ExoPlanet News
An Electronic Newsletter

No. 56, February 1st, 2013

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Contents

1 Editorial

Welcome to the fifty sixth edition of ExoPlanet News. After a short break over the new year, this month's edition has plenty of interesting abstracts and news of attractive jobs, exciting conferences and informative announcements to keep everyone busy til next time. Welcome also to the new subscribers to the newsletter – remember, it's only as good as the contents you send me, so please keep items coming if you want to bring them to the attention of the 1100+ subscribers.

The next edition of the newsletter is planned for early March 2013, so please send anything relevant over the next few weeks to exoplanet@open.ac.uk, and it will appear then. 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.

Best wishes
Andrew Norton
The Open University

2 Abstracts of refereed papers

Transit timing variations in WASP-10b induced by stellar activity?

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1301.3760)

The hot-Jupiter WASP-10b was reported by Maciejewski et al. (2011a,b) to show transit timing variations (TTV) with an amplitude of ~ 3.5 minutes. These authors proposed that the observed TTVs were caused by a 0.1 $\mathrm{M_{Jup}}$ perturbing companion with an orbital period of ~ 5.23 d, and hence, close to the outer 5:3 mean motion resonance with WASP-10b. To test this scenario, we present eight new transit light curves of WASP-10b obtained with the Faulkes Telescope North and the Liverpool Telescope. The new light curves, together with 22 previously published ones, were modelled with a Markov-Chain Monte-Carlo transit fitting code.
Transit depth differences reported for WASP-10b are thought to be due to star spot induced brightness modulation of the host star. Assuming the star is brighter at the activity minimum, we favour a small planetary radius. We find $\mathrm{R}_p = 1.039^{+0.043}_{-0.049}\,\mathrm{R_{Jup}}$ in agreement with Johnson et al. (2009) and Maciejewski et al. (2011b). Maciejewski et al. (2011a) and Husnoo et al. (2012) find no evidence for a significant eccentricity in this system. We present consistent system parameters for a circular orbit and refine the orbital ephemeris of WASP-10b.
Our homogeneously derived transit times do not support the previous claimed TTV signal, which was strongly dependent on 2 previously published transits that have been incorrectly normalised. Nevertheless, a linear ephemeris is not a statistically good fit to the transit times of WASP-10b. We show that the observed transit time variations are due to spot occultation features or systematics. We discuss and exemplify the effects of occultation spot features in the measured transit times and show that despite spot occultation during egress and ingress being difficult to distinguish in the transit light curves, they have a significant effect in the measured transit times. We conclude that if we account for spot features, the transit times of WASP-10 are consistent with a linear ephemeris with the exception of one transit (epoch 143) which is a partial transit. Therefore, there is currently no evidence for the existence of a companion to WASP-10b. Our results support the lack of TTVs of hot-Jupiters reported for the Kepler sample.

Download/Website: `http://lanl.arxiv.org/abs/1301.3760`

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On the potential of the EChO mission to characterise gas giant atmospheres

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1212.5020v1)

Space telescopes such as EChO (Exoplanet Characterisation Observatory) and JWST (James Webb Space Telescope) will be important for the future study of extrasolar planet atmospheres. Both of these missions are capable of performing high sensitivity spectroscopic measurements at moderate resolutions in the visible and infrared, which will allow the characterisation of atmospheric properties using primary and secondary transit spectroscopy. We use the NEMESIS radiative transfer and retrieval tool (Irwin et al. 2008, Lee et al. 2012) to explore the potential of the proposed EChO mission to solve the retrieval problem for a range of H_2-He planets orbiting different stars. We find that EChO should be capable of retrieving temperature structure to ∼200 K precision and detecting H_2O, CO_2 and CH_4 from a single eclipse measurement for a hot Jupiter orbiting a Sun-like star and a hot Neptune orbiting an M star, also providing upper limits on CO and NH_3. We provide a table of retrieval precisions for these quantities in each test case. We expect around 30 Jupiter-sized planets to be observable by EChO; hot Neptunes orbiting M dwarfs are rarer, but we anticipate observations of at least one similar planet.

Download/Website: `http://arxiv.org/abs/1212.5020v1`

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Orbital Migration of Protoplanets in a Marginally Gravitationally Unstable Disk

Alan P. Boss

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The Astrophysical Journal, in press

Core accretion and disk instability require giant protoplanets to form in the presence of disk gas. Protoplanet migration models generally assume disk masses low enough that the disk's self-gravity can be neglected. However, disk instability requires a disk massive enough to be marginally gravitationally unstable (MGU). Even for core accretion, a FU Orionis outburst may require a brief MGU disk phase. We present a new set of three dimensional, gravitational radiation hydrodynamics models of MGU disks with multiple protoplanets, which interact gravitationally with the disk and with each other, including disk gas mass accretion. Initial protoplanet masses are 0.01 to 10 $M_\oplus$ for core accretion models, and 0.1 to 3 M_{Jup} for Nice scenario models, starting on circular orbits with radii of 6, 8, 10, or 12 AU, inside a 0.091 $M_\odot$ disk extending from 4 to 20 AU around a $1M_\odot$ protostar. Evolutions are followed for up to $\sim$ 4000 yr and involve phases of relative stability ($e \sim 0.1$) interspersed with chaotic phases ($e \sim 0.4$) of orbital interchanges. The 0.01 to 10 $M_\oplus$ cores can orbit stably for $\sim$ 1000 yr: monotonic inward or outward orbital migration of the type seen in low mass disks does not occur. A system with giant planet masses similar to our Solar System (1.0, 0.33, 0.1, 0.1 M_{Jup}) was stable for over 1000 yr, and a Jupiter-Saturn-like system was stable for over 3800 yr, implying that our giant planets might well survive a MGU disk phase.

Download/Website: `http://www.dtm.ciw.edu/users/boss/ftp/orbital.pdf`

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Lopsided dust rings in transition disks

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Astronomy & Astrophysics, in press (arXiv: 1301.1976)

Context: Particle trapping in local or global pressure maxima in protoplanetary disks is one of the new paradigms in the theory of the first stages of planet formation. However, finding observational evidence for this effect is not easy. Recent work suggests that the large ring-shaped outer disks observed in transition disk sources may in fact be lopsided and constitute large banana-shaped vortices.
Aims: We wish to investigate how effective dust can accumulate along the azimuthal direction. We also want to find out if the size-sorting resulting from this can produce a detectable signatures at millimeter wavelengths.
Methods: To keep the numerical cost under control we develop a 1+1D method in which the azimuthal variations are treated separately from the radial ones. The azimuthal structure is calculated analytically for a steady-state between mixing and azimuthal drift. We derive equilibration time scales and compare the analytical solutions to time-dependent numerical simulations.
Results: We find that weak, but long-lived azimuthal density gradients in the gas can induce very strong azimuthal accumulations of dust. The strength of the accumulations depends on the Péclet number, which is the relative importance of advection and diffusion. We apply our model to transition disks and our simulated observations show that this effect would be easily observable with ALMA and in principle allows to put constraints on the strength of turbulence and the local gas density.

Download/Website: `http://adsabs.harvard.edu/abs/2013arXiv1301.1976B`

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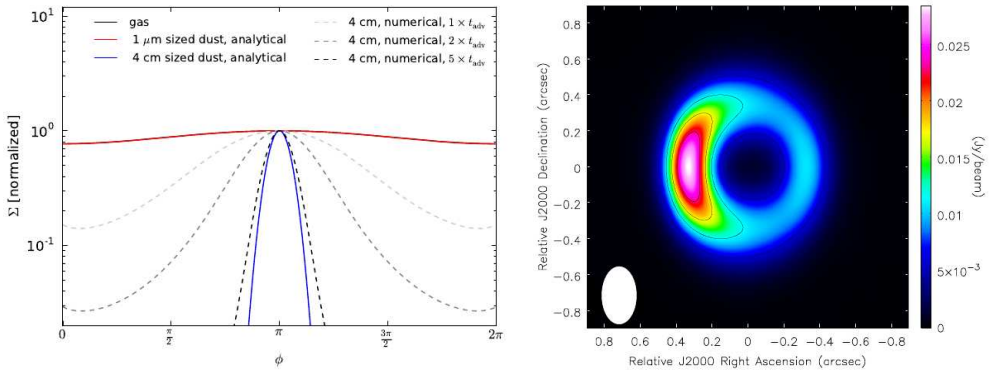

Figure 1: *Left:* steady-state solutions for the azimuthal distribution of small (red line) and large dust grains (blue line) for a given sinusoidal gas profile (black line, identical with red line) with peak-to-valley density ratio of 1.5. Dashed lines show numerical solutions at 1,2, and 5 advection time scales. *Right:* ALMA simulated images at 345 GHz with an observation time of 2 hours. The total flux of the source is 0.13 Jy and the contour lines are at 2, 4, 6, and 8 times the rms of 0.22 mJy.

Atmospheric escape from HD 189733b observed in H I Lyman-α: detailed analysis of HST/STIS September 2011 observations

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Astronomy & Astrophysics, accepted for publication, arXiv:1301.6030

Observations of transits of the hot giant exoplanet HD 189733b in the unresolved H I Lyman-α line show signs of hydrogen escaping the upper atmosphere of the planet. New resolved Lyman-α observations obtained with the STIS spectrograph onboard the Hubble Space Telescope in April 2010 and September 2011 confirmed that the planet is evaporating, and furthermore discovered significant temporal variations in the physical conditions of its evaporating atmosphere. Here we present a detailed analysis of the September 2011 observations of HD 189733b, when an atmospheric signature was detected. We present specific methods to find and characterize this absorption signature of escaping hydrogen in the Lyman-α line, and to calculate its false-positive probability, found to be 3.6%. Taking advantage of the spectral resolution and high sensitivity of the STIS spectrograph, we also present new results on temporal and spectro-temporal variability of this absorption feature. We also report the observation of HD 189733b in other lines (Si III at 1206.5 Å, N V at 1240 Å). Variations in these lines could be explained either by early occultation by a bow-shock rich in highly ionized species, or by stellar variations.

Download/Website: `http://arxiv.org/abs/1301.6030`

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Spitzer Observations of GJ 3470 b: a Very Low-Density Neptune-Size Planet Orbiting a Metal-Rich M dwarf

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The Astrophysical Journal, submitted (1301.6555)

We present *Spitzer*/IRAC 4.5 μm transit photometry of GJ 3470 b, a Neptune-size planet orbiting a M1.5 dwarf star with a 3.3-day period recently discovered in the course of the HARPS M-dwarf survey. We refine the stellar parameters by employing purely empirical mass-luminosity and surface brightness relations constrained by our updated value for the mean stellar density, and additional information from new near-infrared spectroscopic observations.

We derive a stellar mass of $M_\star = 0.539^{+0.047}_{-0.043}\,M_\odot$ and a radius of $R_\star = 0.568^{+0.037}_{-0.031}\,R_\odot$. We determine the host star of GJ 3470 b to be metal-rich, with a metallicity of $[\mathrm{Fe/H}] = +0.20 \pm 0.10$ and an effective temperature of $T_{\rm eff} = 3600 \pm 100$ K. The revised stellar parameters yield a planetary radius $R_p = 4.83^{+0.22}_{-0.21}\,R_\oplus$ that is 13% larger than the value previously reported in the literature. We find a planetary mass $M_p = 13.9^{+1.5}_{-1.4}\,M_\oplus$ that translates to a very low planetary density, $\rho_p = 0.72^{+0.13}_{-0.12}$ g cm^{-3}, which is 33% smaller than the original value. With a mean density half of that of GJ 436 b, GJ 3470 b is an example of a very low-density low-mass planet, similar to Kepler-11 d, Kepler-11 e, and Kepler-18 c but orbiting a much brighter nearby star that is more conducive to follow-up studies.

Download/Website: `http://arxiv.org/abs/1301.6555`

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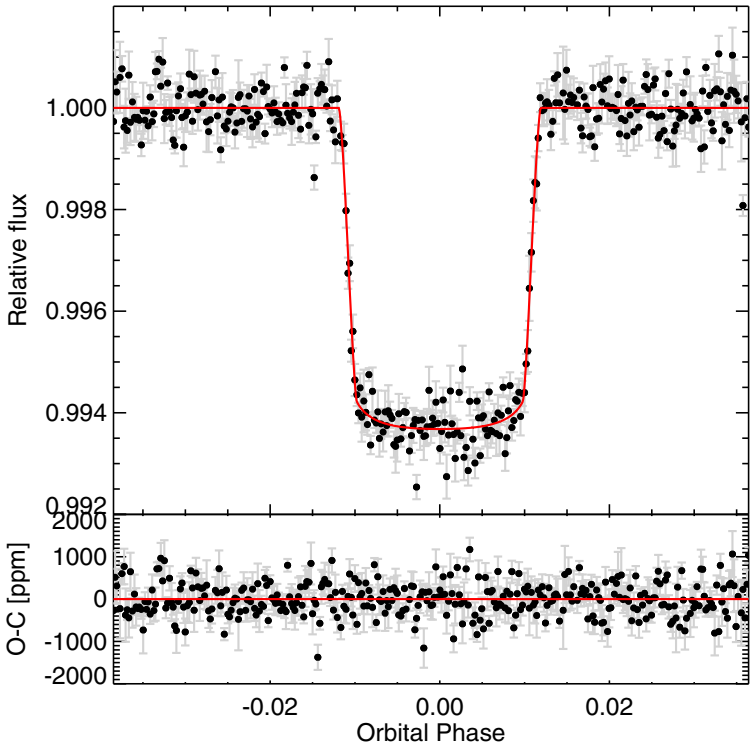

Figure 2: (Demory et al.) GJ 3470 b detrended and phase-folded transit light curve combining our two 4.5 μm *Spitzer*/IRAC visits, with the best-fit transit model superimposed. Data points are binned in 2-minute intervals, and residuals are shown in the bottom panel.

Gravoturbulent Planetesimal Formation: The Positive Effect of long-lived Zonal Flows

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The Astrophysical Journal, 2013ApJ...763..117D/arXiv:1211.2095)

Recent numerical simulations have shown long-lived axisymmetric sub- and super-Keplerian flows in protoplanetary disks. These zonal flows are found in local as well as global simulations of disks unstable to the magnetorotational instability. This paper covers our study of the strength and lifetime of zonal flows and the resulting long-lived gas over- and underdensities as functions of the azimuthal and radial size of the local shearing box. We further investigate dust particle concentrations without feedback on the gas and without self-gravity. Strength and lifetime of zonal flows increase with the radial extent of the simulation box, but decrease with the azimuthal box size. Our simulations support earlier results that zonal flows have a natural radial length scale of $5 - 7$ gas pressure scale heights. This is the first study that combines three-dimensional MHD simulations of zonal flows and dust particles feeling the gas pressure. The pressure bumps trap particles with St $= 1$ very efficiently. We show that St $= 0.1$ particles (of some centimeters in size if at 5AU in an MMSN) reach a hundred-fold higher density than initially. This opens the path for particles of St $= 0.1$ and dust-to-gas ratio of 0.01 or for particles of St ≥ 0.5 and dust-to-gas ratio 10^{-4} to still reach densities that potentially trigger the streaming instability and thus gravoturbulent formation of planetesimals.

Download/Website: `http://adsabs.harvard.edu/abs/2013ApJ...763..117D`

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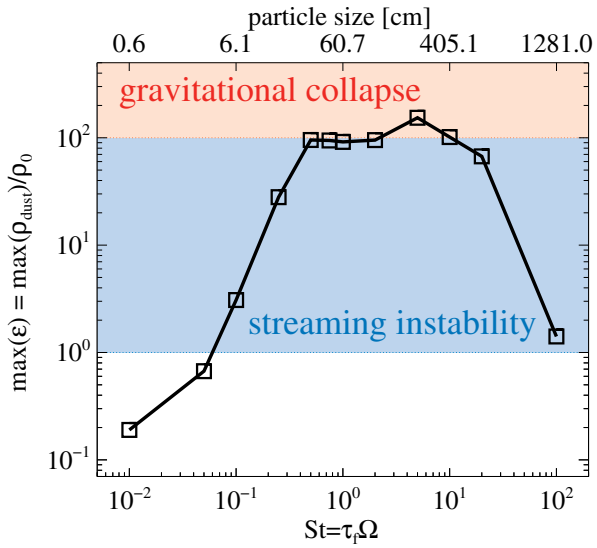

Figure 3: (Dittrich et al.) Shows the highest over-density that occurred for the specific particle size during the entire simulation. The upper labels correspond particle sizes in a MMSN at 5 AU distance to the star. The gravitational collapse regime starts at a dust-to-gas ratio of 100, the Roche density. The streaming instability regime starts at $\epsilon = 1$ (Johansen & Youdin 2007 and Youdin & Johansen 2007). Meter-sized boulders reach the gravitational collapse regime, while decimeter-sized pebbles will trigger the streaming instability. All particle sizes were initialized with $\epsilon_0 = 10^{-2}$.

WASP-54b, WASP-56b and WASP-57b: Three new sub-Jupiter mass planets from SuperWASP

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Astronomy & Astrophysics, Accepted for Publication 23 December 2012

We present three newly discovered sub-Jupiter mass planets from the SuperWASP survey: WASP-54b is a heavily bloated planet of mass $0.636^{+0.025}_{-0.024}$ M_J and radius $1.653^{+0.090}_{-0.083}$ R_J. It orbits a F9 star, evolving off the main sequence, every 3.69 days. Our MCMC fit of the system yields a slightly eccentric orbit ($e = 0.067^{+0.033}_{-0.025}$) for WASP-54b. We investigated further the veracity of our detection of the eccentric orbit for WASP-54b, and we find that it could be real. However, given the brightness of WASP-54 V=10.42 magnitudes, we encourage observations of a secondary eclipse to draw robust conclusions on both the orbital eccentricity and the thermal structure of the planet. WASP-56b and WASP-57b have masses of $0.571^{+0.034}_{-0.035}$ M_J and $0.672^{+0.049}_{-0.046}$ M_J, respectively; and radii of $1.092^{+0.035}_{-0.033}$ R_J for WASP-56b and $0.916^{+0.017}_{-0.014}$ R_J for WASP-57b. They orbit main sequence stars of spectral type G6 every 4.67 and 2.84 days, respectively. WASP-56b and WASP-57b show no radius anomaly and a high density possibly implying a large core of heavy elements; possibly as high as $\sim$50 $M_\oplus$ in the case of WASP-57b. However, the composition of the deep interior of exoplanets remain still undetermined. Thus, more exoplanet discoveries such as the ones presented in this paper, are needed to understand and constrain giant planets' physical properties.

Download/Website: `http://arxiv.org/abs/1210.2329`

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The Effect of Irradiation on the Jeans Mass in Fragmenting Self-Gravitating Discs

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1301.1151)

When a self-gravitating disc is subject to irradiation, its propensity to fragmentation will be affected. The strength of self-gravitating disc stresses is expected to dictate disc fragmentation: as the strength of these torques typically decrease with increasing sound speed, it is reasonable to assume, to first-order, that disc fragmentation is suppressed when compared to the non-irradiated case, although previous work has shown that the details are complicated by the source of the irradiation. We expand on previous analysis of the Jeans mass inside spiral structures in self-gravitating discs, incorporating the effects of stellar irradiation and background irradiation. If irradiation is present, fragmentation is suppressed for marginally unstable discs at low accretion rates (compared to the no-irradiation case), but these lower accretion rates correspond to higher mass discs. Fragmentation can still occur for high accretion rates, but is consequently suppressed at lower disc surface densities, and the subsequent Jeans mass is boosted. These results further bolster the consensus that, without subsequent fragment disruption or mass loss, the gravitational instability is more likely to form brown dwarfs and low-mass stars than gas giant planets.

Download/Website: `http://arxiv/org/abs/1301.1151`

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Coronagraphic observations of Fomalhaut at solar system scales

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The Astrophysical Journal, in press (arXiv:1212.1459)

We report on a search for low mass companions within 10 AU of the star Fomalhaut, using narrow band observations at $4.05\mu m$ obtained with the Apodizing Phase Plate (APP) coronagraph on the VLT/NaCo. Our observations place a model dependent upper mass limit of $12 - 20M_{jup}$ from 4 to 10 AU, covering the semi-major axis search space between interferometric imaging measurements and other direct imaging non-detections. These observations rule out models where the large semi-major axis for the putative candidate companion Fomalhaut b is explained by dynamical scattering from a more massive companion in the inner stellar system, where such giant planets are thought to form.

Download/Website: `http://arxiv.org/abs/1212.1459`

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From dust to planetesimals: an improved model for collisional growth in protoplanetary disks

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The Astrophysical Journal, in press (arXiv:1209.0013)

Planet formation occurs within the gas- and dust-rich environments of protoplanetary disks. Observations of these objects show that the growth of primordial submicron-sized particles into larger aggregates occurs at the earliest evolutionary stages of the disks. However, theoretical models of particle growth that use the Smoluchowski equation to describe collisional coagulation and fragmentation have so far failed to produce large particles while maintaining a significant population of small grains. This has been generally attributed to the existence of two barriers impeding growth due to bouncing and fragmentation of colliding particles. In this paper, we demonstrate that the importance of these barriers has been artificially inflated through the use of simplified models that do not take into account the stochastic nature of the particle motions within the gas disk. We present a new approach in which the relative velocities between two particles is described by a probability distribution function that models both deterministic motion (from the vertical settling, radial drift and azimuthal drift) and stochastic motion (from Brownian motion and turbulence). Taking both into account can give quite different results to what has been considered recently in other studies. We demonstrate the vital effect of two "ingredients" for particle growth: the proper implementation of a velocity distribution function that overcomes the bouncing barrier and, in combination with mass transfer in high-mass-ratio collisions, boosts the growth of larger particles beyond the fragmentation barrier. A robust result of our simulations is the emergence of two particle populations (small and large), potentially explaining simultaneously a number of long-standing problems in protoplanetary disks, including planetesimal formation close to the central star, the presence of mm- to cm-size particles far out in the disk, and the persistence of micron-size grains for millions of years.

Download/Website: `http://arxiv.org/abs/1209.0013`

Contact: `farzana.meru@phys.ethz.ch`

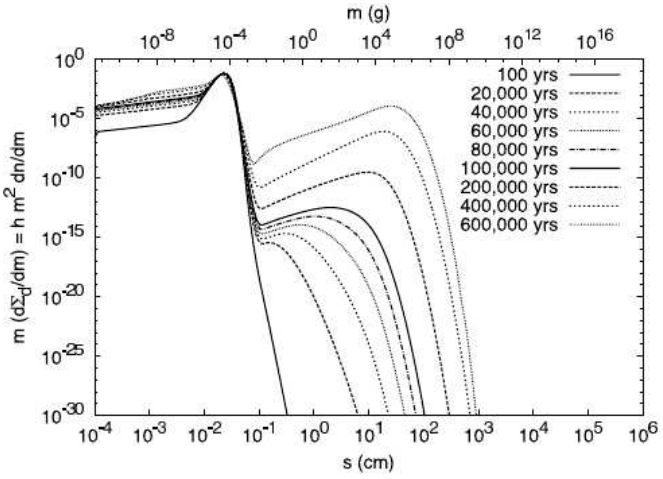

Figure 4: (Garaud et al.) Particle evolution at 30AU with bouncing and mass transfer using the new model, where the bouncing and fragmentation velocities are $v_b = 5$cm/s and $v_f = 100$cm/s, respectively, and where the mass ratio above which every collision (that would otherwise lead to fragmentation) sticks is $\phi = 50$. This figure shows snapshots of the mass distribution function at different times. Note the gradual emergence of a large particle population, of sizes up to a few cm. Although difficult to see, mass is indeed conserved in this simulation – as time evolves, the particle peak is slightly eroded.

Hot Moons and Cool Stars

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Proceedings to the ROPACS meeting "Hot Planets and Cool Stars" (Nov. 2012, Garching), to be published in EPJ Web of Conferences (http://arxiv.org/abs/1301.0235)

The exquisite photometric precision of the *Kepler* space telescope now puts the detection of extrasolar moons at the horizon. Here, we firstly review observational and analytical techniques that have recently been proposed to find exomoons. Secondly, we discuss the prospects of characterizing potentially habitable extrasolar satellites. With moons being much more numerous than planets in the solar system and with most exoplanets found in the stellar habitable zone being gas giants, habitable moons could be as abundant as habitable planets. However, satellites orbiting planets in the habitable zones of cool stars will encounter strong tidal heating and likely appear as hot moons.

Download/Website: `http://www.aip.de/People/RHeller`

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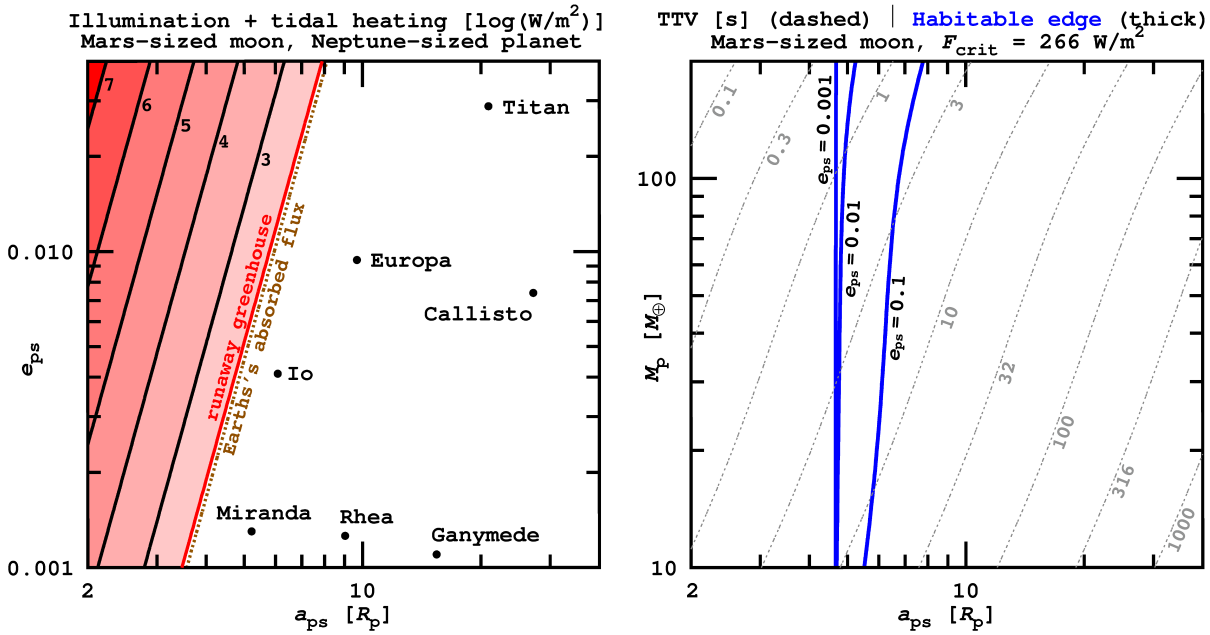

Figure 5: (Heller & Barnes) *Left*: Total top-of-the-atmosphere flux (in logarithmic units of W/m^2) of a Mars-sized moon about a Neptune-sized planet in the habitable zone of a $0.25\,M_\odot$ star. Tidal heating increases with decreasing semi-major axis $a_{\rm ps}$ (abscissa) and increasing eccentricity $e_{\rm ps}$ (ordinate). Some examples for orbital elements of solar system moons are indicated. *Right*: Amplitude of the transit timing variation (TTV, dashed lines) for a Mass-sized moon about a range of host planets. Planetary masses are shown in Earth masses on the ordinate. The habitable edge (blue, thick lines) is indicated for three different orbital eccentricities $e_{\rm ps}$ of the satellite: 0.1, 0.01, and 0.001. Note that for increasing eccentricity the habitable edge moves outward to counterbalance the effect of tidal heating.

Detection of Laplace-resonant three-planet systems from transit timing variations

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Monthly Notices of the Royal Astronomical Society, in press(arXiv:1301.2891)

Transit timing variations (TTVs) are useful to constrain the existence of perturbing planets, especially in resonant systems where the variations are strongly enhanced. Here we focus on Laplace-resonant three-planet systems, and assume the inner planet transits the star. A dynamical study is performed for different masses of the three bodies, with a special attention to terrestrial planets. We consider a maximal time-span of ~ 100 years and discuss the shape of the inner planet TTVs curve. Using frequency analysis, we highlight the three periods related to the evolution of the system: two periods associated with the Laplace-resonant angle and the third one with the precession of the pericenters. These three periods are clearly detected in the TTVs of an inner giant planet perturbed by two terrestrial companions. Only two periods are detected for a Jupiter-Jupiter-Earth configuration (the ones associated with the giant interactions) or for three terrestrial planets (the Laplace periods). However, the latter system can be constrained from the inner planet TTVs. We finally remark that the TTVs of resonant three or two Jupiter systems mix up, when the period of the Laplace resonant angle matches the pericenter precession of the two-body configuration. This study highlights the importance of TTVs long-term observational programs for the detection of multiple-planet resonant systems.

Download/Website: `http://arxiv.org/abs/1301.2891`

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Clouds and Hazes in Exoplanet Atmospheres

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book chapter to appear in "Comparative Climatology of Terrestrial Planets" (S. Mackwell, M. Bullock, J. Harder, eds.; University of Arizona Press, 2013), in press (arXiv:1301.5627)

Clouds and hazes are commonplace in the atmospheres of solar system planets and are likely ubiquitous in the atmospheres of extrasolar planets as well. Clouds affect every aspect of a planetary atmosphere, from the transport of radiation, to atmospheric chemistry, to dynamics and they influence–if not control–aspects such as surface temperature and habitability. In this review we aim to provide an introduction to the role and properties of clouds in exoplanetary atmospheres. We consider the role clouds play in influencing the spectra of planets as well as their habitability and detectability. We briefly summarize how clouds are treated in terrestrial climate models and consider the far simpler approaches that have been taken so far to model exoplanet clouds, the evidence for which we also review. Since clouds play a major role in the atmospheres of certain classes of brown dwarfs we briefly discuss brown dwarf cloud modeling as well. We also review how the scattering and extinction efficiencies of cloud particles may be approximated in certain limiting cases of small and large particles in order to facilitate physical understanding. Since clouds play such important roles in planetary atmospheres, cloud modeling may well prove to be the limiting factor in our ability to interpret future observations of extrasolar planets.

Download/Website: `http://xxx.lanl.gov/abs/1301.5627`

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A lower radius and mass for the transiting extrasolar planet HAT-P-8 b

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Astronomy & Astrophysics, in press (arXiv:1212.3701)

Context. The extrasolar planet HAT-P-8 b was thought to be one of the more inflated transiting hot Jupiters.
Aims. By using new and existing photometric data, we computed precise estimates of the physical properties of the system.
Methods. We present photometric observations comprising eleven light curves covering six transit events, obtained using five medium-class telescopes and telescope-defocussing technique. One transit was simultaneously obtained through four optical filters, and two transits were followed contemporaneously from two observatories. We modelled these and seven published datasets using the JKTEBOP code. The physical parameters of the system were obtained from these results and from published spectroscopic measurements. In addition, we investigated the theoretically-predicted variation of the apparent planetary radius as a function of wavelength, covering the range 330–960 nm.
Results. We find that HAT-P-8 b has a significantly lower radius ($1.321 \pm 0.037\,R_{\rm Jup}$) and mass ($1.275 \pm 0.053\,M_{\rm Jup}$) compared to previous estimates ($1.50^{+0.08}_{-0.06}\,R_{\rm Jup}$ and $1.52^{+0.18}_{-0.16}\,M_{\rm Jup}$ respectively). We also detect a radius variation in the optical bands that, when compared with synthetic spectra of the planet, may indicate the presence of a strong optical absorber, perhaps TiO and VO gases, near the terminator of HAT-P-8 b.
Conclusions. These new results imply that HAT-P-8 b is not significantly inflated, and that its position in the planetary mass–radius diagram is congruent with those of many other transiting extrasolar planets.

Download/Website: `http://arxiv.org/abs/1212.3701`

Contact: `mancini@mpia.de`

Physical properties of the WASP-44 planetary system from simultaneous multi-colour photometry

L. Mancini[1], Nikolov[1], J. Southworth[2], G. Chen[1,3] J. J. Fortney[4], J. Tregloan-Reed[2], N. S. Ciceri[1], R. van Boekel[1], Th. Henning[1]

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1301.3005)

We present ground-based broad-band photometry of two transits in the WASP-44 planetary system obtained simultaneously through four optical (Sloan g', r', i', z') and three near-infrared (NIR; J, H, K) filters. We achieved low scatters of 1–2 mmag per observation in the optical bands with a cadence of ≈ 48 s, but the NIR-band light curves present much greater scatter. We also observed another transit of WASP-44 b by using a Gunn-r filter and telescope defocussing, with a scatter of 0.37 mmag per point and an observing cadence around 135 s. We used these data to improve measurements of the time of mid-transit and the physical properties of the system. In particular, we improved the radius measurements of the star and planet by factors of 3 and 4, respectively. We find that the radius of WASP-44 b is $1.002 \pm 0.033 \pm 0.018\,R_{\rm Jup}$ (statistical and systematic errors, respectively), which is slightly smaller than previously thought and differs from that expected for a core-free planet. In addition, with the help of a synthetic spectrum, we investigated the theoretically-predicted variation of the planetary radius as a function of wavelength, covering the range 370–2440 nm. We can rule out extreme variations at optical wavelengths, but unfortunately our data are not precise enough (especially in the NIR bands) to differentiate between the theoretical spectrum and a radius which does not change with wavelength.

Download/Website: `http://arxiv.org/abs/1301.3005`

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Finding Exoplanets Orbiting Young Active Stars. I. Technique

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1212.5922)

Stellar activity, such as starspots, can induce radial velocity (RV) variations that can mask or even mimic the RV signature of orbiting exoplanets. For this reason RV exoplanet surveys have been unsuccessful when searching for planets around young, active stars and are therefore failing to explore an important regime which can help to reveal how planets form and migrate. This paper describes a new technique to remove spot signatures from the stellar line-profiles of moderately rotating, active stars (vsini ranging from 10 to 50 $\rm kms^{-1}$). By doing so it allows planetary RV signals to be uncovered. We used simulated models of a G5V type star with differing dark spots on its surface along with archive data of the known active star HD49933 to validate our method. The results showed that starspots could be effectively cleaned from the line-profiles so that the stellar RV jitter was reduced by more than 80%. Applying this procedure to the same models and HD49933 data, but with fake planets injected, enabled the effective removal of starspots so that Jupiter mass planets on short orbital periods were successfully recovered. These results show that this approach can be useful in the search for hot-Jupiter planets that orbit around young, active stars with a vsini of $\sim$ 10 - 50 $\rm kms^{-1}$.

Download/Website: `http://arxiv.org/abs/1212.5922`

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Spectral Fingerprints of Earth-like Planets around FGK Stars

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Astrobiology, in press (arXiv:1212.2638)

We present model atmospheres for an Earth-like planet orbiting the entire grid of main sequence FGK stars with effective temperatures ranging from T_{eff} = 4250K to T_{eff} = 7000K in 250K intervals. We model the remotely detectable spectra of Earth-like planets for clear and cloudy atmospheres at the 1 AU equivalent distance from the VIS to IR ($0.4\mu m - 20\mu m$) to compare detectability of features in different wavelength ranges in accordance with JWST and future design concepts to characterize exo-Earths. We also explore the effect of the stellar UV levels as well as spectral energy distribution on a terrestrial atmosphere concentrating on detectable atmospheric features that indicate habitability on Earth, namely: H_2O, O_3, CH_4, N_2O and CH_3Cl.
The increase in UV dominates changes of O_3, OH, CH_4, N_2O and CH_3Cl whereas the increase in stellar temperature dominates changes in H_2O. The overall effect as stellar effective temperatures and corresponding UV increase, is a lower surface temperature of the planet due to a bigger part of the stellar flux being reflected at short wavelengths, as well as increased photolysis. Earth-like atmospheric models show more O_3 and OH but less stratospheric CH_4, N_2O, CH_3Cl and tropospheric H_2O (but more stratospheric H_2O) with increasing effective temperature of Main Sequence stars. The corresponding spectral features on the other hand show different detectability depending on the wavelength observed.
We concentrate on directly imaged planets here as framework to interpret future lightcurves, direct imaging and secondary eclipse measurements of atmospheres of terrestrial planets in the HZ at varying orbital positions.

Download/Website: `http://arxiv.org/abs/1212.2638`

Contact: `srugheimer@cfa.harvard.edu`

WASP-80b: a gas giant transiting a cool dwarf

Amaury H. M. J. Triaud[1], D. R. Anderson[2], A. Collier Cameron[3], A. P. Doyle[2], A. Fumel[4], M. Gillon[4], C. Hellier[2], E. Jehin[4], M. Lendl[1], C. Lovis[1], P. F. L. Maxted[2], F. Pepe[1], D. Pollacco[5], D. Queloz[1], D. Ségransan[1], B. Smalley[2], A. M. S. Smith[2,6], S. Udry [1], R. G. West[7], P. J. Wheatley[5]

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Astronomy & Astrophysics, in press

We report the discovery of a planet transiting the star WASP-80 (1SWASP J201240.26-020838.2; 2MASS J20124017-0208391; TYC 5165-481-1; BPM 80815; V=11.9, K=8.4). Our analysis shows this is a 0.55 ± 0.04 M_{jup}, 0.95 ± 0.03 R_{jup} gas giant on a circular 3.07 day orbit around a star with a spectral type between K7V and M0V. This system produces one of the largest transit depths so far reported, making it a worthwhile target for transmission spectroscopy. We find a large discrepancy between the $v \sin i_\star$ inferred from stellar line broadening and the observed amplitude of the Rossiter-McLaughlin effect. This can be understood either by an orbital plane nearly perpendicular to the stellar spin or by an additional, unaccounted for source of broadening.

Download/Website: `http://dx.doi.org/10.1051/0004-6361/201220900`

Contact: `Amaury.Triaud@unige.ch`

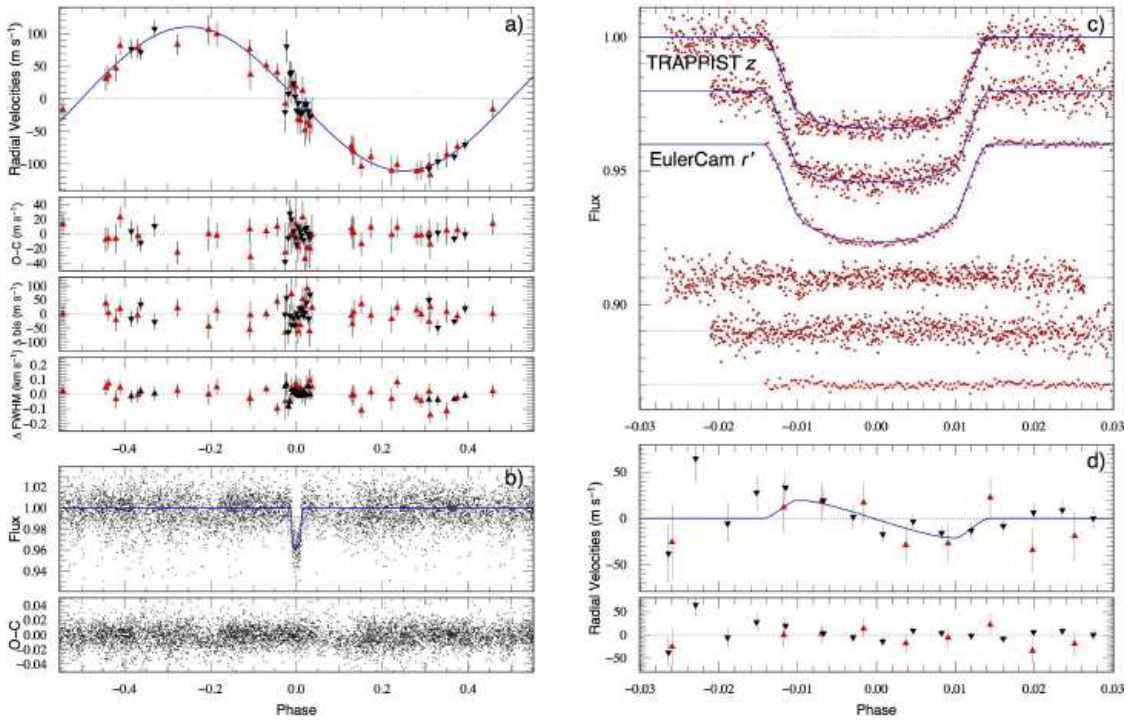

Figure 6: (Triaud et al.) (a) Top to bottom: CORALIE (upright red triangles) and HARPS (inverted black triangles) radial velocities on WASP-80 plotted with a circular Keplerian model and residuals; below: change in the span of the bisector slope and change in the FWHM of the CCF. (b) Phase-folded WASP V+R photometry with model and its residuals. (c) Top to bottom: the two TRAPPIST z band and the EulerCam r'-Gunn transit lightcurves with models over plotted. The residuals are displayed in the same order below. (d) Zoom on the Rossiter-McLaughlin effect showing CORALIE and HARPS radial velocities with the most likely model and the residuals from the fit.

3 Abstracts of theses

The Identification and Classification of Variability in Stellar Sources Observed with SuperWASP

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Ph.D. Thesis, Accepted

The purpose of this thesis was to create an automated classifier for periodic stellar objects in the Wide-Angle Search for Planets Survey (SuperWASP) and to use the classified stars to investigate three phenomena: differentiation of Beta Lyrae and W UMa eclipsing binary stars using eclipse-depth ratio; identification of RR Lyrae stars exhibiting the Blazhko effect; and, the presence of the Oosterhoff dichotomy in the Milky Way.

During this work, period/amplitude ranges and distribution maps were created for the classified stars in stellar classes Algol, Beta Lyrae, W UMa, Delta Scuti and RR Lyrae (RRAB) and comparison made with published equivalents. SuperWASP objects known in the General Catalogue of Variable Stars (GCVS) were also assessed to identify differences.

The automated system contained three neural networks (NNs) that processed parameters defining the shape of the phase-folded light-curve and they were trained with representative sets of eclipsing binary, pulsating and sinusoidal-like stars. The system, installed at Leicester University processed 4.3 million object/periods from the SuperWASP database, of which 1.1 million were given prospective classifications. From these, approximately 64 thousand objects consisting of eclipsing binary and pulsating stars were assessed manually to confirm the given period/classifications and roughly half were classified correctly. The reasons for the misclassifications were identified and recommendations made on improving the results.

The manually confirmed objects consisted of 12,882 Algols, 5,226 Beta Lyrae, 2,875 W UMa, 1,979 Delta Scutis and 8,322 RR Lyraes (RRAB), where significant numbers of each were unknown in SIMBAD or the GCVS. A separation range for eclipse-depth ratio between Beta Lyrae and W UMa stars was identified, but a cross-over point existed where differentiation was not possible. A number of new RRAB Blazhko stars were identified and the amplitude range between peaks calculated. The presence of the Oosterhoff dichotomy in the Milky Way galaxy was supported, but the causative factors could not be confirmed.

Comparison of the SuperWASP periods with the GCVS resulted in 649 variable stars being identified where the period was unknown in the GCVS and also revision of the variability period of 194 GCVS variable stars was suggested. For comparison of classification, sub-classes were suggested for 333 unconfirmed objects in the GCVS (e.g. CEP:, EA:, RR etc.) and re-classification was suggested for 197 GCVS objects with suspected incorrect classes.

4 Jobs and Positions

Postdoctoral Researcher Position in "Exoplanetary Magnetospheres"

Maxim Khodachenko
Space Research Institute, Austrian Academy of Sciences, Graz, Austria

Graz, Austria, February 1, 2013

The Space Research Institute of the Austrian Academy of Sciences in Graz, Austria, announces the availability of a Postdoctoral Researcher position in the "Exoplanetary Magnetospheres" project which is a part of a Key National Research Network program "Pathways to Habitability" (S116) supported by the Austrian Science Foundation (FWF). The research scope of the project includes (but not limited) the investigation of plasma processes and self-consistent magnetic field structure in the magnetospheres of giant exoplanets in the presence of a rotating magnetized planetary body and an escaping ionized atmospheric material flow.

The position will be given initially for 2 years, with a monthly (14 times, incl. vacations subsistence) brutto salary 3382 Euro. Prolongation of the position up to full 6 years may be possible, depending on the project performance and availability of funds. An early starting date, February 1, 2013 is encouraged.

A successful candidate is expected to have an advanced knowledge of space plasma physics with an expertise in plasma kinetic and MHD theories. Research experience in the field of planetary magnetospheric physics, planetary radio emission, as well as competence in numerical simulations would be an advantage.

Further details regarding the position may be requested from the project leader Dr. Maxim Khodachenko at Space Research Institute in Graz (maxim.khodachenko@oeaw.ac.at). Applications include a CV, a publication list, a summary of previous and current research (max 3 pages) submitted electronically as a PDF file to the project leader. Applicants also should arrange for three letters of reference sent by the referees directly to the same contact. Applications review begins in January 2013 and will continue until the position is given.

Contact: `maxim.khodachenko@oeaw.ac.at`

Postdoctoral Researcher in Planetary Astrophysics

Zoë Leinhardt
Astrophysics group, School of Physics, University of Bristol, UK

Bristol, UK, March 3, 2013

Applications are invited for a Research Assistant/Associate to work with Dr. Zoë Leinhardt in the Astrophysics group in the School of Physics at the University of Bristol on an interdisciplinary project to study changes in the bulk composition of the Earth during accretion. The level of the role will depend on the previous experience of the successful candidate and will be decided at the appointment stage.

The Research Assistant/Associate will be responsible for (1) conducting numerical simulations of the formation of planetary embryos in the terrestrial region using an N-body code and (2) analyzing these results to determine the compositional differences between embryos and the original planetesimals that could arise because of incomplete accretion. The main focus of this project is to determine if the collisional growth and evolution of the Earth could result in a non-chondritic bulk composition.

The Research Assistant/Associate will also collaborate with colleagues Prof. Tim Elliott and Prof. Mike Walter in the School of Earth Sciences at the University of Bristol and Prof. Sarah T. Stewart in the Department of Earth and

Planetary Science at Harvard University.

Applicants with interests in computational astrophysics/geophysics and planetary chemistry are strongly encouraged to apply. A PhD in Astrophysics, Geophysics or related field is required.

The appointment is for 30 months with a nominal start date in early May. Applicants are requested to apply online at www.bris.ac.uk/jobs (ref:ACAD100184) by 3rd March. Interviews will be held the week commencing 11th March. For inquiries please email Dr. Leinhardt at Zoe.Leinhardt@bristol.ac.uk.

Download/Website: `http:www.bris.ac.uk/jobs`

Contact: `Zoe.Leinhardt@bristol.ac.uk`

5 Conference announcements

The Universe Explored by Herschel

Göran Pilbratt, on behalf of the SOC and LOC
European Space Agency

ESTEC, Noordwijk, The Netherlands, 15-18 October 2013

The Herschel 'First Results Symposium' was held in May 2010 in the ESTEC Conference Centre. More than 400 astronomers shared in the excitement during the four memorable days of the first major scientific symposium featuring Herschel results. There have been numerous expressions of interest regarding future meetings. The organisers are now pleased to be in a position to extend an invitation to the community for a follow-up meeting.

The overall objective of 'The Universe Explored by Herschel' meeting will be to present, discuss, and take stock of the scientific breakthroughs to date based on Herschel observations, and their impact. The symposium will feature invited and contributed talks, and posters in five sessions:

- Galaxy formation & evolution
- Large scale galactic structure & nearby galaxies
- Water, astrochemistry & ISM physics
- Star & planetary system formation & evolution
- The Solar System & its evolution

The Second Announcement and Call for Papers was issued on 25 January 2013, the deadline for abstract submission is 31 May 2013. All information about the meeting is available on the conference website below.

Download/Website: `http://congrexprojects.com/13a12/`

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

2013 Sagan Summer Workshop: Imaging Planets and Disks

C. Brinkworth
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, July 29 – August 2, 2013

Registration and the application for financial aid are now available for the 2013 Sagan Exoplanet Summer Workshop on "Imaging Planets and Disks" hosted by the NASA Exoplanet Science Institute (NExScI). The workshop will take place on the Caltech campus July 29 - August 2, 2013. The workshop is intended for graduate students and postdocs, however all interested parties are welcome to attend.

The 2013 workshop will explore current techniques and technology used to detect exoplanets and debris disks, as well as the underlying science driving the modeling of exoplanetary atmospheres and disk structure. A number of ground-based surveys are presently underway using advanced coronagraphs and Extreme Adaptive Optics on 5-10 m telescopes while new algorithms are being used to dig deeper in space-based datasets. Leaders in the field will summarize the current state of the art in science, hardware, and software. Prospects for future space instruments will also be discussed. Attendees will participate in hands-on exercises to gain experience working with imaging data, astrophysical models, and instrument design. Attendees will also have the opportunity to present their own work through short presentations (research POPs) and posters.

Important Dates

- February 1: On-line Registration available and Financial Support Application period open
- March 1: Financial Support applications and supporting letter of recommendation due
- March 25: Financial Support decisions announced via email
- April 1: POP/Poster submission page on-line
- June 14: Early on-line registration ends
- June 28: POP/Poster Submission deadline
- July 12: On-line registration closed and Hotel Registration deadline to be eligible for group rate
- July 12: Deadline for hotel reservations in room block at the Pasadena Sheraton
- July 12: Final Agenda posted
- July 28: Sagan Exoplanet Summer Workshop Opening Reception
- July 29-Aug 2: 2013 Sagan Exoplanet Summer Workshop

Download/Website: `http://nexsci.caltech.edu/workshop/2013`
Contact: `sagan_workshop@ipac.caltech.edu`

6 Announcements

Habitable Zone Gallery upgrade

Stephen R. Kane & Dawn M. Gelino
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The Habitable Zone Gallery (www.hzgallery.org) is a service to the exoplanet community which provides Habitable Zone information for each of the exoplanetary systems with known planetary orbital parameters. We announce significant upgrades to the service to improve both functionality and the scientific content. These include:

- Upgrades to the interface, front page, and table environments.
- Complete site rebuild to incorporate new Habitable Zone estimates by Kopparapu et al. 2013, ApJ, in press (arXiv:1301.6674)
- New animations for circumbinary planetary systems based on the calculations of Kane & Hinkel, 2013, ApJ, 762, 7.
- Movies are now in High Definition MPEG-2 and MPEG-4 formats.

We welcome feedback and suggestions.

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

Contact: `skane@ipac.caltech.edu,dawn@ipac.caltech.edu`

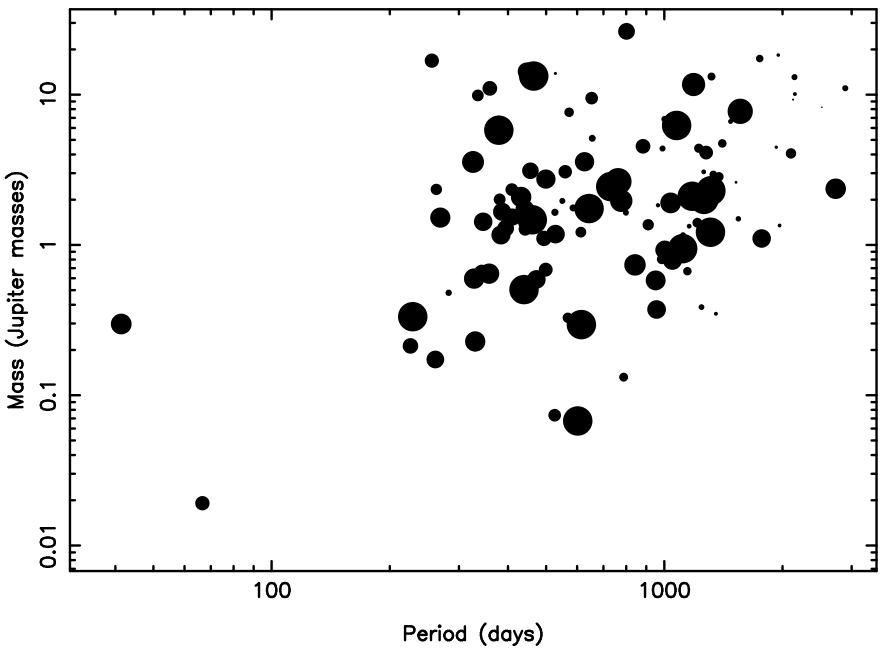

Figure 7: (Kane & Gelino) The current state of known exoplanets which enter their Habitable Zones. This is shown with respect to the planetary masses and orbital periods. The size of the points linearly increases with the percentage of time spent within the Habitable Zone.

2013B NASA Keck Call for General Observing Proposals and Special Multi-Semester Kepler Key Science Call

Dr. Dawn M. Gelino
NASA Exoplanet Science Institute

Proposals Due: March 14, 2013, 4 pm PDT

NASA is soliciting proposals to use the two 10m W. M. Keck Telescopes for the 2013B observing semester (August 2013 - January 2014). The opportunity to propose as Principal Investigators for NASA time on the Keck Telescopes is open to all U.S.-based astronomers (U.S.-based astronomers have their principal affiliation at a U.S. institution). *Investigators from institutions outside of the U.S. may be on proposals as Co-Investigators.*

NASA intends the use of the Keck telescopes to be highly strategic in support of on-going space missions and/or high priority, long term science goals. NASA Keck time is open to a wide range of disciplines including exoplanets and solar system topics, galactic, and extragalactic topics, cosmology and high energy astrophysics.

Proposals are also sought in the following discipline areas: (1) investigations in support of EXOPLANET EXPLORATION science goals and missions; (2) investigations of our own SOLAR SYSTEM; (3) investigations in support of COSMIC ORIGINS science goals and missions; (4) investigations in support of PHYSICS OF THE COSMOS science goals and missions; and (5) direct MISSION SUPPORT.

Special Multi-Semester Kepler Key Science Call:
Keck has been critical to validation and characterization of Kepler exoplanets since 2009. For the period 2013B-2015A, NASA will allocate $\sim$10 nights per semester for follow-up activities via competitive selection of Key Projects. This will be the only opportunity to propose for the majority of Keck follow-up time for Kepler exoplanet science.

Single-semester proposals for all Kepler-related science will continue to be accepted as part of the standard NASA Keck call.

Properties of the Kepler Key Projects are:

- Proposals must be relevant to Kepler's exoplanet goals
- Multi-semester proposals requesting between 2 and 4 semesters
- Up to a total of 40 nights with no more than $\sim$10 nights/semester
- Small, multi-semester proposals are also encouraged

The text of this call along with the online electronic submission page will be available on Feb. 7. The proposal process is being handled by the NASA Exoplanet Science Institute (NExScI) at Caltech and all proposals are due on 14 March 2013 at 4 pm PDT.

Download/Website: `http://nexsci.caltech.edu/missions/KeckSolicitation/index.shtml`

Contact: `KeckCFP@ipac.caltech.edu`

NASA Exoplanet Archive hosts Kepler mission KOIs and TCEs

Rachel Akeson on behalf of the NASA Exoplanet Archive team
NASA Exoplanet Science Institute/Caltech

Update to the NASA Exoplanet Archive, Data available now

The NASA Exoplanet Science Institute (NExScI) announces a major update to the NASA Exoplanet Archive (http://exoplanetarchive.ipac.caltech.edu). As part of the Kepler Extended Mission, the NASA Exoplanet Archive hosts interactive tables for Kepler Objects of Interest (KOIs) and Threshold Crossing Events (TCEs). The Kepler project has released the KOI list for the quarter 1-8 data as well as the cumulative KOI table, which compiles historical information from the individual KOI tables to provide the most accurate dispositions and stellar and planetary information in one place. The cumulative KOI table contains 2740 candidates and confirmed planets and 801 false positives and can be accessed in an interactive table. The Kepler project is making additional information from the pipeline available to the entire community including 18,406 TCEs and Data Validation (DV) Reports. The data are available from the NASA Exoplanet Archive interactive tables, popup bubbles, and Kepler overview pages.
Sign-up for NASA Exoplanet Archive updates at https://lists.ipac.caltech.edu/mailman/listinfo/exoplanet-announce

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

Contact: `http://exoplanetarchive.ipac.caltech.edu/applications/Helpdesk`

7 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during December 2012 and January 2013. If you see any that we missed, please let us know and we'll include them in the next issue.

December 2012

astro-ph/1212.0028 : **Dynamical Instabilities in High-Obliquity Systems** by *Daniel Tamayo, et al*
astro-ph/1212.0113 : **On the probability of habitable planets** by *Francois Forget*
astro-ph/1212.0236 : **Stellar Surface Magneto-Convection as a Source of Astrophysical Noise. I. Multi-component Parameterisation of Absorption Line Profiles** by *H. M. Cegla, et al.*
astro-ph/1212.0285 : **MOST Space Telescope Photometry of the 2010 January Transit of Extrasolar Planet HD80606b** by *Jessica E. Roberts, et al.*
astro-ph/1212.0519 : **Planets in the Early Universe** by *Yu. A. Shchekinov, M. Safonova, J. Murthy*
astro-ph/1212.0686 : **An extremely high photometric precision in ground-based observations of two transits in the WASP-50 planetary system** by *Jeremy Tregloan-Reed, John Southworth*
astro-ph/1212.1206 : **0.94 - 2.42 micron ground-based transmission spectra of the hot-Jupiter HD-189733b** by *C. Danielski, et al.*
astro-ph/1212.1219 : **Rossby Wave Instability in Accretion Discs with Large-Scale Poloidal Magnetic Fields** by *Cong Yu, Dong Lai*
astro-ph/1212.1450 : **The debris disk around gamma Doradus resolved with Herschel** by *Hannah Broekhoven-Fiene, et al.*
astro-ph/1212.1459 : **Coronagraphic observations of Fomalhaut at solar system scales** by *M. A. Kenworthy et al.*
astro-ph/1212.1465 : **Planet formation in small separation binaries: not so excited after all** by *Roman R. Rafikov*
astro-ph/1212.1466 : **Spiral Arms in the Asymmetrically Illuminated Disk of MWC 758 and Constraints on Giant Planets** by *C. A. Grady, et al.*

astro-ph/1212.1482 : **Constraints on planet formation via gravitational instability across cosmic time** by *Jarrett L. Johnson, Hui Li*
astro-ph/1212.1558 : **Dynamics and Accretion of Planetesimals** by *Eiichiro Kokubo, Shigeru Ida*
astro-ph/1212.1561 : **Circumstellar disks can erase the effects of stellar fly-bys on planetary systems** by *Francesco Marzari, Giovanni Picogna*
astro-ph/1212.1732 : **Microlens Terrestrial Parallax Mass Measurements: A Rare Probe of Isolated Brown Dwarfs and Free-Floating Planets** by *Andrew Gould, Jennifer C. Yee*
astro-ph/1212.1793 : **Tracing large-scale structures in circumstellar disks with ALMA** by *Jan Philipp Ruge, et al.*
astro-ph/1212.1810 : **Dust particles in mean motion resonances influenced by an interstellar gas flow** by *P. Pastor*
astro-ph/1212.1859 : **On The Relative Sizes of Planets Within Kepler Multiple Candidate Systems** by *David R. Ciardi et al.*
astro-ph/1212.2062 : **Carbonate Formation in Non-Aqueous Environments by Solid-Gas Carbonation of Silicates** by *S. J. Day et al.*
astro-ph/1212.2179 : **The stability of the triangular libration points for the plane circular restricted three-body problem with light pressure** by *M. Alvarez-Ramrez, et al.*
astro-ph/1212.2217 : **How to build Tatooine: reducing secular excitation in Kepler circumbinary planet formation** by *Roman R. Rafikov*
astro-ph/1212.2227 : **The ESPRI project: astrometric exoplanet search with PRIMA I. Instrument description and performance of first light observations** by *J. Sahlmann, et al.*
astro-ph/1212.2372 : **The effect of stellar limb darkening values on the accuracy of the planet radii derived from photometric transit observations** by *Sz. Csizmadia, et al.*
astro-ph/1212.2402 : **Mechanisms of Planetary and Stellar Dynamos** by *Emmanuel Dormy, Ludovic Petitdemange, Martin Schrinner*
astro-ph/1212.2545 : **An Analytic Theory for the Orbits of Circumbinary Planets** by *Gene C. K. Leung, Man Hoi Lee*
astro-ph/1212.2637 : **High Resolution Infrared Imaging & Spectroscopy of the Z Canis Majoris System During Quiescence & Outburst** by *Sasha Hinkley et al.*
astro-ph/1212.2638 : **Spectral Fingerprints of Earth-like Planets Around FGK Stars** by *Sarah Rugheimer, et al.*
astro-ph/1212.2662 : **Gas Giants in Hot Water: Inhibiting Giant Planet Formation and Planet Habitability in Dense Star Clusters Through Cosmic Time** by *Todd A. Thompson*
astro-ph/1212.2779 : **3D Gas Dynamic Simulation of the Interaction Between the Exoplanet WASP-12b and Its Host Star** by *D. Bisikalo, et al.*
astro-ph/1212.2848 : **Impact of stellar companions on precise radial velocities** by *D. Cunha, et al.*
astro-ph/1212.2915 : **Detection of Potential Transit Signals in the First Twelve Quarters of Kepler Mission Data** by *Peter Tenenbaum, et al.*
astro-ph/1212.3056 : **The Possibility of the Kelvin-Helmholtz Instability during Sedimentation of Dust Grains in the Protoplanetary Disk** by *Yukihiko Hasegawa, Toru Tsuribe*
astro-ph/1212.3101 : **Study of the chemical evolution and spectral signatures of some interstellar precursor molecules of adenine, glycine alanine** by *Liton Majumdar, et al.*
astro-ph/1212.3297 : **Exploring organic chemistry in planet-forming zones** by *Jeanette E. Bast, et al.*
astro-ph/1212.3340 : **The Physical Structure of Protoplanetary Disks: the Serpens Cluster Compared with Other Regions** by *Isa Oliveira, et al.*
astro-ph/1212.3372 : **Metallicity of M dwarfs III. Planet-metallicity and planet-stellar mass correlations of the HARPS GTO M dwarf sample** by *V. Neves, et al.*
astro-ph/1212.3553 : **A Photometric Study of the Hot Exoplanet WASP-19b** by *M. Lendl, et al.*
astro-ph/1212.3701 : **A lower radius and mass for the transiting extrasolar planet HAT-P-8b** by *L. Mancini,*

et al.

astro-ph/1212.3843 : **Analysis of the motion of an extrasolar planet in a binary system** by *E. Plvalov, N. A. Solovaya*

astro-ph/1212.4058 : **Additional Keplerian Signals in the HARPS data for Gliese 667C from a Bayesian Re-analysis** by *Philip C. Gregory*

astro-ph/1212.4088 : **The most common habitable planets - atmospheric characterization of the subgroup of fast rotators** by *R. Pinotti*

astro-ph/1212.4150 : **Exoplanets Beyond the Solar Neighbourhood: Galactic Tidal Perturbations** by *Dimitri Veras, N. Wyn Evans*

astro-ph/1212.4277 : **Signals embedded in the radial velocity noise. Periodic variations in the tau Ceti velocities** by *Mikko Tuomi, et al.*

astro-ph/1212.4425 : **Magnetic Activity Cycles in the Exoplanet Host Star epsilon Eridani** by *T.S. Metcalfe, et al.*

astro-ph/1212.4710 : **XUV exposed, non-hydrostatic hydrogen-rich upper atmospheres of terrestrial planets II: Hydrogen coronae and ion escape** by *K. G. Kislyakova, et al.*

astro-ph/1212.4833 : **The Ultraviolet Radiation Environment Around M dwarf Exoplanet Host Stars** by *Kevin France, et al.*

astro-ph/1212.4853 : **Fast Rise of "Neptune-Size" Planets (4 – 8 R_Earth) from P $\sim$ 10 to $\sim$ 250 days – Statistics of Kepler Planet Candidates Up to ~ 0.75 AU** by *Subo Dong, Zhaohuan Zhu*

astro-ph/1212.4867 : **Single mode, extreme precision Doppler spectrographs** by *Christian Schwab, et al.*

astro-ph/1212.4884 : **Detectability of Earth-like Planets in Circumstellar Habitable Zones of Binary Star Systems with Sun-like Components** by *Siegfried Eggl, Nader Haghighipour, Elke Pilat-Lohinger*

astro-ph/1212.4982 : **XUV exposed non-hydrostatic hydrogen-rich upper atmospheres of terrestrial planets. Part I: Atmospheric expansion and thermal escape** by *N. V. Erkaev, et al.*

astro-ph/1212.5020 : **On the potential of the EChO mission to characterise gas giant atmospheres** by *Joanna K. Barstow, et al.*

astro-ph/1212.5601 : **Orbital and Evolutionary Constraints on the Planet Hosting Binary GJ 86 from the Hubble Space Telescope** by *J. Farihi, et al.*

astro-ph/1212.5922 : **Finding Exoplanets Orbiting Young Active Stars. I. Technique** by *V. E. Moulds, et al.*

astro-ph/1212.6448 : **HAT-P-42b and HAT-P-43b. Two Inflated Transiting Hot Jupiters from the HATNet Survey** by *I. Boisse, et al.*

astro-ph/1212.6713 : **Saturation of Stellar Winds from Young Suns** by *Takeru K. Suzuki et al.*

January 2013

astro-ph/1301.0023 : **Characterizing the Cool KOIs IV: Kepler-32 as a prototype for the formation of compact planetary systems throughout the Galaxy** by *Jonathan J. Swift, et al.*

astro-ph/1301.0217 : **Characterization of potentially habitable planets: Retrieval of atmospheric and planetary properties from emission spectra** by *P. von Paris, et al.*

astro-ph/1301.0235 : **Hot Moons and Cool Stars** by *Ren Heller, Rory Barnes*

astro-ph/1301.0250 : **Successful Asteroseismology for a Better Characterization of the Exoplanet HAT-P-7b** by *M. Oshagh, et al.*

astro-ph/1301.0318 : **Non-turbulent Accretion in Protoplanetary Disks. I: Suppression of the Magnetorotational Instability and Launching of the Magnetocentrifugal Wind** by *Xue-Ning Bai, James M. Stone*

astro-ph/1301.0625 : **Imaging Discovery of the Debris Disk Around HIP 79977** by *C. Thalmann et al.*

astro-ph/1301.0644 : **Planet Hunters. V. A Confirmed Jupiter-Size Planet in the Habitable Zone and 42 Planet Candidates from the Kepler Archive Data** by *Ji Wang, et al.*

astro-ph/1301.0779 : **Disk-planets interactions and the diversity of period ratios in Kepler's multi-planetary systems** by *Clement Baruteau, John C. B. Papaloizou*

astro-ph/1301.0818 : **A Detailed Model Grid for Solid Planets from 0.1 through 100 Earth Masses** by *Li Zeng, Dimitar D. Sasselov*
astro-ph/1301.0842 : **The false positive rate of Kepler and the occurrence of planets** by *Francois Fressin, et al.*
astro-ph/1301.0968 : **Re-evaluating Hot Jupiter WASP-12b: An Update** by *Ian J. M. Crossfield, et al.*
astro-ph/1301.1151 : **The Effect of Irradiation on the Jeans Mass in Fragmenting Self-Gravitating Protostellar Discs** by *Duncan Forgan, Ken Rice*
astro-ph/1301.1331 : **Asteroid Belts in Debris Disk Twins: VEGA and FOMALHAUT** by *Kate Y. L. Su, et al.*
astro-ph/1301.1472 : **Properties of extrasolar planets and their host stars - a case study of HAT-P-7** by *Vincent Van Eylen, et al.*
astro-ph/1301.1487 : **Magnetized Accretion and Dead Zones in Protostellar Disks** by *Natalia Dzyurkevich, et al.*
astro-ph/1301.1516 : **Influence of viscosity and the adiabatic index on planetary migration** by *B. Bitsch, A. Boley, W. Kley*
astro-ph/1301.1698 : **Mineral Processing by Short Circuits in Protoplanetary Disks** by *Colin P. McNally, et al.*
astro-ph/1301.1727 : **The structure of gas-accreting protoplanets and the condition of the critical core mass** by *Kazuhiro D. Kanagawa, M. Y. Fujimoto*
astro-ph/1301.1853 : **The Hunt for Exomoons with Kepler (HEK): II. Analysis of Seven Viable Satellite-Hosting Planet Candidates** by *David M. Kipping, et al.*
astro-ph/1301.1860 : **Near-UV Absorption, Chromospheric Activity, and Star-Planet Interactions in the WASP-12 system** by *C. A. Haswell, et al.*
astro-ph/1301.1874 : **From Planetesimals to Dust: Low Gravity Experiments on Recycling Solids at the Inner Edge of Protoplanetary Disks** by *Caroline De Beule, et al.*
astro-ph/1301.1976 : **Lopsided dust rings in transition disks** by *T. Birnstiel, C. P. Dullemond, P. Pinilla*
astro-ph/1301.2004 : **Effects of a planetesimal debris disk on stability scenarios for the extrasolar planetary system HR 8799** by *Alexander J. Moore, Alice C. Quillen*
astro-ph/1301.2048 : **EXOTIME: searching for planets and measuring Pdot in sdB pulsators** by *Ronny Lutz, Sonja Schuh, Roberto Silvotti*
astro-ph/1301.2064 : **Global streaming instability in ring-shaped protoplanetary disks** by *Mir Abbas Jalali*
astro-ph/1301.2109 : **Searching for the signatures of terrestrial planets in F-, G-type main-sequence stars** by *J. I. Gonzalez Hernandez, et al.*
astro-ph/1301.2337 : **Type I planet migration in weakly magnetised laminar discs** by *Jerome Guilet, Clement Baruteau, John C. B. Papaloizou*
astro-ph/1301.2384 : **Candidate Planets in the Habitable Zones of Kepler Stars** by *Eric Gaidos*
astro-ph/1301.2394 : **Kepler's Missing Planets** by *Jason H. Steffen*
astro-ph/1301.2600 : **Turbulent Disks are Never Stable: Fragmentation and Turbulence-Promoted Planet Formation** by *Philip F. Hopkins, Jessie L. Christiansen*
astro-ph/1301.2624 : **CARMA interferometric observations of 2MASS J044427+2512: the first spatially resolved observations of thermal emission of a brown dwarf disk** by *L. Ricci, et al.*
astro-ph/1301.2741 : **The HARPS search for southern extrasolar planets: XXXIII. New multi-planet systems in the HARPS volume limited sample: a super-Earth and a Neptune in the habitable zone** by *G. Lo Curto, et al.*
astro-ph/1301.2891 : **Detection of Laplace-resonant three-planet systems from transit timing variations** by *A.-S. Libert, S. Renner*
astro-ph/1301.3005 : **Physical properties of the WASP-44 planetary system from simultaneous multi-colour photometry** by *L. Mancini, et al.*
astro-ph/1301.3015 : **The interplay between X-ray photoevaporation and planet formation** by *Giovanni P. Rosotti, et al.*
astro-ph/1301.3145 : **Planetary System Disruption by Galactic Perturbations to Wide Binary Stars** by *Nathan A. Kaib, Sean N. Raymond, Martin Duncan*

astro-ph/1301.3178 : **Orbital Migration of Protoplanets in a Marginally Gravitationally Unstable Disk** by *Alan P. Boss*

astro-ph/1301.3380 : **The GROUSE project III: Ks-band observations of the thermal emission from WASP-33b** by *E. J. W. de Mooij, et al.*

astro-ph/1301.3438 : **Signals embedded in the radial velocity noise** by *Mikko Tuomi*

astro-ph/1301.3629 : **Bouncing Behavior of Microscopic Dust Aggregates** by *Alexander Seizinger, Wilhelm Kley*

astro-ph/1301.3760 : **Transit timing variations in WASP-10b induced by stellar activity?** by *S. C. C. Barros et al.*

astro-ph/1301.3910 : **Hybrid methods in planetesimal dynamics: Formation of protoplanetary systems and the mill condition** by *Pau Amaro-Seoane, Patrick Glaschke, Rainer Spurzem*

astro-ph/1301.3955 : **Observations of the WASP-2 System by the APOSTLE Program** by *Andrew C. Becker, et al.*

astro-ph/1301.4041 : **Blind extraction of an exoplanetary spectrum through Independent Component Analysis** by *Ingo P. Waldmann, et al.*

astro-ph/1301.4229 : **Small flow rate can supply inwardly migrating shortest-period planets** by *Stuart F. Taylor*

astro-ph/1301.4453 : **Habitable Planets Eclipsing Brown Dwarfs: Strategies for Detection and Characterization** by *Adrian R. Belu, et al.*

astro-ph/1301.4503 : **Kepler's Optical Secondary Eclipse of HAT-P-7b and Probable Detection of Planet-Induced Stellar Gravity Darkening** by *Brett M. Morris, Avi M. Mandell, Drake Deming*

astro-ph/1301.4522 : **3D mixing in hot Jupiter atmospheres I: application to the day/night cold trap in HD 209458b** by *Vivien Parmentier, Adam P. Showman, Yuan Lian*

astro-ph/1301.4994 : **Detecting bio-markers in habitable-zone earths transiting white dwarfs** by *Abraham Loeb, Dan Maoz*

astro-ph/1301.4996 : **The sub-stellar birth rate from UKIDSS** by *A. C. Day-Jones, et al.*

astro-ph/1301.5239 : **On close-in magnetized star-planet interactions** by *A. Strugarek, A. S. Brun, S. Matt*

astro-ph/1301.5441 : **Multi-Planet Destabilisation and Escape in Post-Main Sequence Systems** by *George Voyatzis, et al.*

astro-ph/1301.5499 : **Transit Timing Observations from Kepler. VIII Catalog of Transit Timing Measurements of the First Twelve Quarters** by *Tsevi Mazeh, et al.*

astro-ph/1301.5562 : **The Elemental Compositions of Extrasolar Planetesimals** by *M. Jura*

astro-ph/1301.5627 : **Clouds and Hazes in Exoplanet Atmospheres** by *Mark S. Marley, et al.*

astro-ph/1301.5665 : **Water transport in protoplanetary disks and the hydrogen isotopic composition of chondrites** by *Emmanuel Jacquet, Franois Robert*

astro-ph/1301.5817 : **On vertical variations of gas flow in protoplanetary disks and their impact on the transport of solids** by *Emmanuel Jacquet*

astro-ph/1301.5884 : **On High-Contrast Characterization of Nearby, Short-Period Exoplanets with Giant Segmented-Mirror Telescopes** by *Ian J. M. Crossfield*

astro-ph/1301.5976 : **Multi-site campaign for transit timing variations of WASP-12 b: possible detection of a long-period signal of planetary origin** by *G. Maciejewski, et al.*

astro-ph/1301.6030 : **Atmospheric escape from HD 189733b observed in HI Lyman-alpha: detailed analysis of HST/STIS September 2011 observations** by *Vincent Bourrier, et al.*

astro-ph/1301.6147 (cross-list from astro-ph.SR) : **A Search for Exozodiacal Clouds with Kepler** by *Christopher C. Stark, et al.*

astro-ph/1301.6289 : **The Stellar Obliquity and the Long-period planet in the HAT-P-17 Exoplanetary System** by *Benjamin J. Fulton, et al.*

astro-ph/1301.6555 : **Spitzer Observations of GJ3470b: a Very Low-density Neptune-size Planet Orbiting a Metal-rich M dwarf** by *Brice-Olivier Demory, et al.*

astro-ph/1301.6674 : **Habitable Zones Around Main-Sequence Stars: New Estimates** by *Ravi kumar Koppa-*

rapu, et al.

astro-ph/1301.6763 : **Spitzer Transits of the Super-Earth GJ1214b and Implications for Its Atmosphere** by *Jonathan D. Fraine, et al.*

astro-ph/1301.6876 (cross-list from astro-ph.SR) : **The twofold debris disk around HD 113766 A - Warm and cold dust as seen with VLTI/Midi and Herschel/Pacs** by *Johan Olofsson, et al.*

astro-ph/1301.7431 : **Testing In Situ Assembly with the Kepler Planet Candidate Sample** by *Brad Hansen, Norm Murray*

astro-ph/1301.7586 : **Ionisation in atmospheres of Brown Dwarfs and extrasolar planets III. Breakdown conditions for mineral clouds** by *Ch. Helling et al.*