ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the thirty-second edition of ExoPlanet News, an electronic newsletter reporting the latest developments and research outputs in the field of exoplanets.

We are pleased to present a full newsletter this month, covering the last two months of exciting new results. If you'd like to bring your recent papers to the attention of a wider audience, please submit them to the next and future editions – the newsletter now has a circulation of over 1000 readers. 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.

Please send anything relevant to exoplanet@open.ac.uk, and it will appear in the next edition which we plan to send out at the beginning of October 2010. As for this issue, if you wish to include ONE .eps figure per abstract, please do so.

Best wishes
Andrew Norton & Glenn White
The Open University

2 Abstracts of refereed papers

The climate of HD 189733b from fourteen transits and eclipses measured by Spitzer

Eric Agol[1,2], *Nicolas B. Cowan*[1], *Heather A. Knutson*[3], *Drake Deming*[4], *Jason H. Steffen*[5], *Gregory W. Henry*[6], *and David Charbonneau*[7]
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Astrophysical Journal, in press (arXiv:1007.4378)

We present observations of six transits and six eclipses of the transiting planet system HD 189733 taken with the *Spitzer Space Telescope IRAC* camera at 8 microns, as well as a re-analysis of previously published data. We use several novel techniques in our data analysis, the most important of which is a new correction for the detector "ramp" variation with a double-exponential function which performs better and is a better physical model for this detector variation. Our main scientific findings are: (1) an upper limit on the variability of the day-side planet flux of 2.7% (68% confidence); (2) the most precise set of transit times measured for a transiting planet, with an average

accuracy of 3 seconds; (3) a lack of transit-timing variations, excluding the presence of second planets in this system above 20% of the mass of Mars in low-order mean-motion resonance at 95% confidence; (4) a confirmation of the planet's phase variation, finding the night side is 64% as bright as the day side, as well as an upper limit on the night-side variability of 17% (68% confidence); (5) a better correction for stellar variability at 8 micron causing the phase function to peak 3.5 hours before secondary eclipse, confirming that the advection and radiation timescales are comparable at the 8 micron photosphere; (6) variation in the depth of transit, which possibly implies variations in the surface brightness of the portion of the star occulted by the planet, posing a fundamental limit on non-simultaneous multi-wavelength transit absorption measurements of planet atmospheres; (7) a measurement of the infrared limb-darkening of the star, which is in good agreement with stellar atmosphere models; (8) an offset in the times of secondary eclipse of 69 seconds, which is mostly accounted for by a 31 second light travel time delay and 33 second delay due to the shift of ingress and egress by the planet hot spot; this confirms that the phase variation is due to an offset hot spot on the planet; (9) a retraction of the claimed eccentricity of this system due to the offset of secondary eclipse, which is now just an upper limit; and (10) high precision measurements of the parameters of this system. These results were enabled by the exquisite photometric precision of the *Spitzer IRAC* camera; for repeat observations the scatter is less than 0.35 mmag over the 590 day time scale of our observations after decorrelating with detector parameters.

Download/Website: `http://arxiv.org/abs/1007.4378`

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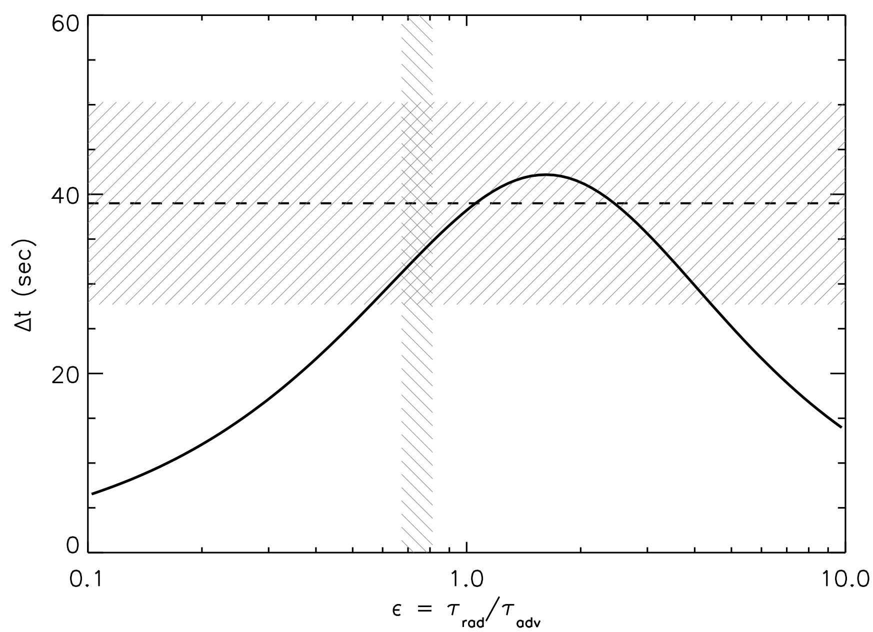

Figure 1: (Agol et al.) Timing offset for a hot spot model as a function of the ratio of the radiative to advective time scales (ϵ). The dashed line is the best-fit eclipse time offset after correction for light travel time, and horizontal rectangular shaded region is the 1-σ confidence limit on this time. The vertical rectangular shaded region is the best-fit value of ϵ to the 8 micron phase function, after correcting for stellar variability.

Probing potassium in the atmosphere of HD 80606b with tunable filter transit spectrophotometry from the Gran Telescopio Canarias

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Monthly Notices of the Royal Astronomical Society, submitted (arXiv:1008.4800)

We report observations of HD 80606 using the 10.4-m Gran Telescopio Canarias (GTC) and the OSIRIS tunable filter imager. We acquired very-high-precision, narrow-band photometry in four bandpasses around the K I absorption feature during the January 2010 transit of HD 80606b and during out-of-transit observations conducted in April 2010. We obtained differential photometric precisions as small as $\sim 2.9 \times 10^{-5}$. We find no significant difference between observations at 768.76 and 769.91 nm, which probe the K I line core. Yet, we observe significant differences ($3.08 \pm 0.53 \times 10^{-4}$ and $7.00 \pm 0.40 \times 10^{-4}$) between these observations and observations at two longer wavelengths that probe the K I wing (773.66 and 777.36 nm). The large change in the apparent planetary radius with wavelength (~ 3.6%) is much larger than the atmospheric scale height. This implies the observations probed the atmosphere at low pressures as well as a dramatic change in the pressure at which the slant optical depth reaches unity between $\sim$770 and 777 nm. We hypothesize that the excess absorption may be due to K I in a high-speed wind being driven from the exoplanet's exosphere. We discuss the viability of this and alternative interpretations. Finally, we discuss the future prospects for exoplanet characterization using tunable filter spectrophotometry.

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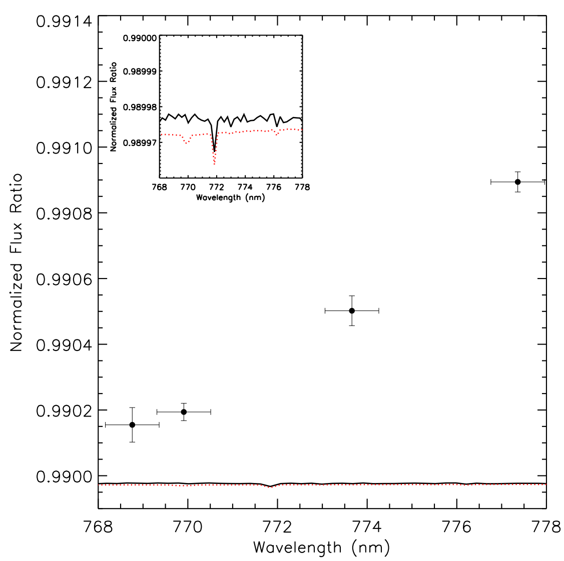

Figure 2: (Colon et al.) Normalized in-transit flux ratio versus observed wavelength (in the frame of the planet). The flux ratios shown are the weighted mean ratios as computed for each bandpass (see Section 3). The vertical error bars include a scaling factor to account for the effects of red noise. The "error bars" in the horizontal direction indicate the FWHM of each bandpass. The lines show the predictions of planetary atmosphere models (see Section 4.4 for details). The inset figure shows the predicted variation with wavelength with a small vertical scale. While limb darkening or night-to-night variability (of Earth's atmosphere or either star) could affect the overall normalization, the change in the flux ratio with wavelength is insensitive to such systematics.

Realisation of a fully-deterministic microlensing observing strategy for inferring planet populations

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Astronomische Nachrichten, published (ADS:2010AN....331..671D; DOI:10.1002/asna.201011400)

Within less than 15 years, the count of known planets orbiting stars other than the Sun has risen from none to more than 400 with detections arising from four successfully applied techniques: Doppler-wobbles, planetary transits, gravitational microlensing, and direct imaging. While the hunt for twin Earths is on, a statistically well-defined sample of the population of planets in all their variety is required for probing models of planet formation and orbital evolution so that the origin of planets that harbour life, like and including ours, can be understood. Given the different characteristics of the detection techniques, a complete picture can only arise from a combination of their respective results. Microlensing observations are well-suited to reveal statistical properties of the population of planets orbiting stars in either the Galactic disk or bulge from microlensing observations, but a mandatory requirement is the adoption of strictly-deterministic criteria for selecting targets and identifying signals. Here, we describe a fully-deterministic strategy realised by means of the ARTEMiS (Automated Robotic Terrestrial Exoplanet Microlensing Search) system at the Danish 1.54m telescope at ESO La Silla between June and August 2008 as part of the MiNDSTEp (Microlensing Network for the Detection of Small Terrestrial Exoplanets) campaign, making use of immediate feedback on suspected anomalies recognized by the SIGNALMEN anomaly detector. We demonstrate for the first time the feasibility of such an approach, and thereby the readiness for studying planet populations down to Earth mass and even below, with ground-based observations. While the quality of the real-time photometry is a crucial factor on the efficiency of the campaign, an impairment of the target selection by data of bad quality can be successfully avoided. With a smaller slew time, smaller dead time, and higher through-put, modern robotic telescopes could significantly outperform the 1.54m Danish, whereas lucky-imaging cameras could set new standards for high-precision follow-up monitoring of microlensing events.

Download/Website: `http://dx.doi.org/10.1002/asna.201011400`

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Detection limits for close eclipsing and transiting sub-stellar and planetary companions to white dwarfs in the WASP survey

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1008.1089)

We have performed extensive simulations to explore the possibility of detecting eclipses and transits of close, sub-stellar and planetary companions to white dwarfs in WASP light-curves. Our simulations cover companions $\sim$0.3$R_\oplus < R_{pl} < 12R_\oplus$ and orbital periods 2h$<$ P $<$15d, equivalent to orbital radii 0.003AU$< a < 0.1$AU. For Gaussian random noise WASP is sensitive to transits by companions as small as the Moon orbiting a $V \simeq 12$ white dwarf. For fainter white dwarfs WASP is sensitive to increas- ingly larger radius bodies. However, in the presence of correlated noise structure in the light-curves the sensitivity drops, although Earth-sized companions remain detectable in principle even in low S/N data. Mars-sized, and even Mercury-sized bodies yield reasonable detection rates in high-quality light-curves with little residual noise. We searched for eclipses and transit signals in long-term light-curves of a sample of 194 white dwarfs resulting from a cross-correlation of the McCook & Sion catalogue and the WASP archive. No evidence for eclipsing or transiting sub-stellar and planetary companions was found. We used this non-detection and results from our simulations to place tentative upper limits to the frequency of such objects in close orbits at white dwarfs. While only weak limits can be placed on the likely frequency of Earth-sized or smaller companions, brown dwarfs and gas giants (radius$\simeq R_{jup}$) with periods < 0.1-0.2 days must certainly be rare ($< 10\%$). More stringent constraints likely requires significantly larger white dwarf samples, higher observing cadence and continuous coverage. The short duration of eclipses and transits of white dwarfs compared to the cadence of WASP observations appears to be one of the main factors limiting the detection rate in a survey optimised for planetary transits of main sequence stars.

Download/Website: http://arxiv.org/pdf/1008.1089

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The Nature of Angular Momentum Transport in Radiative Self-Gravitating Protostellar Discs

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1008.1547)

Semi-analytic models of self-gravitating discs often approximate the angular momentum transport generated by the gravitational instability using the phenomenology of viscosity. This allows the employment of the standard viscous evolution equations, and gives promising results. It is, however, still not clear when such an approximation is appropriate.

This paper tests this approximation using high resolution 3D smoothed particle hydrodynamics (SPH) simulations of self-gravitating protostellar discs with radiative transfer. The nature of angular momentum transport associated with the gravitational instability is characterised as a function of both the stellar mass and the disc-to-star mass ratio.

The effective viscosity is calculated from the Reynolds and gravitational stresses in the disc. This is then compared to what would be expected if the effective viscosity were determined by assuming local thermodynamic equilibrium or, equivalently, that the local dissipation rate matches the local cooling rate.
In general, all the discs considered here settle into a self-regulated state where the heating generated by the gravitational instability is modulated by the local radiative cooling. It is found that low-mass discs can indeed be represented by a local α-parametrisation, provided that the disc aspect ratio is small ($H/R \leq 0.1$) which is generally the case when the disc-to-star mass ratio $q \lesssim 0.5$. However, this result does not extend to discs with masses approaching that of the central object. These are subject to transient burst events and global wave transport, and the effective viscosity is not well modelled by assuming local thermodynamic equilibrium. In spite of these effects, it is shown that massive (compact) discs can remain stable and not fragment, evolving rapidly to reduce their disc-to-star mass ratios through stellar accretion and radial spreading.

Download/Website: http://arxiv.org/abs/1008.1547

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Demonstration of exoplanet detection using an infrared telescope array

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Astronomy & Astrophysics, forthcoming (DOI: 10.1051/0004-6361/201014942)

Technology is being developed for the characterization and detection of small, Earth-size exoplanets by nulling interferometry in the mid-infrared waveband. While high-performance nulling experiments have shown the possibility of using the technique, to achieve these goals, nulling has to be done on multiple beams, with high stability over periods of hours. To address the issues of the perceived complexity and difficulty of the method, a testbed was developed for the Terrestrial Planet Finder Interferometer (TPF-I) project which would demonstrate four beam nulling and faint exoplanet signal extraction at levels traceable to flight requirements. Containing star and planet sources, the testbed would demonstrate the principal functional processes of the TPF-I beam-combiner by generating four input beams of star and planet light, and recovering the planet signature at the output. Here we report on experiments designed with traceability to a flight system, showing faint exoplanet signal detection in the presence of strong starlight. The experiments were designed to show nulling at the flight level of $\approx 10^{-5}$, starlight suppression of 10^{-7} or better, and detection of an exoplanet at a contrast of 10^{-6} compared to the star. This performance level meets the flight requirements for the parts of the detection process that can be demonstrated using a monochromatic source. To achieve these results, the testbed would have to operate stably for several hours, showing control of disturbances at levels equivalent to the flight requirements. A test process was designed which would show that the necessary performance could be achieved. To show reproducibility, the tests were run on three separate occasions, separated by several days. The tests were divided into three main parts which would show first, starlight suppression, second, a realistic faint exoplanet signal production, and finally, exoplanet signal detection in the presence of the starlight. A number of data sets were acquired showing the achievement of the required performance. The data reported here show nulling at levels between about 5.5 and 8.5×10^{-6}, starlight suppression between 8.4×10^{-9} and 1.4×10^{-8}, and detection of planet signals with contrast to the star between 3.8×10^{-7} and 4.4×10^{-7}. The signal to noise ratios for the detections were between 14.0 and 26.9. These data met all the criteria of the demonstration, showing reproducible stable performance over several hours of operation. These data show the successful execution, at flight-like performance levels, of almost the whole exoplanet detection process using a four beam, nulling beam-combiner.

Download/Website: http://dx.doi.org/10.1051/0004-6361/201014942

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On the fragmentation criteria of self-gravitating protoplanetary discs

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1008.0465)

We investigate the fragmentation criterion in massive self-gravitating discs. We present new analysis of the fragmentation conditions which we test by carrying out global three-dimensional numerical simulations. Whilst previous work has placed emphasis on the cooling timescale in units of the orbital timescale, β, we find that at a given radius the surface mass density (i.e. disc mass and profile) and star mass also play a crucial role in determining whether a disc fragments or not as well as where in the disc fragments form. We find that for shallow surface mass density profiles ($p < 2$, where $\Sigma \propto R^{-p}$), fragments form in the outer regions of the disc. However for steep surface mass density profiles ($p \gtrsim 2$), fragments form in the inner regions of a disc. In addition, we also find that the critical value of the cooling timescale in units of the orbital timescale, $\beta_{\rm crit}$, found in previous simulations is only applicable to certain disc surface mass density profiles and for particular disc radii and is not a general rule for all discs. We find an empirical fragmentation criteria between the cooling timescale in units of the orbital timescale, β, the surface mass density, the star mass and the radius.

Download/Website: `http://arxiv.org/abs/1008.0465`

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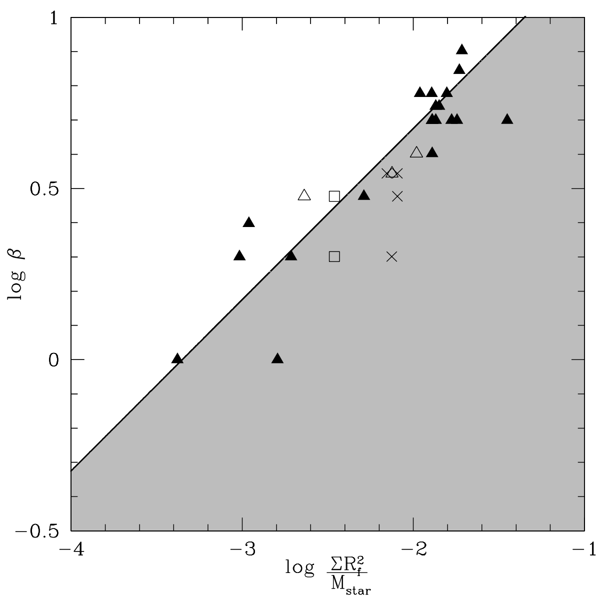

Figure 3: (Meru & Bate) Logarithmic graph showing the trend between β and $\Sigma R_{\rm f}^2/M_\star$ determined by considering the location at which the first fragment forms in the discs, $R_{\rm f}$. The results include those simulations with a surface mass density profile, $p = 1$ (filled triangles), $p = 1.5$ (open triangles), $p = 2$ (open squares) and $p = 2.5$ (crosses). It is clear that a single critical value of β is not the case for all discs and that there is a relation between β, $M_{\rm disc}$, $M_\star$ and the surface mass density profile, p, that determines whether fragmentation occurs or not. The trendline has been determined by considering discs with shallow surface mass density profiles, $p < 2$ only as those discs with $p \gtrsim 2$ will always fragment in the innermost regions first. The grey shaded region is where we expect subsequent fragmentation may take place in discs with $p < 2$.

An algorithm for detrending and correcting CoRoT light curves

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Astronomy & Astrophysics, published (arXive-Code)

We introduce the CoRoT detrend algorithm (*CDA*) for detrending CoRoT stellar light curves. The algorithm *CDA* has the capability to remove random jumps and systematic trends encountered in typical CoRoT data in a fully automatic fashion. Since enormous jumps in flux can destroy the information content of a light curve, such an algorithm is essential. From a study of 1030 light curves in the CoRoT IRa01 field, we developed three simple assumptions which upon CDA is based. We describe the algorithm analytically and provide some examples of how it works. We demonstrate the functionality of the algorithm in the cases of CoRoT0102702789, CoRoT0102874481, CoRoT0102741994, and CoRoT0102729260. Using CDA in the specific case of CoRoT0102729260, we detect a candidate exoplanet around the host star of spectral type G5, which remains undetected in the raw light curve, and estimate the planetary parameters to be $R_p = 6.27 R_E$ and $P = 1.6986$ days.

Download/Website: `http://arxiv.org/abs/1008.0300`

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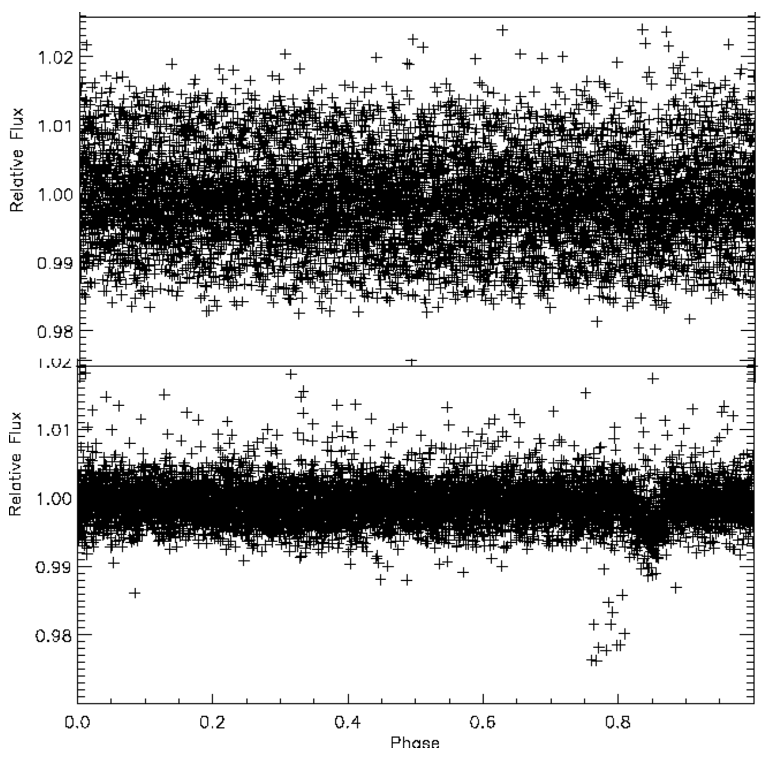

Figure 4: (Mislis et al.) CoRoT0102729260. A phase-folded light curve before *CDA*. Bottom: A phase-folded light curve after *CDA*

Forming the first planetary systems: debris around Galactic thick disc stars

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MNRAS, in press; arXiv from 2 Sep

The thick disc contains stars formed within the first Gyr of Galactic history, and little is known about their planetary systems. The Spitzer MIPS instrument was used to search 11 of the closest of these old low-metal stars for circumstellar debris, as a signpost that bodies at least as large as planetesimals were formed. A total of 22 thick disc stars has now been observed, after including archival data, but dust is not found in any of the systems. The data rule out a high incidence of debris among star systems from early in the Galaxy's formation. However, some stars of this very old population do host giant planets, at possibly more than the general incidence among low-metal Sun-like stars. As the Solar System contains gas giants but little cometary dust, the thick disc could host analogue systems that formed many Gyr before the Sun.

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Debris discs in binaries

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Astronomy & Astrophysics, in press (arXiv:1008.1264v1)

Debris disc analysis and modelling provide crucial information about the structure and the processes at play in extrasolar planetary systems. In binary systems, this issue is more complex because the disc should in addition respond to the companion star's perturbations. We explore the dynamical evolution of a collisionally active debris disc for different initial parent body populations, diverse binary configurations and optical depths. We focus on the radial extent and size distribution of the disc at a stationary state. We numerically follow the evolution of 10^5 massless small grains, initially produced from a circumprimary disc of parent bodies following a size distribution in $dN \propto s^{-3.5}$ds . Grains are submitted to both stars' gravity as well as radiation pressure. In addition, particles are assigned an empirically derived collisional lifetime. For all the binary configurations the disc extends far beyond the critical semimajor axis $a_c rit$ for orbital stability. This is due to the steady production of small grains, placed on eccentric orbits reaching beyond $a_c rit$ by radiation pressure. The amount of matter beyond acrit depends on the balance between collisional production and dynamical removal rates: it increases for more massive discs as well as for eccentric binaries. Another important effect is that, in the dynamically stable region, the disc is depleted from its smallest grains. Both results could lead to observable signatures. We have shown that a companion star can never fully truncate a collisionally active disc. For eccentric companions, grains in the unstable regions can significantly contribute to the thermal emission in the mid-IR. Discs with sharp outer edges, especially bright ones such as HR4796A, are probably shaped by other mechanisms.

Download/Website: `http://fr.arxiv.org/abs/1008.1264/`

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Detectability of giant planets in protoplanetary disks by CO emission lines

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Astronomy & Astrophysics, in press (2010arXiv1007.2169R)

Context. Planets are thought to form in protoplanetary accretion disks around young stars. Detecting a giant planet still embedded in a protoplanetary disk would be very important and give observational constraints on the planet-formation process. However, detecting these planets with the radial velocity technique is problematic owing to the strong stellar activity of these young objects.
Aims. We intend to provide an indirect method to detect Jovian planets by studying near infrared emission spectra originating in the protoplanetary disks around T Tauri stars. Our idea is to investigate whether a massive planet could induce any observable effect on the spectral lines emerging in the disks atmosphere. As a tracer molecule we propose CO, which is excited in the ro-vibrational fundamental band in the disk atmosphere to a distance of $\sim 2-3$ AU (depending on the stellar mass) where terrestrial planets are thought to form.
Methods. We developed a semi-analytical model to calculate synthetic molecular spectral line profiles in a protoplanetary disk using a double layer disk model heated on the outside by irradiation by the central star and in the midplane by viscous dissipation due to accretion. 2D gas dynamics were incorporated in the calculation of synthetic spectral lines. The motions of gas parcels were calculated by the publicly available hydrodynamical code FARGO which was developed to study planet-disk interactions.
Results. We demonstrate that a massive planet embedded in a protoplanetary disk strongly influences the originally circular Keplerian gas dynamics. The perturbed motion of the gas can be detected by comparing the CO line profiles in emission, which emerge from planet-bearing to those of planet-free disk models. The planet signal has two major characteristics: a permanent line profile asymmetry, and short timescale variability correlated with the orbital phase of the giant planet. We have found that the strength of the asymmetry depends on the physical parameters of the star-planet-disk system, such as the disk inclination angle, the planetary and stellar masses, the orbital distance, and the size of the disk inner cavity. The permanent line profile asymmetry is caused by a disk in an eccentric state in the gap opened by the giant planet. However, the variable component is a consequence of the local dynamical perturbation by the orbiting giant planet. We show that a forming giant planet, still embedded in the protoplanetary disk, can be detected using contemporary or future high-resolution near-IR spectrographs like VLT/CRIRES and ELT/METIS.

Download/Website: `http://arxiv.org/abs/1007.2169`

Contact: `regaly@konkoly.hu`

Observational biases in determining extrasolar planet eccentricities in single-planet systems

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Monthly Notices of the Royal Astronomical Society, accepted (arXiv:1008.4152)

We investigate potential biases in the measurements of exoplanet orbital parameters obtained from radial velocity observations for single-planet systems. We create a mock catalog of radial velocity data, choosing input planet masses, periods, and observing patterns from actual radial velocity surveys and varying input eccentricities. We apply Markov Chain Monte Carlo (MCMC) simulations and compare the resulting orbital parameters to the input values. We find that a combination of the effective signal-to-noise ratio of the data, the maximal gap in phase coverage, and the total number of periods covered by observations is a good predictor of the quality of derived orbit parameters. As eccentricity is positive definite, we find that eccentricities of planets on nearly circular orbits are preferentially overestimated, with typical bias of $1-2$ times the median eccentricity uncertainty in a survey (e.g., 0.04 in the Butler et al. 2006 catalog). When performing population analysis, we recommend using the mode of the marginalized posterior eccentricity distribution to minimize potential biases. While the Butler et al. (2006) catalog reports eccentricities below 0.05 for just 17% of single-planet systems, we estimate that the true fraction of $e \leq 0.05$ orbits is about $f_{0.05} = 38 \pm 9\%$. For planets with $P > 10$ days, we find $f_{0.05} = 28 \pm 8\%$ versus 10% from Butler et al. (2006). These planets either never acquired a large eccentricity or were circularized following any significant eccentricity excitation.

Download/Website: `http://arxiv.org/abs/1008.4152`

Contact: `zakamska@pha.jhu.edu`

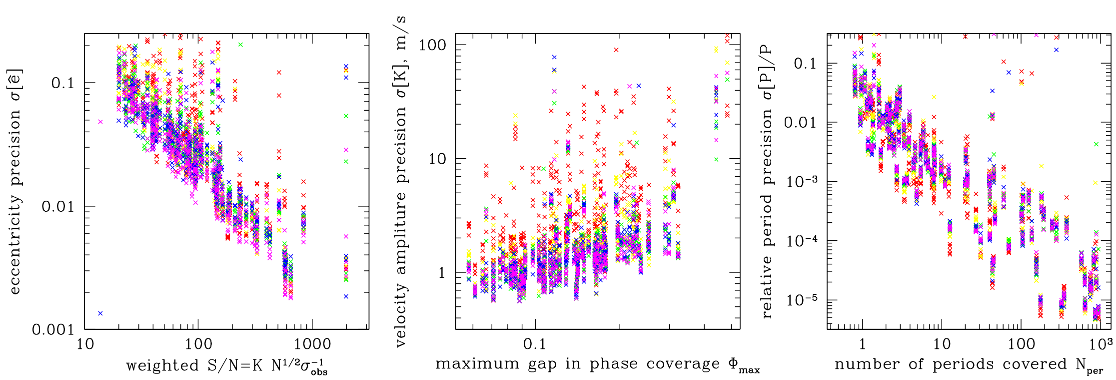

Figure 5: (Zakamska et al.) Selected correlations between data set quality and output quality metrics we find in our simulations. These correlations form the basis for guidelines we provide to observers regarding expected quality of orbital parameter fits. The points are color-coded by the input eccentricity used in our simulations, from $e_{\rm in} = 0$ (magenta) to $e_{\rm in} = 0.6$ (red). As the effective signal to noise of the data increases, the eccentricity precision improves, and the bias of eccentricity measurements decreases.

3 Other abstracts

Planetary Trojans - the main source of short period comets?

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International Journal of Astrobiology, in press

One of the key considerations when assessing the potential habitability of telluric worlds will be that of the impact regime experienced by the planet. In this work, we present a short review of our understanding of the impact regime experienced by the terrestrial planets within our own Solar system, describing the three populations of potentially hazardous objects which move on orbits that take them through the inner Solar system. Of these populations, the origins of two (the Near-Earth Asteroids and the Long-Period Comets) are well understood, with members originating in the Asteroid belt and Oort cloud, respectively. By contrast, the source of the third population, the Short-Period Comets, is still under debate. The proximate source of these objects is the Centaurs, a population of dynamically unstable objects that pass perihelion (closest approach to the Sun) between the orbits of Jupiter and Neptune. However, a variety of different origins have been suggested for the Centaur population. Here, we present evidence that at least a significant fraction of the Centaur population can be sourced from the planetary Trojan clouds, stable reservoirs of objects moving in 1:1 mean-motion resonance with the giant planets (primarily Jupiter and Neptune). Focussing on simulations of the Neptunian Trojan population, we show that an ongoing flux of objects should be leaving that region to move on orbits within the Centaur population. With conservative estimates of the flux from the Neptunian Trojan clouds, we show that their contribution to that population could be of order 3%, while more realistic estimates suggest that the Neptune Trojans could even be the main source of fresh Centaurs. We suggest that further observational work is needed to constrain the contribution made by the Neptune Trojans to the ongoing flux of material to the inner Solar system, and believe that future studies of the habitability of exoplanetary systems should take care not to neglect the contribution of resonant objects (such as planetary Trojans) to the impact flux that could be experienced by potentially habitable worlds.

Download/Website: `http://jontihorner.com/index.php?p=1_10_Publications`

Contact: `jonathan.horner@durham.ac.uk`

Determining Habitability: Which exoEarths should we search for life?

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International Journal of Astrobiology, in press

Within the next few years, the first Earth-mass planets will be discovered around other stars. Some of those worlds will certainly lie within the classical habitable zone of their parent stars, and we will quickly move from knowing of no exoEarths to knowing many. For the first time, we will be in a position to carry out a detailed search for the first evidence of life beyond our Solar System. However, such observations will be hugely taxing and time consuming to perform, and it is almost certain that far more potentially habitable worlds will be known than it is possible to study. It is therefore important to catalogue and consider the various effects which make a promising planet more or less suitable for the development of life. In this work, we review the various planetary, dynamical and stellar influences that could influence the habitability of exoEarths. The various influences must be taken in concert when we attempt to decide where to focus our first detailed search for life. While there is no guarantee that any given planet will be

inhabited, it is vitally important to ensure that we focus our time and effort on those planets most likely to yield a positive result.

Download/Website: `http://jontihorner.com/index.php?p=1_10_Publications`

Contact: `jonathan.horner@durham.ac.uk`

Dynamical Simulations of the HR8799 Planetary System

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International Journal of Astrobiology, in press

HR8799 is a young (20 - 160Myr) A-dwarf main sequence star with an IRAS detected debris disc. In 2008, it was one of two stars around which exoplanets were directly imaged for the first time. The presence of three Jupiter-mass planets around HR8799 provoked much interest in modelling the dynamical stability of the system. Initial simulations indicated that the observed planetary architecture was unstable on timescales much shorter than the lifetime of the star (105 yrs). Subsequent models suggested that the system could be stable if the planets were locked in a 1:2:4 mutual mean motion resonance (MMR). In this work, we have examined the influence of varying orbital eccentricity and semi-major axis on the stability of the three planet system, through dynamical simulations using the MERCURY n-body integrator. We find that, in agreement with previous work on this system, the 1:2:4 MMR is the most stable planetary configuration, and that the system stability is dominated by the interaction between the inner pair of planets. In contrast to previous results we find that with small eccentricities, the three planetary system can be stable for timescales comparable to the system lifetime and, potentially, much longer.

Download/Website: `http://jontihorner.com/index.php?p=1_10_Publications`

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4 Conference announcements

Towards a scientific and societal agenda on extra-terrestrial life

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Kavli Royal Society International Centre, Chicheley Hall (Buckinghamshire, UK), 4-5 October 2010

Should extra-terrestrial life exist, upcoming efforts will provide living generations with a realistic chance of its detection. Even more than the scientific agenda, a corresponding complementary societal agenda needs to be debated. With a mix of invited talks and panel debates, we particularly look into the detection of life, the communication with potential extra-terrestrial civilizations, the implications for the future of humanity, and the political processes that are required.
Four panel debates include

- Calling ET, or not even answering the phone?
- Societal questions raised by the detection of extra-terrestrial life

- What could studies of extra-terrestrial life tell us about the future of humanity?
- Extra-terrestrial life and arising political issues for the UN agenda

Speakers and panelists: Ivan Almar, Stephen Baxter, James Benford, John Billingham (remote), Baruch Blumberg (TBC), David Brin, Milan Cirkovic, Jean-Michel Contant, Richard Crowther, Kathryn Denning, Steven Dick, Stephane Dumas, Frans von der Dunk, John Elliott, Lisa Kaltenegger (TBC), Claudio Maccone, Michael Michaud, Mazlan Othman (TBC), Ted Peters, Margaret Race, Seth Shostak, John Smart, Russell Stannard, Jill Tarter (remote), Nicholas Tosca, Doug Vakoch, Clement Vidal, Felisa Wolfe-Simon, Alexander Zaitsev.

Download/Website: `http://royalsociety.org/extra-terrestrial-life/`

Contact: `kavli@royalsociety.org`

The Astrophysics of Planetary Systems: Formation, Structure, and Dynamical Evolution

M. Lattanzi
Torino, Italy

Conference Center Torino Incontra, via Nino Costa 8, Torino, Italy, 11-15 October 2010

More than 450 planets are now known to orbit main-sequence stars in the neighborhood of our Sun, discovered using a variety of detection and characterization techniques. Fifteen years after the first announcement, the formation and evolution of planetary systems is now emerging as a new, quickly expanding interdisciplinary research field. The

Symposium will bring together leading experts from the many different research disciplines involved with two broad aims:

1. To present the state-of-the-art of the field of extrasolar planets, through an organic discussion of the observational evidence in connection with the most recent theoretical progress,
2. To identify objectives and strategies necessary in the coming years to advance our comprehension of the many complex processes which connect the formation, structure, and evolution of planetary systems.

The meeting will comprise four main sessions, covering the following list of topics:
1. PLANET FORMATION: Statistical properties of giant exoplanets. Emerging properties of low-mass planets. The role of environment (host/disk properties, single- vs. multiple-planet systems). New insights on the relative role of competing models of giant planet formation. Brown dwarfs vs. giant planets. New perspectives on terrestrial and Super-Earths formation models.
2. STRUCTURES AND ATMOSPHERES: Structural properties of transiting systems in the CoRoT and Kepler era. The chemistry and circulation of hot giant planets atmospheres. nternal structure and evolution of giant planets. Internal structure and evolution of Super-Earths and terrestrial planets. Giant planets atmospheres: composition and dynamics. Solid exoplanets atmospheres: composition and dynamics.
3. INTERACTIONS: Properties (orbital architecture, internal structure) of planetary systems as fossil evidence of migration and dynamical evolution processes. Interactions as a function of time (orbital migration models, long-term dynamical evolution) and environment (the role of gas/planetesimal disks, single- vs. multiple-planet systems, the central star properties, and binary companions)
4. THE NEXT DECADE OF EXOPLANETS DISCOVERIES: Strategies and development plans (both from the ground and in space) for the next decade. The views of community and agencies. Planetary systems studies and the search for life beyond the solar system. Habitability, biosignatures, and the emergence and maintenance of life.

July 15th: Second Announcement
July 31st: Abstract submission (oral)

August 31th: Abstract submission (poster)
Late August: Final Announcement
Late August: Scientific Program online
Early September: Registration closed
October 11: Symposium start

For further information regarding the format and scientific objectives of the meeting, contact the SOC Chair: sozzetti@oato.inaf.it
For further information regarding conference logistics, announcements, and accommodations, contact the LOC Chair: iaus276@oato.inaf.it
For further information regarding abstract submission and registration, contact: sarasso@oato.inaf.it

Download/Website: `http://iaus276.oato.inaf.it/IAUS_276/index.htm`

Contact: `iaus276@oato.inaf.it`

5 Jobs and Positions

Sagan Exoplanet Postdoctoral Fellowships

Dr. Dawn M. Gelino

Pasadena, CA, Due: November 4, 2010; Start Date: Fall 2011

/it We are now accepting applications for the 2011 Sagan Exoplanet Postdoctoral Fellowships! Applications are due Thursday, November 4 at 4 PM PDT.//
On behalf of the NASA Astrophysics Division, the NASA Exoplanet Science Institute (NExScI) is pleased to announce the 2011 Sagan Postdoctoral Fellowship Program and solicits applications for fellowships to begin in the Fall of 2011. The Sagan Fellowships support outstanding recent postdoctoral scientists to conduct independent research that is broadly related to the science goals of the NASA Exoplanet Exploration area. The primary goal of missions within this program is to discover and characterize planetary systems and Earth-like planets around nearby stars.//
The proposed research may be theoretical, observational, or instrumental. This program is open to applicants of any nationality who have earned (or will have earned) their doctoral degrees between January 1, 2008 and September 1, 2011, in astronomy, physics, or related disciplines. The fellowships are tenable at U.S. host institutions of the fellows' choice, subject to a maximum of one new fellow per host institution per year. The duration of the fellowship is up to three years: an initial one-year appointment and two annual renewals contingent on satisfactory performance and availability of NASA funding.//
The Announcement of Opportunity, which includes detailed program policies and application instructions, is available on-line at: http://nexsci.caltech.edu/sagan/fellowship.shtml . Applicants must follow all instructions given in this Announcement including those for submitting applications through the web. Inquiries about the Sagan Fellowships may be directed to saganfellowship@ipac.caltech.edu.//
The deadline for all required materials, including applications and letters of reference, is Thursday, November 4, 2010 (4:00 PM PDT). We anticipate awarding 6 fellowships in 2011. Offers are expected to be made before February 1, 2011, and new Sagan Fellow appointments are expected to begin on or about September 1, 2011.

Download/Website: `http://nexsci.caltech.edu/sagan/fellowship.shtml`

Contact: `saganfellowship@ipac.caltech.edu`

6 Announcements

Fizeau exchange visitors program in optical interferometry - call for applications

European Interferometry Initiative

www.european-interferometry.eu, application deadline: Sept. 15

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).
The deadline for applications is the 15th September for visits starting 1st of November.
Further informations and application forms can be found at: www.european-interferometry.eu
The program is funded by OPTICON/FP7.
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`

7 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during July and August 2010. If you spot any that we missed, please let us know and we'll include them in the next issue. And of course, the best way to ensure we include your paper is to send us the abstract.

Exoplanets

astro-ph/1007.0008: **The Earth as an extrasolar transiting planet: Earth's atmospheric composition and thickness revealed by Lunar eclipse observations** by *Alfred Vidal-Madjar, Luc Arnold, David Ehrenreich et al.*

astro-ph/1007.0145: **On the rotational behavior of parent stars of extrasolar planets** by *S.Alves, J.D.do Nascimento Jr., J.R.De Medeiros*

astro-ph/1007.0245: **The Posterior Distribution of sin(i) for Exoplanets with $M_T \sin(i)$ Determined from Radial Velocity Data** by *Shirley Ho, Edwin L.Turner*

astro-ph/1007.0324: **Methane in the atmosphere of the transiting hot Neptune GJ436b?** by *J.-P.Beaulieu, G.Tinetti, D.M.Kipping et al.*

astro-ph/1007.0589: **New Parameters and Transit Timing Studies for OGLE2-TR-L9 b** by *M.Lendl, C.Afonso, J.Koppenhoefer et al.*

astro-ph/1007.2252: **Ancient planetary systems are orbiting a large fraction of white dwarf stars** by *B.Zuckerman, C.Melis, B.Klein et al.*

astro-ph/1007.2296: **Observations of Extrasolar Planet Transit at the Bosscha Observatory** by *R.Satyaningsih, B.dermawan, T.Hidayat et al.*

astro-ph/1007.2497: **Transiting exoplanets from the CoRoT space mission.XII.CoRoT-12b: a short-period low-density planet transiting a solar analog star** by *M.Gillon, A.Hatzes, Sz.Csizmadia et al.*

astro-ph/1007.2537: **Water/Icy Super-Earths: Giant Impacts and Maximum Water Content** by *Fathi Namouni*
astro-ph/1007.2681: **Stellar Parameters and Metallicities of Stars Hosting Jovian and Neptunian Mass Planets: A Possible Dependence of Planetary Mass on Metallicity** by *L.Ghezzi, K.Cunha, V.V.Smith et al.*
astro-ph/1007.2881: **The Invisible Majority? Evolution and Detection of Outer Planetary Systems without Gas Giants** by *Andrew W.Mann, Eric Gaidos, B.Scott Gaudi*
astro-ph/1007.2942: **Atmospheric Circulation of Eccentric Hot Neptune GJ436b** by *Nikole K.Lewis, Adam P.Showman, Jonathan J.Fortney et al.*
astro-ph/1007.3082: **A detailed spectropolarimetric analysis of the planet hosting star WASP-12** by *L.Fossati, S.Bagnulo, A.Elmasli et al.*
astro-ph/1007.3212: **Water/Icy Super-Earths: Giant Impacts and Maximum Water Content** by *Robert A.Marcus, Dimitar Sasselov, Sarah T.Stewart et al.*
astro-ph/1007.3413: **Determining Habitability: Which exoEarths should we search for life?** by *J.Horner, B.W.Jones*
astro-ph/1007.3501: **On the Transit Potential of the Planet Orbiting iota Draconis** by *Stephen R.Kane, Sabine Reffert, Gregory W.Henry et al.*
astro-ph/1007.3647: **Photospheric activity, rotation, and star-planet interaction of the planet-hosting star CoRoT-6** by *A.F.Lanza, A.S.Bonomo, I.Pagano et al.*
astro-ph/1007.3703: **Stellar-Mass-Dependent Disk Structure in Coeval Planet-Forming Disks** by *Laszlo Szucs, Daniel Apai, Ilaria Pascucci et al.*
astro-ph/1007.4159: **Formation of planets by tidal downsizing of giant planet embryos** by *Sergei Nayakshin*
astro-ph/1007.4162: **Grain sedimentation inside giant planet embryos** by *Sergei Nayakshin*
astro-ph/1007.4165: **Formation of terrestrial planet cores inside giant planet embryos** by *Sergei Nayakshin*
astro-ph/1007.4315: **A High Contrast Imaging Survey of SIM Lite Planet Search Targets** by *Angelle M.Tanner, Christopher R.Gelino, Nicholas M.Law*
astro-ph/1007.4497: **Dipolar Magnetic Moment of the Bodies of the Solar System and the Hot Jupiters** by *Hector Javier Durand-Manterola*
astro-ph/1007.4520: **On the orbital evolution of a giant planet pair embedded in a gaseous disk.II.A Saturn-Jupiter configuration** by *Hui Zhang, Ji-Lin Zhou*
astro-ph/1007.4552: **Retired A Stars and Their Companions VI.A Pair of Interacting Exoplanet Pairs Around the Subgiants 24 Sextanis and HD200964** by *John Asher Johnson, Matthew Payne, Andrew W.Howard et al.*
astro-ph/1007.4555: **Retired A Stars and Their Companions V.A hot Jupiter orbiting the 1.7 Msun Subgiant HD102956** by *John Asher Johnson, Brendan P.Bowler, Andrew W.Howard*
astro-ph/1007.4593: **Metal-Rich M-dwarf Planet Hosts: Metallicities with K-Band Spectra** by *Barbara Rojas-Ayala, Kevin R.Covey, Philip S.Muirhead et al.*
astro-ph/1007.4722: **Embryo impacts and gas giant mergers I: Dichotomy of Jupiter and Saturn's core mass** by *Shu Lin Li, C.B.Agnor, D.N.C.Lin*
astro-ph/1007.4785: **Formation and Evolution of Close-in Planets** by *Soko Matsumura, Stanton J.Peale, Frederic A.Rasio*
astro-ph/1007.4799: **Two Populations of Companions around White Dwarfs: The Effect of Tides and Tidal Engulfment** by *J.Nordhaus*
astro-ph/1007.4808: **The Gemini NICI Planet-Finding Campaign: Discovery of a Close Substellar Companion to the Young Debris Disk Star PZ Tel** by *Beth A.Biller, Michael C.Liu, Zahed Wahhaj*
astro-ph/1007.4850: **HAT-P-18b and HAT-P-19b: Two Low-Density Saturn-Mass Planets Transiting Metal-Rich K Stars** by *J.D.Hartman, G.A.Bakos, B.Sato et al.*
astro-ph/1007.4964: **A torque formula for non-isothermal Type I planetary migration - II.Effects of diffusion** by *S.-J.Paardekooper, C.Baruteau, W.Kley*
astro-ph/1007.5481: **Transiting exoplanets from the CoRoT space mission.XIII.CoRoT-13b: a dense hot**

Jupiter in transit around a star with solar metallicity and super-solar lithium content by *J.Cabrera, H.Bruntt, M.Ollivier et al.*

astro-ph/1008.0028: **Primary and secondary eclipse spectroscopy with JWST: exploring the exoplanet parameter space** by *A.R.Belu, F.Selsis, J-C.Morales et al.*

astro-ph/1008.0325: **Transiting exoplanets from the CoRoT space mission.XI.CoRoT-8b: a hot and dense sub-Saturn around a K1 dwarf** by *P.Borde, F.Bouchy, M.Deleuil et al.*

astro-ph/1008.0393: **A New 24 micron Phase Curve for upsilon Andromedae b** by *Ian J.Crossfield, Brad M.S.Hansen, Joseph Harrington et al.*

astro-ph/1008.0575: **Lithium depletion in solar-like stars: no planet connection** by *Patrick Baumann, Ivan Ramirez, Jorge Melendez et al.*

astro-ph/1008.0645: **The Mechanical Greenhouse: Burial of Heat by Turbulence in Hot Jupiter Atmospheres** by *Andrew N.Youdin, Jonathan L.Mitchell*

astro-ph/1008.1073: **Exo-Planetary Transits of Limb Brightened Lines; Tentative Si IV Absorption by HD209458b** by *Everett Schlawin, Eric Agol, Lucianne Walkowicz et al.*

astro-ph/1008.1089: **Detection limits for close eclipsing and transiting sub-stellar and planetary companions to white dwarfs in the WASP survey** by *F.Faedi, R.G.West, M.R.Burleigh et al.*

astro-ph/1008.1748: **Recent Transits of the Super-Earth Exoplanet GJ 1214b** by *Pedro V.Sada, Drake Deming, Brian Jackson et al.*

astro-ph/1008.1775: **Shocks and a Giant Planet in the Disk Orbiting BP Piscium?** by *C.Melis, C.Gielen, C.H.Chen et al.*

astro-ph/1008.1799: **Six High-Precision Transits of OGLE-TR-113b** by *E.R.Adams, M.Lopez-Morales, J.L.Elliot et al.*

astro-ph/1008.1983: **High-Contrast 3.8 Micron Imaging Of The Brown Dwarf/Planet-Mass Companion to GJ 758** by *Thayne Currie, Vanessa Bailey, Daniel Fabrycky et al.*

astro-ph/1008.2481: **Transit spectrophotometry of the exoplanet HD189733b.II.New Spitzer observations at 3.6 microns** by *J.-M.Desert, D.Sing, A.Vidal-Madjar et al.*

astro-ph/1008.2553: **Spin-orbit angle measurements for six southern transiting planets; New insights into the dynamical origins of hot Jupiters** by *Amaury H.M.J.Triaud, Andrew Collier Cameron, Didier Queloz et al.*

astro-ph/1008.3028: **Detection of the ellipsoidal and the relativistic beaming effects in the CoRoT-3 lightcurve** by *Tsevi Mazeh, Simchon Faigler*

astro-ph/1008.3096: **WASP-37b: a 1.7 MJ exoplanet transiting a metal-poor star** by *E.K.Simpson, F.Faedi, S.C.C.Barros et al.*

astro-ph/1008.3148: **Evolution of Spin Direction of Accreting Magnetic Protostars and Spin-Orbit Misalignment in Exoplanetary Systems** by *Dong Lai, Francois Foucart, Douglas N.C.Lin*

astro-ph/1008.3388: **HAT-P-20b–HAT-P-23b: Four Massive Transiting Extrasolar Planets** by *G.A.Bakos, J.Hartman, G.Torres*

astro-ph/1008.3389: **HAT-P-24b: An inflated hot-Jupiter on a 3.36d period transiting a hot, metal-poor star** by *D.M.Kipping, G.A.Bakos, J.Hartman et al.*

astro-ph/1008.3467: **The (Un)Lonely Planet Guide: Formation and Evolution of Planetary Systems from a 'Blue Dots' Perspective** by *Michael R.Meyer*

astro-ph/1008.3539: **Metallicities of Planet Hosting Stars: A Sample of Giants and Subgiants** by *L.Ghezzi, K.Cunha, S.C.Schuler et al.*

astro-ph/1008.3656: **HAT-P-25b: a Hot-Jupiter Transiting a Moderately Faint G Star** by *S.N.Quinn, G.A.Bakos, J.Hartman et al.*

astro-ph/1008.3566: **XMM-Newton observations of HD189733 during planetary transits** by *I.Pillitteri, S.J.Wolk, O.Cohen et al.*

astro-ph/1008.3647: **Photospheric activity, rotation, and star-planet interaction of the planet-hosting star**

CoRoT-6 by *A.F.Lanza, A.S.Bonomo, I.Pagano et al.*

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