ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the 91st edition of Exoplanet News. This month's newsletter contains the usual selection of excellent abstracts for recent papers, job adverts and conference announcements, along with last month's relevant arXiv entries. Please keep your abstracts and announcements coming in time for the next (November) issue.

best wishes
Andrew Norton

2 Abstracts of refereed papers

Linking long-term planetary N-body simulations with periodic orbits: application to white dwarf pollution

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Monthly Notices of the Royal Astronomical Society, published (DOI: 10.1093/mnras/stw2264)

Mounting discoveries of debris discs orbiting newly-formed stars and white dwarfs (WDs) showcase the importance of modeling the long-term evolution of small bodies in exosystems. WD debris discs are in particular thought to form from very long-term (0.1-5.0 Gyr) instability between planets and asteroids. However, the time-consuming nature of N-body integrators which accurately simulate motion over Gyrs necessitates a judicious choice of initial conditions. The analytical tools known as *periodic orbits* can circumvent the guesswork. Here, we begin a comprehensive analysis directly linking periodic orbits with N-body integration outcomes with an extensive exploration of the planar circular restricted three-body problem (CRTBP) with an outer planet and inner asteroid near or inside of the 2:1 mean motion resonance. We run nearly 1000 focused simulations for the entire age of the Universe (14 Gyr) with initial conditions mapped to the phase space locations surrounding the unstable and stable periodic orbits for that commensurability. In none of our simulations did the planar CRTBP architecture yield a long-timescale ($\gtrsim 0.25\%$ of the age of the Universe) asteroid-star collision. The pericentre distance of asteroids which survived beyond this timescale ($\approx$ 35 Myr) varied by at most about 60%. These results help affirm that collisions occur too quickly to explain WD pollution in the planar CRTBP 2:1 regime, and highlight the need for further periodic orbit studies with the eccentric and inclined TBP architectures and other significant orbital period commensurabilities.

Download/Website: `http://arxiv.org/abs/1609.01734`

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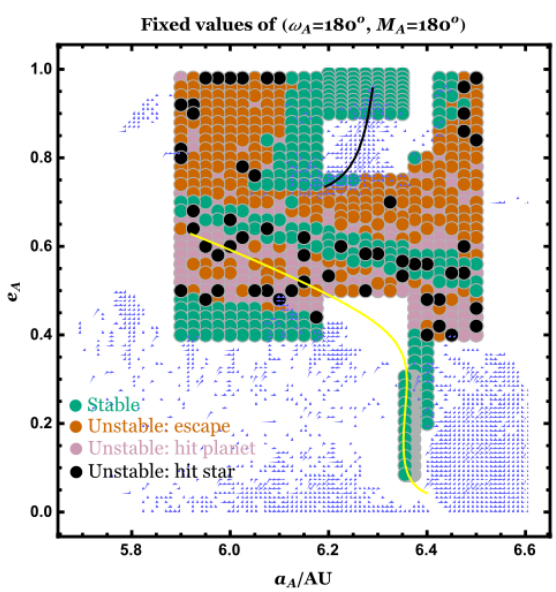

Figure 1: (Antoniadou & Veras) Stability portrait from 14 Gyr N-body simulations for fixed $(\omega_{\rm A}, M_{\rm A})$. Green spheres indicate stable systems and other dots indicate unstable systems. Orange, purple and black spheres respectively refer to systems where the asteroid escaped, hit the planet, and hit the star. The grey-looking spheres are the result of densely packed green spheres. Families of stable (black) and unstable (yellow) periodic orbits, as well as grid points where $log(DFLI) \leq 1.2$ (pale blue triangular symbols) are overplotted.

No hydrogen exosphere detected around the super-Earth HD 97658

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Astronomy & Astrophysics, in press (arXiv:1609.04416)

The exoplanet HD 97658b provides a rare opportunity to probe the atmospheric composition and evolution of moderately irradiated super-Earths. It transits a bright K star at a moderate orbital distance of 0.08 au. Its low density is compatible with a massive steam envelope that could photodissociate at high altitudes and become observable as escaping neutral hydrogen. Our analysis of three transits with HST/STIS at Lyman-α reveals no such signature, suggesting that the thermosphere of HD 97658b is not hydrodynamically expanding and is subjected to a low escape of neutral hydrogen ($<10^8$ g s^{-1} at 3σ).
Using HST/STIS Lyman-α observations and Chandra/ACIS-S & XMM-Newton/EPIC X-ray observations at different epochs, we find that HD 97658 is in fact a weak and soft X-ray source with signs of chromospheric variability in the Lyman-α line core. We determine an average reference for the intrinsic Lyman-α line and X-EUV (XUV) spectrum of the star, and show that HD 97658 b is in mild conditions of irradiation compared to other known evaporating exoplanets with an XUV irradiation about three times lower than the evaporating warm Neptune GJ436 b. This could be the reason why the thermosphere of HD 97658b is not expanding: the low XUV irradiation prevents an efficient photodissociation of any putative steam envelope. Alternatively, it could be linked to a low hydrogen content or inefficient conversion of the stellar energy input. The HD 97658 system provides clues for understanding the stability of low-mass planet atmospheres in terms of composition, planetary density, and irradiation.
Our study of HD 97658 b can be seen as a control experiment of our methodology, confirming that it does not bias detections of atmospheric escape and underlining its strength and reliability. Our results show that stellar activity can be efficiently discriminated from absorption signatures by a transiting exospheric cloud. They also highlight the potential of observing the upper atmosphere of small transiting planets to probe their physical and chemical properties.

Download/Website: `https://arxiv.org/abs/1609.04416`

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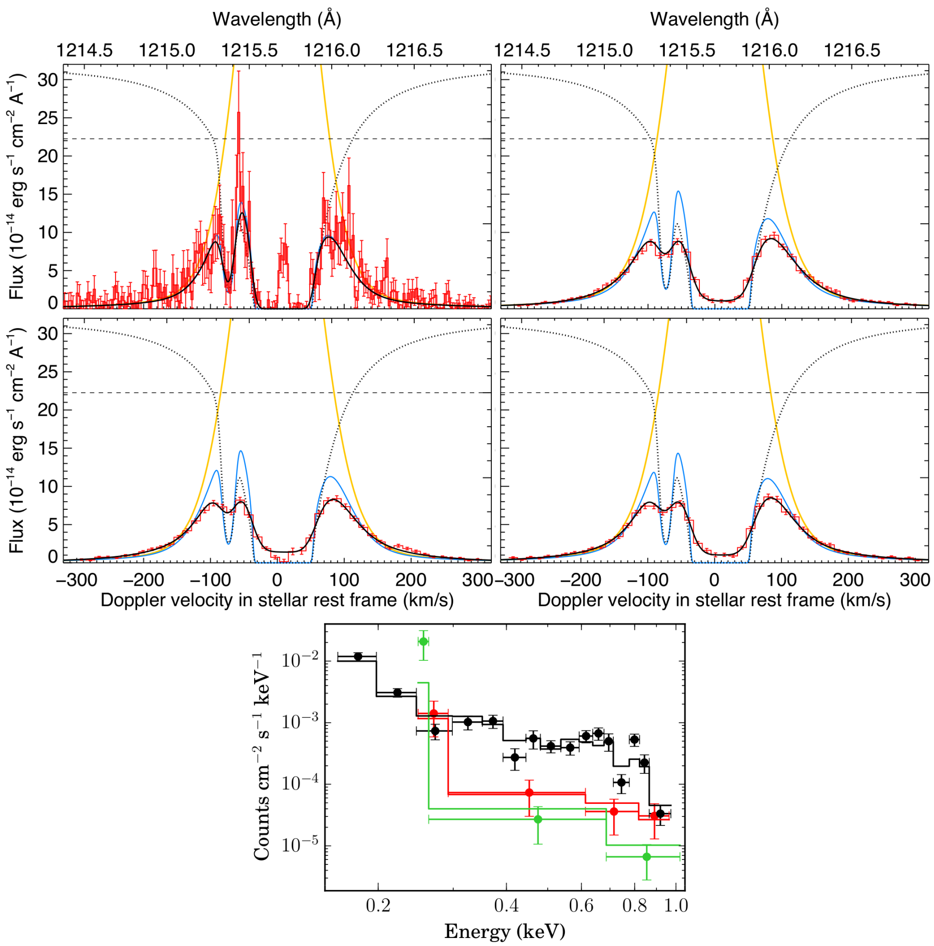

Figure 2: (Bourrier et al.) Our HST and XMM-Newton/Chandra observations of HD 97658 at five different epochs show no signs of an extended exosphere around the super-Earth HD 97658 b, but reveal signs of both short-term and long-term variability in the Lyman-α and X-ray stellar emission. *Upper panels:* Lyman-α line profiles of HD 97658 at four different epochs. The yellow line shows our best estimate for the theoretical intrinsic stellar emission line profile as seen by the planet upper atmosphere. The solid blue line shows the Lyman-α line profile after absorption by the interstellar hydrogen (1215.6Å) and deuterium (1215.25Å), whose cumulated profile is plotted as a dotted black line. The solid black line shows the line profile convolved with the high-resolution STIS/E140M LSF in the first epoch and with the lower resolution STIS/G140M LSF in the other epochs. It is compared to the observations shown as a red histogram. *Lower panel:* X-ray spectrum of HD 97658, measured with XMM-Newton EPIC-PN (black points, in between the first and second epochs of Lyman-α observations) and with Chandra (red and green points, contemporaneous of the third and fourth Lyman-α observations). The histogram spectra correspond to the best fits obtained with the CEMEKL model.

Variable Radio Emission from the Young Stellar Host of a Hot Jupiter

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The Astrophysical Journal, in press (arXiv:1608.00962)

We report the discovery of variable radio emission associated with the T Tauri star, V830 Tau, which was recently shown to host a hot Jupiter companion. Very Large Array observations at a frequency of 6 GHz reveal a detection on 01 May 2011 with a flux density 919 ± 26 μJy, along with non-detections in two other epochs at < 66 and < 150 μJy. Additionally, Very Long Baseline Array observations include one detection and one non-detection at comparable sensitivity, demonstrating that the emission is nonthermal in origin. The emission is consistent with the gyro-synchrotron or synchrotron mechanism from a region with a magnetic field $\gtrsim$30 G, and is likely driven by an energetic event such as magnetic reconnection that accelerated electrons. With the limited data we have, we are not able to place any constraint on the relationship between the radio emission and the rotational or orbital properties of V830 Tau. This is the first detection of radio emission from a non-degenerate star known to host an exoplanet.

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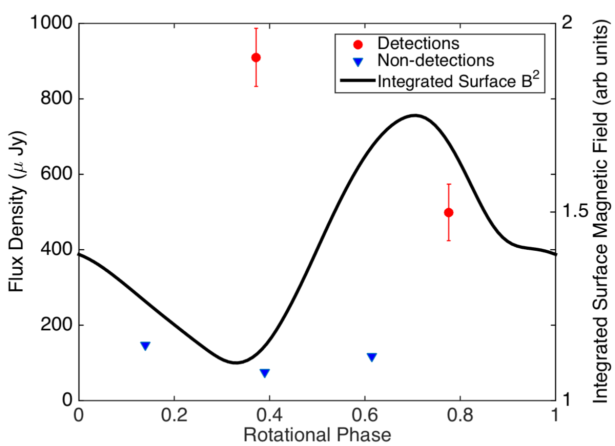

Figure 3: (Bower et al.) Radio flux density as a function of stellar rotational phase. The left y-axis shows the range of flux densities, which are plotted for VLA and VLBA detections and non-detections (3σ upper limits). The right y-axis shows the relative scaling of the integrated surface magnetic field energy, which was determined from 2015 observations and is plotted as the dark line. Differential rotation and changes in the stellar dynamo imply that only radio observations obtained within ~ 1 year of the spectropolarimetric data are likely to be meaningfully related to the shape of the magnetic energy curve. Thus, only the VLBA detection at phase of 0.8 has a direct relationship with the magnetic energy curve.

Measuring stellar granulation during planet transits

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Astronomy & Astrophysics, in press (arXiv:1609.08966)

Context. Stellar activity and convection-related surface structures might cause bias in planet detection and characterization that use these transits. Surface convection simulations help to quantify the granulation signal.
Aims. We used realistic three-dimensional (3D) radiative hydrodynamical (RHD) simulations from the Stagger grid and synthetic images computed with the radiative transfer code Optim3D to model the transits of three prototype planets: a hot Jupiter, a hot Neptune, and a terrestrial planet.
Methods. We computed intensity maps from RHD simulations of the Sun and a K-dwarf star at different wavelength bands from optical to far-infrared that cover the range of several ground- and space-based telescopes which observe exoplanet transits. We modeled the transit using synthetic stellar-disk images obtained with a spherical-tile imaging method and emulated the temporal variation of the granulation intensity generating random images covering a granulation time-series of 13.3 hours. We measured the contribution of the stellar granulation on the light curves during the planet transit.
Results. We identified two types of granulation noise that act simultaneously during the planet transit: (i) the intrinsic change in the granulation pattern with timescale (e.g., 10 minutes for solar-type stars assumed in this work) is smaller than the usual planet transit ($\sim$ hours as in our prototype cases), and (ii) the fact that the transiting planet occults isolated regions of the photosphere that differ in local surface brightness as a result of convection-related surface structures. First, we showed that our modeling approach returns granulation timescale fluctuations that are comparable with what has been observed for the Sun. Then, our statistical approach shows that the granulation pattern of solar and K-dwarf-type stars have a non-negligible effect of the light curve depth during the transit, and, consequentially on the determination of the planet transit parameters such as the planet radius (up to 0.90% and ? 0.47% for terrestrial and gaseous planets, respectively). We also showed that larger (or smaller) orbital inclination angles with respect to values corresponding to transit at the stellar center display a shallower transit depth and longer ingress and egress times, but also granulation fluctuations that are correlated to the center-to-limb variation: they increase (or decrease) the value of the inclination, which amplifies the fluctuations. The granulation noise appears to be correlated among the different wavelength ranges either in the visible or in the infrared regions.
Conclusions. The prospects for planet detection and characterization with transiting methods are excellent with access to large amounts of data for stars. The granulation has to be considered as an intrinsic uncertainty (as a result of stellar variability) on the precise measurements of exoplanet transits of planets. The full characterization of the granulation is essential for determining the degree of uncertainty on the planet parameters. In this context, the use of 3D RHD simulations is important to measure the convection- related fluctuations. This can be achieved by performing precise and continuous observations of stellar photometry and radial velocity, as we explained with RHD simulations, before, after, and during the transit periods.

Download/Website: `http://adsabs.harvard.edu/abs/2016arXiv160908966C`

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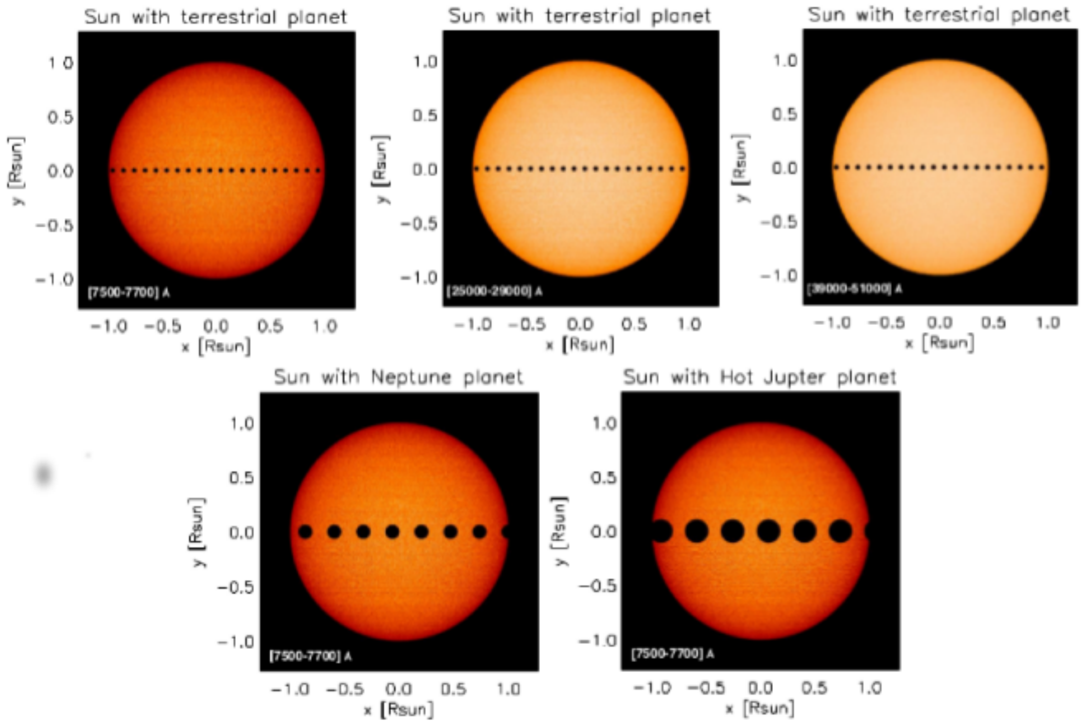

Figure 4: (Chiavassa et al.) Synthetic solar disk images with transiting planet at different wavelengths for a solar type star. There are three different prototype of planet for the transit: a terrestrial, a Neptune and a hot Jupiter planet.

Prospects for detecting the Rossiter-McLaughlin effect of Earth-like planets: the test case of TRAPPIST-1b and c

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The Rossiter-McLaughlin effect is the principal method of determining the sky-projected spin-orbit angle (β) of transiting planets. Taking the example of the recently discovered TRAPPIST-1 system, we explore how ultracool dwarfs facilitate the measurement of the spin-orbit angle for Earth-sized planets by creating an effect that can be an order of magnitude more ample than the Doppler reflex motion caused by the planet if the star is undergoing rapid rotation. In TRAPPIST-1's case we expect the semi-amplitudes to be 40-50 m s^{-1} for the known transiting planets. Accounting for stellar jitter expected for ultracool dwarfs and instrumental noise, and assuming radial velocity precisions both demonstrated and anticipated for upcoming near-infrared spectrographs, we quantify the observational effort required to measure the planets' masses and spin-orbit angles. We conclude that if the planetary system is well-aligned then β can be measured to a precision of $\lesssim 10°$ if the spectrograph is stable at the level of 2 m s^{-1}. We also investigate the measure of $\Delta\beta$, the mutual inclination, when multiple transiting planets are present in the system. Lastly, we note that the rapid rotation rate of many late M-dwarfs will amplify the Rossiter-McLaughlin signal to the point where variations in the chromatic Rossiter-McLaughlin effect from atmospheric absorbers should be detectable.

Download/Website: `http://adsabs.harvard.edu/abs/2016MNRAS.462.4018C`

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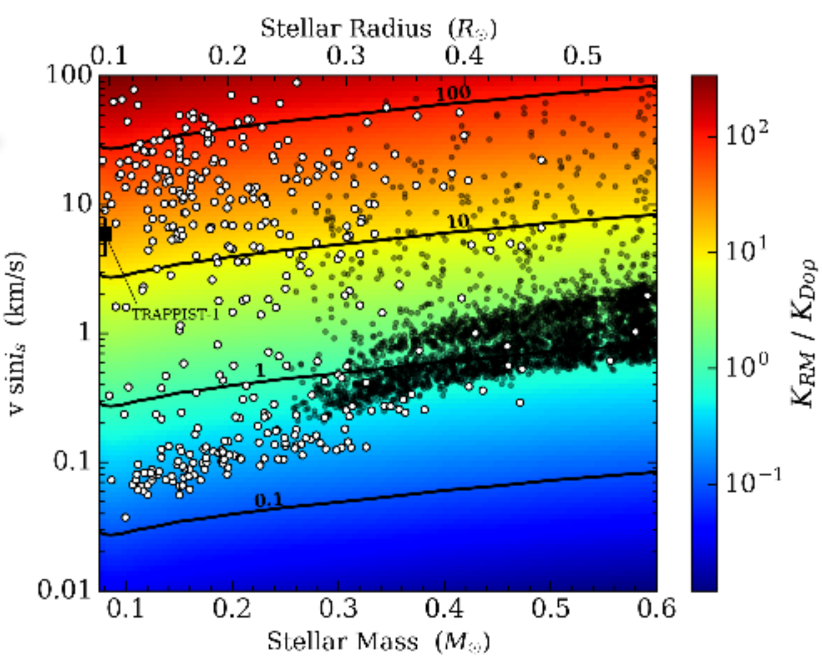

Figure 5: (Cloutier & Triaud) The ratio of the Rossiter-McLaughlin semi-amplitude to the Doppler semi-amplitude for an Earth-sized planet at the inner edge of the habitable zone. White and black symbols depict stellar rotation periods measured with MEarth and Kepler respectively. TRAPPIST-1 is depicted as the black square according to its mass. Over the range of observed M-dwarf rotation velocities, the semi-amplitude of the RM effect can be over two orders-of-magnitude less than or greater than the Doppler semi-amplitude of a typical rocky planet in the habitable zone.

Is the activity level of HD 80606 influenced by its eccentric planet?

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Astronomy & Astrophysics, Published: http://adsabs.harvard.edu/abs/2016A%26A...592A.143F

Aims: Several studies suggest that the activity level of a planet-host star can be influenced by the presence of a close-by orbiting planet. Moreover, the interaction mechanisms that have been proposed, magnetic interaction and tidal interaction, exhibit a very different dependence on orbital separation between the star and the planet. A detection of activity enhancement and characterization of its dependence on planetary orbital distance can, in principle, allow us to characterize the physical mechanism behind the activity enhancement.
Methods: We used the HARPS-N spectrograph to measure the stellar activity level of HD 80606 during the planetary periastron passage and compared the activity measured to that close to apastron. Being characterized by an eccentricity of 0.93 and an orbital period of 111 days, the system's extreme variation in orbital separation makes it a perfect target to test our hypothesis.
Results: We find no evidence for a variation in the activity level of the star as a function of planetary orbital distance, as measured by all activity indicators employed $\log(R'_{HK})$, H_α, NaI, and HeI. None of the models employed, whether magnetic interaction or tidal interaction, provides a good description of the data. The photometry revealed no variation either, but it was strongly affected by poor weather conditions.
Conclusions: We find no evidence for star-planet interaction in HD 80606 at the moment of the periastron passage of its very eccentric planet. The straightforward explanation for the non-detection is the absence of interaction as a result of a low magnetic field strength on either the planet or the star and of the low level of tidal interaction between the two. However, we cannot exclude two scenarios: *i)* the interaction can be instantaneous and of magnetic origin, being concentrated on the substellar point and its surrounding area, and *ii)* the interaction can lead to a delayed activity enhancement. In either scenario, a star-planet interaction would not be detectable with the dataset described in this paper.

Download/Website: `http://arxiv.org/abs/1606.05549`

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WASP-92b, WASP-93b and WASP-118b: Three new transiting close-in giant planets

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1607.00774)

We present the discovery of three new transiting giant planets, first detected with the WASP telescopes, and establish their planetary nature with follow up spectroscopy and ground-based photometric lightcurves. WASP-92 is an F7 star, with a moderately inflated planet orbiting with a period of 2.17 days, which has $R_p = 1.461 \pm 0.077 R_{\mathrm{J}}$ and $M_p = 0.805 \pm 0.068 M_{\mathrm{J}}$. WASP-93b orbits its F4 host star every 2.73 days and has $R_p = 1.597 \pm 0.077 R_{\mathrm{J}}$ and $M_p = 1.47 \pm 0.029 M_{\mathrm{J}}$. WASP-118b also has a hot host star (F6) and is moderately inflated, where $R_p = 1.440 \pm 0.036 R_{\mathrm{J}}$ and $M_p = 0.514 \pm 0.020 M_{\mathrm{J}}$ and the planet has an orbital period of 4.05 days. They are bright targets (V = 13.18, 10.97 and 11.07 respectively) ideal for further characterisation work, particularly WASP-118b, which is being observed by K2 as part of campaign 8. The WASP-93 system has sufficient angular momentum to be tidally migrating outwards if the system is near spin-orbit alignment, which is divergent from the tidal behaviour of the majority of hot Jupiters discovered.

Download/Website: `http://arxiv.org/abs/1607.00774`

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First limits on the occurrence rate of short-period planets orbiting brown dwarfs

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Monthly Notices of the Royal Astronomical Society, published (arXiv:1609.05053)

Planet formation theories predict a large but still undetected population of short-period terrestrial planets orbiting brown dwarfs. Should specimens of this population be discovered transiting relatively bright and nearby brown dwarfs, the Jupiter-size and the low luminosity of their hosts would make them exquisite targets for detailed atmospheric characterisation with *JWST* and future ground-based facilities. The eventual discovery and detailed study of a significant sample of transiting terrestrial planets orbiting nearby brown dwarfs could prove to be useful not only for comparative exoplanetology but also for astrobiology, by bringing us key information on the physical requirements and timescale for the emergence of life.

In this context, we present a search for transit-signals in archival time-series photometry acquired by the *Spitzer Space Telescope* for a sample of 44 nearby brown dwarfs. While these 44 targets were not particularly selected for their brightness, the high precision of their *Spitzer* light curves allows us to reach sensitivities below Earth-sized planets for 75% of the sample and down to Europa-sized planets on the brighter targets. We could not identify any unambiguous planetary signal. Instead, we could compute the first limits on the presence of planets on close-in orbits. We find that within a 1.28 day orbit, the occurrence rate of planets with a radius between 0.75 and 3.25 $R_\oplus$ is $\eta < 67 \pm 1\%$. For planets with radii between 0.75 and 1.25 $R_\oplus$, we place a 95% confident upper limit of $\eta < 87 \pm 3\%$. If we assume an occurrence rate of $\eta = 27\%$ for these planets with radii between 0.75 and 1.25 $R_\oplus$, as the discoveries of the Kepler-42b and TRAPPIST-1b systems would suggest, we estimate that 175 brown dwarfs need to be monitored in order to guarantee (95%) at least one detection.

Download/Website: `https://arxiv.org/pdf/1609.05053v1.pdf`

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Figure 6: (He, Triaud & Gillon) (**Top left:** Map of transiting planets versus planet radius and orbital period. Blue filled in dots represent transiting planets that are detected, hollow red circles represent transiting planets that are captured on the light curve but are not detected, and red x's represent transiting planets that are missed by the time series. **Top right:** The corresponding transit fractions and detection statistics per box: the top right corner indicates the probability of transit, while the three percentages on the left side of each box represent, from top to bottom, the fraction of transits missed by the observation (red x's), the fraction of transits undetected using our methods (hollow red circles), and the fraction of detected transits (blue dots). The percentage in parenthesis in the bottom right corner of each box represent the rate of false positives. **Bottom:** Info-graphic showing the fractions of brown dwarfs that would have a planet (in black, center of each box), in order to be consistent with having no detections for 44 observations, 95% of the time. The top right corner of each box gives the probability of transit (top-most) and detection chance of those transits as derived from sampling. The bottom right value gives the number of detections we would expect for $\eta = 1$, of our 44 brown dwarfs.)

Effect of surface-mantle water exchange parameterizations on exoplanet ocean depths

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The Astrophysical Journal, in press (arXiv:1609.04786)

Terrestrial exoplanets in the canonical habitable zone may have a variety of initial water fractions due to random volatile delivery by planetesimals. If the total planetary water complement is high, the entire surface may be covered in water, forming a "waterworld." On a planet with active tectonics, competing mechanisms act to regulate the abundance of water on the surface by determining the partitioning of water between interior and surface. Here we explore how the incorporation of different mechanisms for the degassing and regassing of water changes the volatile evolution of a planet. For all of the models considered, volatile cycling reaches an approximate steady-state after ~ 2 Gyr. Using these steady-states, we find that if volatile cycling is either solely dependent on temperature or seafloor pressure, exoplanets require a high abundance ($\gtrsim 0.3\%$ of total mass) of water to have fully inundated surfaces. However, if degassing is more dependent on seafloor pressure and regassing mainly dependent on mantle temperature, the degassing rate is relatively large at late times and a steady-state between degassing and regassing is reached with a substantial surface water fraction. If this hybrid model is physical, super-Earths with a total water fraction similar to that of the Earth can become waterworlds. As a result, further understanding of the processes that drive volatile cycling on terrestrial planets is needed to determine the water fraction at which they are likely to become waterworlds.

Download/Website: `http://arxiv.org/abs/1609.04786`

Contact: `tkomacke@lpl.arizona.edu`

Cloud Atlas: Discovery of Patchy Clouds and High-amplitude Rotational Modulations in a Young, Extremely Red L-type Brown Dwarf

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Astrophysical Journal Letters, Accepted (arXiv: 1609.04804)

Condensate clouds fundamentally impact the atmospheric structure and spectra of exoplanets and brown dwarfs but the connections between surface gravity, cloud structure, dust in the upper atmosphere, and the red colors of some brown dwarfs remain poorly understood. Rotational modulations enable the study of different clouds in the same atmosphere, thereby providing a method to isolate the effects of clouds. Here, we present the discovery of high peak-to-peak amplitude (8%) rotational modulations in a $18 M_{Jup}$, low-gravity, extremely red (J-K_s=2.55)

L6 dwarf WISEP J004701.06+680352.1 (W0047). Using the *Hubble Space Telescope* (HST) time-resolved grism spectroscopy, we find a best-fit rotational period (13.20±0.14 hours) with a larger amplitude at 1.1 μm than at 1.7 μm. This is the third-largest near-infrared variability amplitude measured in a brown dwarf, demonstrating that large-amplitude variations are not limited to the L/T transition but are present in some extremely red L-type dwarfs. We report a tentative trend between the wavelength dependence of relative amplitude, possibly proxy for small dust grains lofted in the upper atmosphere, and the likelihood of large-amplitude variability. By assuming forsterite as haze particle, we successfully explain the wavelength-dependent amplitude with sub-micron-sized haze particle sizes of around 0.4 μm. W0047 links the earlier spectral and later spectral type brown dwarfs in which rotational modulations have been observed; the large amplitude variations in this object make this a benchmark brown dwarf for the study of cloud properties close to the L/T transition.

Download/Website: `http://arxiv.org/abs/1609.04804`

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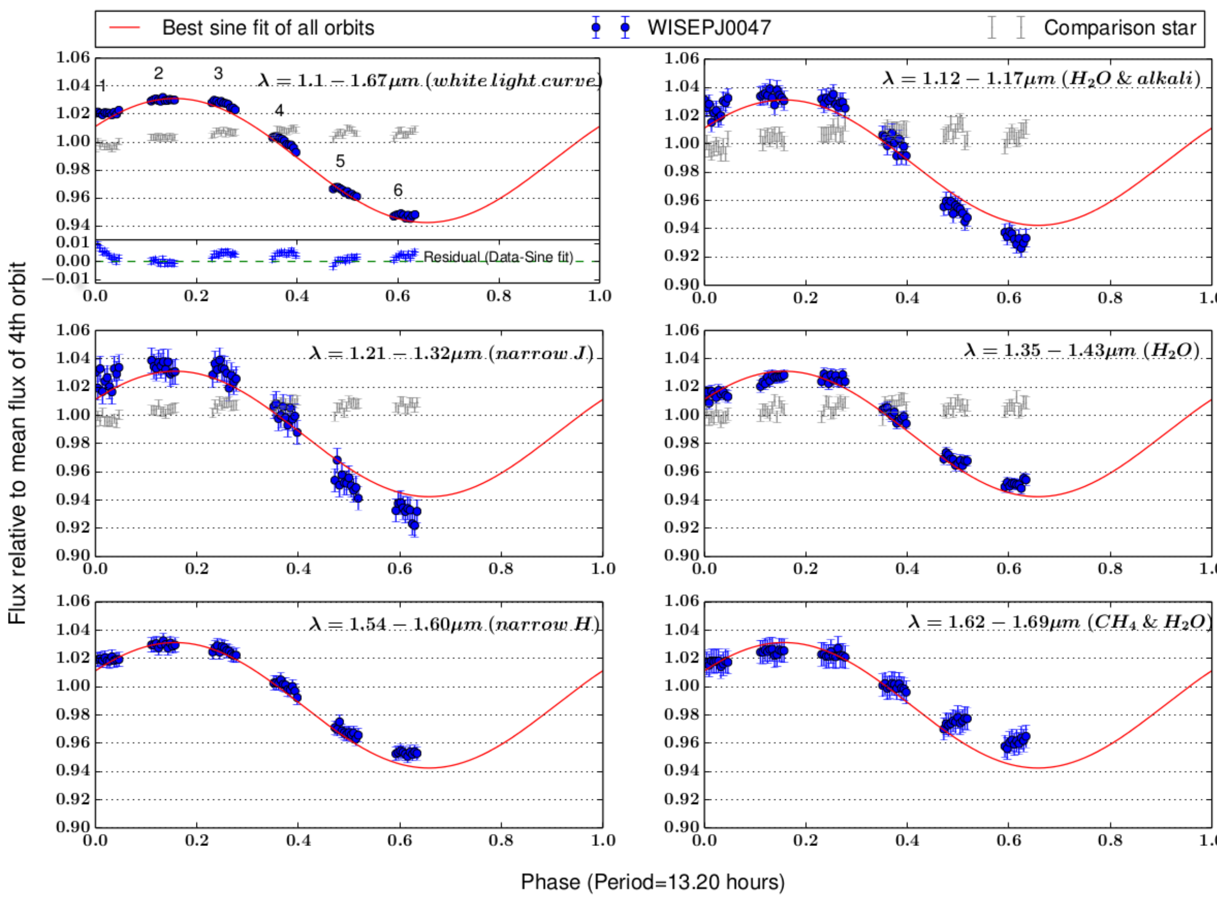

Figure 7: (Lew et al.) Phase-folded white light curve in comparison with five different narrowband light curves to probe different atmospheric pressure levels. All variation is in phase, and the light curves of shorter wavelengths have a slightly larger amplitude. The integrated flux of W0047 of six HST orbits are plotted as blue solid dots, while the comparison star are plotted in gray. The red line shows the best sine fit of all orbits with period = 13.20 hr.

The long-term dynamical evolution of disc-fragmented multiple systems in the Solar Neighborhood

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The Astrophysical Journal, in press (arXiv:1609.00120)

The origin of very low-mass hydrogen-burning stars, brown dwarfs, and planetary-mass objects at the low-mass end of the initial mass function is not yet fully understood. Gravitational fragmentation of circumstellar discs provides a possible mechanism for the formation of such low-mass objects. The kinematic and binary properties of very low-mass objects formed through disc fragmentation at early times (<10 Myr) were discussed in Li et al. (2015). In this paper we extend the analysis by following the long-term evolution of disc-fragmented systems, up to an age of 10 Gyr, covering the ages of the stellar and substellar population in the Galactic field. We find that the systems continue to decay, although the rates at which companions escape or collide with each other are substantially lower than during the first 10 Myr, and that dynamical evolution is limited beyond 1 Gyr. By $t = 10$ Gyr, about one third of the host stars is single, and more than half have only one companion left. Most of the other systems have two companions left that orbit their host star in widely separated orbits. A small fraction of companions have formed binaries that orbit the host star in a hierarchical triple configuration. The majority of such double companion systems have internal orbits that are retrograde with respect to their orbits around their host stars. Our simulations allow a comparison between the predicted outcomes of disc-fragmentation with the observed low-mass hydrogen-burning stars, brown dwarfs, and planetary-mass objects in the Solar neighbourhood. Imaging and radial velocity surveys for faint binary companions among nearby stars are necessary for verification or rejection for the formation mechanism proposed in this paper.

Download/Website: `https://arxiv.org/abs/1609.00120`

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A Super-Solar Metallicity For Stars With Hot Rocky Exoplanets

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The Astronomical Journal, arXiv:1609.05898

The host star metallicity provide a measure of the conditions in protoplanetary disks at the time of planet formation. Using a sample of over 20,000 *Kepler* stars with spectroscopic metallicities from the `LAMOST` survey, we explore how the exoplanet population depends on host star metallicity as a function of orbital period and planet size. We find that exoplanets with orbital periods less than 10 days are preferentially found around metal-rich stars ([Fe/H]$\simeq 0.15 \pm 0.05$ dex). The occurrence rates of these hot exoplanets increases to $\sim 30\%$ for super-solar metallicity stars from $\sim 10\%$ for stars with a sub-solar metallicity. Cooler exoplanets, that reside at longer orbital periods and constitute the bulk of the exoplanet population with an occurrence rate of $>\sim 90\%$, have host-star metallicities consistent with solar. At short orbital periods, $P < 10$ days, the difference in host star metallicity is largest for hot rocky planets ($< 1.7\ R_\oplus$), where the metallicity difference is [Fe/H]$\simeq 0.25 \pm 0.07$ dex. The excess of hot rocky planets around metal-rich stars implies they either share a formation mechanism with hot Jupiters, or trace a planet

trap at the protoplanetary disk inner edge which is metallicity-dependent. We do not find statistically significant evidence for a previously identified trend that small planets toward the habitable zone are preferentially found around low-metallicity stars. Refuting or confirming this trend requires a larger sample of spectroscopic metallicities.

Download/Website: `http://arxiv.org/abs/1609.05898`

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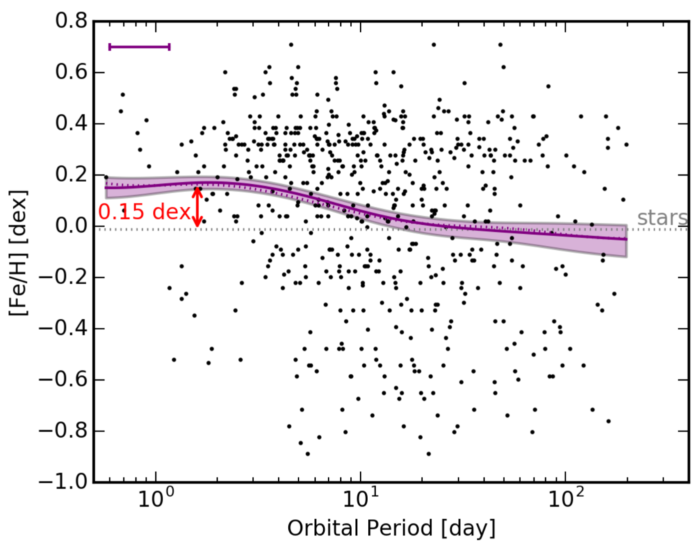

Figure 8: (Mulders et al.) Host star metallicities as function of planet orbital period (black dots). The solid purple line shows the kernel regression of the mean metallicity of the planet population. The shaded purple area shows the 68% confidence interval on the mean from bootstrapping. The kernel bandwidth of 0.29 dex is shown in the top left. The grey dashed line shows the mean metallicity of the stellar sample, which is consistent with solar. An increase with respect to longer-period planets in the host star metallicity of ~ 0.15 dex is evident in the planet population at orbital periods less than 10 days, indicated by the red arrow.

Efficiency of Planetesimal Ablation in Giant Planetary Envelopes

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Monthly Notices of the Royal Astronomical Society, accepted (arXiv:1609.02143)

Observations of exoplanetary spectra are leading to unprecedented constraints on their atmospheric elemental abundances, particularly O/H, C/H, and C/O ratios. Recent studies suggest that elemental ratios could provide important constraints on formation and migration mechanisms of giant exoplanets. A fundamental assumption in such studies is that the chemical composition of the planetary envelope represents the sum-total of compositions of the accreted gas and solids during the formation history of the planet. We investigate the efficiency with which accreted planetesimals ablate in a giant planetary envelope thereby contributing to its composition rather than sinking to the core. From considerations of aerodynamic drag causing 'frictional ablation' and the envelope temperature structure causing 'thermal ablation', we compute mass ablations for impacting planetesimals of radii 30 m to 1 km for different compositions (ice to iron) and a wide range of velocities and impact angles, assuming spherical symmetry. Icy impactors are fully ablated in the outer envelope for a wide range of parameters. Even for Fe impactors substantial ablation occurs in the envelope for a wide range of sizes and velocities. For example, iron impactors of sizes below $\sim$0.5 km and velocities above $\sim$30 km/s are found to ablate by $\sim$ 60-80% within the outer envelope at pressures below 10^3 bar due to frictional ablation alone. For deeper pressures ($\sim 10^7$ bar), substantial ablation happens over a wider range of parameters. Therefore, our exploratory study suggests that atmospheric abundances of volatile elements in giant planets reflect their accretion history during formation.

Download/Website: `http://arxiv.org/abs/1609.02143`

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Radial velocity observations of the 2015 Mar 20 eclipse – A benchmark Rossiter-McLaughlin curve with zero free parameters

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Astronomy & Astrophysics, in press (arXiv:1609.00535)

Spectroscopic observations of a solar eclipse can provide unique information for solar and exoplanet research; the huge amplitude of the Rossiter-McLaughlin (RM) effect during solar eclipse and the high precision of solar radial velocities (RVs) allow detailed comparison between observations and RV models, and they provide information about the solar surface and about spectral line formation that are otherwise difficult to obtain. On March 20, 2015, we obtained 159 spectra of the Sun as a star with the solar telescope and the Fourier Transform Spectrograph at the Institut für Astrophysik Göttingen, 76 spectra were taken during partial solar eclipse. We obtained RVs using I_2 as wavelength reference and determined the RM curve with a peak-to-peak amplitude of almost $1.4\,\mathrm{km\,s^{-1}}$ at typical RV precision better than $1\,\mathrm{m\,s^{-1}}$. We modeled the disk-integrated solar RVs using well-determined parameterizations of solar surface velocities, limb darkening, and information about convective blueshift from 3D magnetohydrodynamic simulations. We confirm that convective blueshift is crucial to understand solar RVs during eclipse. Our best model reproduced the observations to within a relative precision of 10 % with residuals lower than $30\,\mathrm{m\,s^{-1}}$. We cross-checked parameterizations of velocity fields using a Dopplergram from the Solar Dynamics Observatory and conclude that disk-integration of the Dopplergram does not provide correct information about convective blueshift necessary for $\mathrm{m\,s^{-1}}$ RV work. As main limitation for modeling RVs during eclipses, we identified limited knowledge about convective blueshift and line shape as functions of solar limb angle. We suspect that our model line profiles are too shallow at limb angles larger than $\mu = 0.6$, resulting in incorrect weighting of the velocities across the solar disk. Alternative explanations cannot be excluded, such as suppression of convection in magnetic areas and undiscovered systematics during eclipse observations. To make progress, accurate observations of solar line profiles across the solar disk are suggested. We publish our RVs taken during solar eclipse as a benchmark curve for codes calculating the RM effect and for models of solar surface velocities and line profiles.

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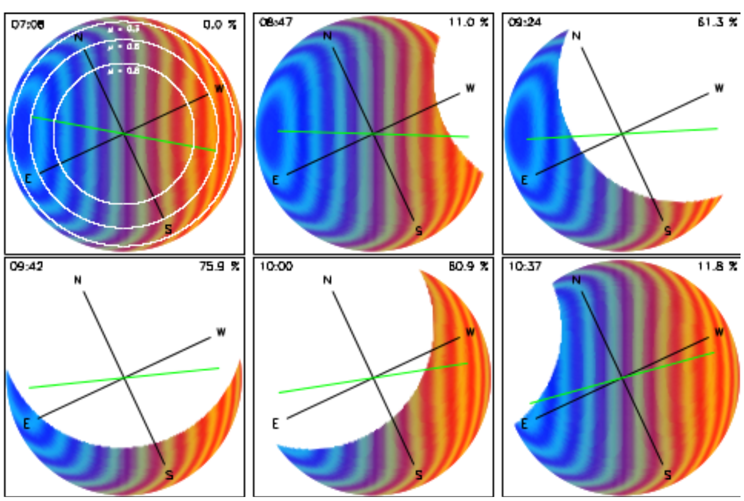

Figure 9: (Reiners et al.) Solar radial velocities during partial eclipse.

K2-99: a subgiant hosting a transiting warm Jupiter in an eccentric orbit and a long-period companion

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1609.00239)

We report the discovery from *K2* of a transiting planet in an 18.25-d, eccentric (0.19 ± 0.04) orbit around K2-99, an 11th magnitude subgiant in Virgo. We confirm the planetary nature of the companion with radial velocities, and determine that the star is a metal-rich ([Fe/H]= 0.20 ± 0.05) subgiant, with mass $1.60^{+0.14}_{-0.10}\ M_\odot$ and radius $3.1 \pm 0.1\ R_\odot$. The planet has a mass of $0.97 \pm 0.09\ M_{\rm Jup}$ and a radius $1.29 \pm 0.05\ R_{\rm Jup}$. A measured systemic radial acceleration of $-2.12 \pm 0.04\ {\rm m\,s^{-1}d^{-1}}$ offers compelling evidence for the existence of a third body in the system, perhaps a brown dwarf orbiting with a period of several hundred days.

Download/Website: `http://arxiv.org/abs/1609.00239`

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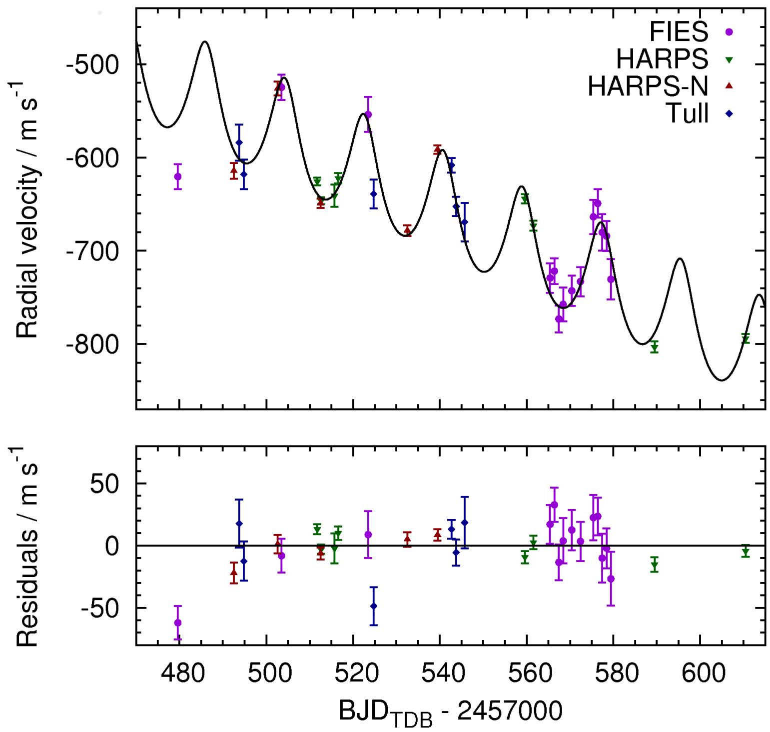

Figure 10: (Smith et al.) Radial velocities of K2-99 as a function of time, with best-fitting Keplerian plus linear acceleration model, and residuals to that model plotted below. Data points (with 1-σ error bars) are from four different spectrographs, represented by different colours and symbol types.

The ExoMol database: molecular line lists for exoplanet and other hot atmosphere

Jonathan Tennyson, Sergei N. Yurchenko, Ahmed F. Al-Refaie, Emma J. Barton, Katy L. Chubb, Phillip A. Coles, S. Diamantopoulou, Maire N. Gorman, Christian Hill, Aden Z. Lam, Lorenzo Lodi, Laura K. McKemmish, Yueqi Na, Alec Owens, Oleg L. Polyansky, Clara Sousa-Silva, Daniel S. Underwood, Andrey Yachmenev and Emil Zak
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J. Molec. Spectrosc., 372, 73-94 (2016); arXiv:1603.05890

The ExoMol database (www.exomol.com) provides extensive line lists of molecular transitions which are valid over extended temperatures ranges. The status of the current release of the database is reviewed and a new data structure is specified. This structure augments the provision of energy levels (and hence transition frequencies) and Einstein A coefficients with other key properties, including lifetimes of individual states, temperature-dependent cooling functions, Landé g-factors, partition functions, cross sections, k-coefficients and transition dipoles with phase relations. Particular attention is paid to the treatment of pressure broadening parameters. The new data structure includes a definition file which provides the necessary information for utilities accessing ExoMol through its application programming interface (API). Prospects for the inclusion of new species into the database are discussed.

Download/Website: `www.exomol.com`

Contact: `j.tennyson@ucl.ac.uk`

The fates of solar system analogues with one additional distant planet

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1608.07580)

The potential existence of a distant planet ("Planet Nine") in the Solar system has prompted a re-think about the evolution of planetary systems. As the Sun transitions from a main sequence star into a white dwarf, Jupiter, Saturn, Uranus and Neptune are currently assumed to survive in expanded but otherwise unchanged orbits. However, a sufficiently-distant and sufficiently-massive extra planet would alter this quiescent end scenario through the combined effects of Solar giant branch mass loss and Galactic tides. Here, I estimate bounds for the mass and orbit of a distant extra planet that would incite future instability in systems with a Sun-like star and giant planets with masses and orbits equivalent to those of Jupiter, Saturn, Uranus and Neptune. I find that this boundary is diffuse and strongly dependent on each of the distant planet's orbital parameters. Nevertheless, I claim that instability occurs more often than not when the planet is as massive as Jupiter and harbours a semimajor axis exceeding about 300 au, or has a mass of a super-Earth and a semimajor axis exceeding about 3000 au. These results hold for orbital pericentres ranging from 100 to at least 400 au. This instability scenario might represent a common occurrence, as potentially evidenced by the ubiquity of metal pollution in white dwarf atmospheres throughout the Galaxy.

Download/Website: `http://arxiv.org/abs/1608.07580`

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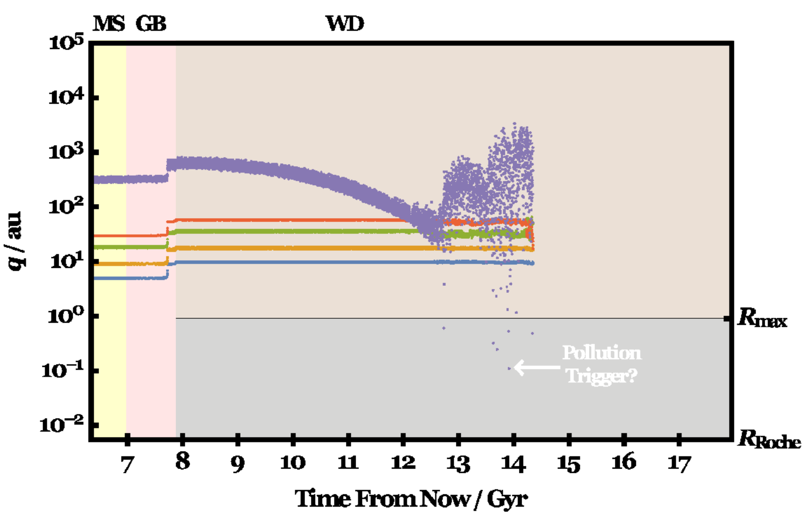

Figure 11: (Veras) Tidally-induced instability due to a "Planet Nine"-like object whose semimajor axis is high enough to gravitationally scatter Uranus and Neptune analogues after the Sun-like star has become a white dwarf.

ALMA reveals the anatomy of the mm-sized dust and molecular gas in the HD 97048 disk

Catherine Walsh[1,2], *Attila Juhász*[3], *Gwendolyn Meeus*[4], *William R. F. Dent*[5], *Luke Maud*[1], *Yuri Aikawa*[6], *Tom J. Millar*[7], *Hideko Nomura*[8]

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The Astrophysical Journal, in press, 2016arXiv160902011W

Transitional disks show a lack of excess emission at infrared wavelengths due to a large dust cavity, that is often corroborated by spatially-resolved observations at $\sim$ mm wavelengths. We present the first spatially-resolved $\sim$ mm-wavelength images of the disk around the Herbig Ae/Be star, HD 97048. Scattered light images show that the disk extends to ≈ 640 au. The ALMA data reveal a circular-symmetric dusty disk extending to ≈ 350 au, and a molecular disk traced in CO J=3-2 emission, extending to ≈ 750 au. The CO emission arises from a flared layer with an opening angle $\approx 30^\circ - 40^\circ$. HD 97048 is another source for which the large ($\sim$ mm-sized) dust grains are more centrally concentrated than the small ($\sim$ μm-sized) grains and molecular gas, likely due to radial drift. The images and visibility data modelling suggests a decrement in continuum emission within ≈ 50 au, consistent with the cavity size determined from mid-infrared imaging (34 ± 4 au). The extracted continuum intensity profiles show ring-like structures with peaks at $\approx$ 50, 150, and 300 au, with associated gaps at $\approx$ 100 and 250 au. This structure should be confirmed in higher-resolution images (FWHM $\approx 10 - 20$ au). These data confirm the classification of HD 97048 as a transitional disk that also possesses multiple ring-like structures in the dust continuum emission. Additional data are required at multiple and well-separated frequencies to fully characterise the disk structure, and thereby constrain the mechanism(s) responsible for sculpting the HD 97048 disk.

Download/Website: `http://cdsads.u-strasbg.fr/abs/2016arXiv160902011W`

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3 Conference announcements

Radio Exploration of Planetary Habitability (An AAS Topical Conference)

Alexander Wolszczan

The Pennsylvania State University, University Park, PA, USA

Indian Wells, CA, USA, 7–12 May 2017

FIRST ANNOUNCEMENT. Radio astronomy provides means that allow the most direct investigation of the processes driving stellar activity. It also offers the best chance to detect and characterize exoplanetary magnetic fields over a wide range of planet masses and ages. The idea of this meeting has grown out of the need to better understand star-planet interaction and its impact on habitability of planetary companions, especially those in close orbits around low-mass stars. The meeting will address a wide range of the related topics, broadly divided into the following three categories: (i) stellar activity and planetary habitability, (ii) detection of planets and planetary magnetic fields, and (iii) the relevant theoretical considerations, emphasizing a potential impact of radio astronomy, especially the existing and the planned, large radio telescopes, in this area of research.

Download/Website: `https://aas.org/meetings/aastcs/radiohab`

Contact: `alex@astro.psu.edu`

ARIEL Science Conference

The ESA ARIEL Science Team

Brussels, Belgium, November 21–23, 2016

Dear colleague,
We kindly invite you to attend the ARIEL (Atmospheric Remote-Sensing Infrared Exoplanet Large-survey) science conference to be held at the University Foundation, Egmontstraat 11 rue d'Egmont, in Brussels (Belgium) on November 21-23, 2016.
ARIEL is one of the medium class mission candidates in the Cosmic Vision programme of the European Space Agency (ESA) to be launched in the 2026 timeframe. The selection of one of the three mission candidates is foreseen for mid 2017.
ARIEL will investigate the atmospheres of several hundreds of planets orbiting bright stars. During its four-year mission, ARIEL will observe exoplanets ranging from Jupiter- and Neptune-size down to super-Earth and Earth-size in a wide variety of environments. The main focus of the mission will be primarily on warm and hot planets in orbits close to their star. These exoplanets represent a natural laboratory in which to study the chemistry and formation of exoplanets, and hence the evolution of planetary systems. ARIEL will investigate their composition and chemical/physical properties through repeated, simultaneous, multi-wavelength, high photometric stability spectroscopic observations.
This international conference will provide an overview of the ARIEL science and mission, including presenting the opportunities for the general community that ARIEL will offer, as well as providing a forum for discussion and feedback in advance of the ESA Cosmic Vision review process.
The ESA study and science teams will present the current ARIEL science case, mission objectives, technical concept, and data policies. The main goal of this public conference is to inform and receive critical feedback and contributions from the community covering all aspects of ARIEL; including, but not limited to, exoplanetary modelling, target selection, atmospheric retrieval and data processing, mission and instrument design and critical technologies. In addition, time will be set aside for dedicated poster sessions and open discussions.
Registration and abstract submission are now open at:
http://arielconference.eu
We look forward to seeing you at the ARIEL conference in November!
The ESA ARIEL Science Team

Download/Website: `http://arielconference.eu`

2$^{\rm nd}$ Advanced School on Exoplanetary Science: Astrophysics of Exoplanetary Atmospheres

Valerio Bozza[1], *Luigi Mancini*[2], *Alessandro Sozzetti*[3]

[1] Department of Physics, University of Salerno, Via Giovanni Paolo II 132, 84084 – Fisciano (SA), Italy
[2] Max Planck Institute for Astronomy, Königstuhl 17, 69117 – Heidelberg, Germany
[3] INAF – Astrophysical Observatory of Turin, via Osservatorio 20, 10025 – Pino Torinese, Italy

Vietri sul Mare (Salerno), Italy, from 22 to 26 May, 2017

Rationale:
The Advanced School on Exoplanetary Science – taking place in the enchanting Amalfi Coast – is aimed at providing a comprehensive, state-of-the-art picture of the rich variety of relevant aspects of the fast-developing, highly interdisciplinary field of extoplanet research (both from an observational and theoretical viewpoint). The School is addressed to graduate students and young post-doctoral researchers, and offers the fascinating possibility to interact with world-class experts engaged in different areas of the astrophysics of planetary systems. The 2$^{\rm nd}$ edition of the School will be focused on the Astrophysics of Exoplanetary Atmospheres, covering both the theoretical and observational perspective.

Organizing Committee:
V. Bozza (University of Salerno), L. Mancini (Max Planck Institute for Astronomy, Heidelberg), A. Sozzetti (INAF - Astrophysical Observatory of Turin)

Confirmed School Lecturers:
Theoretical models: Prof. J. J. Fortney, Dep. of Astron. and Astroph., University of California, USA
Observational techniques: Prof. D. Sing, Astrophysics Group, School of Physics, University of Exeter, UK
Molecular spectroscopy: Prof. J. Tennyson, Dep. of Phys. and Astron., University College London, UK
Solar system atmospheres: Dr. D. Grassi, Instit. for Space Astrophysics and Planetology, INAF, Italy

Lecture Notes: The Lecture Notes of the 2^{nd} Advanced School on Exoplanetary Science will be published by Springer in its Astrophysics and Space Science Library series. A copy of the book will be given to each participant. The first book of the series is available on http://www.springer.com/gp/book/9783319274560.

Fees:
The registration fee is 320 Euro, and includes a copy of the Lecture Notes, conference kit, coffee breaks and social dinner. Lodging and meals (full-board accommodation at Hotel La Lucertola adjoint to the School venue), for the entire duration of the course (arrival on Sunday May 21, departure in the morning of Saturday May 27, 2015), will be in the order of 540-600 Euro. A limited number of grants, partially covering accommodation expenses, will be available for selected participants. Justified requests for economic support (addressed via email to the Organizing Committee) will have to be accompanied by the submission of a Curriculum Vitae.

Registration, abstract submission:
Registration will open on October 10, 2016.
There is a limited number of time slots for brief seminars of participants to present their own research. Title/Abstract submission is possible at any later moment after registration by sending an email to the Organizing Committee. All participants are allowed and encouraged to bring a poster.

Important Dates:
10^{th} October 2016: First Announcement, Registration opens
15^{th} January 2017: Second and Final Announcement
1^{st} February 2017: Accommodation Subsidy Deadline
1^{st} March 2017: Registration Deadline
1^{st} May 2017: Final School programme
$22^{\text{th}} - 26^{\text{th}}$ May 2017: The School

Download/Website: `http://www.mpia.de/ases2`
Contact: `ases2@mpia.de - facebook.com/ases2017 - twitter.com/ases2017 - #ases2`

4 Jobs and positions

Assistant Professor of Physics (3 positions)(Vacancy Reference 1583723)

Don Pollacco
Department of Physics, University of Warwick, UK

Department of Physics, University of Warwick , 21st November 2016

The Department of Physics at the University of Warwick seeks to make up to three permanent academic appointments in the area of Exoplanets. Applicants will have a strong research track record and be ready to build your own research team with the support of colleagues at Warwick.

Warwick has leading positions in the WASP and NGTS ground based transit experiments, membership of the ESA S mission CHEOPS board, and the Science Coordination of ESAs PLATO mission (the PLATO Science office is being established at Warwick). It is expected that the successful candidates will take advantage of the opportunities presented by these experiments. One of these appointments could suit an applicant with a theoretical background. Suitable areas could include planetary atmospheres and orbital dynamics.

In addition to the above posts, we invite applications from outstanding scientists who either already hold an externally funded Research Fellowship or are seeking a top-class institution with which to apply for such a Fellowship in this research area.

Assistant Professor is a tenure track position leading to appointment as Associate Professor after successful completion of probation. Teaching and administration duties are reduced during the probationary period.

The University of Warwick maintains a global outlook and has affiliates around the globe. The Department of Physics will provide an exciting and highly supportive environment in which academics can develop their careers. We are fully committed to equality of opportunity and encourage application and enquiries from all suitably qualified candidates.

Candidates should submit their application via the online application system at the Warwick portal. Details are available from the website below.

Note: Closing date for applications is the 21st November 2016.
Informal enquiries can be addressed to Professor Pollacco on Tel: +44 24765 74329 or at the address below.

Download/Website: `http://www.jobs.ac.uk/job/AUI351/assistant-professor-plato-78318-086/`

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

Post-doctoral Position in Exoplanet Research

Sascha P. Quanz
Institute for Astronomy, ETH Zurich, Zurich, Switzerland

ETH Zurich, Start date: preferably early / mid 2017; later dates can be negotiated

The Institute for Astronomy, ETH Zurich, Star and Planet Formation Research Group invites applications for a new post-doctoral fellowship to work with Dr. Sascha P. Quanz on extra-solar planets. Research in our group covers several areas including the direct detection and characterization of extra-solar planets, the structure and evolution of circumstellar disks, and the formation of planets in those disks.
The new position will mainly be in support of currently ongoing large imaging surveys at the Very Large Telescope as well as for the development of new image processing and data analysis algorithms to maximise the scientific return of these surveys.
Salary and duration of the appointment will be commensurate with experience. Starting salary begins at CHF 86'300, with an initial appointment of 2+1 years (depending on performance). Successful applicants will have the opportunity to work with students at all levels. Switzerland is a member of ESO and ESA, and the successful applicant will have full access to their facilities. The Institute for Astronomy maintains access to a range of high performance computing options, including stand-alone machines, large clusters, and the resources of the Swiss National Supercomputing Center (CSCS). Interested applicants will also be welcome to explore research opportunities in the Astronomical Instrumentation Laboratory. Our group is also involved in the Swiss National Centre for Competence in Research (NCCR) "PlanetS" Project, an interdisciplinary and inter-institutional research program focussed on the origin, evolution, and characterization of planets inside and outside the Solar System. For more information see: http://nccr-planets.ch.
Applications should consist of a CV and brief descriptions of past/proposed research (combined length not to exceed 6 pages). A separate publication list should be attached. Materials should be sent electronically in a single pdf file. This file, as well as three letters of reference (sent directly by the referees), should be sent to eth-astro-star-planet@phys.ethz.ch. Review of applications will begin December 1, 2016 and will continue until the position is filled.
The ETH Zurich will provide benefits for maternity leave, retirement, and accident insurance. Weblink: https://www.ethz.ch/en/the-eth-zurich/working-teaching-and-research.html

Contact: `eth-astro-star-planet@phys.ethz.ch`

Postdoctoral position: Precise radius of extrasolar planets

François Bouchy

University of Geneva, position available immediately

The exoplanet team of Geneva University has an opening for a postdoctoral researcher to work on the radius determination of transiting exoplanets. The group is part of *SWASP* and *NGTS* ground-based photometric surveys and to *CHEOPS* and *TESS* space missions. The selected applicant will address light-curve analysis, transit fitting, vetting and ranking of exoplanet candidates from ground-survey *NGTS* and space mission *K2*. The postdoc will have access to the 1.2-m *Euler* telescope and will conduct the imaging and photometric follow-up with *EulerCam* and will contribute to the data-reduction pipeline optimization of this facility. The selected applicant will participate to the identification and follow-up of mono-transit exoplanet candidates. The postdoc will be welcome to contribute to the preparation of *TESS* photometric follow-up, to the science preparation of *CHEOPS* mission, and to the development of the *DACE* (Data & Analysis Center for Exoplanets) platform.

The Department of Astronomy of the University of Geneva offers a modern and vibrant work environment, with a wide range of activities including theory, numerical simulations, observations and instrumental developments in the domains of exoplanets, stellar physics, galactic dynamics, observational cosmology and high-energy astrophysics. The exoplanet team is especially well renown, with strong involvement in planet detection, the determination of the planet physical properties, the characterization of planet atmospheres, and the development of an associated world-class instrumentation. We are also co-leading the Swiss-wide National Centre of Competence in Research (NCCR) *PlanetS*, dedicated to the study of the origin, evolution, and characterization of planets inside and outside our Solar System. The applicant will also have the opportunity to develop collaborations with members of *PlanetS*.

Applicants are expected to have a strong experience in the data reduction and analysis of high-precision photometric light curves. The length of a postdoc contract is of 2 years, with possible extension to a third year depending on available funds. Candidates should be less than 3 years after their PhD at the beginning of the position. The University is actively seeking to increase the numbers of women in physics and hence women are strongly encouraged to apply. This position is founded by Swiss National Science Foundation with a gross salary around 80'000 CHF a year. The position is available immediately. Interested candidates should contact Prof. François Bouchy, University of Geneva, Francois.Bouchy@unige.ch, and send (in a singe pdf file) a CV, a publication list, a motivation letter, a short research statement describing past achievements and future projects and arrange for three letters of recommendation to be sent before **31th October 2016**.

Download/Website: `http://www.exoplanets.ch/`
Contact: `Francois.Bouchy@unige.ch`

PhD position: Density of extrasolar planets

François Bouchy

University of Geneva, position available immediately

Exoplanets that transit their host star are a real gold mine because they are the only ones for which it is possible to precisely measure their fundamental properties. Combining photometric transit with radial velocity measurements yields the exact mass, radius and bulk density of a planet, allowing their internal structure and composition to be determined. The confirmation and mass determination with radial velocities is however very challenging and so far the transition from Neptune-like objects, to intermediate-mass planets with or without a thick gaseous envelope, and ultimately to rocky planets similar in composition to the Earth, is still poorly understood and constrained.

The main focus of the PhD will be to study the density of exoplanets, putting specific efforts on the low-mass range of exoplanets including Neptune and super-Earth planets. For that purpose, the applicant will actively contribute to radial-velocity follow-up programs of transiting candidates from ground-based photometric surveys *SWASP* and *NGTS* and from space missions *K2* and *TESS* using *CORALIE*, *SOPHIE*, *HARPS*, *HARPS-N*, *SPIROU* and *ESPRESSO* facilities. The PhD will also be involved in the data-reduction software optimization, and will participate to the tests and validation of *SPIROU* and *NIRPS* near-infrared spectrographs.

The Department of Astronomy of the University of Geneva offers a modern and vibrant work environment, with a wide range of activities including theory, numerical simulations, observations and instrumental developments in the domains of exoplanets, stellar physics, galactic dynamics, observational cosmology and high-energy astrophysics. The exoplanet team is especially well renown, with strong involvement in planet detection, the determination of the planet physical properties, the characterization of planet atmospheres, and the development of an associated world-class instrumentation. We are also co-leading the Swiss-wide National Centre of Competence in Research (NCCR) *PlanetS*, dedicated to the study of the origin, evolution, and characterization of planets inside and outside our Solar System. The applicant will also have the opportunity to develop collaborations with members of *PlanetS*.

The applicant is required to have a Master in astrophysics. Proficiency in C and Python programming is considered as a plus. This four-years PhD position is founded by Swiss National Science Foundation with a gross salary around 50'000 CHF a year. The position is available immediately and a rapid start by the student would be appreciated. The University is actively seeking to increase the numbers of women in physics and hence women are strongly encouraged to apply. Interested applicants should send (in a single pdf file) their curriculum vitae, a motivation letter, the grades obtained at university, names of people who can be contacted for a letter of recommendation, and the contact details to Prof. François Bouchy, University of Geneva, francois.bouchy@unige.ch, before **31th October 2016**.

Download/Website: `http://www.exoplanets.ch/`

Contact: `Francois.Bouchy@unige.ch`

5 As seen on astro-ph

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

astro-ph/1609.00016 : **Stellar Companions to the Exoplanet Host Stars HD 2638 and HD 164509** by *Justin M. Wittrock, et al.*

astro-ph/1609.00120: **The long-term dynamical evolution of disc-fragmented multiple systems in the Solar Neighborhood** by *Yun Li, et al.*

astro-ph/1609.00239 : **K2-99: a subgiant hosting a transiting warm Jupiter in an eccentric orbit and a long-period companion** by *A.M.S. Smith, et al.*

astro-ph/1609.00275 : **Dusty tails of evaporating exoplanets. II. Physical modelling of the KIC 12557548b light curve** by *R. van Lieshout, et al.*

astro-ph/1609.00319 : **Coupled orbital and spin evolution of the CoRoT-7 two-planet system using a Maxwell viscoelastic rheology** by *Adrián Rodrguez Colucci, Nelson Callegari Jr., Alexandre Correia*

astro-ph/1609.00382 : **Imaging an 80 AU Radius Dust Ring Around the F5V Star HD 157587** by *Maxwell A. Millar-Blanchaer, et al.*

astro-ph/1609.00437 : **Evolution of Protoplanetary Discs with Magnetically Driven Disc Winds** by *Takeru K. Suzuki, et al.*

astro-ph/1609.00501 : **Failed Growth at the Bouncing Barrier in Planetesimal Formation** by *Maximilian Kruss, et al.*

astro-ph/1609.00535: **Radial velocity observations of the 2015 Mar 20 eclipse - A benchmark Rossiter-McLaughlin curve with zero free parameters** by *Ansgar Reiners, et al.*

astro-ph/1609.00707 : **Geomagnetic properties of Proxima Centauri b analogues** by *Jorge I. Zuluaga, Sebastian Bustamant*

astro-ph/1609.00726 : **Zodiacal Exoplanets in Time (ZEIT) IV: seven transiting planets in the Praesepe cluster** by *Andrew W. Mann, et al.*

astro-ph/1609.00796 : **Runaway Freeze-out of Volatiles in Weakly Turbulent Protoplanetary disks** by *Rui Xu, Xue-Ning Bai, Karin Oberg*

astro-ph/1609.00898 : **Planetary systems in star clusters** by *M.B.N. Kouwenhoven et al.*

astro-ph/1609.00960 : **Planet formation with envelope enrichment: new insights on planetary diversity** by *Julia Venturini, Yann Alibert, Willy Benz*

astro-ph/1609.01314 : **The stellar obliquity, planet mass, and very low albedo of Qatar-2 from K2 Photometry** by *Fei Dai, et al.*

astro-ph/1609.01734 : **Linking long-term planetary N-body simulations with periodic orbits: application to white dwarf pollution** by *Kyriaki I. Antoniadou, Dimitri Veras*

astro-ph/1609.02011 : **ALMA reveals the anatomy of the mm-sized dust and molecular gas in the HD 97048 disk** by *Catherine Walsh et al.*

astro-ph/1609.02085 : **Magnetic fields in protoplanetary disks: from MHD simulations to ALMA observations** by *Gesa H.-M. Bertrang, Mario Flock, Sebastian Wolf*

astro-ph/1609.02143 : **Efficiency of Planetesimal Ablation in Giant Planetary Envelopes** by *Arazi Pinhas, Nikku Madhusudhan, Cathie Clarke*

astro-ph/1609.02153 : **Photochemical-dynamical models of externally FUV irradiated protoplanetary discs** by *Thomas J. Haworth, et al.*

astro-ph/1609.02493 : **An Ordered Magnetic Field in the Protoplanetary Disk of AB Aur Revealed by Mid-Infrared Polarimetry** by *Dan Li, et al.*

astro-ph/1609.02559 : **Imaging protoplanets: observing transition disks with non-redundant masking** by *Steph Sallum, et al.*

astro-ph/1609.02563 : **Mass and eccentricity constraints on the planetary debris orbiting the white dwarf WD 1145+017** by *Pol Gurri, Dimitri Veras, Boris T. Gänsicke*

astro-ph/1609.02576 : **MagAO Imaging of Long-period Objects (MILO). II. A Puzzling White Dwarf around the Sun-like Star HD 11112** by *Timothy J. Rodigas, et al.*

astro-ph/1609.02706 : **Modeling of deep gaps created by giant planets in protoplanetary discs** by *K.D. Kanagawa, et al.*

astro-ph/1609.02767 : **HAT-P-65b and HAT-P-66b: Two Transiting Inflated Hot Jupiters and Observational Evidence for the Re-Inflation of Close-In Giant Planets** by *Joel D. Hartman, et al.*

astro-ph/1609.02859 : **Spectral energy distribution simulations of a possible ring structure around the young, red brown dwarf G196-3B** by *Olga V. Zakhozhay, et al.*

astro-ph/1609.02917 : **The origin of the eccentricity of the hot Jupiter in CI Tau** by *Giovanni P. Rosotti, et al.*

astro-ph/1609.03019 : **The imprint of exoplanet formation history on observable present-day spectra of hot Jupiters** by *Christoph Mordasini, et al.*

astro-ph/1609.03037 : **An all-sky catalog of solar-type dwarfs for exoplanetary transit surveys** by *V. Nascimbeni, et al.*

astro-ph/1609.03082 : **Atmospheric characterization of Proxima b by coupling the SPHERE high-contrast imager to the ESPRESSO spectrograph** by *C. Lovis, et al.*

astro-ph/1609.03449 : **A terrestrial planet candidate in a temperate orbit around Proxima Centauri** by *Guillem Anglada-Escudé, et al.*

astro-ph/1609.03674 : **Radial-Velocity Fitting Challenge. II. First results of the analysis of the data set** by *X. Dumusque, et al.*

astro-ph/1609.03903 : **A photo-evaporative gap in the closest planet forming disc** by *Barbara Ercolano et al.*

astro-ph/1609.03905 : **Transits Probabilities Around Hypervelocity and Runaway Stars** by *Giacomo Fragione, Idan Ginsburg*

astro-ph/1609.03906 : **Potassium detection in the clear atmosphere of a hot-Jupiter: FORS2 transmission spectroscopy of WASP-17b** by *Elyar Sedaghati et al.*

astro-ph/1609.03908 : **A generalized bayesian inference method for constraining the interiors of super Earths and sub-Neptunes** by *C. Dorn, et al.*

astro-ph/1609.03909 : **Bayesian analysis of interiors of HD 219134b, Kepler-10b, Kepler-93b, CoRoT-7b, 55 Cnc e, and HD 97658b using stellar abundance proxies** by *C. Dorn, N. R. Hinkel, J. Venturini*

astro-ph/1609.04010 : **Constraining the Frequency of Free-Floating Planets from a Synthesis of Microlensing, Radial Velocity, and Direct Imaging Survey Results** by *Christian Clanton, B. Scott Gaudi*

astro-ph/1609.04027 : **Direct detection of scattered light gaps in the transitional disk around HD 97048 with VLT/SPHERE** by *C. Ginski, et al.*

astro-ph/1609.04128 : **Revised Stellar Properties of Kepler Targets for the Q1-17 (DR25) Transit Detection**

Run by *Savita Mathur, et al.*

astro-ph/1609.04263 : **Exocomet signatures around the A-shell star F Leo?** by *C. Eiroa, et al.*

astro-ph/1609.04389 : **Accurate, Empirical Radii and Masses of Planets with Gaia Parallaxes** by *Keivan G. Stassun, Karen A. Collins, B. Scott Gaudi*

astro-ph/1609.04416 : **No hydrogen exosphere detected around the super-Earth HD97658 b** by *Vincent Bourrier, et al.*

astro-ph/1609.04786 : **Effect of surface-mantle water exchange parameterizations on exoplanet ocean depths** by *Thaddeus D. Komacek, Dorian S. Abbot*

astro-ph/1609.04798 : **Super-Earths as Failed Cores in Orbital Migration Traps** by *Yasuhiro Hasegawa*

astro-ph/1609.05016 : **Stability of multiplanet systems in binaries** by *F. Marzari, G. Gallina*

astro-ph/1609.05048 : **Comprehensive Wide-Band Magnitudes and Albedos for the Planets, With Applications to Exo-Planets and Planet Nine** by *Anthony Mallama, Bruce Krobusek, Hristo Pavlov*

astro-ph/1609.05053 : **First limits on the occurrence rate of short-period planets orbiting brown dwarfs** by *Matthias Y. He, Amaury H.M.J. Triaud, Michaël Gillon*

astro-ph/1609.05089 : **SIOUX project: a simultaneous multiband camera for exoplanet atmospheres studies** by *Jean Marc Christille, et al.*

astro-ph/1609.05638 : **Belt(s) of debris resolved around the Sco-Cen star HIP 67497** by *M. Bonnefoy, et al.*

astro-ph/1609.05729 : **The discovery of a planetary candidate around the evolved low-mass Kepler giant star HD 175370** by *M. Hrudková, et al.*

astro-ph/1609.05898 : **A Super-Solar Metallicity For Stars With Hot Rocky Exoplanets** by *Gijs D. Mulders, et al.*

astro-ph/1609.05912 : **Generalized Hill-Stability Criteria for Hierarchical Three-Body Systems at Arbitrary Inclinations** by *Evgeni Grishin, et al.*

astro-ph/1609.05931 : **The Log Log Prior for the Frequency of Extraterrestrial Intelligences** by *Brian C. Lacki*

astro-ph/1609.06056 : **On the formation of planetary systems in photoevaporating transition discs** by *Caroline Terquem*

astro-ph/1609.06148 : **Exoplanetary Detection By Multifractal Spectral Analysis** by *Sahil Agarwal, Fabio Del Sordo, John S. Wettlaufer*

astro-ph/1609.06337 : **Hydrocarbon emission rings in protoplanetary disks induced by dust evolution** by *Edwin A. Bergin, et al.*

astro-ph/1609.06409 : **Why are pulsar planets rare?** by *Rebecca G. Martin, Mario Livio, Divya Palaniswamy*

astro-ph/1609.06639 : **Terrestrial Planet Formation from an Annulus** by *Kevin J. Walsh, Hal F. Levison*

astro-ph/1609.06708 : **A gas density drop in the inner 6 AU of the transition disk around the Herbig Ae star HD 139614: Further evidence for a giant planet inside the disk?** by *A. Carmona, et al.*

astro-ph/1609.06718 : **Exocometary gas structure, origin and physical properties around Pictoris through ALMA CO multi-transition observations** by *L. Matrà, et al.*

astro-ph/1609.06720 : **The First Circumbinary Planet Found by Microlensing: OGLE-2007-BLG-349L(AB)c** by *D.P. Bennett, et al.*

astro-ph/1609.06801 : **Numerical search for a potential planet sculpting the young disc of HD 115600** by *E. Thilliez, S.T. Maddison*

astro-ph/1609.06914 : **The role of pebble fragmentation in planetesimal formation I. Experimental study** by *M. Bukhari Syed, et al.*

astro-ph/1609.07052 : **The role of pebble fragmentation in planetesimal formation II. Numerical simulations** by *Karl Wahlberg Jansson, et al.*

astro-ph/1609.07238 : **Fitting Formulas for Determining the Existence of S-type and P-type Habitable Zones in Binary Systems: First Results** by *Zhaopeng Wang, Manfred Cuntz*

astro-ph/1609.07503 : **Dawes Review. The tidal downsizing hypothesis of planet formation** by *Sergei Nayakshin* astro-ph/1609.07510 : **Wind-driven Accretion in Transitional Protostellar Disks** by *Lile Wang, Jeremy J. Goodman*

astro-ph/1609.07617 : **Kepler-21b: A rocky planet around a V = 8.25 magnitude star** by *Mercedes Lopez-Morales, et al.*

astro-ph/1609.07930 : **On dust-gas gravitational instabilities in protoplanetary discs** by *Henrik Latter, Roxana Rosca*

astro-ph/1609.08058 : **The effects of external planets on inner systems: multiplicities, inclinations, and pathways to eccentric warm Jupiters** by *Alexander J Mustill, Melvyn B Davies, Anders Johansen*

astro-ph/1609.08110 : **Dynamically hot Super-Earths from outer giant planet scattering** by *Chelsea X. Huang, Cristobal Petrovich, Emily Deibert*

astro-ph/1609.08159 : **On the origin of horseshoes in transitional discs** by *Enrico Ragusa, et al.*

astro-ph/1609.08185 : **The Abundance of Atmospheric CO2 in Ocean Exoplanets: A Novel CO2 Deposition Mechanism** by *Amit Levi, Dimitar Sasselov, Morris Podolak*

astro-ph/1609.08506 : **Mass-Loss Rates of "Hot-Jupiter" Exoplanets with Various Types of Gaseous Envelopes** by *A. A. Cherenkov, D. V. Bisikalo, P. V. Kaigorodov*

astro-ph/1609.08633 : **Exoplanet Orbital Eccentricities Derived From LAMOST-Kepler Analysis** by *Ji-Wei Xie et al.*

astro-ph/1609.08634 : **Global Instability of Exo-Moon System Triggered by Photo-Evaporation** by *Ming Yang, et al.*

astro-ph/1609.08636 : **Asymmetric Orbital Distribution near Mean Motion Resonance: Application to Planets Observed by Kepler and Radial Velocities** by *Ji-Wei Xie*

astro-ph/1609.08652 : **Thermodynamics of Giant Planet Formation: Shocking Hot Surfaces on Circumplanetary Disks** by *J. Szul'agyi, C. Mordasini*

astro-ph/1609.08718 : **No Conclusive Evidence for Transits of Proxima b in MOST photometry** by *David M. Kipping, et al.*

astro-ph/1609.08933 : **The Influence of Coronal Mass Ejections on the Gas Dynamics of the Atmosphere of a "Hot Jupiter" Exoplanet** by *D. V. Bisikalo, A. A. Cherenkov*

astro-ph/1609.08966 : **Measuring stellar granulation during planet transits** by *A. Chiavassa, et al.*

astro-ph/1609.09074 : **Evidence for the Direct Detection of the Thermal Spectrum of the Non-Transiting Hot Gas Giant HD 88133 b** by *Danielle Piskorz, et al.*

astro-ph/1609.09075 : **The Pale Green Dot: A Method to Characterize Proxima Centauri b using Exo-Aurorae** by *Rodrigo Luger, et al.*

astro-ph/1609.09126 : **Evolution of Gas Giant Entropy During Formation by Runaway Accretion** by *David Berard, Andrew Cumming, Gabriel-Dominique Marleau*

astro-ph/1609.09135 : **The origin and 9:7 MMR dynamics of the Kepler-29 system** by *Cezary Migaszewski, Krzysztof Gozdziewski, Federico Panichi*

astro-ph/1609.09250 : **Shock-driven Accretion in Circumplanetary Disks: Observables and Satellite Formation** by *Zhaohuan Zhu, Wenhua Ju, James M. Stone*

astro-ph/1609.09355 : **Astrobiological Effects of Gamma-Ray Bursts in the Milky Way Galaxy** by *Michael G. Gowanlock*

astro-ph/1609.09505 : **Scattered light mapping of protoplanetary disks** by *T. Stolker, et al.*

astro-ph/1609.09512 : **Probability of Physical Association of 104 Blended Companions to *Kepler* Objects of Interest Using Visible and Near-Infrared Adaptive Optics Photometry** by *Dani Atkinson, et al.*

astro-ph/1609.09757 : **Possible Internal Structures and Compositions of Proxima Centauri b** by *B. Brugger, et al.*