures, as long as the drift of the moons' pericenters is sufficiently slow. We find that MMR exomoons produce loops in the TTV-TDV diagram and that the number of these loops is equal to the order of the MMR, or the largest integer in the MMR ratio. We use a Bayesian model and Monte Carlo simulations to test the discoverability of exomoons using TTV-TDV diagrams with current and near-future technology. In a blind test, two of us (BP, DA) successfully retrieved a large moon from simulated TTV-TDV by co-authors MH and RH, which resembled data from a known *Kepler* planet candidate. Single exomoons with a 10 % moon-to-planet mass ratio, like to Pluto-Charon binary, can be detectable in the archival data of the *Kepler* primary mission. Multi-exomoon systems, however, require either larger telescopes or brighter target stars. Complementary detection methods invoking a moon's own photometric transit or its orbital sampling effect can be used for validation or falsification. A combination of *TESS*, *CHEOPS*, and *PLATO* data would offer a compelling opportunity for an exomoon discovery around a bright star.

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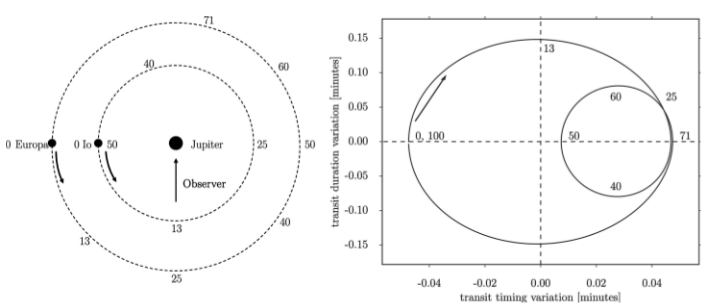


Figure 8: (Heller et al.) Construction of the planetary TTV-TDV diagram for a Jupiter-Io-Europa system in a 2:1 MMR. Numbers denote the percental orbital phase of the outer moon, Europa. *Left*: Top-down perspective on our two-dimensional $N$-body simulation. The senses of orbital motion of the moons are indicated with curved arrows along their orbits. *Right*: TDV-TTV diagram for the same system after an arbitrarily large number of transits. The progression of the numerical TTV-TDV measurements is clockwise.

## Close-in planets around giant stars. Lack of hot-Jupiters and prevalence of multi-planetary systems

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*Astronomy & Astrophysics, published (2016, A&A, 589, A124; arXiv ID: 1603.09719)*

Extrasolar planets abound in almost any possible configuration. However, until five years ago, there was a lack of planets orbiting closer than 0.5 au to giant or subgiant stars. Since then, recent detections have started to populated this regime by confirming 13 planetary systems. We discuss the properties of these systems in terms of their formation and evolution off the main sequence. Interestingly, we find that $70.0 \pm 6.6\%$ of the planets in this regime are inner components of multiplanetary systems. This value is $4.2\sigma$ higher than for main-sequence hosts, which we find to be $42.4 \pm 0.1\%$. The properties of the known planets seem to indicate that the closest-in planets ($a < 0.06$ au) to main-sequence stars are massive (i.e., hot Jupiters) and isolated and that they are subsequently engulfed by their host as it evolves to the red giant branch, leaving only the predominant population of multiplanetary systems in orbits $0.06 < a < 0.5$ au. We discuss the implications of this emerging observational trend in the context of formation and evolution of hot Jupiters.

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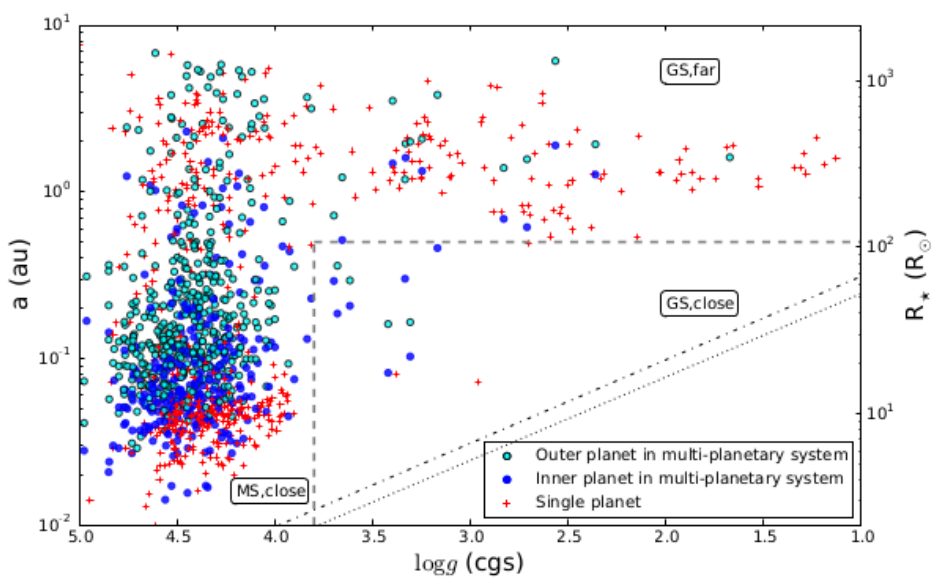


Figure 9: (Lillo-Box et al.) Semi-major axis of known planets against their host surface gravity. We include single planets (red plus symbols) and multiplanetary systems (circles) with the inner component being the dark blue and the outer planet(s) in light blue. For reference, we also plot the stellar radius of the host star at every evolutionary stage (i.e., for the different surface gravities) for two masses that comprise the range of masses of the hosts analyzed in this paper, $1\ M_\odot$(dotted) and $1.6\ M_\odot$(dash-dotted).

## EPIC210957318 b and EPIC212110888 b: two inflated hot-Jupiters around Solar-type stars

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*Astronomy & Astrophysics, submitted*

We report the discovery of the two hot-Jupiters EPIC210957318 b and EPIC212110888 b (hereafter EPIC-318 b and EPIC-888 b, respectively). The two planets were detected transiting their main-sequence stars with periods $\sim 4.099$ and $\sim 2.996$ days, in campaigns 4 and 5 of the extension of the *Kepler* mission, K2. Subsequent ground-based radial velocity follow-up with SOPHIE, HARPS-N and CAFE established the planetary nature of the transiting objects. We analysed the transit signal, radial velocity and spectral energy distributions of the two systems to characterize their properties. Both planets (EPIC-318 b and EPIC-888 b) are bloated hot-Jupiters (1.20 $R_{\rm Jup}$ and 1.22 $R_{\rm Jup}$) around relatively bright ($V = 13.5$ and $V = 11.5$), slow rotating main-sequence (G8 and F9) stars. Thus, these systems are good candidates for detecting the Rossiter-MacLaughlin effect to measure their obliquity and for atmospheric studies.

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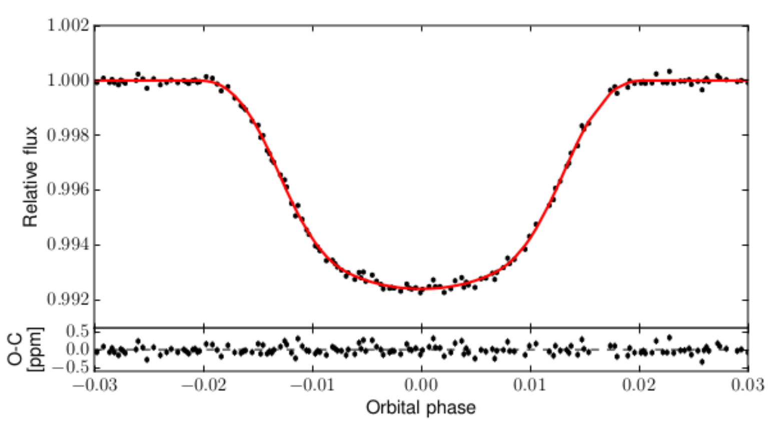


Figure 10: (Lillo-Box et al.) K2 phase-folded light curve of EPIC-888 around the primary transit signal.

## Transmission spectroscopy of HAT-P-32b with the LBT: confirmation of clouds/hazes in the planetary atmosphere

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*Astronomy & Astrophysics, in press (arXiv:1603.09136)*

Spectroscopic observations of a transit event of an extrasolar planet offer the opportunity to study the composition of the planetary atmosphere. This can be done with comparably little telescope time using a low-resolution multi-object spectrograph at a large aperture telescope. We observed a transit of the inflated hot Jupiter HAT-P-32b with the Multi-Object Double Spectrograph at the Large Binocular Telescope to characterize its atmosphere from 3300 to 10000 Å. A time series of target and reference star spectra was binned in two broad-band wavelength channels, from which differential transit light curves were constructed. These broad-band light curves were used to confirm previous transit parameter determinations. To derive the planetary transmission spectrum with a resolution of $\mathrm{R} \sim 60$, we created a chromatic set of 62 narrow-band light curves. The spectrum was corrected for the third light of a nearby M star. Additionally, we undertook a photometric monitoring campaign of the host star to correct for the influence of starspots. The transmission spectrum of HAT-P-32b shows no pressure-broadened absorption features from Na and K, which is interpreted by the presence of clouds or hazes in the planetary atmosphere. This result is in agreement with previous studies on the same planet. The presence of TiO in gas phase could be ruled out. We find a $2.8\,\sigma$ indication of increased absorption in the line core of potassium (K I 7699 Å). No narrow absorption features of Na and H$\alpha$ were detected. Furthermore, tentative indications were found for a slope of increasing opacity toward blue wavelengths from the near-IR to the near-UV with an amplitude of two scale heights. If confirmed by follow-up observations, it can be explained by aerosols either causing Mie scattering or causing Rayleigh scattering with an aerosol - gas scale height ratio below unity. The host star was found to be photometrically stable within the measurement precision.

*Download/Website:* `http://arxiv.org/abs/1603.09136`

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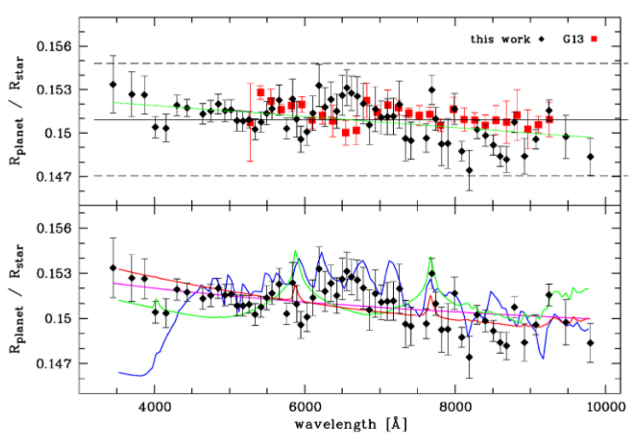


Figure 11: (Mallonn & Strassmeier) Transmission spectrum of HAT-P-32b derived from the MODS transit measurement. Upper panel: This work (black) in comparison to the derived spectrum of Gibson et al. 2013. The horizontal dashed lines indicate three pressure scale heights of the planetary atmosphere. Lower panel: Our spectrum (black) overplotted by several theroretical atmosphere models.

## An optical transmission spectrum of the giant planet WASP-36b

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*Monthly Notices of the Royal Astronomical Society, published (2016MNRAS.459.1393M)*

We present broad-band photometry of five transits in the planetary system WASP-36, totaling 17 high-precision light curves. Four of the transits were simultaneously observed in four passbands ($g'$, $r'$, $i'$, $z'$), using the telescope-defocussing technique, and achieving scatters of less than 1 mmag per observation. We used these data to improve the measured orbital and physical properties of the system, and obtain an optical transmission spectrum of the planet. We measured a decreasing radius from bluer to redder passbands with a confidence level of more than $5\sigma$. The radius variation is roughly 11 pressure scale heights between the $g'$ and the $z'$ bands. This is too strong to be Rayleigh scattering in the planetary atmosphere, and implies the presence of a species which absorbs strongly at bluer wavelengths.

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## Kepler-539: a young extrasolar system with two giant planets on wide orbits and in gravitational interaction

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*Astronomy & Astrophysics, in press (arXiv:1504.04625)*

We confirm the planetary nature of Kepler-539 b (aka Kepler object of interest K00372.01), a giant transiting exoplanet orbiting a solar-analogue G2 V star. The mass of Kepler-539 b was accurately derived thanks to a series of precise radial velocity measurements obtained with the CAFE spectrograph mounted on the CAHA 2.2-m telescope. A simultaneous fit of the radial-velocity data and *Kepler* photometry revealed that Kepler-539 b is a dense Jupiter-like planet with a mass of $M_{\rm p} = 0.97 \pm 0.29\,M_{\rm Jup}$ and a radius of $R_{\rm p} = 0.747 \pm 0.018\,R_{\rm Jup}$, making a complete circular revolution around its parent star in 125.6 days. The semi-major axis of the orbit is roughly $0.5$ au, implying that the planet is at $\approx 0.45$ au from the habitable zone. By analysing the mid-transit times of the 12 transit events of Kepler-539 b recorded by the *Kepler* spacecraft, we found a clear modulated transit time variation (TTV), which is attributable to the presence of a planet c in a wider orbit. The few timings available do not allow us to precisely estimate the properties of Kepler-539 c and our analysis suggests that it has a mass between 1.2 and 3.6 $M_{\rm Jup}$, revolving on a very eccentric orbit ($0.4 < e \leq 0.6$) with a period larger than 1000 days. The high eccentricity of planet c is the probable cause of the TTV modulation of planet b. The analysis of the CAFE spectra revealed a relatively high photospheric lithium content, $A({\rm Li}) = 2.48 \pm 0.12$ dex, which, together with both a gyrochronological and isochronal analysis, suggests that the parent star is relatively young.

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## Atmospheric effects of stellar cosmic rays on Earth-like exoplanets orbiting M-dwarfs

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*Astronomy & Astrophysics, published (arXiv:1511.04920)*

M-dwarf stars are generally considered favourable for rocky planet detection. However, such planets may be subject to extreme conditions due to possible high stellar activity. The goal of this work is to determine the potential effect of stellar cosmic rays on key atmospheric species of Earth-like planets orbiting in the habitable zone of M-dwarf stars and show corresponding changes in the planetary spectra. We build upon the cosmic rays model scheme of Grenfell et al. (2012), who considered cosmic ray induced NOx production, by adding further cosmic ray induced production mechanisms (e.g. for HOx) and introducing primary protons of a wider energy range (16 MeV - 0.5 TeV). Previous studies suggested that planets in the habitable zone that are subject to strong flaring conditions have high atmospheric methane concentrations, while their ozone biosignature is completely destroyed. Our current study shows, however, that adding cosmic ray induced HOx production can cause a decrease in atmospheric methane abundance of up to 80%. Furthermore, the cosmic ray induced HOx molecules react with NOx to produce $HNO_3$, which produces strong $HNO_3$ signals in the theoretical spectra and reduces NOx-induced catalytic destruction of ozone so that more than 25% of the ozone column remains. Hence, an ozone signal remains visible in the theoretical spectrum (albeit with a weaker intensity) when incorporating the new cosmic ray induced NOx and HOx schemes, even for a constantly flaring M-star case. We also find that $HNO_3$ levels may be high enough to be potentially detectable. Since ozone concentrations, which act as the key shield against harmful UV radiation, are affected by cosmic rays via NOx-induced catalytic destruction of ozone, the impact of stellar cosmic rays on surface UV fluxes is also studied.

*Download/Website:* `http://arxiv.org/abs/1511.04920`

*Contact:* `Fachreddin.Tabataba-Vakili@physics.ox.ac.uk`

## The Water Abundance of the Directly Imaged Substellar Companion $\kappa$ And b Retrieved from a Near Infrared Spectrum

*K. O. Todorov*[1], *M. R. Line*[2], *J. E. Pineda*[1,3], *M. R. Meyer*[1], *S. P. Quanz*[1], *S. Hinkley*[4], *J. J. Fortney*[2]

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[2] Department of Astronomy & Astrophysics, University of California, Santa Cruz, Santa Cruz, CA 95064, USA
[3] Current address: Max Planck Institute for Extraterrestrial Physics, 85748 Garching, Germany
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*The Astrophysical Journal, accepted (arXiv:1504.00217)*

Spectral retrieval has proven to be a powerful tool for constraining the physical properties and atmospheric compositions of extrasolar planet atmospheres from observed spectra, primarily for transiting objects but also for directly imaged planets and brown dwarfs. Despite its strengths, this approach has been applied to only about a dozen targets. Determining the abundances of the main carbon and oxygen-bearing compounds in a planetary atmosphere can lead to the C/O ratio of the object, which is crucial in understanding its formation and migration history. We present a retrieval analysis on the published near-infrared spectrum of $\kappa$ And b, a directly imaged substellar companion to a young B9 star. We fit the emission spectrum model utilizing a Markov Chain Monte Carlo algorithm. We estimate the abundance of water vapor, and its uncertainty, in the atmosphere of the object. In addition, we place an upper limit on the abundance of $CH_4$. We compare qualitatively our results to studies that have applied model retrieval

on multiband photometry and emission spectroscopy of hot Jupiters (extrasolar giant planets with orbital periods of several days) and the directly imaged giant planet HR 8799b.

*Download/Website:* http://arxiv.org/abs/1504.00217

*Contact:* todorovk@phys.ethz.ch

## Ground-based near-UV observations of 15 transiting exoplanets: Constraints on their atmospheres and no evidence for asymmetrical transits

*Jake D. Turner[1,2], Kyle A. Pearson[3], Lauren I. Biddle[3], Brianna M. Smart[3,4], Robert T. Zellem[1], Johanna K. Teske[3,5], Kevin K. Hardegree-Ullman[3,6], Caitlin C. Griffith[1], Robin M. Leiter[2], Ian T. Cates[3], Megan N. Nieberding[3], Carter-Thaxton W. Smith[3], Robert M. Thompson[3], Ryan Hofmann[3], Michael P. Berube[3], Chi H. Nguyen[3], Lindsay C. Small[3], Blythe C. Guvenen[7], Logan Richardson[8], Allison McGraw[3], Brandon Raphael[3], Benjamin E. Crawford[3], Amy N. Robertson[3], Ryan Tombleson[3], Timothy M. Carleton[9], Allison P.M. Towner[3], Amanda M. Walker-LaFollette[3], Jeffrey R. Hume[3], Zachary T. Watson[3], Christen K. Jones[3], Matthew J. Lichtenberger[3], Shelby R. Hoglund[3], Kendall L. Cook[3], Cory A. Crossen[3], Curtis R. Jorgensen[3], James M. Romine[3] Alejandro R. Thompson[3], Christian F. Villegas[3], Ashley A. Wilson[3], Brent Sanford[3], Joanna M. Taylor[10],*

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[6] Department of Physics and Astronomy, University of Toledo, Toledo, OH, 43606, USA
[7] Kitt Peak National Observatory, National Optical Astronomy Observatory, Tucson, AZ 85719, USA
[8] Institut für Quantenoptik, Leibniz Universität Hannover, D-30167 Hannover, Germany
[9] Department of Physics and Astronomy, University of California, Irvine, Irvine, CA, 92687, USA
[10] Space Telescope Science Institute, Baltimore, MD 21218, USA

*Monthly Notices of the Royal Astronomical Society, published (2016, MNRAS, 459, 789)*

Transits of exoplanets observed in the near-UV have been used to study the scattering properties of their atmospheres and possible star-planet interactions. We observed the primary transits of 15 exoplanets (CoRoT-1b, GJ436b, HAT-P-1b, HAT-P-13b, HAT-P-16b, HAT-P-22b, TrES-2b, TrES-4b, WASP-1b, WASP-12b, WASP-33b, WASP-36b, WASP-44b, WASP-48b, and WASP-77Ab) in the near-UV and several optical photometric bands to update their planetary parameters, ephemerides, search for a wavelength dependence in their transit depths to constrain their atmospheres, and determine if asymmetries are visible in their light curves. Here, we present the first ground-based near-UV light curves for 12 of the targets (CoRoT-1b, GJ436b, HAT-P-1b, HAT-P-13b, HAT-P-22b, TrES-2b, TrES-4b, WASP-1b, WASP-33b, WASP-36b, WASP-48b, and WASP-77Ab). We find that none of the near-UV transits exhibit any non-spherical asymmetries, this result is consistent with recent theoretical predictions by Ben-Jaffel et al. and Turner et al. The multiwavelength photometry indicates a constant transit depth from near-UV to optical wavelengths in 10 targets (suggestive of clouds), and a varying transit depth with wavelength in 5 targets (hinting at Rayleigh or aerosol scattering in their atmospheres). We also present the first detection of a smaller near-UV transit depth than that measured in the optical in WASP-1b and a possible opacity source that can cause such radius variations is currently unknown. WASP-36b also exhibits a smaller near-UV transit depth at 2.6$\sigma$. Further observations are encouraged to confirm the transit depth variations seen in this study.

*Download/Website:* http://adsabs.harvard.edu/abs/2016MNRAS.459..789T

*Contact:* jt6an@virginia.edu

## Investigation of the environment around close-in transiting exoplanets using CLOUDY

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*Monthly Notices of the Royal Astronomical Society, published (2016, MNRAS, 458, 3880)*

It has been suggested that hot stellar wind gas in a bow shock around an exoplanet is sufficiently opaque to absorb stellar photons and give rise to an observable transit depth at optical and UV wavelengths. In the first part of this paper, we use the CLOUDY plasma simulation code to model the absorption from X-ray to radio wavelengths by 1D slabs of gas in coronal equilibrium with varying densities ($10^4 - 10^8 \mathrm{cm}^{-3}$) and temperatures ($2000 - 10^6$ K) illuminated by a solar spectrum. For slabs at coronal temperatures ($10^6$ K) and densities even orders of magnitude larger than expected for the compressed stellar wind ($10^4 - 10^5$ cm$^{-3}$), we find optical depths orders of magnitude too small ($> 3 \times 10^{-7}$) to explain the $\sim$3 per cent UV transit depths seen with Hubble. Using this result and our modelling of slabs with lower temperatures ($2000 - 10^4$ K), the conclusion is that the UV transits of WASP-12b and HD 189733b are likely due to atoms originating in the planet, as the stellar wind is too highly ionized. A corollary of this result is that transport of neutral atoms from the denser planetary atmosphere outward must be a primary consideration when constructing physical models. In the second part of this paper, additional calculations using CLOUDY are carried out to model a slab of planetary gas in radiative and thermal equilibrium with the stellar radiation field. Promising sources of opacity from the X-ray to radio wavelengths are discussed, some of which are not yet observed.

*Download/Website:* http://adsabs.harvard.edu/abs/2016MNRAS.458.3880T

*Contact:* jt6an@virginia.edu

## Radial Velocity Planet Detection Biases at the Stellar Rotational Period

*Andrew Vanderburg*[1,2], *Peter Plavchan*[3], *John Asher Johnson*[1], *David R. Ciardi*[4], *Jonathan Swift*[5], *Stephen R. Kane*[6]

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*Monthly Notices of the Royal Astronomical Society, in press(2016MNRAS.tmp..650V/1604.03143)*

Future generations of precise radial velocity (RV) surveys aim to achieve sensitivity sufficient to detect Earth mass planets orbiting in their stars' habitable zones. A major obstacle to this goal is astrophysical radial velocity noise caused by active areas moving across the stellar limb as a star rotates. In this paper, we quantify how stellar activity impacts exoplanet detection with radial velocities as a function of orbital and stellar rotational periods. We perform data-driven simulations of how stellar rotation affects planet detectability and compile and present relations for the typical timescale and amplitude of stellar radial velocity noise as a function of stellar mass. We show that the characteristic timescales of quasi-periodic radial velocity jitter from stellar rotational modulations coincides with the orbital period of habitable zone exoplanets around early M-dwarfs. These coincident periods underscore the importance of monitoring the targets of RV habitable zone planet surveys through simultaneous photometric measurements for determining rotation periods and activity signals, and mitigating activity signals using spectroscopic indicators and/or RV measurements at different wavelengths.

*Download/Website:* http://mnras.oxfordjournals.org/content/early/2016/04/14/mnras.stw863.abstra

*Contact:* avanderburg@cfa.harvard.edu

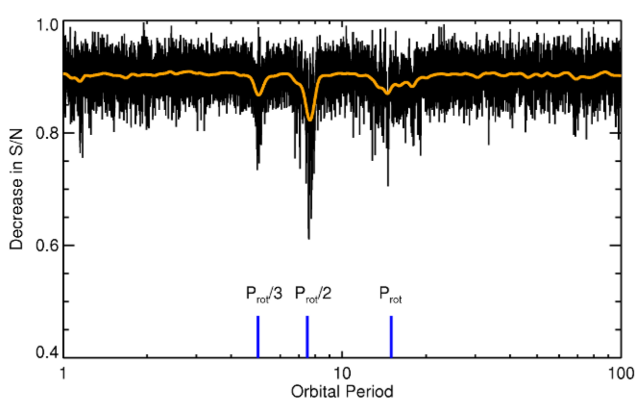


Figure 12: (Vanderburg et al.) Relative detection efficiency of planets around an active star as a function of orbital period. The black lines are the ratio in detection efficiency for planets around this star with and without stellar RV jitter, and the thick orange line is a Gaussian smoothed version of the individual detection efficiencies. We include blue hash marks at the stellar rotation period and its first two harmonics. The baseline level of detection efficiency is about 0.9, implying that adding stellar activity generally decreases the efficiency of planet detections by about 10% around this star, under our assumptions. There are three troughs at orbital periods corresponding to the rotation period of star and its first two harmonics. Even under idealized circumstances, it is more difficult to find planets with orbital periods close to the stellar rotation period and its harmonics.

## Full-lifetime simulations of multiple unequal-mass planets across all phases of stellar evolution

*Dimitri Veras*[1], *Alexander J. Mustill*[2], *Boris T. Gänsicke*[1], *Seth Redfield*[3], *Nikolaos Georgakarakos*[4], *Alex B. Bowler*[1], *Maximillian J.S. Lloyd*[1]

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[4] New York University Abu Dhabi, Saadiyat Island, P.O. Box 129188, Abu Dhabi, UAE

*Monthly Notices of the Royal Astronomical Society, in press (arXiv:1603.00025)*

We know that planetary systems are just as common around white dwarfs as around main sequence stars. However, self-consistently linking a planetary system across these two phases of stellar evolution through the violent giant branch poses computational challenges, and previous studies restricted architectures to equal-mass planets. Here, we remove this constraint and perform over 450 numerical integrations over a Hubble time (14 Gyr) of packed planetary systems with unequal-mass planets. We characterize the resulting trends as a function of planet order and mass. We find that intrusive radial incursions in the vicinity of the white dwarf become less likely as the dispersion amongst planet masses increases. The orbital meandering which may sustain a sufficiently dynamic environment around a white dwarf to explain observations is more dependent on the presence of terrestrial-mass planets than any variation in planetary mass. Triggering unpacking or instability during the white dwarf phase is comparably easy for systems of unequal-mass planets and systems of equal-mass planets; instabilities during the giant branch phase remain rare and require fine-tuning of initial conditions. We list the key dynamical features of each simulation individually as a potential guide for upcoming discoveries.

*Download/Website:* `http://arxiv.org/abs/1603.00025`

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

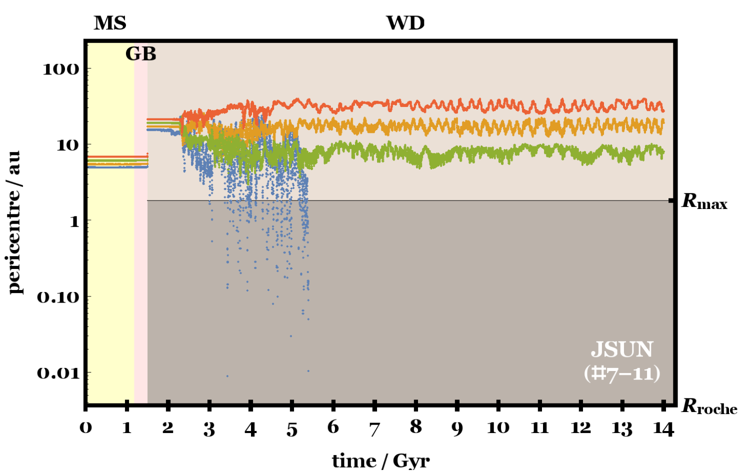


Figure 13: (Veras et al.) Example of unpacking then repacking of four planets (an inner Uranus-mass planet, and three outer Jupiter-mass planets) during the white dwarf phase, where the least massive innermost, planet becomes engulfed into the star and two of the other planets (orange and green) switch order.

## Carbon to oxygen ratios in extrasolar planetesimals

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*Monthly Notices of the Royal Astronomical Society, published (2016MNRAS.tmp..627W)*

Observations of small extrasolar planets with a wide range of densities imply a variety of planetary compositions and structures. Currently, the only technique to measure the bulk composition of extrasolar planetary systems is the analysis of planetary debris accreting onto white dwarfs, analogous to abundance studies of meteorites. We present measurements of the carbon and oxygen abundances in the debris of planetesimals at ten white dwarfs observed with the *Hubble Space Telescope*, along with C/O ratios of debris in six systems with previously reported abundances. We find no evidence for carbon-rich planetesimals, with C/O $< 0.8$ by number in all 16 systems. Our results place an upper limit on the occurrence of carbon-rich systems at $< 17$ percent with a $2\,\sigma$ confidence level. The range of C/O of the planetesimals is consistent with that found in the Solar System, and appears to follow a bimodal distribution: a group similar to the CI chondrites, with $\log(<\mathrm{C/O}>) = -0.92$, and oxygen-rich objects with C/O less than or equal to that of the bulk Earth. The latter group may have a higher mass fraction of water than the Earth, increasing their relative oxygen abundance.

*Download/Website:* http://arxiv.org/abs/1604.03104

*Contact:* d.j.wilson.1@warwick.ac.uk

# 3 Conference announcements

## Exoplanet Biosignatures Workshop Without Walls and ExoPAG SAG 16 Activity

*Nancy Kiang, on behalf of the SOC*
NASA GISS, USA

*Seattle, WA, USA, July 27 – 29, 2016*

We would like to invite you to participate in online science discussions, and an Exoplanet Biosignatures Workshop Without Walls sponsored jointly by the Nexus for Exoplanet System Science (NExSS) and the NASA Astrobiology Program. The outputs from these coordinated eff orts will include a report for the 16th Study Analysis Group (SAG 16) of the Exoplanet Exploration Program Analysis Group (ExoPAG). These activities will bring together scientists from diverse disciplines to review and advance the science and technology of remotely detectable signs of life on exoplanets.

There is a need for an updated review of exoplanet biosignatures. Over 10 years have passed since the last major community review on the topic (Des Marais et al., 2002). Since then, novel biosignatures have been proposed. Additionally, concepts have been developed that can help provide context for existing biosignatures, or help identify new ones. Recently, NASA formed Science and Technology Definition Teams (STDTs) for two strategic missions (LUVOIR and HabEx) that will explore how to search for signs of habitability and life on exoplanets.

The goals for the workshop and online meetings are to: 1) review prior work identifying biosignatures for life on exoplanets; 2) formulate conceptual frameworks that could be used to advance the science and to identify new biosignatures; and 3) develop a paradigm informed by both scientists and technologists to establish confidence standards for biosignature detection.

This effort will begin with a review of the 'state of the science' of exoplanet biosignatures via bi-weekly videoconferences that will begin in mid-April. This review will provide time-critical inputs to the ongoing ST DTs, and the background needed to facilitate discussions at a workshop that will be held from July 27-29 in Seattle, WA. The workshop will focus on advancing the science of exoplanet biosignatures, and will include both in-person and remote participation. After the workshop, online meetings will continue to draft the SAG 16 report.

Because biosignature characterization is such an interdisciplinary endeavor, this workshop will be a community activity that will involve astronomers, planetary scientists, atmospheric scientists, Earth system scientists, biogeochemists, biologists, mission designers, and more. If you are interested in participating in this endeavor, we ask that you fill out the survey on our websit.

*Download/Website:* `http://nai.nasa.gov/calendar/workshop-without-walls-exoplanet-biosignatures/`

## Linking Exoplanet and Disk Compositions

*Andrea Banzatti (chair), Nikole Lewis (co-chair)*
Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD, USA

*Baltimore MD, USA, September 12-14, 2016*

This workshop will gather scientists working on the compositional characterization of planets and planet-forming regions in protoplanetary disks. Recent and upcoming advancements make it timely to have a round-table conversation among the several communities involved, to join forces in tackling our most compelling questions on the origins of exoplanet diversity. Do exoplanet compositions retain the imprint of large-scale disk processes? Do disks include compositional trends that imprint on planets? What do we learn in this context from observations of Solar System bodies? And what can we test with observations of disks and exoplanets in the near future? We intend to identify long-lasting and observable links between exoplanet and disk compositions, to help the community in shaping ongoing modeling efforts as well as the essential parameter space to cover with existing and upcoming observatories for exoplanet and disk characterization.

**Pre-registration and abstract submission are now open through the link provided below.**
Please check the preliminary schedule available on the website for details on invited talks and workshop sessions.

**Invited Speakers:**
Conel Alexander (Carnegie DTM), Uma Gorti (SETI, NASA Ames), Mike Line (Arizona State), Jonathan Lunine (Cornell Univ.), Christoph Mordasini (Univ. of Bern), Ilaria Pascucci (Univ. of Arizona), Sean Raymond (Univ. of Bordeaux), Leslie Rogers (Univ. of Chicago).

**SOC:**
Daniel Apai (Univ. of Arizona), Andrea Banzatti (STScI, chair) , Fred Ciesla (Univ. of Chicago), Jonathan Fortney (UCSC), Sarah Horst (JHU), Inga Kamp (Kapteyn Inst. Groningen), Nikole Lewis (STScI, co-chair), Amaya Moro-Martin (STScI), Karin Oberg (Harvard CfA), Klaus Pontoppidan (STScI), Olivia Venot (Katholieke Univ. Leuven), Marie Ygouf (STScI).

*Download/Website:* `http://www.cvent.com/d/ffqwn1`

*Contact:* `exodisks@stsci.edu`

## International Astronomical Union Symposium 328: Living around Active Stars

*D. Nandi*[1], *S. Gibson*[2], *P. Petit*[3]

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[2] High Altitude Observatory/National Center for Atmospheric Research, 3080 Center Green Dr. Boulder, CO, 80027, USA
[3] Université de Toulouse, UPS-OMP, Institut de Recherche en Astrophysique et Planétologie, 31000, Toulouse, France

*Maresias, SP, Brazil, 17-21 October, 2016*

First Announcement

**Rationale:** The variable activity of stars such as the Sun is mediated via stellar magnetic fields, radiative and energetic particle fluxes, stellar winds and magnetic storms. This activity influences planetary atmospheres, climate and habitability. Studies of this intimate relationship between the parent star, its astrosphere (i.e., the equivalent of the heliosphere) and the planets that it hosts have reached a certain level of maturity within our own Solar System – fuelled both by advances in theoretical modelling and a host of satellites that observe the Sun-Earth system. In conjunction, the first attempts are being made to characterize the interactions between stars and planets and their coupled evolution, which have relevance for habitability and the search for habitable planets. This Symposium will bring together scientists from diverse, interdisciplinary scientific areas such as solar, stellar and planetary physics, atmospheric and climate physics and astrobiology to review the current state of our understanding of solar and stellar environments. The Symposium is expected to fertilize exchange of ideas and identify outstanding issues – tackling which necessitates coordinated scientific efforts across disciplines.

**Invited Speakers:** Anil Bhardwaj (India), Cesar Bertucci (Argentina), Paul Charbonneau (Canada), Manuel Guedel (Austria), Gaitee Hussain (Germany), Moira Jardine (UK), Colin Johnstone (Austria), Laurne Jouve (France), Eiichiro Kokubo (Japan), Hiroyuki Maehara (Japan), Jose Dias do Nascimento Jr. (Brazil), Rachel Olsten (USA), Katja Poppenhaeger (UK), Steve Saar (USA), Alexander Shapiro (Germany)

**Important dates** The symposium will be held in the sea side town of Maresias, Brazil from 17-21 October, 2016. Further details, including registration, abstract submission, financial support and accommodation information are available at the conference website.

Financial support application deadline: 30 April 2016
Abstract submission deadline: 16 June 2016
Early Registration deadline: 16 July 2016

**SOC**: Dibyendu Nandi (Chair), Sarah Gibson (Co-Chair), Pascal Petit (Co-Chair), Margit Haberreiter, Emre Isik, Heidi Korhonen, Kanya Kusano, Duncan Mackay, Cristina Mandrini, Allan Sacha-Brun, Adriana Valio, Aline Vidotto, David Webb

*Download/Website:* `http://www.sab-astro.org.br/IAUS328`

*Contact:* `iaustars328@gmail.com`

## 2016 Sagan Summer Workshop: Is There a Planet in My Data? Statistical Approaches to Finding and Characterizing Planets in Astronomical Data

*D. Gelino, R. Paladini*
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

*Pasadena, CA, July 18-22, 2016*

There are still spaces available for the 2016 Sagan Summer Workshop! There is no registration fee for this workshop, however attendance is limited.

The 2016 Sagan Summer Workshop will focus on data analysis techniques used to find planets in various types of data. In particular, leaders in the field will discuss Monte Carlo Markov Chain (MCMC) and Bayesian inference relevant to transit analysis and spectral retrieval as well as RV analysis. Image processing techniques such as Principal Component Analysis (PCA), LOCI, and KLIP methods will also be discussed. In addition, for each of these areas, noise sources and mitigation strategies will be highlighted. Attendees will participate in hands-on group projects and will have the opportunity to present their own work through short presentations (research POPs) and posters.

**Important Dates**

- April 15, 2016: POP/Poster/Talk submission period open
- July 8, 2016: On-line Registration closed; final agenda posted
- July 18-22, 2016: Sagan Exoplanet Summer Workshop

*Download/Website:* `http://nexsci.caltech.edu/workshop/2016`
*Contact:* `sagan_workshop@ipac.caltech.edu`

## Exoplanets: Bridging the Gap between Theory and Observations

*A. Reiners*[1], *J. Cabrera*[2]
[1] Universität Göttingen, Institut für Astrophysik, Friedrich-Hund-Platz 1, D-37077 Göttingen
[2] Institut für Planetenforschung, Deutsches Zentrum für Luft- und Raumfahrt e.V., Rutherfordstr. 2, D-12489 Berlin

*Physikzentrum Bad Honnef, south of Bonn, Germany, November 28 to December 1, 2016*

The WE-Heraeus-Seminar 629 *Exoplanets: Bridging the Gap between Theory and Observations* will bring together experts on exoplanet research to present a comprehensive overview about exoplanet research and to discuss future developments.
The Seminar will be held from November 28 to December 1, 2016, in the Physikzentrum Bad Honnef, in the city of Bad Honnef, south of Bonn, Germany.
Scientific organization: Ansgar Reiners and Juan Cabrera.
Link: `www.astro.physik.uni-goettingen.de/~areiners/WEH`
The target audience are young researchers working in the field of extrasolar planets at an early career stage, i.e., PhD students or postdoctoral researchers doing their first or second postdoc.
Deadline for application: September 25, 2016.
Interested participants, please, send an email with your full name, affiliation, career stage and a short abstract (max. half a page) of your poster to the organizers before the deadline:

– ansgar.reiners@phys.uni-goettingen.de

– juan.cabrera@dlr.de

The WE-Heraeus Foundation will inform applicants about their acceptance shortly after the deadline.

*Download/Website:* `http://www.astro.physik.uni-goettingen.de/ areiners/WEH`

*Contact:* `ansgar.reiners@phys.uni-goettingen.de, juan.cabrera@dlr.de`

# 4 Jobs and Positions

## Postdoctoral Research Scientist

*Prof. Dr. Inga Kamp*
Kapteyn Astronomical Institute, PO Box 800, 9700 AV Groningen, The Netherlands

*Groningen, The Netherlands, send applications before June 20, 2016*

The Kapteyn Astronomical Institute in Groningen, The Netherlands, invites applications for a postdoctoral research scientist. The successful candidate is expected to carry out research on protoplanetary disks. He or she will be required to do code development, but also participate in the analysis and interpretation of observational data (VLT, ALMA) in close collaboration with the groups of Prof. Dr. Carsten Dominik (University of Amsterdam) and Prof. Dr. Rens Waters (University of Amsterdam, SRON). We plan to work on establishing the connection between protoplanetary disks and the resulting planetary system architecture through a combination of observations and models.

The group of Dr. Kamp is strongly involved in research on the structure and evolution of protoplanetary disks linking sophisticated two-dimensional thermo-chemical disk models with new multi-wavelength observational data. The postdoctoral research scientist will encounter a stimulating scientific environment ranging from cosmology, galaxy evolution, star and planet formation and interstellar matter to instrumentation. The institute is co-located with the low-energy division of the Netherlands Institute for Space Research (SRON), the PI institute for the SPICA/SAFARI instrument. The Kapteyn Institute is part of the Netherlands Research School for Astronomy and belongs to the top research institutions in Astronomy worldwide. Thus, there is an exciting range of opportunities to establish new collaborations.

Interested applicants should have a PhD in astrophysics or physics and proven experience in programming. The ability to work in an international team and a good command of the English language are essential. Experience with IR, far-IR and/or submm observations is an asset.

The University of Groningen offers an appointment for two years with the option of extension conditional on satisfactory performance to a third year. The job is fulltime (38h/week) with a maximum salary of 3,400 (salary scale 10.7 Dutch Universities) gross per month, depending on qualifications and work experience. University of Groningen is an equal-opportunity employer.

Interested candidates should send application material, including a curriculum vitae, a brief statement of past research and future plans (max. 3 pages), and arrange for three letters of reference to be sent to Prof. Dr. Inga Kamp, Kapteyn Astronomical Institute, P.O. Box 800, 9700 AV Groningen, The Netherlands (E-mail address: kamp@astro.rug.nl). Selection of candidates will start **June 20, 2016**, and will continue until the position is filled.

*Download/Website:* `http://www.astro.rug.nl`

*Contact:* `kamp@astro.rug.nl`

## Birmingham Fellowships: permanent positions, Exoplanets and Stellar Astrophysics

*Bill Chaplin*
School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham B15 2TT, England UK

*Birmingham, UK, Closing date for applications: 13 May 2016*

The University of Birmingham is inviting applications to its Professorial Fellows and Birmingham Fellows schemes. Fellows will be recruited in targeted research areas across the University and are as such competitive across all disciplines. Exoplanets and stellar astrophysics are amongst the targeted areas.

**Birmingham Fellows: Stellar & Exoplanets**
The aim of the Fellows scheme is to give the most promising early career academics a permanent academic post, the first 5 years of which will be to develop their research and teaching. We seek a future international research leader from the stellar and exoplanet fields, to contribute to and expand on the internationally leading work of our Solar & Stellar Physics Group. Successful applicants will be appointed at the outset to a permanent academic post.

**Professorial Fellows: Exoplanets**
This scheme is targeting established mid-career academics on a clear rising trajectory towards a Professorial position. We seek to expand significantly on our internationally leading work in stellar astrophysics by appointing a Professorial Fellow in the exoplanets area. A successful applicant will establish and develop a new programme of exoplanets research in the Solar & Stellar Physics Group, with a start-up fund and protected research time for a period of 3 years, after which they will be promoted to a full Professorial position.

For informal inquiries, please contact Professor Bill Chaplin.

*Download/Website:* `http://www.birmingham.ac.uk/staff/excellence/fellows/birmingham-fellows.asp`
`http://www.birmingham.ac.uk/staff/excellence/fellows/professorial-research-fellow.aspx`

*Contact:* `w.j.chaplin@bham.ac.uk`

# 5 Announcements

## Astronomical Review

*Andrew Norton*
The Open University

*Taylor & Francis, Journal re-launched in 2016*

The journal *Astronomical Review* is now re-launched, following its takeover by the publishers Taylor & Francis, with me (Andrew Norton) as Editor-in-Chief.
The focus is to be on authoritative and topical review articles, across the entire field of astronomy (Solar physics, Solar system, exoplanets, stars, high energy phenomena, galaxies & local Universe, cosmology & distant Universe, instrumentation, computational modelling and astronomical software). The journal will be entirely online and is open access.
I know that many of us are (rightly) sceptical whenever a new journal is launched. However, I believe that there is a real need for a journal publishing high quality reviews in astronomy, which none of the current major journals do on a regular basis. With the backing of an international publisher like Taylor & Francis, I am confident this journal will therefore be of great use to the professional astronomical community.

If anyone would like to write and submit a review article for the journal, on any aspect of exoplanet science, please contact me. This is a good opportunity especially for career-young researchers who have an idea for a particular review they'd like to see in print to produce such an article and get it in circulation.

*Download/Website:* `http://www.tandfonline.com/loi/tare20`

*Contact:* `andrew.norton@open.ac.uk`

# 6 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during March and April 2016. If you see any that we missed, please let us know and we'll include them in the next issue.

**March**

astro-ph/1603.00020 : **A Super-Jupiter Microlens Planet Characterized by High-Cadence KMTNet Microlensing Survey Observations** by *I.-G. Shin, et al.*

astro-ph/1603.00025 : **Full-lifetime simulations of multiple unequal-mass planets across all phases of stellar evolution** by *Dimitri Veras, et al.*

astro-ph/1603.00029 : **Collision velocity of dust grains in self-gravitating protoplanetary discs** by *Richard A. Booth, Cathie J. Clarke*

astro-ph/1603.00042 : **A Transiting Jupiter Analog** by *David M. Kipping, et al.*

astro-ph/1603.00174 : **Transits of extrasolar moons around luminous giant planets** by *René Heller*

astro-ph/1603.00392 : **Tidal Decay and Disruption of Short-Period Gaseous Exoplanets** by *Brian Jackson, et al.*

astro-ph/1603.00414 : **On the origin of the sub-Jovian desert in the orbital-period–planetary-mass plane** by *Titos Matsakos, Arieh Königl*

astro-ph/1603.00481 : **Shadows cast on the transition disk of HD 135344B** by *T. Stolker, et al.*

astro-ph/1603.00484 : **Towards a Global Evolutionary Model of Protoplanetary Disks** by *Xue-Ning Bai*

astro-ph/1603.00487 : **Stellar Activity and Exclusion of the Outer Planet in the HD 99492 System** by *Stephen R. Kane, et al.*

astro-ph/1603.00653 : **Growth of eccentric modes in disc-planet interactions** by *Jean Teyssandier, Gordon I. Ogilvie*

astro-ph/1603.00776 : **The Search for Extraterrestrial Intelligence in Earth's Solar Transit Zone** by *René Heller et al.*

astro-ph/1603.00950 : **The inhabitance paradox: how habitability and inhabitancy are inseparable** by *Colin Goldblatt*

astro-ph/1603.01125 : **Influence of the water content in protoplanetary discs on planet migration and formation** by *Bertram Bitsch, Anders Johansen*

astro-ph/1603.01144 : **Ruling out the orbital decay of the WASP-43b** by *Sergio Hoyer, et al.*

astro-ph/1603.01229 : **Investigation of the environment around close-in transiting exoplanets using CLOUDY** by *Jake D. Turner, et al.*

astro-ph/1603.01272 : **The Effect of Orbital Configuration on the Possible Climates and Habitability of Kepler-62f** by *Aomawa L. Shields, et al.*

astro-ph/1603.01280 : **Gravitational Instabilities in Circumstellar Disks** by *Kaitlin M. Kratter, Giuseppe Lodato*

astro-ph/1603.01378 : **Gas Gaps in the Protoplanetary Disk around the Young Protostar HL Tau** by *Hsi-Wei Yen, et al.*

astro-ph/1603.01402 : **A revised condition for self-gravitational fragmentation of protoplanetary disks** by *Sanemichi Z. Takahashi, et al.*

astro-ph/1603.01618 : **Signatures of Gravitational Instability in Resolved Images of Protostellar Disks** by *Ruobing Dong, et al.*

astro-ph/1603.01721 : **An independent discovery of two hot Jupiters from the K2 mission** by *Rafael Brahm, et al.*

astro-ph/1603.01862 : **On the radio detection of multiple-exomoon systems due to plasma torus sharing** by *J. P. Noyola, et al.*

astro-ph/1603.01934 : **Spitzer Observations of Exoplanets Discovered with The Kepler K2 Mission** by *Charles Beichman, et al.*

astro-ph/1603.02017 : **High-Contrast Imaging of Intermediate-Mass Giants with Long-Term Radial Velocity Trends** by *Tsuguru Ryu, et al.*

astro-ph/1603.02141 : **The minimum mass of detectable planets in protoplanetary discs and the derivation of planetary masses from high resolution observations** by *Giovanni P. Rosotti, et al.*

astro-ph/1603.02475 : **Self-organisation in protoplanetary disks: global, non-stratified Hall-MHD simulations** by *William Béthune, et al.*

astro-ph/1603.02544 : **Nonlinear hydrodynamical evolution of eccentric Keplerian discs in two dimensions: validation of secular theory** by *Adrian J. Barker, Gordon I. Ogilvie*

astro-ph/1603.02587 : **Ground-based near-UV observations of 15 transiting exoplanets: Constraints on their atmospheres and no evidence for asymmetrical transits** by *Jake D. Turner, et al.*

astro-ph/1603.02630 : **Dust diffusion and settling in the presence of collisions: Trapping (sub)micron grains in the midplane** by *Sebastiaan Krijt, Fred J. Ciesla*

astro-ph/1603.02794 : **Shear-driven instabilities and shocks in the atmospheres of hot Jupiters** by *Sébastien Fromang, Jérémy Leconte, Kevin Heng*

astro-ph/1603.02876 : **Blackbody Radiation from Isolated Neptunes** by *Sivan Ginzburg, Re'em Sari, Abraham Loeb*

astro-ph/1603.02894 : **HATS-11b and HATS-12b: Two transiting Hot Jupiters orbiting sub-solar metallicity stars selected for the K2 Campaign 7** by *M. Rabus, et al.*

astro-ph/1603.02898 : **Frequency Modulation of Directly Imaged Exoplanets: Geometric Effect as a Probe of Planetary Obliquity** by *Hajime Kawahara*

astro-ph/1603.03090 : **Large size and slow rotation of the trans-Neptunian object (225088) 2007 OR10 discovered from Herschel and K2 observations** by *András Pál et al.*

astro-ph/1603.03123 : **Light Scattering and Thermal Emission by Primitive Dust Particles in Planetary Systems** by *Hiroshi Kimura, et al.*

astro-ph/1603.03135 : **Planet-disc evolution and the formation of Kozai-Lidov planets** by *Rebecca G. Martin, et al.*

astro-ph/1603.03168 : **Cohesion of Amorphous Silica Spheres: Toward a Better Understanding of the Coagulation Growth of Silicate Dust Aggregates** by *Hiroshi Kimura, et al.*

astro-ph/1603.03268 : **New transit observations for HAT-P-30 b, HAT-P-37 b, TrES-5 b, WASP-28 b, WASP-36 b, and WASP-39 b** by *G. Maciejewski, et al.*

astro-ph/1603.03274 : **High-resolution Imaging of Transiting Extrasolar Planetary systems (HITEP). I. Lucky imaging observations of 101 systems in the southern hemisphere** by *D. F. Evans, et al.*

astro-ph/1603.03383 : **Spitzer IRAC Sparsely Sampled Phase Curve of the Exoplanet WASP-14b** by *J.E. Krick, et al.*

astro-ph/1603.03731 : **The VLA view of the HL Tau Disk - Disk Mass, Grain Evolution, and Early Planet Formation** by *Carlos Carrasco-Gonzalez, et al.*

astro-ph/1603.03738 : **Four new planets around giant stars and the mass-metallicity correlation of planet-hosting stars** by *M. I. Jones, et al.*

astro-ph/1603.03853 : **Mass constraint for a planet in a protoplanetary disk from the gap width** by *Kazuhiro D. Kanagawa, et al.*

astro-ph/1603.03937 : **Magnetic field and wind of Kappa Ceti: towards the planetary habitability of the young**

**Sun when life arose on Earth** by *J.-D. do Nascimento Jr., et al.*
astro-ph/1603.04022 : **The mineral clouds on HD 209458b and HD189733b** by *Ch. Helling et al.*
astro-ph/1603.04065 : **ExoMol molecular line lists - XIV: The rotation-vibration spectrum of hot $SO_2$** by *Daniel S. Underwood, et al.*
astro-ph/1603.04853 : **Resolving the Planetesimal Belt of HR 8799 with ALMA** by *Mark Booth, et al.*
astro-ph/1603.04857 : **Insights into planet formation from debris disks: II. Giant impacts in extrasolar planetary systems** by *Mark C. Wyatt, Alan P. Jackson*
astro-ph/1603.05179 : **Gaps, rings, and non-axisymmetric structures in protoplanetary disks - Emission from large grains** by *J.P. Ruge, et al.*
astro-ph/1603.05249 : **On the Feasibility of Characterizing Free-floating Planets with Current and Future Space-based Microlensing Surveys** by *Calen B. Henderson, Yossi Shvartzvald*
astro-ph/1603.05418 : **Analytical Models of Exoplanetary Atmospheres. III. Gaseous C-H-O-N Chemistry with 9 Molecules** by *Kevin Heng, Shang-Min Tsai*
astro-ph/1603.05638 : **WASP-157b, a Transiting Hot Jupiter Observed with K2** by *T. Mocnik, et al.*
astro-ph/1603.05662 : **Bayesian priors for transiting planets** by *David M. Kipping, Emily Sandford*
astro-ph/1603.05677 : **Discovery of a Gas giant Planet in Microlensing Event OGLE-2014-BLG-1760** by *A. Bhattacharya, et al.*
astro-ph/1603.05745 : **The polarisation of HD 189733** by *Kimberly Bott, et al.*
astro-ph/1603.05754 : **Spin-orbit alignments for Three Transiting Hot Jupiters: WASP-103b, WASP-87b, & WASP-66b** by *B. C. Addison, et al.*
astro-ph/1603.06000 : **Photo-reverberation Mapping of a Protoplanetary Accretion Disk around a T Tauri Star** by *Huan Y. A. Meng, et al.*
astro-ph/1603.06268 : **Effect of the rotation and tidal dissipation history of stars on the evolution of close-in planets** by *Emeline Bolmont, Stéphane Mathis*
astro-ph/1603.06488 : **Ultra Short Period Planets in K2: SuPerPiG Results for Campaigns 0-5** by *Elisabeth R. Adams, et al.*
astro-ph/1603.06500 : **Galactic cosmic rays on extrasolar Earth-like planets: II. Atmospheric implications** by *J.–M. Grießmeier, et al.*
astro-ph/1603.06575 : **Dust dynamics in 2D gravito-turbulent disks** by *Ji-Ming Shi, et al.*
astro-ph/1603.06596 : **Evolutionary Analysis of Gaseous Sub-Neptune-Mass Planets with MESA** by *Howard Chen, Leslie A. Rogers*
astro-ph/1603.06645 : **Insights into planet formation from debris disks: I. The solar system as an archetype for planetesimal evolution** by *Brenda C. Matthews, JJ Kavelaars*
astro-ph/1603.06839 : **Nonlinear tides in a homogeneous rotating planet or star: global modes and elliptical instability** by *Adrian J. Barker, et al.*
astro-ph/1603.06840 : **Nonlinear tides in a homogeneous rotating planet or star: global simulations of the elliptical instability** by *Adrian J. Barker*
astro-ph/1603.06911 : **Planetary and satellite three body mean motion resonances** by *Tabaré Gallardo, et al.*
astro-ph/1603.06945 : **Planet Hunters X: Searching for Nearby Neighbors of 75 Planet and Eclipsing Binary Candidates from the K2 Kepler extended mission** by *Joseph R. Schmitt, et al.*
astro-ph/1603.07112 : **Modeling the Orbital Sampling Effect of Extrasolar Moons** by *René Heller, et al.*
astro-ph/1603.07247 : **Is there an exoplanet in the Solar System?** by *Alexander J. Mustill, et al.*
astro-ph/1603.07255 : **The (w)hole survey: an unbiased sample study of transition disk candidates based on Spitzer catalogs** by *Nienke van der Marel et al.*
astro-ph/1603.07306 : **Dynamics and Transit Variations of Resonant Exoplanets** by *D. Nesvorny, D. Vokrouhlicky*
astro-ph/1603.07581 : **TAPAS IV. TYC 3667-1280-1 b - the most massive red giant star hosting a warm Jupiter** by *A. Niedzielski, et al.*
astro-ph/1603.07597 : **Exploration of the brown dwarf regime around solar-like stars by CoRoT** by *Szilárd*

*Csizmadia*
astro-ph/1603.07674 : **Trapping planets in an evolving protoplanetary disk: preferred time, locations and planet mass** by *Kévin Baillié, et al.*
astro-ph/1603.07761 : **Ejection of gaseous clumps from gravitationally unstable protostellar disks** by *Eduard I. Vorobyov*
astro-ph/1603.07985 : **WISEA J114724.10-204021.3: A Free-Floating Planetary Mass Member of the TW Hya Association** by *Adam C. Schneider, et al.*
astro-ph/1603.08005 : **Circumstellar Debris Disks: Diagnosing the Unseen Perturber** by *Erika R. Nesvold, et al.*
astro-ph/1603.08031 : **An optical transmission spectrum of the giant planet WASP-36 b** by *L. Mancini, et al.*
astro-ph/1603.08145 : **On the Formation of Super-Earths with Implications for the Solar System** by *Rebecca G. Martin, Mario Livio*
astro-ph/1603.08238 : **The way forward** by *Malcolm Fridlund, et al.*
astro-ph/1603.08484 : **ELLC - a fast, flexible light curve model for detached eclipsing binary stars and transiting exoplanets** by *P. F. L. Maxted*
astro-ph/1603.08614 : **Probabilistic Forecasting of the Masses and Radii of Other Worlds** by *Jingjing Chen, David M. Kipping*
astro-ph/1603.08928 : **A Cloaking Device for Transiting Planets** by *David M. Kipping, Alex Teachey*
astro-ph/1603.08930 : **Probing Planet Forming Zones with Rare CO Isotopologues** by *Mo Yu, et al.*
astro-ph/1603.08942 : **Chromatic line-profile tomography to reveal exoplanetary atmospheres: application to HD 189733b** by *Francesco Borsa, et al.*
astro-ph/1603.09096 : **The (impossible?) formation of acetaldehyde on the grain surfaces: insights from quantum chemical calculations** by *Joan Enrique-Romero, et al.*
astro-ph/1603.09098 : **Dynamic mineral clouds on HD 189733b I. 3D RHD with kinetic, non-equilibrium cloud formation** by *G. Lee, et al.*
astro-ph/1603.09136 : **Transmission spectroscopy of HAT-P-32b with the LBT: confirmation of clouds/hazes in the planetary atmosphere** by *Matthias Mallonn, Klaus G. Strassmeier*
astro-ph/1603.09344 : **Liberating exomoons in white dwarf planetary systems** by *Matthew J. Payne, et al.*
astro-ph/1603.09352 : **Ringed Substructure and a Gap at 1 AU in the Nearest Protoplanetary Disk** by *Sean M. Andrews, et al.*
astro-ph/1603.09357 : **Constraining turbulence mixing strength in transitional discs with planets using SPHERE and ALMA** by *M. de Juan Ovelar, et al.*
astro-ph/1603.09391 : **New Planetary Systems from the Calan-Hertfordshire Extrasolar Planet Search and the Core Accretion Mass Limit** by *J.S. Jenkins, et al.*
astro-ph/1603.09428 : **SET-E: The Search for Extraterrestrial Environmentalism** by *Benjamin Montet, Ryan Loomis*
astro-ph/1603.09496 : **Astrology in the Era of Exoplanets** by *Michael B. Lund*
astro-ph/1603.09506 : **Hot Jupiters and Super-Earths** by *Alexander James Mustill, Melvyn B Davies, Anders Johansen*
astro-ph/1603.09512 : **Water ice at the surface of HD 100546 disk** by *M. Honda, et al.*
astro-ph/1603.09719 : **Close-in planets around giant stars. Lack of hot-Jupiters and prevalence of multiplanetary systems** by *J. Lillo-Box, et al.*

**April**

astro-ph/1604.00010 : **Warm Jupiters from secular planet-planet interactions** by *Cristobal Petrovich, Scott Tremaine*
astro-ph/1604.00323 : **First detection of gas-phase ammonia in a planet-forming disk** by *Vachail N. Salinas, et al.*

astro-ph/1604.00792 : **A CRIRES-search for H3+ emission from the hot Jupiter atmosphere of HD 209458 b** by *Lea Lenz, et al.*
astro-ph/1604.00859 : **High Contrast Imaging with Spitzer : Constraining the Frequency of Giant Planets out to 1000 AU separations** by *Stephen Durkan, et al.*
astro-ph/1604.00917 : **Exoplanets versus brown dwarfs: the CoRoT view and the future** by *Jean Schneider*
astro-ph/1604.01037 : **Orbital Stability of Multi-Planet Systems: Behavior at High Masses** by *Sarah J. Morrison, Kaitlin M. Kratter*
astro-ph/1604.01265 : **Mass determination of K2-19b and K2-19c from radial velocities and transit timing variations** by *D. Nespral, et al.*
astro-ph/1604.01291 : **The radial dependence of pebble accretion rates: A source of diversity in planetary systems I. Analytical formulation** by *Shigeru Ida, et al.*
astro-ph/1604.01320 : **Characterizing Exoplanet Atmospheres: From Light-curve Observations to Radiative-transfer Modeling** by *Patricio E. Cubillos*
astro-ph/1604.01411 : **Spectroscopic characterization of HD 95086 b with the Gemini Planet Imager** by *Robert J. De Rosa, et al.*
astro-ph/1604.01413 : **Doppler Monitoring of five K2 Transiting Planetary Systems** by *Fei Dai, et al.*
astro-ph/1604.01554 : **Decaying shock studies of phase transitions in MgOSiO2 systems: implications for the Super-Earths interiors** by *R. M. Bolis, et al.*
astro-ph/1604.01778 : **Modelling circumbinary protoplanetary disks II. Gas disk feedback on planetesimal dynamical and collisional evolution in the circumbinary systems Kepler-16 and 34** by *S. Lines, et al.*
astro-ph/1604.01781 : **Dynamical constraints on the origin of hot and warm Jupiters with close friends** by *Fabio Antonini, et al.*
astro-ph/1604.02076 : **Searching for the HR 8799 Debris Disk with HST/STIS** by *Benjamin L. Gerard, et al.*
astro-ph/1604.02108 : **The Search for Directed Intelligence** by *Philip Lubin*
astro-ph/1604.02310 : **Detection of H2O and evidence for TiO/VO in an ultra hot exoplanet atmosphere** by *Thomas M. Evans, et al.*
astro-ph/1604.02692 : **Observations, Thermochemical Calculations, and Modeling of Exoplanetary Atmospheres** by *Jasmina Blecic*
astro-ph/1604.02952 : **Dust Evolution and the Formation of Planetesimals** by *T. Birnstiel, et al.*
astro-ph/1604.03104 : **Carbon to oxygen ratios in extrasolar planetesimals** by *David J. Wilson, et al.*
astro-ph/1604.03107 : **The Occurrence of Additional Giant Planets Inside the Water-Ice Line in Systems with Hot Jupiters: Evidence Against High-Eccentricity Migration** by *Kevin C. Schlaufman, Joshua N. Winn*
astro-ph/1604.03121 : **Planet Scattering Around Binaries: Ejections, Not Collisions** by *Rachel A. Smullen, et al.*
astro-ph/1604.03135 : **The Impact of Stellar Rotation on the Detectability of Habitable Planets Around M Dwarfs** by *Elisabeth R. Newton, et al.*
astro-ph/1604.03143 : **Radial Velocity Planet Detection Biases at the Stellar Rotational Period** by *Andrew Vanderburg, et al.*
astro-ph/1604.03151 : **The Fine Structure Constant and Habitable Planets** by *McCullen Sandora*
astro-ph/1604.03341 : **Resonant capture of multiple planet systems under dissipation and stable orbital configurations** by *George Voyatzis*
astro-ph/1604.03369 : **Ionisation and discharge in cloud-forming atmospheres of brown dwarfs and extrasolar planets** by *Ch. Helling et al.*
astro-ph/1604.03790 : **Extrasolar comets : the origin of dust in exozodiacal disks?** by *Ulysse Marboeuf, et al.*
astro-ph/1604.03979 : **Characterization of transiting exoplanets: analyzing the impact of the host star on the planet parameters** by *Giovanni Bruno*
astro-ph/1604.04116 : **Population synthesis of planet formation using a torque formula with dynamic effects** by *Takanori Sasaki, Toshikazu Ebisuzaki*
astro-ph/1604.04195 : **WASP-South transiting exoplanets: WASP-130b, WASP-131b, WASP-132b, WASP-**

**139b, WASP-140b, WASP-141b & WASP-142b** by *Coel Hellier, et al.*

astro-ph/1604.04544 : **An Earth-Like Planet in GJ 832 System** by *S. Satyal, et al.*

astro-ph/1604.04601 : **Radiation hydrodynamical models of the inner rim in protoplanetary disks** by *M. Flock, et al.*

astro-ph/1604.04697 : **The SEEDS High Contrast Imaging Survey of Exoplanets around Young Stellar Objects** by *Taichi Uyama, et al.*

astro-ph/1604.04751 : **Regular and chaotic orbits in the dynamics of exoplanets** by *Kyriaki I. Antoniadou*

astro-ph/1604.04773 : **Detecting Exomoons Around Self-luminous Giant Exoplanets Through Polarization** by *Sujan Sengupta, Mark S. Marley*

astro-ph/1604.04776 : **The MUSCLES Treasury Survey III: X-ray to Infrared Spectra of 11 M and K Stars Hosting Planets** by *R. O. Parke Loyd, et al.*

astro-ph/1604.04917 : **Long-Term Stability of Planets in the $\alpha$ Centauri System** by *Billy Quarles, Jack J. Lissauer*

astro-ph/1604.05078 : **The Imprecise Search for Habitability** by *Kevin Heng*

astro-ph/1604.05094 : **Predictable patterns in planetary transit timing variations and transit duration variations due to exomoons** by *Ren Heller et al.*

astro-ph/1604.05139 : **Constraints on the architecture of the HD 95086 planetary system with the Gemini Planet Imager** by *Julien Rameau, et al.*

astro-ph/1604.05191 : **Giant planet formation in radially structured protoplanetary discs** by *Gavin A. L. Coleman, Richard P. Nelson*

astro-ph/1604.05220 : **Hot super-Earths stripped by their host stars** by *M. S. Lundkvist, et al.*

astro-ph/1604.05370 : **Developing Atmospheric Retrieval Methods for Direct Imaging Spectroscopy of Gas Giants in Reflected Light I: Methane Abundances and Basic Cloud Properties** by *Roxana E. Lupu, et al.*

astro-ph/1604.05450 : **An Origin of Multiple Ring Structure and Hidden Planets in HL Tau: A Unified Picture by Secular Gravitational Instability** by *Sanemichi Z. Takahashi, Shu-ichiro Inutsuka*

astro-ph/1604.05463 : **OGLE-2012-BLG-0724Lb: A Saturn-mass Planet around an M-dwarf** by *Y. Hirao, et al.*

astro-ph/1604.05719 : **ALMA Survey of Lupus Protoplanetary Disks I: Dust and Gas Masses** by *Megan Ansdell, et al.*

astro-ph/1604.05725 : **A map of the large day-night temperature gradient of a super-Earth exoplanet** by *Brice-Olivier Demory, et al.*

astro-ph/1604.05744 : **The Impact of Stellar Multiplicity on Planetary Systems, I.: The Ruinous Influence of Close Binary Companions** by *Adam L. Kraus et al.*

astro-ph/1604.05842 : **From Birth to Death of Protoplanetary Disks: Modeling Their Formation, Evolution, and Dispersal** by *Shigeo S. Kimura, et al.*

astro-ph/1604.05845 : **A full, self-consistent, treatment of thermal wind balance on oblate fluid planets** by *Eli Galanti, et al.*

astro-ph/1604.06005 : **Star-planet interactions: I. Stellar rotation and planetary orbits** by *Giovanni Privitera, et al.*

astro-ph/1604.06041 : **The GTC exoplanet transit spectroscopy survey. IV. Confirmation of the flat transmission spectrum of HAT-P-32b** by *L. Nortmann, et al.*

astro-ph/1604.06091 : **Habitability of planets on eccentric orbits: the limits of the mean flux approximation** by *Emeline Bolmont, et al.*

astro-ph/1604.06092 : **Exoplanetary Atmospheres - Chemistry, Formation Conditions, and Habitability** by *Nikku Madhusudhan, et al.*

astro-ph/1604.06097 : **Detection and Characterization of Exoplanets using Projections on Karhunen-Loeve Eigenimages: Forward Modeling** by *Laurent Pueyo*

astro-ph/1604.06140 : **Detection of Potential Transit Signals in 17 Quarters of Kepler Data: Results of the**

**Final Kepler Mission Transiting Planet Search (DR25)** by *Joseph D. Twicken, et al.*
astro-ph/1604.06165 : **Zodiacal Exoplanets in Time (ZEIT) III: A Neptune-sized planet orbiting a pre-main-sequence star in the Upper Scorpius OB Association** by *Andrew W. Mann, et al.*
astro-ph/1604.06362 : **Pebble Accretion and the Diversity of Planetary Systems** by *J. E. Chambers*
astro-ph/1604.06435 : **Long-term orbital stability of exosolar planetary systems with highly eccentric orbits** by *Kyriaki I. Antoniadou, George Voyatzis*
astro-ph/1604.06458 : **Exoplanet Atmospheres and Giant Ground-Based Telescopes** by *I.J.M. Crossfield*
astro-ph/1604.06533 : **A New Non-Planetary Interpretation of the Microlensing Event OGLE-2013-BLG-0723** by *Cheongho Han, et al.*
astro-ph/1604.06847 : **Magellan AO System $z'$, $Y_S$, and $L'$ Observations of the Very Wide 650 AU HD 106906 Planetary System** by *Ya-Lin Wu, et al.*
astro-ph/1604.07388 : **Photolytic Hazes in the Atmosphere of 51 Eri b** by *Kevin J. Zahnle, et al.*
astro-ph/1604.07405 : **Simultaneous infrared and optical observations of the transiting debris cloud around WD 1145+017** by *G. Zhou, et al.*
astro-ph/1604.07406 : **Lightning as a possible source of the radio emission on HAT-P-11b** by *Gabriella Hodosán, Paul B. Rimmer, Christiane Helling*
astro-ph/1604.07558 : **Formation, Orbital and Internal Evolutions of Young Planetary Systems** by *Clément Baruteau, et al.*
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