ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Here is the 78th edition of ExoPlanet News and I think its the largest ever. We have a record number of abstracts this month, no doubt due to the lengthy gap since the last edition. As a new feature this month, we have a report on the recent UK Exoplanet Community meeting held at the University of Warwick. I would encourage other conference organizers to submit reports on their meetings to future editions of the newsletter, for the benefit of those unable to attend.

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

The Inner Disk Structure, Disk-Planet Interactions, and Temporal Evolution in the β Pictoris System: A Two-Epoch HST/STIS Coronagraphic Study

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The Astrophysical Journal, published (2015ApJ...800..136A)

We present deep HST/STIS coronagraphic images of the β Pic debris disk obtained at two epochs separated by 15 years. The new images and the re-reduction of the 1997 data provide the most sensitive and detailed views of the disk at optical wavelengths as well as the yet smallest inner working angle optical coronagraphic image of the disk. Our observations characterize the large-scale and inner-disk asymmetries and we identify multiple breaks in the disk radial surface brightness profile. We study in detail the radial and vertical disk structure and show that the disk is warped. We explore the disk at the location of the β Pic b super-jupiter and find that the disk surface brightness slope is continuous between 0.5" and 2.0", arguing for no change at the separations where β Pic orbits.

The two epoch images constrain the disk's surface brightness evolution on orbital and radiation pressure blow-out timescales. We place an upper limit of 3% on the disk surface brightness change between 3-5", including the locations of the disk warp, and the CO and dust clumps.

We discuss the new observations in the context of high-resolution multi-wavelength images and divide the disk asymmetries in two groups: axisymmetric and non-axisymmetric. The axisymmetric structures (warp, large-scale butterfly, etc.) are consistent with disk structure models that include interactions of a planetesimal belt and a non-coplanar giant planet. The non-axisymmetric features, however, require a different explanation.

Download/Website: `http://adsabs.harvard.edu/abs/2015ApJ...800..136A`

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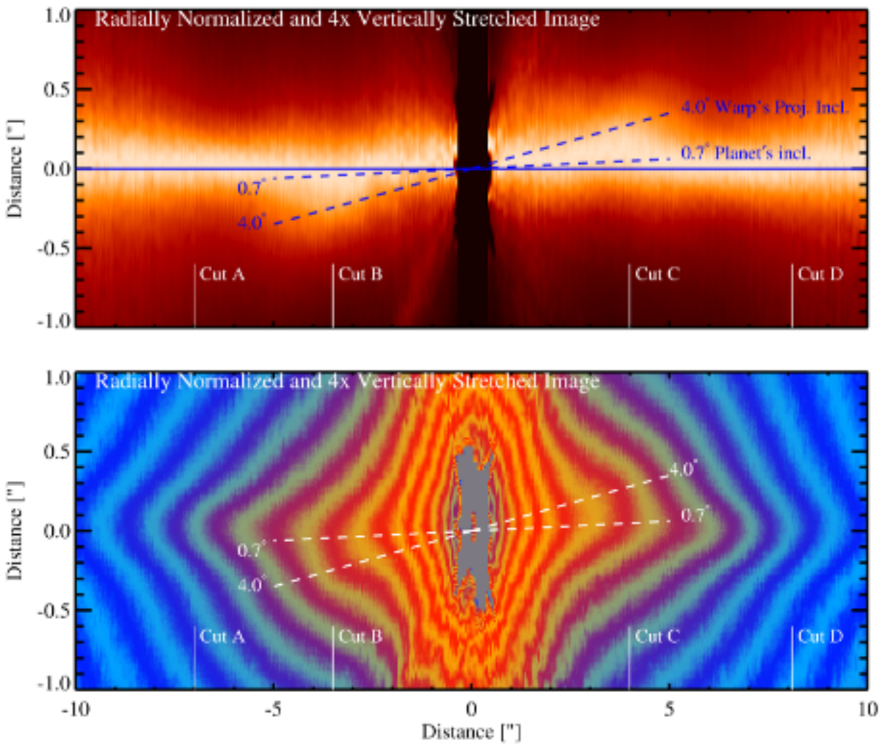

Figure 1: (Apai et al.) The warp and the planet's orbit in β Pictoris. The planet's inclination with respect to the disk midplane is $(0.7° \pm 0.7$, while the warp (vertically extended disk emission) is seen up to at least 4° from the midplane.

SOPHIE velocimetry of Kepler transit candidates XVI. Tomographic measurement of the low obliquity of KOI-12b, a warm Jupiter transiting a fast rotator.

V. Bourrier[1,2], *A. Lecavelier des Etangs*[1], *G. Hébrard*[1,3], *A. Santerne*[4,5], *M. Deleuil*[4], *J.M. Almenara*[6], *S.C.C. Barros*[4], *I. Boisse*[4], *A.S. Bonomo*[7], *G. Bruno*[4], *B. Courcol*[4], *R.F. Diaz*[2], *G. Montagnier*[1,3], *C. Moutou*[4,8]

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Astronomy & Astrophysics, in press (arXiv:1504.04130)

We present the detection and characterization of the transiting warm Jupiter KOI-12b, first identified with Kepler with an orbital period of 17.86 days. We combine the analysis of Kepler photometry with Doppler spectroscopy and line-profile tomography of time-series spectra obtained with the SOPHIE spectrograph to establish its planetary nature and derive its properties. To derive reliable estimates for the uncertainties on the tomographic model parameters, we devised an empirical method to calculate statistically independent error bars on the time-series spectra. KOI-12b has a radius of 1.43±0.13 $R_{\rm Jup}$ and a 3σ upper mass limit of $10 M_{\rm Jup}$. It orbits a fast-rotating star ($v\sin i_\star$ = 60.0±0.9 km s^{-1}) with mass and radius of 1.45±0.09 $M_{\rm Sun}$ and 1.63±0.15 $R_{\rm Sun}$, located at 426±40 pc from the Earth. Doppler tomography allowed a higher precision on the obliquity to be reached by comparison with the analysis of the Rossiter-McLaughlin radial velocity anomaly, and we found that KOI-12b lies on a prograde, slightly misaligned orbit with a low sky-projected obliquity $\lambda = 12.6^{+3.0}_{-2.9}{}^\circ$. The properties of this planetary system, with a 11.4 magnitude host-star, make of KOI-12b a precious target for future atmospheric characterization.

Download/Website: `http://arxiv.org/abs/1504.04130`

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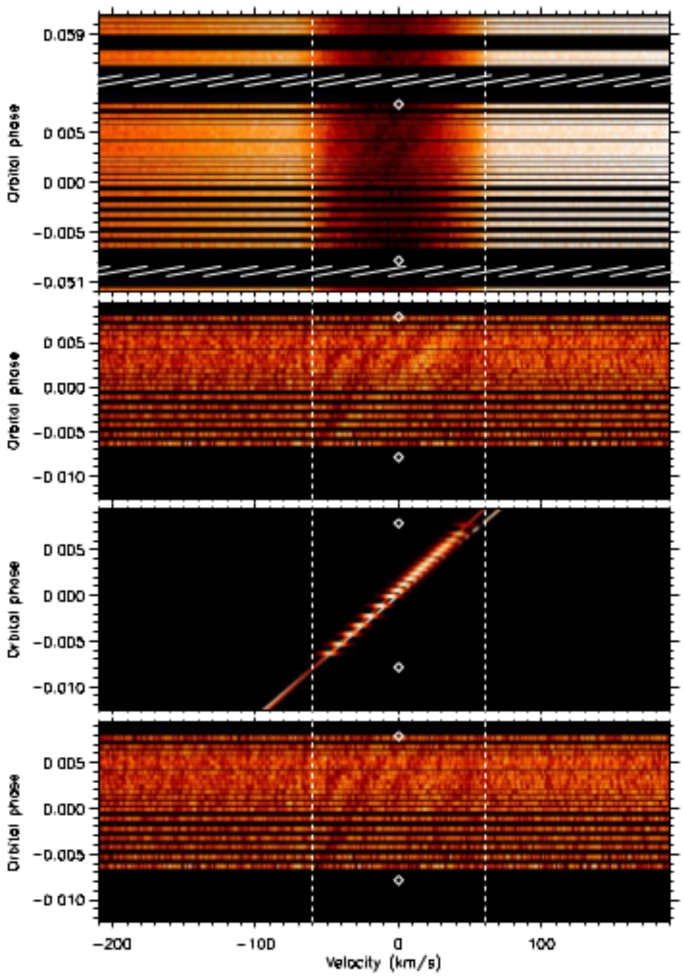

Figure 2: (Bourrier et al.) Map of the transit residuals between the time-series CCFs of KOI-12 produced by the SOPHIE pipeline and our best-fit model stellar profile. Abscissa corresponds to radial velocity relative to the star, ordinate to the orbital phase increasing vertically. Flux values increase from dark red to white. Vertical dashed white lines are plotted at $\pm\ v\sin i_\star$ = 60.0±0.9 km s^{-1}, and white diamonds indicate the time of the 1^{st} and 4^{th} contacts. The bright and wide feature that crosses the entire width of the line profile from ingress to egress is the signature of the warm Jupiter KOI-12b. This signature travels from negative to positive velocities during the transit, which shows that the planet is on a prograde orbit. The signature is also asymmetric, ingress occuring at a slightly higher absolute velocity (∼60 km s^{-1}) than egress (∼50 km s^{-1}). This is consistent with a moderately inclined orbit, the transit beginning near the equatorial plane and ending at a higher latitude. Line-profile tomography of the spectra yields a best-fit sky-projected obliquity $\lambda = 12.5^{+3.0}_{-2.9}$.

Planet formation around binary stars: Tatooine made easy

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The Astrophysical Journal, in press (arXive:1503.03876)

We examine characteristics of circumbinary orbits in the context of current planet formation scenarios. Analytical perturbation theory predicts the existence of nested circumbinary orbits that are generalizations of circular paths around a single star. These orbits have forced eccentric motion aligned with the binary as well as higher frequency oscillations, yet they do not cross, even in the presence of massive disks and perturbations from large planets. For this reason, dissipative gas and planetesimals can settle onto these "most circular" orbits, facilitating the growth of protoplanets. Outside a region close to the binary where orbits are generally unstable, circumbinary planets form in much the same way as their cousins around a single star. Here, we review the theory and confirm its predictions with a suite of representative simulations. We then consider the circumbinary planets discovered with NASAs *Kepler* satellite. These Neptune- and Jupiter-size planets, or their planetesimal precursors, may have migrated inward to reach their observed orbits, since their current positions are outside of unstable zones caused by overlapping resonances. *In situ* formation without migration seems less likely, only because the surface density of the protoplanetary disks must be implausibly high. Otherwise, the circumbinary environment is friendly to planet formation, and we expect that many Earth-like "Tatooines" will join the growing census of circumbinary planets.

Download/Website: `http://www.physics.utah.edu/˜bromley/tatooine/keplercb.pdf`

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Formation of Super-Earth Mass Planets at 125–250 AU from a Solar-type Star

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The Astrophysical Journal, in press (arXiv:1501.05659)

We investigate pathways for the formation of icy super-Earth mass planets orbiting at 125–250 AU around a 1 $M_\odot$ star. An extensive suite of coagulation calculations demonstrates that swarms of 1 cm to 10 m planetesimals can form super-Earth mass planets on time scales of 1–3 Gyr. Collisional damping of $10^{-2} - 10^{2}$ cm particles during oligarchic growth is a highlight of these simulations. In some situations, damping initiates a second runaway growth phase where 1000–3000 km protoplanets grow to super-Earth sizes. Our results establish the initial conditions and physical processes required for *in situ* formation of super-Earth planets at large distances from the host star. For nearby dusty disks in HD 107146, HD 202628, and HD 207129, ongoing super-Earth formation at 80–150 AU could produce gaps and other structures in the debris. In the solar system, forming a putative planet X at $a \leq$ 300 AU ($a \geq 1000$ AU) requires a modest (very massive) protosolar nebula.

Download/Website: `http://arxiv.org/abs/1501.05659`

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Period, epoch, and prediction errors of ephemerides from continuous sets of timing measurements

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Astronomy & Astrophysics, in press (arXiv:1503.05368D)

Space missions such as *Kepler* and *CoRoT* have led to large numbers of eclipse or transit measurements in nearly continuous time series. This paper shows how to obtain the period error in such measurements from a basic linear least-squares fit, and how to correctly derive the timing error in the prediction of future transit or eclipse events. Assuming strict periodicity, a formula for the period error of these time series is derived, $\sigma_P = \sigma_T \, (12/(N^3 - N))^{1/2}$, where σ_P is the period error, σ_T the timing error of a single measurement, and N the number of measurements. Compared to the iterative method for period error estimation by Mighell & Plavchan (2013), this much simpler formula leads to smaller period errors, whose correctness has been verified through simulations. For the prediction of times of future periodic events, usual linear ephemeris were epoch errors are quoted for the first time measurement, are prone to an overestimation of the error of that prediction. This may be avoided by a correction for the duration of the time series. An alternative is the derivation of ephemerides whose reference epoch and epoch error are given for the centre of the time series. For long continuous or near-continuous time series whose acquisition is completed, such central epochs should be the preferred way for the quotation of linear ephemerides. While this work was motivated from the analysis of eclipse timing measures in space-based light curves, it should be applicable to any other problem with an uninterrupted sequence of discrete timings for which the determination of a zero point, of a constant period and of the associated errors is needed.

Download/Website: `http://cdsads.u-strasbg.fr/abs/2015arXiv150305368D`

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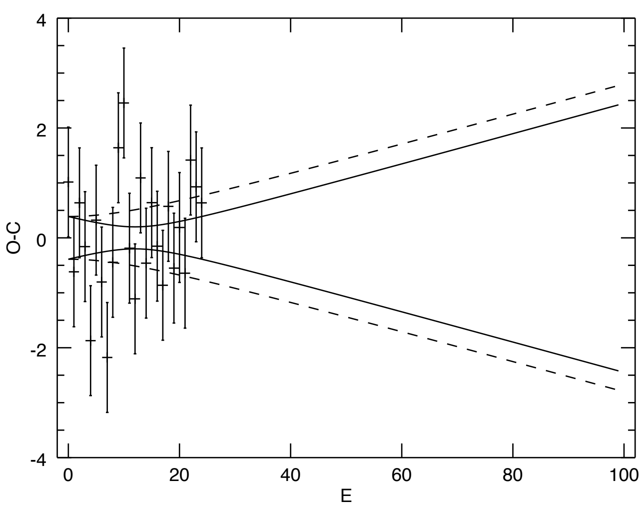

Figure 3: (Deeg) Expected timing uncertainties during and after a sequence of timing measurements, based on an ephemeris with given errors in epoch and period. The dashed line gives the development of the 1-sigma uncertainty from an error sum using the period error and the epoch error at the beginning of the sequence. The solid lines outline the correct timing uncertainty, with the epoch error being derived for the centre of the sequence. For epochs beyond the end of the sequence, this uncertainty is also identical to the prediction uncertainty given by Eq. 18.

Three Super-Earths Orbiting HD 7924

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The Astrophysical Journal, in press (arXiv:1504.06629)

We report the discovery of two super-Earth mass planets orbiting the nearby K0.5 dwarf HD 7924 which was previously known to host one small planet. The new companions have masses of 7.9 and 6.4 $M_{\oplus}$, and orbital periods of 15.3 and 24.5 days. We perform a joint analysis of high-precision radial velocity data from Keck/HIRES and the new Automated Planet Finder Telescope (APF) to robustly detect three total planets in the system. We refine the ephemeris of the previously known planet using five years of new Keck data and high-cadence observations over the last 1.3 years with the APF. With this new ephemeris, we show that a previous transit search for the innermost planet would have covered 70% of the predicted ingress or egress times. Photometric data collected over the last eight years using the Automated Photometric Telescope shows no evidence for transits of any of the planets, which would be detectable if the planets transit and their compositions are hydrogen-dominated. We detect a long-period signal that we interpret as the stellar magnetic activity cycle since it is strongly correlated with the Ca II H & K activity index. We also detect two additional short-period signals that we attribute to rotationally-modulated starspots and a one month alias. The high-cadence APF data help to distinguish between the true orbital periods and aliases caused by the window function of the Keck data. The planets orbiting HD 7924 are a local example of the compact, multi-planet systems that the Kepler Mission found in great abundance.

Download/Website: `http://arxiv.org/abs/1504.06629`

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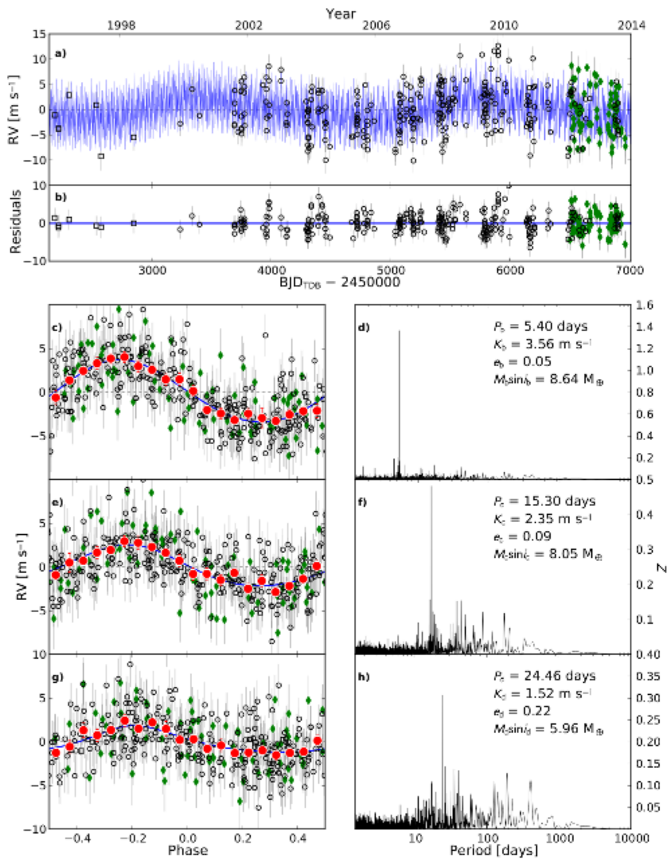

Figure 4: (Fulton et al.) Best-fit 3-planet Keplerian orbital model plus one additional long-period Keplerian to model the stellar magnetic activity cycle. The model plotted is the one that produces the lowest χ^2 while the orbital parameters are the median values of the posterior distributions. **a)** Full binned RV time series. Open black squares indicate pre-upgrade Keck/HIRES data, open black circles are post-upgrade Keck/HIRES data, and filled green diamonds are APF data. The thin blue line is the best fit 3-planet plus stellar activity model. We add in quadrature the RV jitter term with the measurement uncertainties for all RVs. **b)** Residuals to the best fit 3-planet plus stellar activity model. **c)** Binned RVs phase-folded to the ephemeris of planet b. The two other planets and the long-period stellar activity signal have been subtracted. The small point colors and symbols are the same as in panel **a**. For visual clarity, we also bin the velocities in 0.05 units of orbital phase (red circles). The phase-folded model for planet b is shown as the blue line. **d)** 2DKLS periodogram comparing a 2-planet plus activity model to the full 3-planet fit when planet b is included. Panels **e)** and **f)**, and panels **g)** and **h)** are the same as panels **c)** and **d)** but for planets HD 7924 c and HD 7924 d respectively.

Conditions for water ice lines and Mars-mass exomoons around accreting super-Jovian planets at 1 - 20 AU from Sun-like stars

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Astronomy & Astrophysics, in press (2015arXiv150401668H)

Exomoon detections might be feasible with NASA's Kepler or ESA's upcoming PLATO mission or the ground-based E-ELT. To use observational resources most efficiently we need to know where the largest, most easily detectable moons can form. We explore the possibility of large exomoons by following the movement of water (H_2O) ice lines in the accretion disks around young super-Jovian planets. We want to know how different heating sources in those disks affect the H_2O ice lines and the formation of large, icy moons. We simulate 2D rotationally symmetric accretion disks in hydrostatic equilibrium around super-Jovian exoplanets. The energy terms in our semi-analytical model – (1) viscous heating, (2) planetary illumination, (3) accretional heating, and (4) stellar illumination – are fed by pre-computed planet evolution tracks. We consider planets accreting 1 to 12 Jupiter masses at distances between 1 and 20 AU to a Sun-like star. Accretion disks around Jupiter-mass planets closer than $\sim$4.5 AU to Sun-like stars do not feature H_2O ice lines, but the most massive super-Jovians can form icy satellites as close as $\sim$3 AU to Sun-like stars. Super-Jovian planets forming beyond $\sim$5 AU can host Mars-mass moons. We study a broad range of disk parameters for planets at 5.2 AU and find that the H_2O ice lines are universally between $\sim$15 and 30 Jupiter radii when the last generation of moons is forming. If the abundant population of super-Jovian planets at $\sim$1 AU formed in situ, then they should lack giant icy moons because their disks did not host H_2O ice in the final stages of accretion. In the more likely case that these planets migrated to their current locations from beyond a few AU, they might be orbited by large, H_2O-rich moons. In this case, Mars-mass ocean moons might be common in the stellar habitable zones. Future exomoon searches can provide powerful constraints on the formation and migration history of giant exoplanets.

Download/Website: `http://dx.doi.org/10.1051/0004-6361/201425487`

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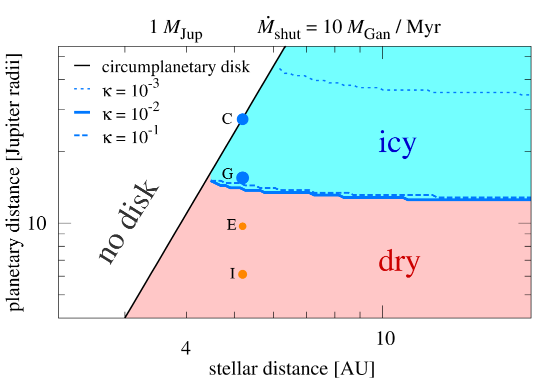

Figure 5: (Heller & Pudritz) Distances of the H_2O ice lines in a circumplanetary disk (CPD) around a Jupiter-like planet (ordinate) as a function of distance to a Sun-like star (abscissa) at the time of moon formation shutdown. Three Planck opacities through the CPD are tested in each panel (in units of $\mathrm{m}^2\,\mathrm{kg}^{-1}$, see legend), the solid blue line denotes our fiducial parameterization. The orbits of the Galilean satellites are represented by filled circles. The black solid line shows the CPD's centrifugal radius (Machida et al. 2008). Closer than $\sim$4.5 AU to the star, the CPD around this Jupiter-like planet cannot form icy moons. Note how the ice line recedes from the planet as stellar illumination increases towards the star. Closer than $\sim$3 AU the CPD disappears completely.

Polarization in exoplanetary systems caused by transits, grazing transits, and starspots

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The Astrophysical Journal, in press (arXiv:1504.02943)

We present results of numerical simulations of flux and linear polarization variations in transiting exoplanetary systems, caused by the host star disk symmetry breaking. We consider different configurations of planetary transits depending on orbital parameters. Starspot contribution to the polarized signal is also estimated. Applying the method to known systems and simulating observational conditions, a number of targets is selected where transit polarization effects could be detected. We investigate several principal benefits of the transit polarimetry, particularly, for determining orbital spatial orientation and distinguishing between grazing and near-grazing planets. Simulations show that polarization parameters are also sensitive to starspots, and they can be used to determine spot positions and sizes.

Download/Website: `http://arxiv.org/abs/1504.02943`

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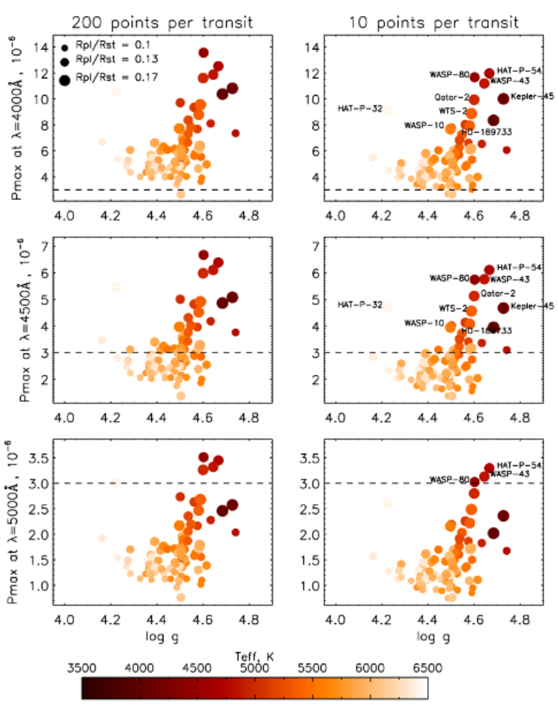

Figure 6: (Kostogryz et al.) Maximum polarization degree during transits for 88 exoplanetary systems as a function of the surface gravity of the host stars. The color scale refers to the effective temperature. The size of each circle designates the planet-to-star radii ratio (in the range from 0.1 to 0.17). The top, middle and bottom plots show the maximum polarization degree at the wavelengths of 4000Å, 4500Å and 5000Å, respectively. The left plots were simulated assuming 200 data points per transit and the right plots with 10 points per transit. The horizontal dashed line marks the lower limit (3σ) of achievable polarization sensitivity. The names on the plot refer to the most promising targets for polarimetric observations.

Disentangling 2:1 resonant radial velocity orbits from eccentric ones and a case study for HD 27894

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Astronomy & Astrophysics, in press (arXiv 1503.07769)

In radial velocity (RV) observations, a pair of extrasolar planets near a 2:1 orbital resonance can be misinterpreted as a single eccentric planet, if data are sparse and measurement precision insufficient to distinguish between these models. Using the Exoplanet Orbit Database (EOD), we determine the fraction of alleged single-planet RV detected systems for which a 2:1 resonant pair of planets is also a viable model and address the question of how the models can be disentangled. By simulation we quantified the mismatch arising from applying the wrong model. Model alternatives are illustrated using the supposed single-planet system HD 27894 for which we also study the dynamical stability of near-2:1 resonant solutions. Using EOD values of the data scatter around the fitted single-planet Keplerians, we find that for 74% of the 254 putative single-planet systems, a 2:1 resonant pair cannot be excluded as a viable model, since the error due to the wrong model is smaller than the scatter. For 187 EOD stars χ^2-probabilities can be used to reject the Keplerian models with a confidence of 95% for 54% of the stars and with 99.9% for 39% of the stars. For HD 27894 a considerable fit improvement is obtained when adding a low-mass planet near half the orbital period of the known Jovian planet. Dynamical analysis demonstrates that this system is stable when both planets are initially placed on circular orbits. For fully Keplerian orbits a stable system is only obtained if the eccentricity of the inner planet is constrained to < 0.3. A large part of the allegedly RV detected single-planet systems should be scrutinized in order to determine the fraction of systems containing near-2:1 resonant pairs of planets. Knowing the abundance of such systems will allow us to revise the eccentricity distribution for extrasolar planets and provide direct constraints for planetary system formation.

Download/Website: `http://arxiv.org/abs/1503.07769`

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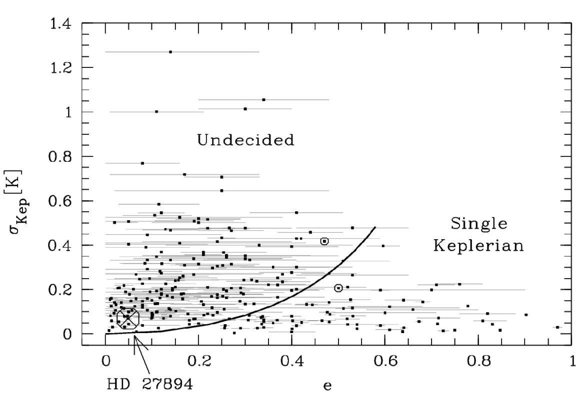

Figure 7: (Kürster et al.) Rms scatter σ_{Kep} of the RV solutions around single-planet Keplerian fits for our sample of 254 stars for which the EOD provides these values (dots). The scatter values are plotted as a function of the formal eccentricity of the Keplerian fit and in units of its RV semi-amplitude. 1σ–errors of the eccentricity are represented by grey horizontal bars. The large circle and cross mark HD 27894. Resulting from our simulations, the solid curve represents the deviation σ_{model} between the single-planet Keplerian model and the model for the 2:1 resonant pair of planets. Scatter values above the curve are larger than the expected deviation arising from applying the erroneous model (single Keplerian instead of 2:1 resonant pair) so that both models are possible, whereas scatter values below the curve are too small to assume an erroneous model and therefore favour the single Keplerian.

Impact of $\eta_{\rm earth}$ on the capabilities of affordable space missions to detect biosignatures on extrasolar planets

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The Astrophysical Journal, in press (arXiv:1504.08232)

We present an analytic model to estimate the capabilities of space missions dedicated to the search for biosignatures in the atmosphere of rocky planets located in the habitable zone of nearby stars. Relations between performance and mission parameters such as mirror diameter, distance to targets, and radius of planets, are obtained. Two types of instruments are considered: coronagraphs observing in the visible, and nulling interferometers in the thermal infrared. Missions considered are: single-pupil coronagraphs with a 2.4 m primary mirror, and formation flying interferometers with 4×0.75 m collecting mirrors. The numbers of accessible planets are calculated as a function of $\eta_{\rm earth}$. When Kepler gives its final estimation for $\eta_{\rm earth}$, the model will permit a precise assessment of the potential of each instrument. Based on current estimations, $\eta_{\rm earth} = 10\%$ around FGK stars and 50% around M stars, the coronagraph could study in spectroscopy only ~ 1.5 relevant planets, and the interferometer ~ 14.0. These numbers are obtained under the major hypothesis that the exozodiacal light around the target stars is low enough for each instrument. In both cases, a prior detection of planets is assumed and a target list established. For the long-term future, building both types of spectroscopic instruments, and using them on the same targets, will be the optimal solution because they provide complementary information. But as a first affordable space mission, the interferometer looks the more promising in term of biosignature harvest.

Download/Website: `http://arxiv.org/abs/1504.08232`

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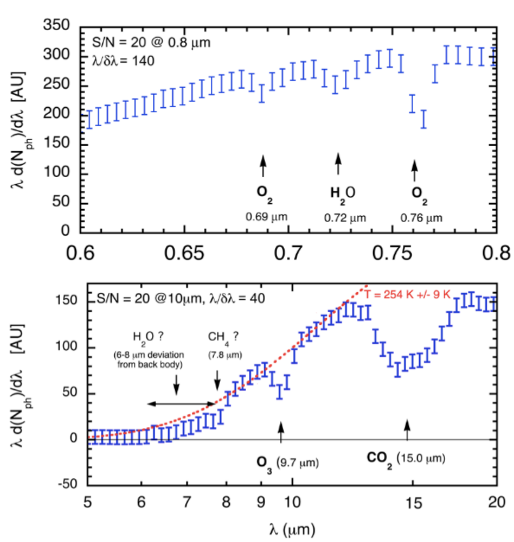

Figure 8: (Léger et al.) Earth spectrum in the visible, and IR seen by a coronagraph, and an interferometer.

Evidence for a spectroscopic direct detection of reflected light from 51 Peg b

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Astronomy & Astrophysics, published (ADS-2015A&A...576A.134M)

Context: The detection of reflected light from an exoplanet is a difficult technical challenge at optical wavelengths. Even though this signal is expected to replicate the stellar signal, not only is it several orders of magnitude fainter, but it is also hidden among the stellar noise. Aims: We apply a variant of the cross-correlation technique to HARPS observations of 51 Peg to detect the reflected signal from planet 51 Peg b. Methods: Our method makes use of the cross-correlation function (CCF) of a binary mask with high-resolution spectra to amplify the minute planetary signal that is present in the spectra by a factor proportional to the number of spectral lines when performing the cross correlation. The resulting cross-correlation functions are then normalized by a stellar template to remove the stellar signal. Carefully selected sections of the resulting normalized CCFs are stacked to increase the planetary signal further. The recovered signal allows probing several of the planetary properties, including its real mass and albedo. Results.We detect evidence for the reflected signal from planet 51 Peg b at a significance of 3-$\sigma_{\rm noise}$. The detection of the signal permits us to infer a real mass of $0.46^{+0.06}_{-0.01}$ $\rm M_{Jup}$ (assuming a stellar mass of 1.04 $\rm M_{\odot}$) for the planet and an orbital inclination of 80^{+10}_{-19} degrees. The analysis of the data also allows us to infer a tentative value for the (radius-dependent) geometric albedo of the planet. The results suggest that 51Peg b may be an inflated hot Jupiter with a high albedo (e.g., an albedo of 0.5 yields a radius of 1.9 ± 0.3 $\rm R_{Jup}$ for a signal amplitude of $6.0\pm0.4\times10^{-5}$). Conclusions: We confirm that the method we perfected can be used to retrieve an exoplanet's reflected signal, even with current observing facilities. The advent of next generation of instruments (e.g. ESPRESSO@VLT-ESO) and observing facilities (e.g. a new generation of ELT telescopes) will yield new opportunities for this type of technique to probe deeper into exoplanets and their atmospheres.

Download/Website: `http://arxiv.org/abs/1504.05962`

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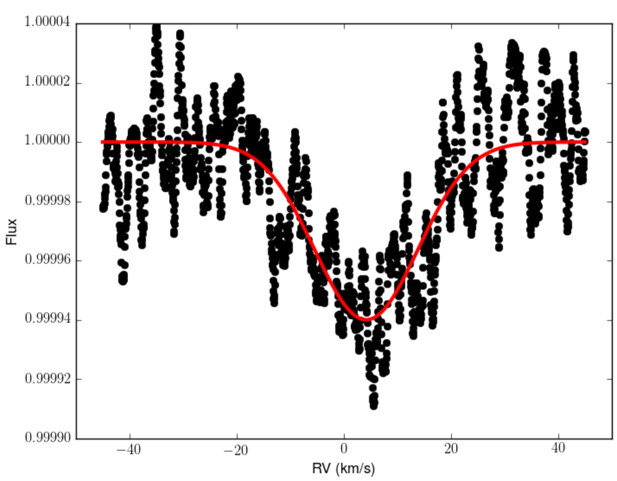

Figure 9: (Martins et al.) Detected signal and fitted CCF.

No variations in transit times for Qatar-1 b

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Astronomy & Astrophysics, in press (arXiv:1503.07191)

The transiting hot Jupiter planet Qatar-1 b was presented to exhibit variations in transit times that could be of perturbative nature. A hot Jupiter with a planetary companion on a nearby orbit would constitute an unprecedented planetary configuration, important for theories of formation and evolution of planetary systems. We performed a photometric follow-up campaign to confirm or refute transit timing variations. We extend the baseline of transit observations by acquiring 18 new transit light curves acquired with 0.6-2.0 m telescopes. These photometric time series, together with data available in the literature, were analyzed in a homogenous way to derive reliable transit parameters and their uncertainties. We show that the dataset of transit times is consistent with a linear ephemeris leaving no hint for any periodic variations with a range of 1 min. We find no compelling evidence for the existence of a close-in planetary companion to Qatar-1 b. This finding is in line with a paradigm that hot Jupiters are not components of compact multi-planetary systems. Based on dynamical simulations, we place tighter constraints on a mass of any fictitious nearby planet in the system. Furthermore, new transit light curves allowed us to redetermine system parameters with the precision better than that reported in previous studies. Our values generally agree with previous determinations.

Download/Website: `http://www.home.umk.pl/~gmac/TTV`

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Three red giants with substellar-mass companions.

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The Astrophysical Journal, published (arXiv:1501.07076)

We present three giant stars from the ongoing Penn State-Toruń Planet Search with the Hobby-Eberly Telescope, which exhibit radial velocity variations that point to a presence of planetary –mass companions around them. BD+49 828 is a $M = 1.52 \pm 0.22 M_{\odot}$ K0 giant with a $m \sin i = 1.6^{+0.4}_{-0.2} M_J$ minimum mass companion in $a = 4.2^{+0.32}_{-0.2}$ AU (2590^{+300}_{-180}d), $e = 0.35^{+0.24}_{-0.10}$ orbit. HD 95127, a $\log L/L_{\odot} = 2.28 \pm 0.38$, $R = 20 \pm 9 R_{\odot}$, $M = 1.20 \pm 0.22 M_{\odot}$ K0 giant has a m*sini*=$5.01^{+0.61}_{-0.44} M_J$ minimum mass companion in $a = 1.28^{+0.01}_{-0.01}$ AU (482^{+5}_{-5}d), $e = 0.11^{+0.15}_{-0.06}$ orbit. Finally, HD 216536, is a $M = 1.36 \pm 0.38 M_{\odot}$ K0 giant with a $m \sin i = 1.47^{+0.20}_{-0.12} M_J$ minimum mass companion in $a = 0.609^{+0.002}_{-0.002}$ AU ($148.6^{+0.7}_{-0.7}$d), $e = 0.38^{+0.12}_{-0.10}$ orbit. Both, HD 95127 b and HD 216536 b in their compact orbits, are very close to the engulfment zone and hence prone to ingestion in the near future. BD+49 828 b is among the longest period planets detected with the radial velocity technique until now and it will remain unaffected by stellar evolution up to a very late stage of its host. We discuss general properties of planetary systems around evolved stars and planet survivability using existing data on exoplanets in more detail.

Download/Website: `http://iopscience.iop.org/0004-637X/803/1/1/`

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Confirmation and characterization of the protoplanet HD100546 b – Direct evidence for gas giant planet formation at 50 au

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The Astrophysical Journal, accepted for publication (arXiv:1412.5173)

We present the first multi-wavelength, high-contrast imaging study confirming the protoplanet embedded in the disk around the Herbig Ae/Be star HD100546. The object is detected at L' ($\sim 3.8\,\mu m$) and M' ($\sim 4.8\,\mu m$), but not at K_s ($\sim 2.1\,\mu m$), and the emission consists of a point source component surrounded by spatially resolved emission. For the point source component we derive apparent magnitudes of $L' = 13.92 \pm 0.10$ mag, $M' = 13.33 \pm 0.16$ mag, and $K_s > 15.43 \pm 0.11$ mag (3σ limit), and a separation and position angle of $(0.457 \pm 0.014)''$ and $(8.4 \pm 1.4)^\circ$, and $(0.472 \pm 0.014)''$ and $(9.2 \pm 1.4)^\circ$ in L' and M', respectively. We demonstrate that the object is co-moving with HD100546 and can reject any (sub-)stellar fore-/background object. Fitting a single temperature blackbody to the observed fluxes of the point source component yields an effective temperature of $T_{eff} = 932^{+193}_{-202}$ K and a radius for the emitting area of $R = 6.9^{+2.7}_{-2.9}\,\mathrm{R_{Jupiter}}$. The best-fit luminosity is $L = (2.3^{+0.6}_{-0.4}) \cdot 10^{-4}\,L_{\rm sun}$. We quantitatively compare our findings with predictions from evolutionary and atmospheric models for young, gas giant planets, discuss the possible existence of a warm, circumplanetary disk, and note that the de-projected physical separation from the host star of (53 ± 2) au poses a challenge standard planet formation theories. Considering the suspected existence of an additional planet orbiting at ∼13–14 au, HD100546 appears to be an unprecedented laboratory to study the formation of multiple gas giant planets empirically.

Download/Website: `http://arxiv.org/abs/1412.5173`

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High-contrast imaging constraints on gas giant planet formation – The Herbig Ae/Be star opportunity

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Astrophysics and Space Science, accepted as invited short review in Herbig Ae/Be stars special issue (arXiv:1504.04880)

Planet formation studies are often focused on solar-type stars, implicitly considering our Sun as reference point. This approach overlooks, however, that Herbig Ae/Be stars are in some sense much better targets to study planet formation processes empirically, with their disks generally being larger, brighter and simply easier to observe across a large wavelength range. In addition, massive gas giant planets have been found on wide orbits around early type stars, triggering the question if these objects did indeed form there and, if so, by what process. In the following I briefly review what we currently know about the occurrence rate of planets around intermediate mass stars, before discussing recent results from Herbig Ae/Be stars in the context of planet formation. The main emphasis is put on spatially resolved polarized light images of potentially planet forming disks and how these images - in combination with other data - can be used to empirically constrain (parts of) the planet formation process. Of particular interest are two objects, HD100546 and HD169142, where, in addition to intriguing morphological structures in the disks, direct observational evidence for (very) young planets has been reported. I conclude with an outlook, what further progress we can expect in the very near future with the next generation of high-contrast imagers at 8-m class telescopes and their synergies with ALMA.

Download/Website: `http://arxiv.org/abs/1504.04880`

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What is the mass of α Cen B b?

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The Astrophysical Journal, in press (arXiv:1503.01772)

We investigate the possibility of constraining the sin i degeneracy of α Cen B b – with orbital period P=3.24 d; a = 0.042 AU; m sin i = 1.1 $M_\oplus$ – to estimate the true mass of the newly reported terrestrial exoplanet in the nearest stellar system to our Sun. We present detailed numerical simulations of the dynamical stability of the exoplanet in the α Cen AB binary system for a range of initial inclinations, eccentricities, and semi-major axes. The system represents a benchmark case for the interplay of the Kozai mechanism, general relativistic and tidal forces. From our simulations, there is only a small boundary in initial inclinations and initial semi-major axes that result in the migration via the Kozai mechanism of α Cen B b to its present location. Inside this boundary, the planet orbit is stable for up to 1 Gyr against the Kozai mechanism, and outside this boundary the planet collides with α Cen B or is ejected. In our three simulations where the planet migrates in towards the star via the Kozai mechanism, the final inclination is 46°–53° relative to the AB orbital plane, lower than the initial inclination of 75° in each case. We discuss inclination constraints from the formation of α Cen B b in situ at its present location, migration in a proto-planetary disk, or migration in resonance with additional planets. We conclude that α Cen B b probably has a mass of less than 2.7 $M_\oplus$, implying a likely terrestrial composition warranting future confirmation.

Download/Website: `http://www.plavchan.com`

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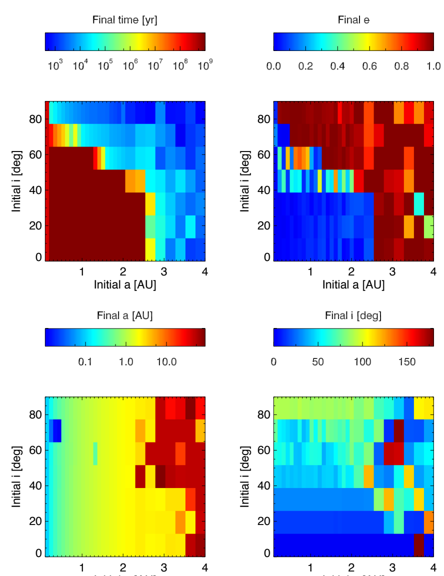

Figure 10: (Plavchan et al.) Simulation results summary for a set of simulations for a range of initial inclinations and semi-major axes, all with an initial eccentricity of zero, including both the tidal forces and general relativistic precession, and with simulations carried out for a duration of 1 Gyr (with the exception of simulations with a starting semi-major axis of 0.1 AU, which were halted after a duration of ∼250 Myr. These plots show a clear stability and ejection regions for simulated planets. Top left: the final integration time; Top right: final eccentricity; Bottom left: final semi-major axis; Bottom right: final inclination.

Know the Star, Know the Planet. III. Discovery of Late-Type Companions to Two Exoplanet Host Stars

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The Astronomical Journal, Published, 2015AJ....149..118R

We discuss two multiple star systems that host known exoplanets: HD 2638 and 30 Ari B. Adaptive optics imagery revealed an additional stellar companion to both stars. We collected multi-epoch images of the systems with Robo-AO and the PALM-3000 adaptive optics systems at Palomar Observatory and provide relative photometry and astrometry. The astrometry indicates that the companions share common proper motion with their respective primaries. Both of the new companions have projected separations less than 30 AU from the exoplanet host star. Using the projected separations to compute orbital periods of the new stellar companions, HD 2638 has a period of 130 yrs and 30 Ari B has a period of 80 years. Previous studies have shown that the true period is most likely within a factor of three of these estimated values. The additional component to the 30 Ari makes it the second confirmed quadruple system known to host an exoplanet. HD 2638 hosts a hot Jupiter and the discovery of a new companion strengthens the connection between hot Jupiters and binary stars. We place the systems on a color-magnitude diagram and derive masses for the companions which turn out to be roughly 0.5 solar mass stars.

Download/Website: `http://arxiv.org/abs/1503.01211`

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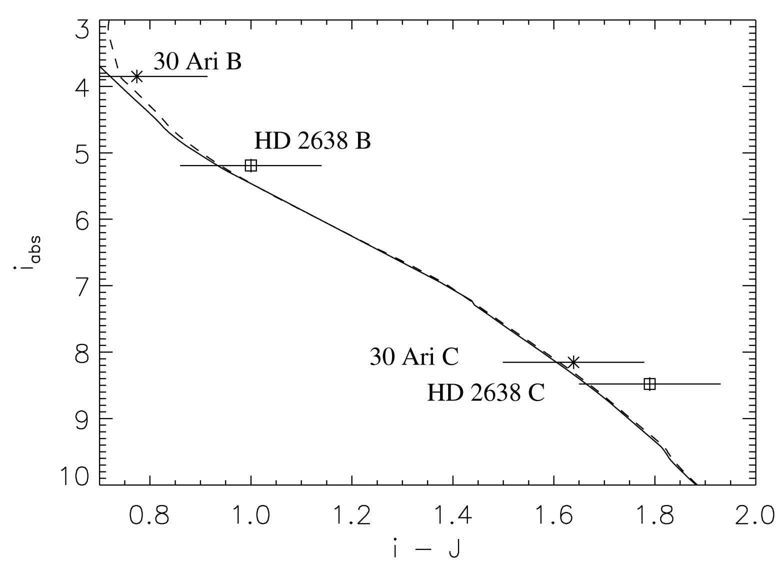

Figure 11: (Roberts et al.) Position of the binary components in the color-magnitude diagram. The full line shows a 1 Gyr isochrone (correspondong to 30 Ari B) and the dashed line shows the 3 Gyr isochrone (corresponding to HD 2638), both with solar metallicity.

Know the Star, Know the Planet. IV. A Stellar Companion to the Host Star of the Eccentric Exoplanet HD 8673b

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The Astronomical Journal, Published, 2015AJ....149..144R

HD 8673 hosts a massive exoplanet in a highly eccentric orbit (e=0.723). Based on two epochs of speckle interferometry a previous publication identified a candidate stellar companion. We observed HD 8673 multiple times with the 10 m Keck II telescope, the 5 m Hale telescope, the 3.63 m AEOS telescope and the 1.5m Palomar telescope in a variety of filters with the aim of confirming and characterizing the stellar companion. We did not detect the candidate companion, which we now conclude was a false detection, but we did detect a fainter companion. We collected astrometry and photometry of the companion on six epochs in a variety of filters. The measured differential photometry enabled us to determine that the companion is an M6V-M8V star. We also constrain the orbit of the stellar companion based on the limited astrometry and discuss the impact the stellar companion may have had on the exoplanet.

Download/Website: `http://arxiv.org/abs/1502.06630`

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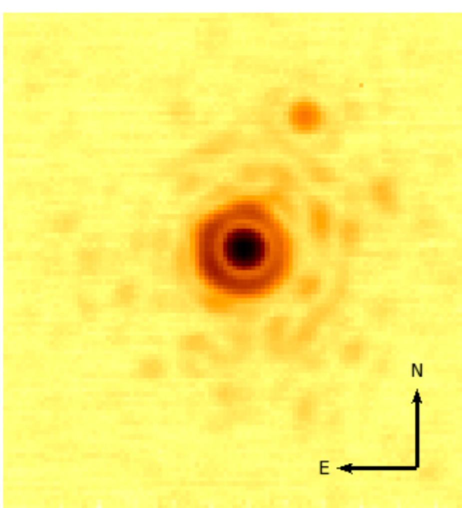

Figure 12: (Roberts et al.) Discovery $Br\gamma$ image of the HD 8673 binary system taken with NIRC2 at the Keck II telescope on 12 June 2012. North is up in the image and East is to the left. This is a sub-image of the full image and is approximately $1''.2$ across.

The Water Abundance of the Directly Imaged Substellar Companion κ And b Retrieved from a Near Infrared Spectrum

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The Astrophysical Journal, in press (arXiv:1504.00217)

Recently, 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 increasingly 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 κ And b, a directly imaged substellar companion to a young B9 star. We fit the emission spectrum model utilising a Markov Chain Monte Carlo algorithm. We estimate the abundance of water vapour, and its uncertainty, in the atmosphere of the object. We also place upper limits on the abundances of CO_2 and CH_4 and constrain the pressure-temperature profile of the atmosphere. We compare 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. We find that the water abundances of the hot Jupiters and the two directly imaged planets inhabit overlapping regions of parameter space and that their P-T profiles are qualitatively similar, despite the wide range of effective temperatures and incident stellar fluxes for these objects.

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

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WASP-80b has a dayside within the T-dwarf range

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[12] N. Copernicus Astronomical Centre, Polish Academy of Sciences, Bartycka 18, 00-716 Warsaw, Poland

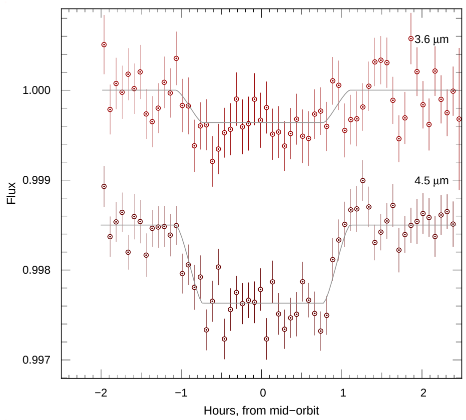
Monthly Notices of the Royal Astronomical Society, in press (arXiv:1503.08152)

WASP-80b is a missing link in the study of exo-atmospheres. It falls between the warm Neptunes and the hot Jupiters and is amenable for characterisation, thanks to its host star's properties. We observed the planet through transit and during occultation with *Warm Spitzer*. Combining our mid-infrared transits with optical time series, we find that the planet presents a transmission spectrum indistinguishable from a horizontal line. In emission, WASP-80b is the intrinsically faintest planet whose dayside flux has been detected in both the 3.6 and 4.5 μm *Spitzer* channels. The depths of the occultations reveal that WASP-80b is as bright and as red as a T4 dwarf, but that its temperature is cooler. If planets go through the equivalent of an L-T transition, our results would imply this happens at cooler temperatures than for brown dwarfs. Placing WASP-80b's dayside into a colour-magnitude diagram, it falls exactly at the junction between a blackbody model and the T-dwarf sequence; we cannot discern which of those two interpretations is the more likely. WASP-80b's flux density is as low as GJ 436b at 3.6 μm; the planet's dayside is also fainter, but bluer than HD 189733Ab's nightside (in the [3.6] and [4.5] *Spitzer* bands). Flux measurements on other planets with similar equilibrium temperatures are required to establish whether irradiated gas giants, like brown dwarfs, transition between two spectral classes. An eventual detection of methane absorption in transmission would also help lift that degeneracy.

We obtained a second series of high-resolution spectra during transit, using HARPS. We reanalyse the Rossiter-McLaughlin effect. The data now favour an aligned orbital solution and a stellar rotation nearly three times slower than stellar line broadening implies. A contribution to stellar line broadening, maybe macroturbulence, is likely to have been underestimated for cool stars, whose rotations have therefore been systematically overestimated.

Download/Website: `http://arxiv.org/abs/1503.08152`

Contact: `amaury.triaud@utoronto.ca`



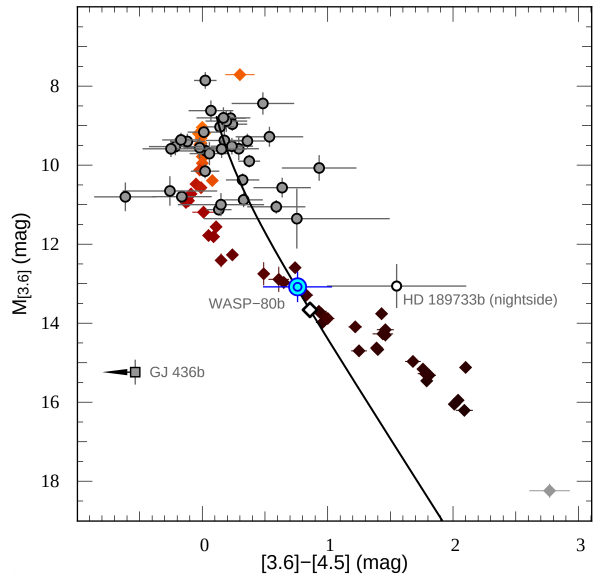


Figure 13: (Triaud et al.) **left**: Two occultations of WASP-80b measured in the *Spitzer* 3.6 and 4.5 μm channels. **right**: Our occupations inserted into a colour-magnitude diagram. Circles represent planets. Diamonds show the location of ultra-cool dwarfs, colour-coded as a function of spectral type (from M5 to Y1). Grey symbols indicate no spectral classification. The blackline outlines the colours of 1 R_{jup} blackbody radiators with effective temperatures less than 4,000K. The empty diamond on this line show 800 K. WASP-80b falls amongst the T4 dwarfs, but is also consistent with a blackbody.

Strong effect of the cluster environment on the size of protoplanetary discs?

K. Vincke, A. Breslau, S. Pfalzner
Max Planck Institute for Radio Astronomy, Auf dem Hügel 69, 53129 Bonn, Germany

Astronomy & Astrophysics, in press, arxiv:1504.06092

Context. Most stars are born in clusters, thus the protoplanetary discs surrounding the newly formed stars might be influenced by this environment. Isolated star-disc encounters have previously been studied, and it was shown that very close encounters are necessary to completely destroy discs. However, relatively distant encounters are still able to change the disc size considerably.
Aims. We quantify the importance of disc-size reduction that is due to stellar encounters in an entire stellar population.
Method. We modelled young, massive clusters of different densities using the code Nbody6 to determine the statistics of stellar encounter parameters. In a second step, we used these parameters to investigate the effect of the environments on the disc size. For this purpose, we performed a numerical experiment with an artificial initial disc size of 10^5 AU.
Results. We quantify to which degree the disc size is more sensitive to the cluster environment than to the disc mass or frequency. We show that in all investigated clusters a large portion of discs is significantly reduced in size. After 5 Myr, the fraction of discs smaller than 1000 AU in ONC-like clusters with an average number density of $\sim 60\,\mathrm{pc}^{-3}$, the fraction of discs smaller than 1000 AU is 65%, while discs smaller than 100 AU make up 15%. These fractions increase to 84% and 39% for discs in denser clusters like IC 348 ($\sim 500\,\mathrm{pc}^{-3}$). Even in clusters with a density four times lower than in the ONC ($\sim 15\,\mathrm{pc}^{-3}$), about 43% of all discs are reduced to sizes below 1000 AU and roughly 9% to sizes below 100 AU.
Conclusions. For any disc in the ONC that initially was larger than 1000 AU, the probability to be truncated to smaller disc sizes as a result of stellar encounters is quite high. Thus, among other effects, encounters are important in shaping discs and potentially forming planetary systems in stellar clusters.

Download/Website: `http://arxiv.org/abs/1504.06092`

Contact: `kvincke@mpifr-bonn.mpg.de`

Close encounters involving free-floating planets in star clusters

Long Wang[1,2], *M. B. N. Kouwenhoven*[2,1], *Xiaochen Zheng*[1,2], *Ross P. Church*[3], *Melvyn B. Davies*[3]

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1503.03077)

Instabilities in planetary systems can result in the ejection of planets from their host system, resulting in free-floating planets (FFPs). If this occurs in a star cluster, the FFP may remain bound to the star cluster for some time and interact with the other cluster members until it is ejected. Here, we use N-body simulations to characterise close star-planet and planet-planet encounters and the dynamical fate of the FFP population in star clusters containing $500 - 2000$ single or binary star members. We find that FFPs ejected from their planetary system at low velocities typically leave the star cluster 40% earlier than their host stars, and experience tens of close (< 1000 AU) encounters with other stars and planets before they escape. The fraction of FFPs that experiences a close encounter depends on both the stellar density and the initial velocity distribution of the FFPs. Approximately half of the close encounters occur within the first 30 Myr, and only 10% occur after 100 Myr. The periastron velocity distribution for all encounters is well-described by a modified Maxwell-Bolzmann distribution, and the periastron distance distribution is linear over almost the entire range of distances considered, and flattens off for very close encounters due to strong gravitational focusing. Close encounters with FFPs can perturb existing planetary systems and their debris structures, and they can result in re-capture of FFPs. In addition, these FFP populations may be observed in young star clusters in imaging surveys; a comparison between observations and dynamical predictions may provide clues to the early phases of stellar and planetary dynamics in star clusters.

Download/Website: `http://arxiv.org/abs/1503.03077`

Contact: `longwang.astro@gmail.com`

Spectrally resolved detection of sodium in the atmosphere of HD 189733b with the HARPS spectrograph

A. Wyttenbach[1], *D. Ehrenreich*[1], *C. Lovis*[1], *S. Udry*[1], *F. Pepe*[1]

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Astronomy & Astrophysics, published (arXiv:1503.05581)

Atmospheric properties of exoplanets can be constrained with transit spectroscopy. At low spectral resolution, this technique is limited by the presence of clouds. The signature of atomic sodium (NaI), known to be present above the clouds, is a powerful probe of the upper atmosphere, where it can be best detected and characterized at high spectral resolution. Our goal is to obtain a high-resolution transit spectrum of HD 189733b in the region around the resonance doublet of NaI at 589 nm, to characterize the absorption signature that was previously detected from space at low resolution.

We analyzed archival transit data of HD 189733b obtained with the HARPS spectrograph ($\mathcal{R} = 115\,000$) at the ESO 3.6-meter telescope. We performed differential spectroscopy to retrieve the transit spectrum and light curve of the planet, implementing corrections for telluric contamination and planetary orbital motion. We compared our results to synthetic transit spectra calculated from isothermal models of the planetary atmosphere.

We spectrally resolve the NaI D doublet and measure line contrasts of $0.64\pm0.07\%$ (D2) and $0.40\pm0.07\%$ (D1) and FWHMs of 0.52 ± 0.08 Å. This corresponds to a detection at the 10-σ level of excess of absorption of $0.32\pm0.03\%$ in a passband of 2×0.75 Å centered on each line. We derive temperatures of $2\,600 \pm 600$ K and 3270 ± 330 K at altitudes of $9\,800 \pm 2\,800$ and $12\,700 \pm 2\,600$ km in the NaI D1 and D2 line cores, respectively. We measure a temperature gradient of ~ 0.2 K km^{-1} in the region where the sodium absorption dominates the haze absorption from a comparison with theoretical models. We also detect a blueshift of 0.16 ± 0.04 Å ($4\,\sigma$) in the line positions. This blueshift may be the result of winds blowing at $8 \pm 2\ km\ s^{-1}$ in the upper layers of the atmosphere.

We demonstrate the relevance of studying exoplanet atmospheres with high-resolution spectrographs mounted on 4-meter-class telescopes. Our results pave the way for an in-depth characterization of physical conditions in the atmospheres of many exoplanetary systems with future spectrographs such as ESPRESSO on the VLT or HiReS and METIS on the E-ELT.

Download/Website: `http://arxiv.org/abs/1503.05581`

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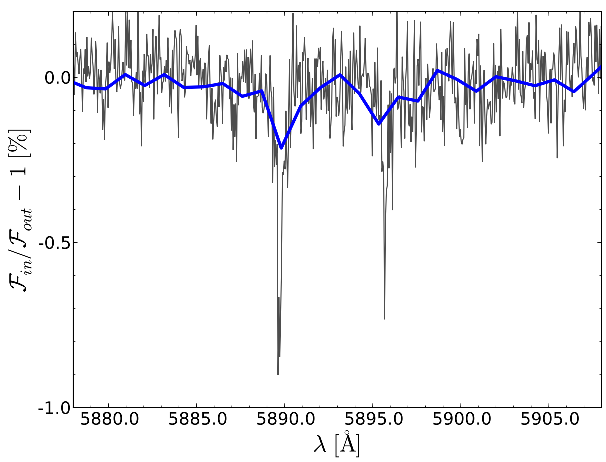

Figure 14: (Wyttenbach et al.) Comparison of the transmission spectra around the NaI doublet obtained by the HST/STIS instrument (Huitson et al. 2012, in blue) and by the HARPS spectrograph (binned by 5×, in black). We would like to point out that the precision obtained in our detection is comparable with the HST/STIS precision (with the same number of observed transits). However, thanks to the high spectral resolution of HARPS ($\mathcal{R} \sim 115\,000$), compared to HST/STIS ($\mathcal{R} \sim 5\,500$), we spectrally resolve the narrow line cores of the NaI doublet and, as a consequence, we can explore higher regions in the atmosphere of HD 189733b.

3 Non-refereed papers

Characterising exoplanets and their environment with UV transmission spectroscopy

L. Fossati[1], V. Bourrier[2], D. Ehrenreich[2], C.A. Haswell[3], K.G. Kislyakova[4], H. Lammer[4], A. Lecavelier des Etangs[5], Y. Alibert[6], T.R. Ayres[7], G.E. Ballester[8], J. Barnes[3], D.V. Bisikalo[9], A. Collier, Cameron[10], S. Czesla[11], J.-M. Désert[7], K. France[7], M. Güdel[12], E. Guenther[13], Ch. Helling[10], K. Heng[6], M. Homström[14], L. Kaltenegger[15], T. Koskinen[8], A.F. Lanza[16], J.L. Linsky[17], C. Mordasini[6], I. Pagano[16], D. Pollacco[18], H. Rauer[19], A. Reiners[20], M. Salz[11], P.C. Schneider[21], V.I. Shematovich[9], D. Staab[3], A.A. Vidotto[2], P.J. Wheatley[18], B.E. Wood[22], R.V. Yelle[8]

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[8] LPL, University of Arizona, USA
[9] INASAN, Moscow, Russia
[10] University of St. Andrews, UK
[11] Universität Hamburg, Germany
[12] University of Vienna, Austria
[13] TLS Tautenburg, Germany
[14] Swedish Institute of Space Physics, Sweden
[15] MPIA, Heidelberg, Germany
[16] INAF-Catania, Italy
[17] JILA, University of Colorado, USA
[18] University of Warwick, UK
[19] TU Berlin, Germany
[20] Universität Göttingen, Germany
[21] ESA, The Netherlands
[22] US NRL, Washington, D.C., USA

White paper submitted to STScI following a call for Hubble's 2020 Vision, arXiv: 1503.01278

Exoplanet science is now in its full expansion, particularly after the CoRoT and Kepler space missions that led us to the discovery of thousands of extra-solar planets. The last decade has taught us that UV observations play a major role in advancing our understanding of planets and of their host stars, but the necessary UV observations can be carried out only by HST, and this is going to be the case for many years to come. It is therefore crucial to build a treasury data archive of UV exoplanet observations formed by a dozen "golden systems" for which observations will be available from the UV to the infrared. Only in this way we will be able to fully exploit JWST observations for exoplanet science, one of the key JWST science case.

Download/Website: `http://arxiv.org/abs/1503.01278`

Contact: `lfossati@astro.uni-bonn.de`

4 Jobs and Positions

Postdoctoral Position in Open Access Stellar Database Development

Angelle Tanner
Department of Physics and Astronomy, Mississippi State University, USA

Mississippi State University, USA, June 1, 2015

The Department of Physics and Astronomy at Mississippi State University expects to fill a postdoctoral appointment starting as soon as June 1, 2015.

This position is open to applicants who have a PhD in physics, astronomy, computer science, or a related field. This position is in the research group of Dr. Angelle Tanner who specializes in multiple methods of exoplanet detection and characterization including direct imaging, radial velocities, photometry and astrometry. The purpose of this three year postdoc position is to complete the development of the open access, open source stellar archive called the Starchive (starchive.org). Some components of the Starchive are being developed from the ground up while others are being adapted from existing databases. The postdoc will be encouraged to pursue their own exoplanet or stellar research programs while utilizing the resources contained within the Starchive. Local resources that may be relevant include the High Performance Computing Collaboratory. Applicants should submit their letter of application electronically to Susan Galloway (srg133@msstate.edu) including a cover letter, curriculum vitae, and a summary of research. The applicant must arrange for three letters of reference to be sent to the department c/o Susan Galloway. Applicants must complete the "Personal Data Information Form" online through the MSU Human Resources website jobs.msstate.edu. Review of the applications will begin on March 15th, 2015, and continue until the position is filled. We are an equal opportunity employer and all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, disability status, protected veteran status or any other characteristic protected by law. Women and minorities are encouraged to apply.

Download/Website: `http://physics.msstate.edu`

Contact: `at876@msstate.edu`

5 Conference announcements

STFC Introductory Summer School: Atomic processes and spectral modelling in astrophysics

Francis Keenan
Queen's University Belfast, Northern Ireland, UK

Astrophysics Research Centre, School of Mathematics and Physics, Queen's University Belfast, 31st August 2015 – 4th September 2015

Spectroscopy makes an essential contribution to the study of a myriad of astronomical sources, ranging from the Sun to the most distant quasars. Modelling of the emission and/or absorption line spectra of such sources provides a wealth of information on their fundamental properties, including (but not limited to) velocity, temperature, particle density and chemical composition. Vital requirements for the reliable modelling of astronomical spectra include: (i) knowledge of the atomic processes which are important in generating the spectrum, (ii) accurate atomic data for these processes, either measured in the laboratory or calculated using atomic structure packages, (iii) sophisticated spectral modelling codes, which include all relevant atomic processes and produce a realistic spectral model which may be confidently compared with observations.

The STFC Introductory Summer School is designed to play an essential role in the early training of both PhD students and postdoctoral researchers in all of the above by providing:

- an introduction to the atomic processes of importance in different types of astronomical sources;
- how data for these processes are measured or (more often) calculated;
- an introduction to the various computer codes available for modelling astronomical spectra;
- what information spectral modelling codes can provide on astronomical sources, ranging from the Sun to quasars, and what are their limitations;
- an introduction to current and future spectroscopic facilities available to UK astrophysicists;
- advice on career development and public engagement;
- allowing PhD students and postdoctoral participants to interact scientifically with each other, and also with lecturers who are leaders in their research field.

The Summer School, including accommodation, meals and travel expenses, is free for STFC-sponsored and self-supporting PhD students, and tuition-free for many other categories of students and postdoctoral researchers. More information and a draft lecture schedule can be found on the Summer School website.

Registration for the Summer School is now open via the above website, and should be completed by Friday 3rd July 2015 to guarantee accommodation.

Please contact the Summer School director Francis Keenan if you have any questions.

Download/Website: `http://go.qub.ac.uk/stfc-iss`

Contact: `f.keenan@qub.ac.uk`

49th ESLAB Symposium: Exploring the Universe with JWST

Pierre Ferruit
ESA / ESTEC, Keplerlaan 1, 2200 AG Noordwijk, The Netherlands

ESA-ESTEC, The Netherlands, 12 – 16 October 2015

Dear Colleague,

We are pleased to announce the 49th ESLAB Symposium: Exploring the Universe with JWST, taking place from 12 – 16 October 2015 at ESA-ESTEC, The Netherlands. The ESLAB Symposium will be an international conference dedicated to the presentation and discussion of future scientific research that will be enabled by the James Webb Space Telescope.

Background Information:
The James Webb Space Telescope (JWST), scheduled for launch in October 2018, will be one of the great observatories of the next decade. JWST will provide imaging, spectroscopic and coronagraphic capabilities over the 0.6 to 28.5 micron wavelength range. It will offer an unprecedented combination of sensitivity and spatial resolution to study targets ranging from our Solar System to the most distant galaxies. With JWST's launch date approaching steadily and a first call for proposals scheduled for the end of 2017, we are organizing an international conference dedicated to the presentation and discussion of future scientific research that will be enabled by JWST.

The conference will cover a broad range of scientific topics that will be organized in the following categories:

- The end of the "dark ages": first light and reionisation.
- The assembly of galaxies.
- The formation and evolution of stars and planets.
- Planetary systems and the origins of life (exoplanets).
- Our Solar system.

The attendance will be limited to approximately 250 persons.

Download/Website: `http://congrexprojects.com/15a02`

Contact: `esa.conference.bureau@esa.int`

OHP Colloquium 2015: 20 Years of Giant Planets

I. Boisse, M. Mayor, R. Alonso, F. Bouchy, D. Fabricky, K. Heng, J. Laskar, I. Snellen, A. Sozzetti, S. Udry, A. Vigan, P. Weathley, J. Wright

Observatoire de Haute-Provence, France, 5 – 9 October 2015

Twenty years after the discovery of 51Pegb, hundreds of giant exoplanets have now been identified with several of them deeply characterized, from both ground- and space-based observations. Radial velocity and photometric surveys have considerably changed our vision of gaseous planets, and the emerging capabilities of direct imaging, astrometry and spectroscopy of atmospheres provide precious new parameter space. Fundamental properties of giant exoplanets are now measured with increasing precision, offering unprecedented constraints on formation and evolution scenarios. Moreover, numerous observational constraints have lead to considerable improvements on the modeling of their internal structure, dynamics, and interactions.

The Colloquium OHP-2015 will be hosted to review all observed characteristics of giant gaseous exoplanets, from 51 Peg b up to distant giants including Jupiter-like exoplanets, and all related theoretical works. We propose to discuss the key questions regarding giant planets and how to solve them in the coming years, exploring the synergies between current and new facilities, and confronting the predictions of theories.

Invited speakers: Don Pollacco, Michel Mayor, Gael Chauvin, Christian Marois (TBC), Ignas Snellen, Isabelle Baraffe, Rosemary Mardling, Rebekah Dawson, Andrew Cameron, Alessandro Sozzetti

The Observatoire de Haute Provence is located in southern France, near the village of Saint Michel l'Observatoire. It is the discovery place of 51 Peg b in 1995 with the ELODIE spectrograph. The 193-cm telescope is now equipped with SOPHIE, which carries a large contribution to the exoplanet studies. Accommodation will be possible inside the Observatory during the Colloquium for a limited number of attendees, and transfer will be organized for those who will stay in hotels around the Observatory. Students and post-docs are encouraged to participate, and can apply for a financial support.

Registration and abstract submission is done through the colloquium webpage. We remind that only 80 participants could attend the conference. Beyond this number, people will be placed on a waiting list.

Important deadlines:
20 June 2015: end of abstract submission and of financial support application
10 July 2015: end of pre-registration
15 August: end of registration

Download/Website: `http://ohp2015.sciencesconf.org`

Contact: `ohp2015@sciencesconf.org`

Exoplanets I Conference (Davos 2016)

Kevin Heng, Eric Agol, Natalie Batalha, Willy Benz, Debra Fischer, Tristan Guillot, Thomas Henning, Didier Queloz, Heather Knutson, Gregory Laughlin, Ruth Murray-Clay, Ignas Snellen

[1] University of Bern, Switzerland
[2] University of Washington, U.S.A.
[3] NASA Ames, U.S.A.
[4] University of Bern, Switzerland
[5] Yale University, U.S.A.
[6] Observatoire de la Cote d'Azur, France
[7] Max Planck Institute for Astronomy, Germany
[8] University of Cambridge, U.K.
[9] Caltech, U.S.A.
[10] University of California at Santa Cruz, U.S.A.
[11] University of California at Santa Barbara, U.S.A.
[12] Leiden Observatory, the Netherlands

Davos Congress Center, Switzerland, 3–8 July 2016

The astronomical community is in an expansion phase of exoplanet science, especially with several American, European and international space missions (TESS, CHEOPS, PLATO, JWST) on the horizon (2017 to 2024). The new Exoplanets conference series aims to consolidate all aspects of exoplanet science and strike a balance between: exoplanet theory, observations and instrumentation; exoplanet discovery and atmospheric characterisation; transiting and directly imaged exoplanets; ground- and space-based surveys/missions; American and European participation. We aim to expand upon the "Planets" in the "Protostars & Planets" conference series by shifting the focus to exoplanet science. We expect about 60% of the program to consist of contributed (rather than invited) talks. Abstraction submission will open on 1st Feb 2016. You may already pre-register to indicate interest. The conference will take place from 3rd to 8th July 2016 (Sunday to Friday) at the Davos Congress Center, Switzerland, site of the World Economic Forum. The registration fee (350 CHF) will cover coffee/tea sessions (twice daily), lunch (once daily) and a conference dinner. Financial aid will be provided for a limited number of students and junior researchers.

Download/Website: `http://www.exoplanetscience.org/`

Contact: `kevin.heng@csh.unibe.ch`

2015 Sagan Summer Workshop: Exoplanetary System Demographics: Theory and Observation

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

Pasadena, CA, July 27-31, 2015

Registration for the 2015 Sagan Exoplanet Summer Workshop on "Exoplanetary System Demographics: Theory and Observation" hosted by the NASA Exoplanet Science Institute (NExScI) is now available. The workshop will take place on the Caltech campus July 27 - 31, 2015. The workshop is intended for graduate students and postdocs, however all interested parties are welcome to attend. There is no registration fee for the workshop and attendance will be capped at 150 attendees.

The 2015 Sagan Summer Workshop will explore exoplanetary systems through the combined lens of theory and observations. Several observational techniques have now detected and characterized exoplanets, resulting in a large population of known systems. Theoretical models, meanwhile, can synthesize populations of planetary systems as a function of the input physics. Differences between the predicted and the observed distributions of planets provide strong constraints on the physical processes that determine how planetary systems form and evolve, ruling out some old theories while suggesting new ones. Leaders in the field will summarize the current state of the art in exoplanet observations and planet formation theory. Observations needed to discriminate between competing theories will be discussed and compared against the expected improvements in exoplanet detection limits.

Attendees will participate in hands-on exercises in which population synthesis models are tuned to match observations. Attendees will also have the opportunity to present their own work through short presentations (research POPs) and posters.

Important Dates

- April 6, 2015: POP/Poster/Talk submission period open
- July 10, 2015: On-line Registration closed; final agenda posted
- July 27-31, 2015: Sagan Exoplanet Summer Workshop

Download/Website: `http://nexsci.caltech.edu/workshop/2015`

Contact: `sagan_workshop@ipac.caltech.edu`

Spectroscopy of Exoplanets

Jonathan Tennyson[1], *France Allard*[2], *Attila Császár*[3], *Sergey Yurchenko*[1], *Laura McKemmish*[1], *Giovanna Tinetti*[1]
[1] Department of Physics & Astronomy, University College London, Gower Street, London, UK
[2] CRAL-ENS, 46, Allée d'Italie, Lyon Cedex 07, France
[3] Eötvös University, Pázmány Péter sétány 1/A, H-1117 Budapest, Hungary

Cumberland Lodge, The Great Park Windsor, Berkshire, SL4 2HP, UK, 24 – 27 July 2015

The fee waiver for registration costs for the Spectroscopy of Exoplanets conference has been extended to May 24th, 2015. No further extensions!

So register now to attend the 2nd ExoMol conference "Spectroscopy of Exoplanets", which will be held at Cumberland Lodge near London. The conference will begin in the morning on 24 July and running through to the evening of 26 July 2015 (departing after breakfast the following day).

Cumberland Lodge is a 17th Century house located in Great Windsor Park. It offers easy access to Heathrow and is close to Windsor Castle, which is the oldest and largest occupied castle in the world and the official residence of Her Majesty the Queen. We would aim to visit the castle during the course of the conference. You may like to look at the Cumberland Lodge website: `http://www.cumberlandlodge.ac.uk/`

The provisional programme includes sessions on:

- Spectroscopy of atmospheres of exoplanets;
- Molecules in stellar and Galactic context;
- Sources of opacity data (theoretical and laboratory);
- Characterising exoplanetary atmospheres;
- Observational issues;
- Chemistry and structure of exoplanets
- as well as Quiz, Windsor Castle Visit, and Karaoke.

Invited speakers are: Peter Bernath (ODU, USA); Vincent Boudon (Dijon, France); Adam Burrows (Princeton, USA); Iouli Gordon (Harvard, USA); Derek Homeier (Lyon, France); Remco de Kok (SRON, Netherlands); Pierre-Olivier Lagage (CEA Saclay, France); Nikku Madhusudhan (Cambridge, UK); Thomas Masseron (Cambridge, UK); Amanda Ross (Lyon, France); Franck Selsis, (Universite Bordeaux); Ingo Walman (UCL, UK)

We have gaps for 20 minute talks and posters if you want to present work.

You will find further details including: a registration form, details of payments and abstract submissions on the Conference website. If you plan to participate in the conference you must register by means of our online registration form. As accommodation at Cumberland Lodge is limited the registration will be at the first come basis. We very much hope that you will be able to attend the conference.

Places are limited; register now!

Download/Website: `http://www.exomol.com/conference/2015/`

Contact: `s.yurchenko@ucl.ac.uk`

Mapping Other Worlds: Spatial Studies of Exoplanets and Ultracool Atmospheres

Session Organizers: D. Apai[1,2,3], N. Cowan[4]

[1] Steward Observatory, The University of Arizona, Tucson, AZ 85721
[2] Lunar and Planetary Laboratory, The University of Arizona, Tucson, AZ 85721
[3] Earths in Other Solar Systems Team, NASA NExSS Program
[4] Amherst College

Bern, Switzerland, July 14, 2015

Spatial information provides powerful and unique constraints on the physics and chemistry of planetary atmospheres and surfaces, including cloud formation, structure, and evolution; atmospheric dynamics; compositional variations in gas, solid, and liquid phases; as well as inferring surface spectra – including biosignatures – and surface coverage. Recent years have seen exciting progress in this new field, including numerical methods to interpret time-resolved exoplanet data, the first maps of brown dwarfs and transiting exoplanets, and exciting ideas and technique to map habitable zone exo-earths.
In this session we will explore:
1) state-of-the-art observations of spatially resolved ultracool atmospheres;
2) methods to obtain spatially resolved exoplanet data in the future;
3) approaches to deduce spatial information from time-resolved data;
4) science goals that can be achieved through spatially resolved data.

The 2-hour-long session will consist of 3 invited talks (15+5 minutes) and 5 contributed talks (8+3 minutes).
Invited Speakers:
Esther Buenzli (MPIA)
Julien de Wit (MIT)
Yuka Fujii (ELSI, Tokyo IT)

Abstract Submission:
To present a contributed talk or poster submit an abstract (complete with title, author list and affiliations) by May 25th to apai@arizona.edu. Up to 5 submissions will be selected for contributed talks; additional submissions may be displayed as posters.

Download/Website: `http://eos-nexus.org/mappingotherworlds/`

IRAC 2nd Workshop on High Precision Time Series Photometry: Getting the Most out of Exoplanet and Brown Dwarf Light Curves

Carey, S.; Krick, J.; Ingalls, J.; Grillmair, C.; Lowrance, P.; Laine, P.; Surace, J.; Glaccum, W.
IRAC Team at the Spitzer Science Center

Hawaii Convention Center Room 327, Friday, 7 August, 2015

Building on the successful 2014 Data Workshop, the IRAC team is organizing a one day session on high precision photometry on August 7, 2015 at the IAU meeting at the Hawaii Convention center in Honolulu. This workshop will include short talks and discussion about instrumental and spacecraft effects and data reduction techniques for warm IRAC time series data of exoplanets and brown dwarfs. In addition we hope to run a data challenge to test out the newest in data reduction techniques. A workshop website will be available soon at the following website. We hope to see many of you there!

Download/Website: `http://irachpp.spitzer.caltech.edu/page/meetings`

Contact: `help@spitzer.caltech.edu`

6 Conference reports

Report on the UK Exoplanet Community Meeting

Don Pollacco
University of Warwick, UK

University of Warwick, UK, Conference report

The University of Warwick played host to the second UK Exoplanet Community meeting between 30th March and 1st April 2015. The format of this years meeting was different to that of the inaugural meeting with every PhD student and PDRA being guaranteed a talk. In addition, established academics presented a series of ”Institutional talks” describing the breadth of research being carried out at their host organisation. Compared to the previous meeting attendance was up by 30% with 131 registered delegates. Over the 3 day conference period we had 56 contributed talks, 18 institutional reviews, and 29 posters papers presented. This produced a rather dense programme (which was of concern to the SOC). However, the presenters rose to the challenge and everyone produced talks of excellent quality and, without fail, kept to their scheduled time slot (to the relief of the organisers!).

The talks will be on line on the conference webpage:
http://www2.warwick.ac.uk/fac/sci/physics/research/astro/research/ukexoplanet2015/

The poster competition as assessed by the SOC was won by Dr Samantha Thompson for her contribution HARPS3 and the Terra Hunting Experiment. Sam became the proud recipient of a delicious Lindt chocolate Easter Egg and half decent bottle of wine.

On the last day we had the opportunity to discuss matters of community interest and the draft STFC Exoplanet Review with representative from the Astronomy Group from STFC. The UK community is well placed to play an important role in many leading exoplanet experiments over the next decade.

Overall feedback from the conference has been positive as everyone had an opportunity to present their work largely to their peers and all researchers could see the quality and breadth of research around the UK. Consequently, we expect that every few years this will be the community meeting format.

The SOC would like to thank the Midlands Alliance and STFC for financial support for the delegates and Dr Amanda Doyle for efforts beyond the call of duty in leading the organization the conference.

We are already looking forward to next years meeting at Exeter!

Download/Website: `http://www2.warwick.ac.uk/fac/sci/physics/research/astro/research/ukexoplanet2015/`

7 Announcements

Fizeau exchange visitors program in optical interferometry – special call for applications

Josef Hron & Laszlo Mosoni
European Interferometry Initiative

www.european-interferometry.eu, application deadline: May 30

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff), non-EU based missions will only be funded if considered essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.

IMPORTANT NOTE: This is a special call to support attendance of the 8th VLTI summer school:
http://www.astro.uni-koeln.de/vltischool2015.
Therefore no research plan and invitation letter from the host institution are required.
The deadline for applications is May 30.
Further informations and application forms can be found at: www.european-interferometry.eu
The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

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

Contact: `fizeau@european-interferometry.eu`

IRAC High Precision Photometry

Krick, J.; Ingalls, J. ; Carey, S.; Grillmair, C.; Lowrance, P.; Glaccum, W.; Surace, J.; Laine, S. ,and Capak, P.
Spitzer Science Center, Pasadena, CA

New website, Available now

The IRAC team is launching a brand new website for IRAC users working on high precision photometry, specifically in optimizing analysis techniques for exoplanet and brown dwarf light curve studies. This new website presents our best understanding of sources of correlated noise and their mitigation, including current techniques and recommendations for both planning observations and understanding/reducing data. Check it out, we guarantee you will find something useful!

Download/Website: `http://irachpp.spitzer.caltech.edu`

Contact: `help@spitzer.caltech.edu`

8 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 2015. If you see any that we missed, please let us know and we'll include them in the next issue.

March 2015

astro-ph/1503.00059 : **Transiting Planets with LSST II. Period Detection of Planets Orbiting 1 Solar Mass Hosts** by *Savannah R. Jacklin, et al.*
astro-ph/1503.00062 : **HATS-9b and HATS-10b: Two compact hot Jupiters in field 7 of the K2 mission** by *R. Brahm, et al.*
astro-ph/1503.00180 : **Maximum entropy detection of planets around active stars** by *P. Petit, et al.*
astro-ph/1503.00692 : **One of the closest planet pairs to the 3:2 Mean Motion Resonance, confirmed with K2 observations and Transit Timing Variations: EPIC201505350** by *David J. Armstrong, et al.*
astro-ph/1503.00701 : **Better Than Earth** by *René Heller*
astro-ph/1503.00762 : **Physical properties of the HAT-P-23 and WASP-48 planetary systems from multi-colour photometry** by *S. Ciceri, et al.*
astro-ph/1503.00906 : **Evolutionary outcomes for pairs of planets undergoing orbital migration and circularization: second order resonances and observed period ratios in Kepler's planetary systems** by *M. Xiang-Gruess, J.C.B. Papaloizou*
astro-ph/1503.01028 : **Effect of Longitudinally Varying Cloud Coverage on Visible Wavelength Reflected-Light Exoplanet Phase Curves** by *Matthew W. Webber, et al.*
astro-ph/1503.01115 : **Characterizing the Cool KOIs VIII. Parameters of the Planets Orbiting Kepler's Coolest Dwarfs** by *Jonathan J. Swift, et al.*
astro-ph/1503.01136 : **Combining high-dispersion spectroscopy (HDS) with high contrast imaging (HCI): Probing rocky planets around our nearest neighbors** by *Ignas Snellen, et al.*
astro-ph/1503.01211 : **Know the Star, Know the Planet. III. Discovery of Late-Type Companions to Two Exoplanet Host Stars** by *Lewis C. Roberts, Jr., et al.*
astro-ph/1503.01278 : **Characterising exoplanets and their environment with UV transmission spectroscopy** by *L. Fossati, et al.*
astro-ph/1503.01320 : **Stellar Multiplicity and Debris Disks: An Unbiased Sample** by *David R. Rodriguez, et al.*
astro-ph/1503.01460 : **Warm exo-Zodi from cool exo-Kuiper belts: the significance of P-R drag and the inference of intervening planets** by *Grant M. Kennedy, Anjali Piette*
astro-ph/1503.01621 : **Re-visit of HST FUV observations of hot-Jupiter system HD 209458: No Si III detection and the need for COS transit observations** by *G. E. Ballester, L. Ben-Jaffel*
astro-ph/1503.01770 : **Radial Velocity Prospects Current and Future: A White Paper Report prepared by the Study Analysis Group 8 for the Exoplanet Program Analysis Group (ExoPAG)** by *Peter Plavchan, et al.*
astro-ph/1503.01771 : **Evidence of Different Formation Mechanisms for Hot versus Warm Super-Earths** by *Wei Zhu*
astro-ph/1503.01772 : **What is the mass of alpha Cen B b?** by *Peter Plavchan, Xi Chen, Garrett Pohl*
astro-ph/1503.01787 : **The GAPS Programme with HARPS-N at TNG VIII: Observations of the Rossiter-McLaughlin effect and characterisation of the transiting planetary systems HAT-P-36 and WASP-11/HAT-P-10** by *L. Mancini, et al.*
astro-ph/1503.01856 : **Discovery of a Disk Gap Candidate at 20 AU in TW Hydrae** by *E. Akiyama, et al.*
astro-ph/1503.01976 : **Comment on "Stellar activity masquerading as planets in the habitable zone of the M dwarf Gliese 581"** by *Guillem Anglada-Escudé, Mikko Tuomi*
astro-ph/1503.02073 : **Kuiper belt structure around nearby super-Earth host stars** by *Grant M. Kennedy, et al.*

astro-ph/1503.02126 : **Photometric defocus observations of transiting extrasolar planets** by *Tobias C. Hinse, et al.*

astro-ph/1503.02246 : **High-precision multi-band time-series photometry of exoplanets Qatar-1b and TrES-5b** by *D. Mislis, et al.*

astro-ph/1503.02443 : **Homogeneous spectroscopic parameters for bright planet host stars from the northern hemisphere** by *S. G. Sousa et al.*

astro-ph/1503.02560 : **UV Habitability of Possible Exomoons in Observed F-star Planetary Systems** by *Satoko Sato, Manfred Cuntz*

astro-ph/1503.02565 : **Response to Comment on "Stellar activity masquerading as planets in the habitable zone of the M dwarf Gliese 581"** by *Paul Robertson et al.*

astro-ph/1503.02668 : **Application of gas dynamical friction for planetesimals: I. Evolution of single planetesimals** by *Evgeni Grishin, Hagai B. Perets*

astro-ph/1503.02694 : **Are protoplanetary disks born with vortices? – Rossby wave instability driven by protostellar infall** by *Jaehan Bae, Lee Hartmann, Zhaohuan Zhu*

astro-ph/1503.03077 : **Close encounters involving free-floating planets in star clusters** by *Long Wang, et al.*

astro-ph/1503.03097 : **MAMBO image of the debris disk around epsilon Eridani : robustness of the azimuthal structure** by *Jean-Francois Lestrade, Elodie Thilliez*

astro-ph/1503.03173 : **Low False-Positive Rate of Kepler Candidates Estimated From A Combination Of Spitzer And Follow-Up Observations** by *Jean-Michel Désert, et al.*

astro-ph/1503.03197 : **OGLE-2013-BLG-0578L: Microlensing Binary Composed of A Brown Dwarf And An M Dwarf** by *H. Park, et al.*

astro-ph/1503.03251 : **Photometry's bright future: Detecting Solar System analogues with future space telescopes** by *Michael Hippke*

astro-ph/1503.03352 : **Time evolution of snow regions and planet traps in an evolving protoplanetary disk** by *Kévin Baillié, Sébastien Charnoz, Éric Pantin*

astro-ph/1503.03469 : **HATS-13b and HATS-14b: two transiting hot Jupiters from the HATSouth survey** by *L. Mancini, et al.*

astro-ph/1503.03504 : **Extracting Periodic Transit Signals from Noisy Light Curves using Fourier Series** by *Johan Samsing*

astro-ph/1503.03516 : **Understanding The Effects Of Stellar Multiplicity On The Derived Planet Radii From Transit Surveys: Implications for Kepler, K2, and TESS** by *David R. Ciardi, et al.*

astro-ph/1503.03539 : **Simultaneous Detection of Water, Methane and Carbon Monoxide in the Atmosphere of Exoplanet HR8799b** by *Travis S. Barman, et al.*

astro-ph/1503.03551 : **Classification of magnetized star–planet interactions: bow shocks, tails, and inspiraling flows** by *Titos Matsakos, Ana Uribe, Arieh Königl*

astro-ph/1503.03874 : **Extracting Radial Velocities of A- and B-type Stars from Echelle Spectrograph Calibration Spectra** by *Juliette C. Becker, et al.*

astro-ph/1503.03876 : **Planet formation around binary stars: Tatooine made easy** by *B. C. Bromley, S. J. Kenyon*

astro-ph/1503.04112 : **Chemical composition of the circumstellar disk around AB Aurigae** by *S. Pacheco-Vázquez, et al.*

astro-ph/1503.04149 : **HAT-P-50b, HAT-P-51b, HAT-P-52b, and HAT-P-53b: Three Transiting Hot Jupiters and a Transiting Hot Saturn From the HATNet Survey** by *Joel D. Hartman et al.*

astro-ph/1503.04155 : **Regaining the FORS: optical ground-based transmission spectroscopy of the exoplanet WASP-19b with VLT+FORS2** by *E. Sedaghati et al.*

astro-ph/1503.04189 : **The Chemical Composition of t Ceti and Possible Effects on Terrestrial Planets** by *Michael Pagano, et al.*

astro-ph/1503.04369 : **Interplay of tidal evolution and stellar wind braking in the rotation of stars hosting massive close-in planets** by *S. Ferraz-Mello, et al.*

astro-ph/1503.04835 : **Habitability of waterworlds: runaway greenhouses, atmospheric expansion and multiple climate states of pure water atmospheres** by *Colin Goldblatt*

astro-ph/1503.05059 : **Fourier spectra from exoplanets with polar caps and ocean glint** by *P.M. Visser, F.J. van de Bult*

astro-ph/1503.05209 : **The properties of discs around planets and brown dwarfs as evidence for disc fragmentation** by *Dimitris Stamatellos, Gregory J. Herczeg*

astro-ph/1503.05309 : **A blind method to detrend instrumental systematics in exoplanetary light-curves** by *Giuseppe Morello*

astro-ph/1503.05446 : **Spin-Orbit Angles of Kepler-13Ab and HAT-P-7b from Gravity-Darkened Transit Light Curves** by *Kento Masuda*

astro-ph/1503.05555 : **The Hunt for Exomoons with Kepler (HEK): V. A Survey of 41 Planetary Candidates for Exomoons** by *David M. Kipping, et al.*

astro-ph/1503.05581 : **Spectrally resolved detection of sodium in the atmosphere of HD189733b with the HARPS spectrograph** by *A. Wyttenbach, et al.*

astro-ph/1503.05582 : **A Non-isothermal Theory for Interpreting Sodium Lines in Transmission Spectra of Exoplanets** by *Kevin Heng, et al.*

astro-ph/1503.05609 : **Large Impacts around a Solar Analog Star in the Era of Terrestrial Planet Formation** by *Huan Y. A. Meng, et al.*

astro-ph/1503.05610 : **Planetary Collisions outside the Solar System: Time Domain Characterization of Extreme Debris Disks** by *Huan Y. A. Meng, et al.*

astro-ph/1503.05624 : **Winds of Planet Hosting Stars** by *B. A. Nicholson, et al.*

astro-ph/1503.05711 : **On the environment surrounding close-in exoplanets** by *A. A. Vidotto et al.*

astro-ph/1503.06113 : **Asteroseismology of Exoplanet-Host Stars in the Kepler Era** by *Tiago L. Campante*

astro-ph/1503.06359 : **Dimming and CO absorption toward the AA Tau protoplanetary disk: An infalling flow caused by disk instability?** by *Ke Zhang, et al.*

astro-ph/1503.06955 : **Stellar wind induced soft X-ray emission from close-in exoplanets** by *K.G. Kislyakova, et al.*

astro-ph/1503.07020 : **Limb darkening and exoplanets: testing stellar model atmospheres and identifying biases in transit parameters** by *Néstor Espinoza, Andrés Jordán*

astro-ph/1503.07165 : **GTC OSIRIS transiting exoplanet atmospheric survey: detection of potassium in HAT-P-1b from narrowband spectrophotometry** by *P. A. Wilson, et al.*

astro-ph/1503.07191 : **No variations in transit times for Qatar-1 b** by *G. Maciejewski, et al.*

astro-ph/1503.07233 : **Growth of calcium-aluminum-rich inclusions by coagulation and fragmentation in a turbulent protoplanetary disk: observations and modelisation** by *S. Charnoz, et al.*

astro-ph/1503.07528 : **Hubble Space Telescope search for the transit of the Earth-mass exoplanet Alpha Centauri Bb** by *Brice-Olivier Demory et al.*

astro-ph/1503.07636 : **Five New Exoplanets Orbiting Three Metal-Rich, Massive Stars: Two-Planet Systems Including Long-Period Planets, and an Eccentric Planet** by *Hiroki Harakawa, et al.*

astro-ph/1503.07769 : **Disentangling 2:1 resonant radial velocity orbits from eccentric ones and a case study for HD 27894** by *Martin Kürster, et al.*

astro-ph/1503.07864 : **Likely detection of water-rich asteroid debris in a metal-polluted white dwarf** by *R. Raddi, et al.*

astro-ph/1503.07866 : **Stellar and Planetary Properties of K2 Campaign 1 Candidates and Validation of 18 Systems, Including a Planet Receiving Earth-like Insolation** by *Benjamin T. Montet, et al.*

astro-ph/1503.08122 : **Theory for planetary exospheres: II. Radiation pressure effect on exospheric density profiles** by *Arnaud Beth, et al.*

astro-ph/1503.08152 : **WASP-80b has a dayside within the T-dwarf range** by *Amaury H.M.J. Triaud, et al.*

astro-ph/1503.08249 : **On detecting biospheres from thermodynamic disequilibrium in planetary atmospheres** by *Joshua Krissansen-Totton, David S. Bergsman, David C. Catling*

astro-ph/1503.08346 : **Chemical abundances and kinematics of 257 G-, K-type field giants. Setting a base for further analysis of giant-planet properties orbiting evolved stars** by *V. Zh. Adibekyan, et al.*
astro-ph/1503.09111 : **A comparison of gyrochronological and isochronal age estimates for transiting exoplanet host stars** by *P. F. L. Maxted, A. M. Serenelli, J. Southworth*
astro-ph/1503.09184 : **Transits and starspots in the WASP-6 planetary system** by *Jeremy Tregloan-Reed, et al.*

April 2015

astro-ph/1504.00051: **Dynamical Evolution of Multi-Resonant Systems: the Case of GJ876** by *Konstantin Batygin, Katherine M. Deck, Matthew J. Holman*
astro-ph/1504.00066: **On shocks driven by high-mass planets in radiatively inefficient disks. I. Two-dimensional global disk simulations** by *Alexander J.W. Richert, et al.*
astro-ph/1504.00096: **High-resolution 25 μm imaging of the disks around Herbig Ae/Be stars** by *M. Honda, et al.*
astro-ph/1504.00217: **The Water Abundance of the Directly Imaged Substellar Companion κ And b Retrieved from a Near Infrared Spectrum** by *Kamen O. Todorov, et al.*
astro-ph/1504.00460: **Birth Locations of the Kepler Circumbinary Planets** by *Kedron Silsbee, Roman R. Rafikov*
astro-ph/1504.00498: **Studying atmosphere-dominated hot Jupiter Kepler phase curves: Evidence that inhomogeneous atmospheric reflection is common** by *Avi Shporer, Renyu Hu*
astro-ph/1504.01160: **The statistical mechanics of planet orbits** by *Scott Tremaine*
astro-ph/1504.01532: **Transiting exoplanets from the CoRoT space mission XXVIII. CoRoT-28b, a planet orbiting an evolved star, and CoRoT-29b, a planet showing an asymmetric transit** by *J. Cabrera, et al.*
astro-ph/1504.01558: **3D climate modeling of Earth-like extrasolar planets orbiting different types of host stars** by *M. Godolt, et al.*
astro-ph/1504.01668: **Conditions for water ice lines and Mars-mass exomoons around accreting super-Jovian planets at 1 - 20 AU from Sun-like stars** by *René Heller, Ralph E. Pudritz*
astro-ph/1504.01680: **Torque on an exoplanet from an anisotropic evaporative wind** by *Jean Teyssandier, et al.*
astro-ph/1504.02145: **A Catalog of Stellar Evolution Profiles and the Effects of Variable Composition on Habitable Systems** by *Amanda Truitt, et al.*
astro-ph/1504.02365: **Tidal Downsizing Model. III. Planets from sub-Earths to Brown Dwarfs: structure and metallicity preferences** by *Sergei Nayakshin, Mark Fletcher*
astro-ph/1504.02469: **Astrometric planet search around southern ultracool dwarfs III. Discovery of a brown dwarf in a 3-year orbit around DE0630-18** by *J. Sahlmann, et al.*
astro-ph/1504.02735: **Very Large Telescope observations of Gomez's Hamburger: Insights into a young protoplanet candidate** by *O. Berne, et al.*
astro-ph/1504.02917: **Tidal Truncation of Inclined Circumstellar and Circumbinary Discs in Young Stellar Binaries** by *Ryan Miranda, Dong Lai*
astro-ph/1504.02943: **Polarization in exoplanetary systems caused by transits, grazing transits, and starspots** by *N.M. Kostogryz, T.M.Yakobchuk, S.V.Berdyugina*
astro-ph/1504.03237: **A reassessment of the in situ formation of close-in super-Earths** by *Masahiro Ogihara, Alessandro Morbidelli, Tristan Guillot*
astro-ph/1504.03334: **Fingering convection and cloudless models for cool brown dwarf atmospheres** by *P. Tremblin, et al.*
astro-ph/1504.03433: **The link between disc dispersal by photoevaporation and the semi-major axis distribution of exoplanets** by *Barbara Ercolano, Giovanni Rosotti*
astro-ph/1504.04017: **The Next Great Exoplanet Hunt** by *Kevin Heng, Joshua Winn*

astro-ph/1504.04028: **Time variation of Kepler transits induced by stellar rotating spots - a way to distinguish between prograde and retrograde motion. II. Application to KOIs** by *Tomer Holczer, et al.*
astro-ph/1504.04066: **A Comprehensive Characterization of the 70 Virginis Planetary System** by *Stephen R. Kane, et al.*
astro-ph/1504.04130: **SOPHIE velocimetry of Kepler transit candidates XVI. Tomographic measurement of the low obliquity of KOI-12b, a warm Jupiter transiting a fast rotator** by *Vincent Bourrier, et al.*
astro-ph/1504.04379: **The K2-ESPRINT Project I: Discovery of the Disintegrating Rocky Planet with a Cometary Head and Tail EPIC 201637175b** by *R. Sanchis-Ojeda, et al.*
astro-ph/1504.04624: **Signatures of planets and protoplanets in the Galactic center: a clue to understand the G2 cloud?** by *Michela Mapelli, Emanuele Ripamonti*
astro-ph/1504.04625: **KOI-372: a young extrasolar system with two giant planets on wide and eccentric orbits** by *L. Mancini, et al.*
astro-ph/1504.04629: **Transient Sulfate Aerosols as a Signature of Exoplanet Volcanism** by *Amit Misra, et al.*
astro-ph/1504.04812: **Millimeter-wave polarization of protoplanetary disks due to dust scattering** by *Akimasa Kataoka, et al.*
astro-ph/1504.04876: **A radiative-convective equilibrium model to study young giant exoplanets by direct imaging** by *J.-L. Baudino, et al.*
astro-ph/1504.04880: **High-contrast imaging constraints on gas giant planet formation - The Herbig Ae/Be star opportunity** by *Sascha P. Quanz*
astro-ph/1504.05199: **K2P^2 – A photometry pipeline for the K2 mission** by *Mikkel N. Lund, et al.*
astro-ph/1504.05201: **A New Method for Characterizing Very-Low-Mass Companions with Low Resolution Near-Infrared Spectroscopy** by *Emily L. Rice et al.*
astro-ph/1504.05223: **Using near infra-red spectroscopy for characterization of transiting exoplanets** by *Erik Aronson, Pierre Waldén, Nikolai Piskunov*
astro-ph/1504.05224: **The Gemini NICI Planet-Finding Campaign: Asymmetries in the HD 141569 disc** by *Beth A. Biller, et al.*
astro-ph/1504.05265: **Computing planetary atmospheres with algorithms derived from action thermodynamics and a novel version of the virial theorem for gravitating polyatomic molecules** by *Ivan R. Kennedy*
astro-ph/1504.05562: **Probing the Final Stages of Protoplanetary Disk Evolution with ALMA** by *A. Hardy, et al.*
astro-ph/1504.05586: **A Detection of Water in the Transmission Spectrum of the Hot Jupiter WASP-12b and Implications for its Atmospheric Composition** by *Laura Kreidberg, et al.*
astro-ph/1504.05702: **A debris disk under the influence of a wide planetary mass companion: The system of HD106906** by *Lucie Jilkova, Simon Portegies Zwart*
astro-ph/1504.05942: **A uniform analysis of HD209458b Spitzer/IRAC lightcurves with Gaussian process models** by *Thomas M. Evans, et al.*
astro-ph/1504.05962: **Evidence for a spectroscopic direct detection of reflected light from 51 Peg b** by *J. H. C. Martins, et al.*
astro-ph/1504.06040: **A SCUBA-2 850 micron Survey of Protoplanetary Discs in the IC 348 Cluster** by *L. Cieza, et al.*
astro-ph/1504.06092: **Strong effect of the cluster environment on the size of protoplanetary discs?** by *Kirsten Vincke, Andreas Breslau, Susanne Pfalzer*
astro-ph/1504.06326: **The Interaction of Venus-like, M-dwarf Planets with the Stellar Wind of Their Host Star** by *O. Cohen, et al.*
astro-ph/1504.06354: **The fragility of planetary systems** by *Simon Portegies Zwart, Lucie Jilkova*
astro-ph/1504.06365: **Extrasolar Binary Planets II: Detectability by Transit Observations** by *K. M. Lewis, et al.*
astro-ph/1504.06629: **Three Super-Earths Orbiting HD 7924** by *Benjamin J. Fulton, et al.*
astro-ph/1504.07170: **UV driven evaporation of close-in planets: energy-limited; recombination-limited and**

photon-limited flows by *James E. Owen, Marcelo A. Alvarez*

astro-ph/1504.07240: **Early Results from VLT-SPHERE: Long-Slit Spectroscopy of 2MASS 0122-2439B, a Young Companion Near the Deuterium Burning Limit** by *Sasha Hinkley et al.*

astro-ph/1504.07433: **PyTransit: Fast and Easy Exoplanet Transit Modelling in Python** by *Hannu Parviainen*

astro-ph/1504.07474: **Modeling the surface temperature of Earth-like planets** by *G. Vladilo, et al.*

astro-ph/1504.07557: **Probabilistic Mass-Radius Relationship for Sub-Neptune-Sized Planets** by *Angie Wolfgang, Leslie A. Rogers, Eric B. Ford*

astro-ph/1504.07655: **Strict Upper Limits on the Carbon-to-Oxygen Ratios of Eight Hot Jupiters from Self-Consistent Atmospheric Retrieval** by *Björn Benneke*

astro-ph/1504.07995: **An Empirically Derived Three-Dimensional Laplace Resonance in the Gliese 876 Planetary System** by *Benjamin E. Nelson, et al.*

astro-ph/1504.08232: **Impact of $\eta_{\rm earth}$ on the capabilities of affordable space missions to detect biosignatures on extrasolar planets** by *Alain Leger, et al.*

astro-ph/1504.07992: **Ages and fundamental properties of Kepler exoplanet host stars from asteroseismology** by *V. Silva Aguirre, et al.*