ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the sixtieth edition of ExoPlanet News. In this month's edition, along with the usual selection of interesting abstracts and enticing job opportunities, we also have a couple of important announcements. One concerns the recent "Blue Dots" submission to the ESA call for White Papers for the L2/L3 mission slots, and the other reports an exchange with the IAU over the naming of Exoplanets. I hope all readers will find these announcements useful.

The next edition of the newsletter is planned for early July 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

Asymmetric transition disks: Vorticity or eccentricity

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Astronomy & Astrophysics Letters, published (2013A& A,553,L3)

Transition disks typically appear in resolved millimeter observations as giant dust rings surrounding their young host stars. More accurate observations with ALMA have shown several of these rings to be in fact asymmetric: they have lopsided shapes. It has been speculated that these rings act as dust traps, which would make them important laboratories for studying planet formation. It has been shown that an elongated giant vortex produced in a disk with a strong viscosity jump strikingly resembles the observed asymmetric rings. We aim to study a similar behavior for a disk in which a giant planet is embedded. However, a giant planet can induce two kinds of asymmetries: (1) a giant vortex, and (2) an eccentric disk. We studied under which conditions each of these can appear, and how one can observationally distinguish between them. This is important because only a vortex can trap particles both radially and azimuthally, while the eccentric ring can only trap particles in radial direction. We used the FARGO code to conduct the hydro-simulations. We set up a disk with an embedded giant planet and took a radial grid spanning from 0.1 to 7 times the planet semi-major axis. We ran the simulations with various viscosity values and planet masses for 1000 planet orbits to allow a fully developed vortex or disk eccentricity. Afterwards, we compared the dust distribution in a vortex-holding disk with an eccentric disk using dust simulations.We find that vorticity and eccentricity are distinguishable by looking at the azimuthal contrast of the dust density. While vortices, as particle traps, produce very pronounced azimuthal asymmetries, eccentric features are not able to accumulate millimeter dust particles in azimuthal direction, and therefore the asymmetries are expected to be modest.

Download/Website: `http://dx.doi.org/10.1051/0004-6361/201321125`

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Low stellar obliquities in compact multiplanet systems

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The Astrophysical Journal, in press (arXiv:1302.4443)

We measure the sky-projected stellar obliquities (λ) in the multiple-transiting planetary systems KOI-94 and Kepler-25, using the Rossiter-McLaughlin effect. In both cases the host stars are well-aligned with the orbital planes of the planets. For KOI-94 we find $\lambda = -11 \pm 11°$, confirming a recent result by Hirano and coworkers. Kepler-25 was a more challenging case because the transit depth is unusually small (0.13%). To obtain the obliquity it was necessary to use prior knowledge of the star's projected rotation rate, and apply two different analysis methods to independent wavelength regions of the spectra. The two methods gave consistent results, $\lambda = 7 \pm 8°$ and $-0.5 \pm 5.7°$.
There are now a total of five obliquity measurements for host stars of systems of multiple transiting planets, all of which are consistent with spin-orbit alignment. This alignment is unlikely to be the result of tidal interactions, because of the relatively large orbital distances and low planetary masses in the systems. In this respect the multi-planet host stars differ from hot-Jupiter host stars, which commonly have large spin-orbit misalignments whenever tidal interactions are weak. In particular the weak-tide subset of hot-Jupiter hosts have obliquities consistent with an isotropic distribution ($p = 0.6$), but the multiplanet hosts are incompatible with such a distribution ($p \sim 10^{-6}$). This suggests that high obliquities are confined to hot-Jupiter systems, and provides further evidence that hot Jupiter formation involves processes that tilt the planetary orbit.

Download/Website: `http://adsabs.harvard.edu/abs/2013arXiv1302.4443A`

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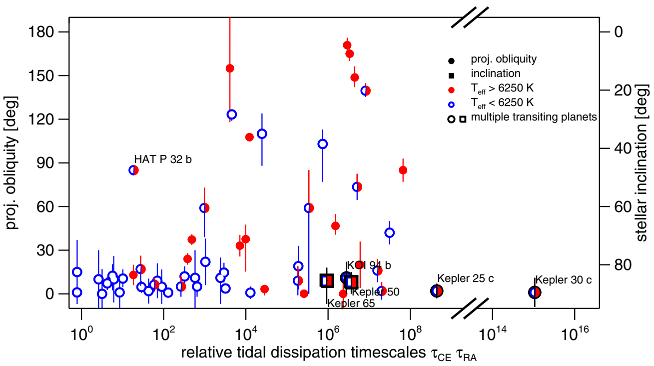

Figure 1: (Albrecht et al.) Projected obliquity (either λ or $i_\star$) as a function of the relative tidal-alignment timescale, for hot-Jupiter and multiple-planet systems. The systems are plotted as a function of a simple metric for the expected timescale for tidal dissipation within the star (see Albrecht et al. 2012b) eq. 2–3). Stars which have temperatures higher then 6250 K are shown with red filled symbols. Blue open symbols show stars with temperatures lower then 6250 K. Stars which measured effective temperature include 6250 K in their 1-σ interval are shown by split symbols. Systems for which λ was measured are indicated by a circle and refer to the left-hand axis. Measurements of $i_\star$ are indicated by a square and refer to the right-hand axis. Systems which harbor multiple planets are given dark black borders. The systems with short tidal timescales are seen to be well-aligned. All of the multiple-planet systems are well-aligned despite having weak tidal dissipation.

Experiments on the consolidation of chondrites and the formation of dense rims around chondrules

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Icarus, published (Volume 225, Issue 1, July 2013, Pages 558 - 569)

We performed impact experiments into mixtures of chondrule analogs and different dust materials to determine the dynamic-pressure range under which these can be compacted to achieve porosities found in chondritic meteorites. The second objective of our study was to test whether or not fine-grained dust rims around chondrules can be formed due to the dynamic compaction process. In our experiments, aluminum cylinders were used as projectiles to compact the chondrite-analog samples in a velocity range between 165 $\mathrm{m\,s^{-1}}$ and 1200 $\mathrm{m\,s^{-1}}$. The resulting impact pressures in the samples fall between ~90 and ~2400 MPa. To measure the achieved porosities of our samples, 25 samples were analyzed using computer-aided tomography. We found volume filling factors (porosities) between $\phi = 0.70\,(30\%)$ and $\phi = 0.99\,(1\%)$ which covers the observed range of volume filling factors of carbonaceous chondrites (CC) and ordinary chondrites (OC). From our experiments, we expect CM chondrites to be likely compacted in a pressure range between between 60 and 150 MPa, CV chondrites appear to be compacted with pressures between 100 and 500 MPa, and for OCs we only determined a lower limit of the compaction pressure of 150 MPa. These dynamic compaction pressures are in good agreement with the typical shock stages of the chondrites, and thus can confirm that CM chondrites are less shocked than CV chondrites and significantly less shocked than OCs. Finally, we found a factor of 10 difference in the dynamic-pressure compaction range of CCs and OCs that allows us to infer either a larger distance between the formation location of the two chondrite families than current models predict or a strong difference in orbital eccentricities for the two groups. As for the high-density rims found around chondrules, we can show that these do not form in dynamic compaction processes as studied in this paper.

Download/Website: `http://dx.doi.org/10.1016/j.icarus.2013.04.028`

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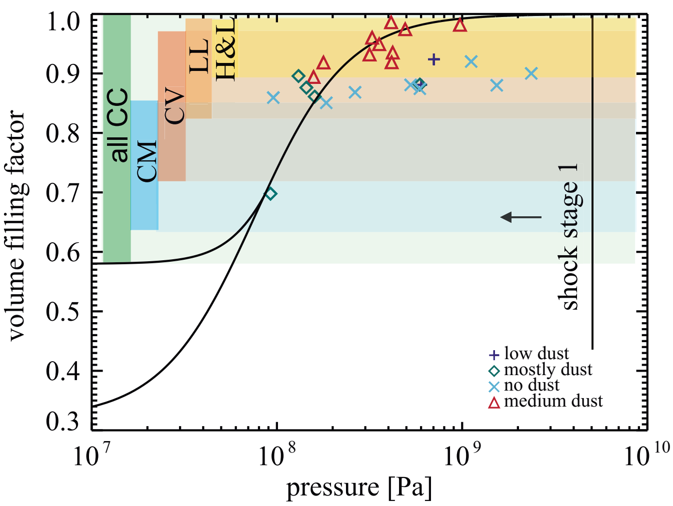

Figure 2: (Beitz et al.) Comparison of the volume filling factors achieved in our impact experiments with those of CC meteorites, their subgroups CV and CM, and the ordinary chondrites with their subgroups H, L, and LL, respectively. The different colors mark the range of reported porosities for the different subgroups of CCs, measured by Macke et al. 2011, and for the ordinary chondrites, measured by Britt & Consolmagno 2004.

The quest for companions to post-common envelope binaries IV. The 2:1 mean-motion resonance of the planets orbiting NN Serpentis

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Astronomy & Astrophysics, in press

We present 69 new mid-eclipse times of the young post-common envelope binary (PCEB) NN Ser, which was previously suggested to possess two circumbinary planets. We have interpreted the observed eclipse-time variations in terms of the light-travel time effect caused by two planets, exhaustively covering the multi-dimensional parameter space by fits in the two binary and ten orbital parameters. We supplemented the fits by stability calculations for all models with an acceptable χ^2. An island of secularly stable 2 : 1 resonant solutions exists, which coincides with the global χ^2 minimum. Our best-fit stable solution yields current orbital periods $P_\mathrm{o} = 15.47$ yr and $P_\mathrm{i} = 7.65$ yr and eccentricities $e_\mathrm{o} = 0.14$ and $e_\mathrm{i} = 0.22$ for the outer and inner planets, respectively. The companions qualify as giant planets, with masses of $7.0\,\mathrm{M}_{Jup}$ and $1.7\,\mathrm{M}_{Jup}$ for the case of orbits coplanar with that of the binary. The two-planet model that starts from the present system parameters has a lifetime greater than 10^8 yr, which significantly exceeds the age of NN Ser of 10^6 yr as a PCEB. The resonance is characterized by libration of the resonant variable Θ_1 and circulation of $\omega_\mathrm{i} - \omega_\mathrm{o}$, the difference between the arguments of periapse of the two planets. No stable nonresonant solutions were found, and the possibility of a 5 : 2 resonance suggested previously by us is now excluded at the 99.3% confidence level.

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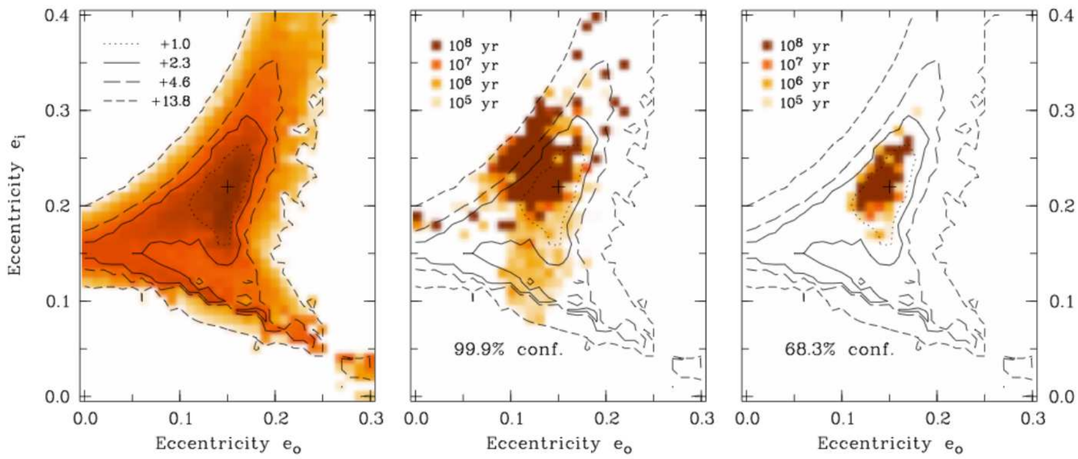

Figure 3: (Beuermann et al.) Constraints on the planet eccentricities: χ^2 values of the two-planet Keplerian fits (left; contours); maximum lifetimes of dynamical models with χ^2 at the 99.9% (middle) and 68.3% (right) confidence levels.

Possible scenarios for eccentricity evolution in the extrasolar planetary system HD 181433

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1305.7508)

We analyse the dynamics of the multiple planet system HD 181433. This consists of two gas giant planets (bodies c and d) with $m \sin i = 0.65\ \mathrm{M_{Jup}}$ and $0.53\ \mathrm{M_{Jup}}$ orbiting with periods 975 and 2468 days, respectively. The two planets appear to be in a 5:2 mean motion resonance, as this is required for the system to be dynamically stable. A third planet with mass $m_b \sin i = 0.023\ \mathrm{M_{Jup}}$ orbits close to the star with orbital period 9.37 days. Each planet orbit is significantly eccentric, with current values estimated to be $e_b = 0.39$, $e_c = 0.27$ and $e_d = 0.47$. In this paper we assess different scenarios that may explain the origin of these eccentric orbits, with particular focus on the innermost body, noting that the large eccentricity of planet b cannot be explained through secular interaction with the outer pair. We consider a scenario in which the system previously contained an additional giant planet that was ejected during a period of dynamical instability among the planets. N-body simulations are presented that demonstrate that during scattering and ejection among the outer planets a close encounter between a giant and the inner body can raise e_b to its observed value. Such an outcome occurs with a frequency of a few percent. We also demonstrate, however, that obtaining the required value of e_b and having the two surviving outer planets land in 5:2 resonance is a rare outcome, leading us to consider alternative scenarios involving secular resonances. We consider the possibility that an undetected planet in the system increases the secular forcing of planet b by the exterior giant planets, but we find that the resulting eccentricity is not large enough to agree with the observed one. We also consider a scenario in which the spin-down of the central star causes the system to pass through secular resonance. In its simplest form this latter scenario fails to produce the system observed today, with the mode of failure depending sensitively on the rate of stellar spin-down. For spin-down rates above a critical value, planet b passes through the resonance too quickly, and the forced eccentricity only reaches maximum values $e_b \simeq 0.25$. Spin-down rates below the critical value lead to long-term capture of planet b in secular resonance, driving the eccentricity toward unity. If additional short-period low mass planets are present in the system, however, we find that mutual scattering can release planet b from the secular resonance, leading to a system with orbital parameters similar to those observed today.

Download/Website: `http://arxiv.org/abs/1305.7508`

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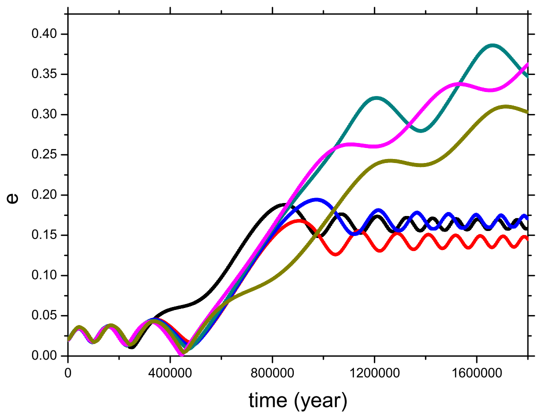

Figure 4: (Campanmella et al.) The growth of e_b during resonant sweeping, considering both GR and J_2 effects. Values of 10% larger and 3% and 4.5% smaller than the nominal α (see the paper) stabilize around a value for e_b equal to 0.15. For values of 6%, 12% and 50% smaller, e_b grow indefinitely.

Lucky Imaging of transiting planet host stars with LuckyCam

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Monthly Notices of the Royal Astronomical Society, Accepted for Publication 16 May 2013 (arXiv:1305.3795)

We obtained high-resolution, high-contrast optical imaging in the SDSS i' band with the LuckyCam camera mounted on the 2.56m Nordic Optical Telescope, to search for faint stellar companions to 16 stars harbouring transiting exoplanets. The Lucky Imaging technique uses very short exposures to obtain near diffraction-limited images yielding sub-arcsecond sensitivity, allowing us to search for faint stellar companions within the seeing disc of the primary planet host. Here we report the detection of two candidate stellar companions to the planet host TrES-1 at separations < 6.5" and we confirm stellar companions to CoRoT-2, CoRoT-3, TrES-2, TrES-4, and HAT-P-7 already known in the literature. We do not confirm the candidate companions to HAT-P-8 found via Lucky Imaging by Bergfors et al.(2013), however, most probably because HAT-P-8 was observed in poor seeing conditions. Our detection sensitivity limits allow us to place constraints on the spectral types and masses of the putative bound companions to the planet host stars in our sample. If bound, the stellar companions identified in this work would provide stringent observational constraints to models of planet formation and evolution. In addition these companions could affect the derived physical properties of the exoplanets in these systems.

Download/Website: `http://arxiv.org/pdf/1305.3795`

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The dynamical evolution of multi-planet systems in open clusters

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1305.1413)

The majority of stars form in star clusters and many are thought to have planetary companions. We demonstrate that multi-planet systems are prone to instabilities as a result of frequent stellar encounters in these star clusters much more than single-planet systems. The cumulative effect of close and distant encounters on these planetary systems are investigated using Monte Carlo scattering experiments. We consider two types of planetary configurations orbiting Sun-like stars: (i) five Jupiter-mass planets in the semi-major axis range $1 - 42$ AU orbiting a Solar mass star, with orbits that are initially co-planar, circular, and separated by 10 mutual Hill radii, and (ii) the four gas giants of our Solar system. We find that in the equal-mass planet model, 70% of the planets with initial semi-major axes $a > 40$ AU are either ejected or have collided with the central star or another planet within the lifetime of a typical cluster, and that more than 50% of all planets with $a < 10$ AU remain bound to the system. Planets with short orbital periods are not directly affected by encountering stars. However, secular evolution of perturbed systems may result in the ejection of the innermost planets or in physical collisions of the innermost planets with the host star, up to many thousands of years after a stellar encounter. The simulations of the Solar system-like systems indicate that Saturn, Uranus and Neptune are affected by both direct interactions with encountering stars, as well as planet-planet

scattering. Jupiter, on the other hand, is almost only affected by direct encounters with neighbouring stars, as its mass is too large to be substantially perturbed by the other three planets. Our results indicate that stellar encounters can account for the apparent scarcity of exoplanets in star clusters, not only for those on wide-orbit that are directly affected by stellar encounters, but also planets close to the star which can disappear long after a stellar encounter has perturbed the planetary system.

Download/Website: http://arxiv.org/abs/1305.1413

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Radial Velocity Detection of Earth-mass Planets in the Presence of Activity Noise: The Case of α Centauri Bb

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The Astrophysical Journal, in press (arXiv:1305.4960)

We present an analysis of the publicly available HARPS radial velocity (RV) measurements for α Cen B, a star hosting an Earth-mass planet candidate in a 3.24 day orbit. The goal is to devise robust ways of extracting low-amplitude RV signals of low mass planets in the presence of activity noise. Two approaches were used to remove the stellar activity signal which dominates the RV variations: 1) Fourier component analysis (pre-whitening), and 2) local trend filtering (LTF) of the activity using short time windows of the data. The Fourier procedure results in a signal at P = 3.236 d and K = 0.42 m s^{-1} which is consistent with the presence of an Earth-mass planet, but the false alarm probability for this signal is rather high at a few percent. The LTF results in no significant detection of the planet signal, although it is possible to detect a marginal planet signal with this method using a different choice of time windows and fitting functions. However, even in this case the significance of the 3.24-d signal depends on the details of how a time window containing only 10% of the data is filtered. Both methods should have detected the presence of α Cen Bb at a higher significance than is actually seen. We also investigated the influence of random noise with a standard deviation comparable to the HARPS data and sampled in the same way. The distribution of the noise peaks in the period range 2.8 – 3.3 d have a maximum of $\approx$ 3.2 d and amplitudes approximately one-half of the K-amplitude for the planet. The presence of the activity signal may boost the velocity amplitude of these signals to values comparable to the planet. It may be premature to attribute the 3.24 day RV variations to an Earth-mass planet. A better understanding of the noise characteristics in the RV data as well as more measurements with better sampling will be needed to confirm this exoplanet.

Download/Website: http://archiv.org/abs/1305.4960

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Observed Properties of Extrasolar Planets

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Science, published (doi:10.1126/science.1233545 / arXiv:1305.0542)

Observational surveys for extrasolar planets probe the diverse outcomes of planet formation and evolution. These surveys measure the frequency of planets with different masses, sizes, orbital characteristics, and host star properties. Small planets between the sizes of Earth and Neptune substantially outnumber Jupiter-sized planets. The survey measurements support the core accretion model, in which planets form by the accumulation of solids and then gas in protoplanetary disks. The diversity of exoplanetary characteristics demonstrates that most of the gross features of the solar system are one outcome in a continuum of possibilities. The most common class of planetary system detectable today consists of one or more planets approximately one to three times Earths size orbiting within a fraction of the Earth-Sun distance.

Download/Website: `http://www.sciencemag.org/content/340/6132/572`

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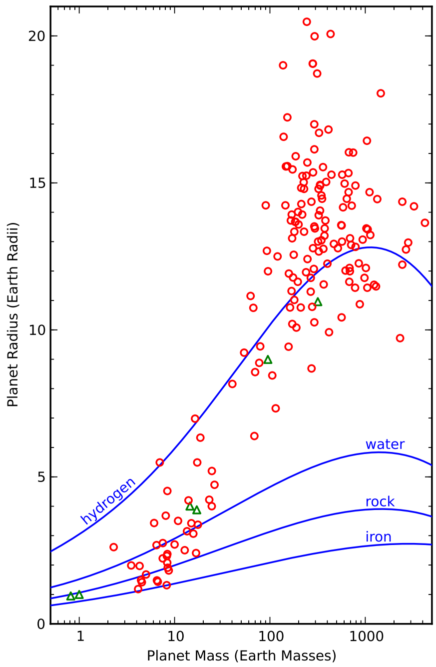

Figure 5: (Howard) Extrasolar planets are shown as open red circles, whereas solar system planets are designated by open green triangles. Radii were measured by means of transit photometry, and masses were measured by radial velocity or transit timing methods. Model mass-radius relationships for idealized planets consisting of pure hydrogen, water, rock (Mg_2SiO_4), or iron are shown as blue lines. Poorly understood heating mechanisms inflate some gas giant planets (larger than $\sim$8 R_E) to sizes larger than predicted by the simple hydrogen model. Smaller planets (less massive than $\sim$30 M_E) show great diversity in size at a fixed mass, likely because of varying density of solids and atmospheric extent. Gas giant planets are over-represented relative to their occurrence in nature

Gaps in Protoplanetary Disks as Signatures of Planets: II. Inclined Disks

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The Astrophysical Journal, in press (arXiv:1305.6313)

We examine the observational appearance of partial gaps being opened by planets in protoplanetary disks, considering the effects of the inclination relative to the line of sight. We model the disks with static α-models with detailed radiative transfer, parametrizing the shape and size of the partially cleared gaps based on the results of hydrodynamic simulations. As in previous work, starlight falling across the gap leads to high surface brightness contrasts. The gap's trough is darkened by both shadowing and cooling, relative to the uninterrupted disk. The gap's outer wall is brightened by direct illumination and also by heating, which puffs it up so that it intercepts more starlight. In this paper, we examine the effects of inclination on resolved images of disks with and without gaps at a wide range of wavelengths. The scattering surface's offset from the disk midplane creates a brightness asymmetry along the axis of inclination, making the disk's near side appear brighter than the far side in scattered light. Finite disk thickness also causes the projected distances of equidistant points on the disk surface to be smaller on the near side of the disk as compared to the far side. Consequently, the gap shoulder on the near side of the disk should appear brighter and closer to the star than on the far side. However, if the angular resolution of the observation is coarser than the width of the brightened gap shoulder, then the gap shoulder on the far side may appear brighter because of its larger apparent size. We present a formula to recover the scale height and inclination angle of an imaged disk using simple geometric arguments and measuring disk asymmetries. Resolved images of circumstellar disks have revealed clearings and gaps, such as the transitional disk in LkCa 15. Models created using our synthetic imaging attempting to match the morphology of observed scattered light images of LkCa 15 indicate that the H-band flux deficit in the inner $\sim 0.5''$ of the disk can be explained with a planet of mass greater than 0.5 Jupiter mass.

Download/Website: `http://arxiv.org/abs/1305.6313`

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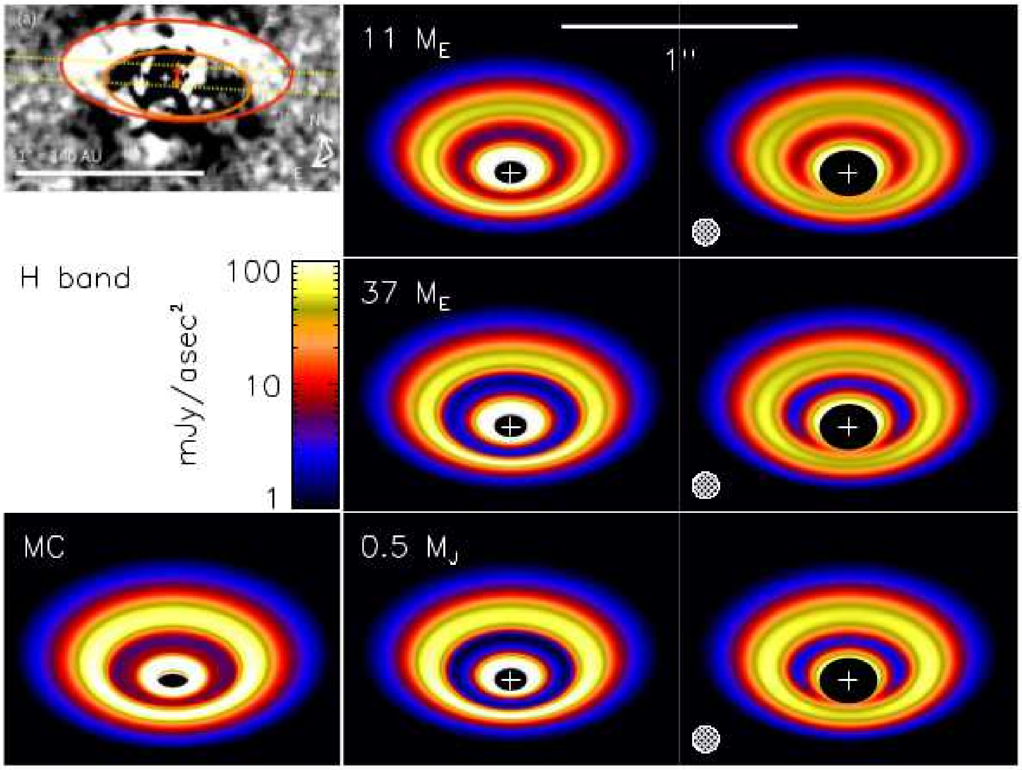

Figure 6: (Jang-Condell & Turner) Observed and synthetic H-band images of the disk around LkCa 15. Upper left: H-band image by Thalmann et al. (2010), with the scale bar representing 140 AU. Remaining panels are synthetic images based on models for LkCa 15. The disk is inclined at $52°$ and oriented so that the top edge of the disk is tipped away from the observer. The white cross indicates the position of the central star, and the blacked out inner region is outside the simulation boundaries. The gaps in the models are created by 11 (top row), 37 (middle row), and 150 (bottom row) $M_\oplus$ planets. The images in the center column are the idealized JC models, while the images on the right have been convolved with a Gaussian PSF of FWHM of $0''.055$, as represented by the size of the hashed white circles. The lower left image is the MC image of the 150 $M_\oplus$ model, generated using 10^8 photon packets.

A Potential Super-Venus in the Kepler-69 System

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Astrophysical Journal Letters, in press (arXiv:1305.2933)

Transiting planets have greatly expanded and diversified the exoplanet field. These planets provide greater access to characterization of exoplanet atmospheres and structure. The Kepler mission has been particularly successful in expanding the exoplanet inventory, even to planets smaller than the Earth. The orbital period sensitivity of the Kepler data is now extending into the Habitable Zones of their host stars, and several planets larger than the Earth have been found to lie therein. Here we examine one such proposed planet, Kepler-69c. We provide new orbital parameters for this planet and an in-depth analysis of the Habitable Zone. We find that, even under optimistic conditions, this 1.7 $R_\oplus$ planet is unlikely to be within the Habitable Zone of Kepler-69. Furthermore, the planet receives an incident flux of 1.91 times the solar constant, which is similar to that received by Venus. We thus suggest that this planet is likely a super-Venus rather than a super-Earth in terms of atmospheric properties and habitability, and we propose follow-up observations to disentangle the ambiguity.

Download/Website: `http://arxiv.org/abs/1305.2933`

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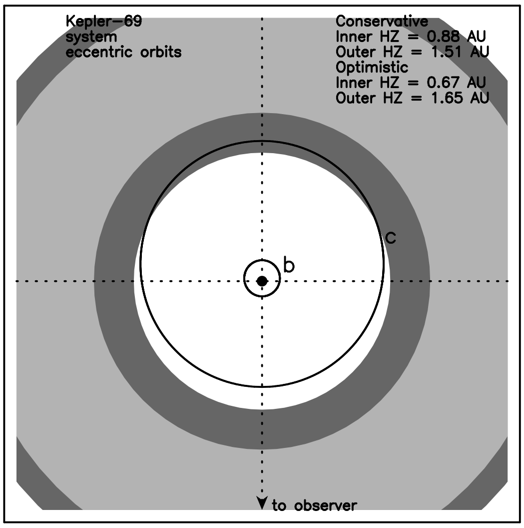

Figure 7: (Kane et al.) The calculated extent of the conservative (light-gray) and optimistic (dark-gray) HZ for the Kepler-69 system along with the Keplerian orbits of the planets.

KELT-3b: A Hot Jupiter Transiting a $V = 9.8$ Late-F Star

Joshua Pepper[1,2], Robert J. Siverd[2], Thomas G. Beatty[3], B. Scott Gaudi[3], Keivan G. Stassun[2,4], Jason Eastman[5,6], Karen Collins[7], David W. Latham[8], Allyson Bieryla[8], Lars A. Buchhave[9,10], Eric L. N. Jensen[11], Mark Manner[12], Kaloyan Penev[13], Justin R. Crepp[14], Phillip A. Cargile[2], Saurav Dhital[2,15], Michael L. Calkins[8], Gilbert A. Esquerdo[8], Perry Berlind[8], Benjamin J. Fulton[5,16], Rachel Street[5], Bo Ma[17], Jian Ge[17], Ji Wang[18], Qingqing Mao[2], Alexander J. W. Richert[19], Andrew Gould[3,20], Darren L. DePoy[21], John F. Kielkopf[7], Jennifer L. Marshall[21], Richard W. Pogge[3,20], Robert P. Stefanik[8], Mark Trueblood[22], Patricia Trueblood[22]

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[11] Department of Physics and Astronomy, Swarthmore College, Swarthmore, PA 19081, USA
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[15] Department of Astronomy, Boston University, 725 Commonwealth Avenue, Boston, MA 02215, USA
[16] Institute for Astronomy, University of Hawaii, Honolulu, HI 96822, USA
[17] Department of Astronomy, University of Florida, Gainesville, FL 32611, USA
[18] Department of Astronomy, Yale University, New Haven, CT 06511 USA
[19] Department of Astronomy and Astrophysics, Pennsylvania State University, University Park, PA 16802, USA
[20] Center for Cosmology and Astroparticle Physics, The Ohio State University, OH 43210, USA
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[22] Winer Observatory, Sonoita, AZ 85637, USA

The Astrophysical Journal, in press (arXiv:1211.1031)

We report the discovery of KELT-3b, a moderately inflated transiting hot Jupiter with a mass of $1.477^{+0.066}_{-0.067} M_J$, and radius of $1.345 \pm 0.072 R_J$, with an orbital period of 2.7033904 ± 0.000010 days. The host star, KELT-3, is a $V = 9.8$ late F star with $M_* = 1.278^{+0.063}_{-0.061} M_\odot$, $R_* = 1.472^{+0.065}_{-0.067} R_\odot$, $T_{\rm eff} = 6306^{+50}_{-49}$ K, log(g) = $4.209^{+0.033}_{-0.031}$, and [Fe/H] = $0.044^{+0.080}_{-0.082}$, and has a likely proper motion companion. KELT-3b is the third transiting exoplanet discovered by the KELT survey, and is orbiting one of the 20 brightest known transiting planet host stars, making it a promising candidate for detailed characterization studies. Although we infer that KELT-3 is significantly evolved, a preliminary analysis of the stellar and orbital evolution of the system suggests that the planet has likely always received a level of incident flux above the empirically-identified threshold for radius inflation suggested by Demory & Seager (2011).

Download/Website: `http://arxiv.org/abs/1211.1031`

Contact: `joshua.pepper@lehigh.edu`

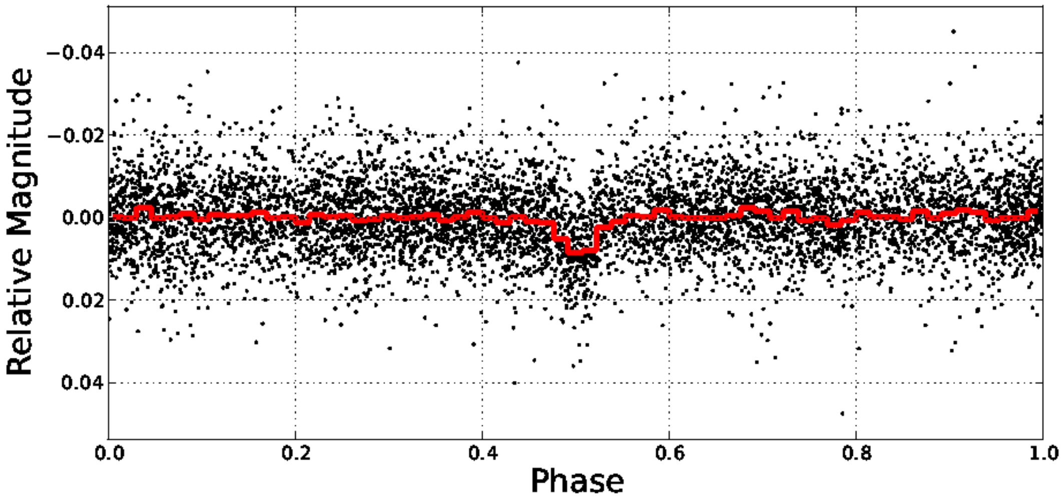

Figure 8: (Pepper et al.) Discovery light curve of KELT-3b from the KELT-North telescope. The light curve contains 6,619 observations spanning 4.4 years, phase-folded to the orbital period of 2.70339 days. The red line represents the same data binned at 1-hour intervals in phase.

Apodization in high-contrast long-slit spectroscopy

A. Vigan[1,2], *M. N'Diaye*[2,3], *K. Dohlen*[2]

[1] Astrophysics group, School of Physics, University of Exeter, Stocker Road, Exeter EX4 4QL, United Kingdom
[2] Aix Marseille Université, CNRS, LAM (Laboratoire d'Astrophysique de Marseille) UMR 7326, 13388, Marseille, France
[3] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD 21218, USA

Astronomy & Astrophysics, in press (arXiv:1305.5142)

The spectroscopy of faint planetary-mass companions to nearby stars is one of the main challenges that new-generation high-contrast spectro-imagers are going to face. In a previous work we presented a long slit coronagraph (LSC), for which the presence of a slit in the coronagraphic focal plane induces a complex distribution of energy in the Lyot pupil-plane that cannot be easily masked with a binary Lyot stop. To alleviate this concern, we propose to use a pupil apodization to suppress diffraction, creating an apodized long slit coronagraph (ALSC). After describing how the apodization is optimized, we demonstrate its advantages with respect to the CLC in the context of SPHERE/IRDIS long slit spectroscopy (LSS) mode at low-resolution with a 0.12" slit and 0.18" coronagraphic mask. We perform different sets of simulations with and without aberrations, and with and without a slit to demonstrate that the apodization is a more appropriate concept for LSS, at the expense of a significantly reduced throughput (37%) compared to the LSC. Then we perform detailed end-to-end simulations of the LSC and the ALSC that include realistic levels of aberrations to obtain datasets representing 1h of integration time on stars of spectral types A0 to M0 located at 10 pc. We insert spectra of planetary companions at different effective temperatures (Teff) and surface gravities (log g) into the data at angular separations of 0.3" to 1.5" and with contrast ratios from 6 to 18 mag. Using the SD method to subtract the speckles, we show that the ALSC brings a gain in sensitivity of up to 3 mag at 0.3" with respect to the LSC, which leads to a much better spectral extraction below 0.5". In terms of Teff, we demonstrate that at small angular separations the limit with the ALSC is always lower by at least 100K, inducing an increase of sensitivity of a factor up to 1.8 in objects' masses at young ages.

Download/Website: `http://arxiv.org/abs/1305.5142`

Contact: arthur.vigan@oamp.fr

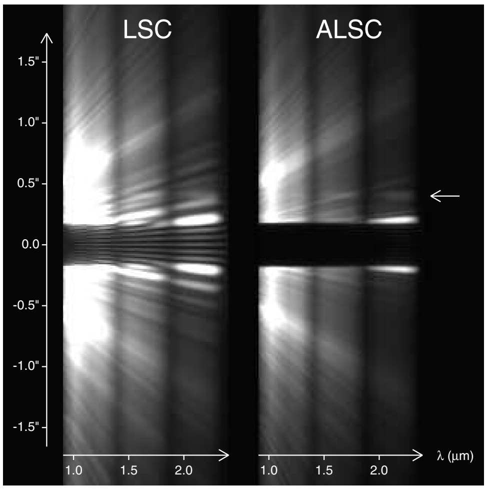

Figure 9: (Vigan et al.) Simulated data with the LSC (left) and ALSC (right) designs representing a 1-hour total integration time on a G0 star at 10 pc. A fake companion (T_{eff} = 1400 K, log g = 5.0) has been introduced at a separation of +0.4" from the star (left pointing arrow). Strong diffraction residuals are clearly visible on either side of the coronagraphic mask for the LSC, while the apodizer has almost completely suppressed diffraction for the ALSC.

MARVELS-1: A face-on double-lined binary star masquerading as a resonant planetary system; and consideration of rare false positives in radial velocity planet searches

Jason T. Wright[1,2], *Arpita Roy*[1,2], *Suvrath Mahadevan*[1,2], *Sharon X. Wang*[1,2], *Eric B. Ford*[3], *Matt Payne*[3,5], *Brian L. Lee*[3,6], *Ji Wang*[4], *Justin R. Crepp*[7], *B. Scott Gaudi*[8], *Jason Eastman*[8], *Joshua Pepper*[9], *Jian Ge*[3], *Scott W. Fleming*[1,2], *Luan Ghezzi*[10,11], *Jonay I. González-Hernández*[12,13], *Phillip Cargile*[9], *Keivan G. Stassun*[9,14], *John Wisniewski*[15], *Leticia Dutra-Ferreira*[16,11], *Gustavo F. Porto de Mello*[16,11], *Márcio A. G. Maia*[10,11], *Luiz Nicolaci da Costa*[10,11], *Ricardo L. C. Ogando*[10,11], *Basilio X. Santiago*[17,11], *Donald P. Schneider*[1,2], *Fred R. Hearty*[18]

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[17] Instituto de Física, UFRGS, Caixa Postal 15051, Porto Alegre, RS 91501-970, Brazil
[18] Department of Astronomy, University of Virginia, 530 McCormick Road, Charlottesville VA, 22901, USA

The Astrophysical Journal, accepted (arXiv:1305.0280)

We have analyzed new and previously published radial velocity observations of MARVELS-1, known to have an ostensibly substellar companion in a $\sim$ 6-day orbit. We find significant ($\sim$ 100 m s^{-1}) residuals to the best-fit model for the companion, and these residuals are naïvely consistent with an interior giant planet with a $P = 1.965$d in a nearly perfect 3:1 period commensuribility ($|P_b/P_c - 3| < 10^{-4}$). We have performed several tests for the reality of such a companion, including a dynamical analysis, a search for photometric variability, and a hunt for contaminating stellar spectra. We find many reasons to be critical of a planetary interpretation, including the fact that most of the three-body dynamical solutions are unstable. We find no evidence for transits, and no evidence of stellar photometric variability. We have discovered two apparent companions to MARVELS-1 with adaptive optics imaging at Keck; both are M dwarfs, one is likely bound, and the other is likely a foreground object. We explore false-alarm scenarios inspired by various curiosities in the data. Ultimately, a line profile and bisector analysis lead us to conclude that the $\sim$ 100 m s^{-1} residuals are an artifact of spectral contamination from a stellar companion contributing $\sim$ 15–30% of the optical light in the system. We conclude that origin of this contamination is the previously detected radial velocity companion to MARVELS-1, which is not, as previously reported, a brown dwarf, but in fact a G dwarf in a face-on orbit.

Download/Website: `http://arxiv.org/abs/1305.0280`

Contact: `jtwright@astro.psu.edu`

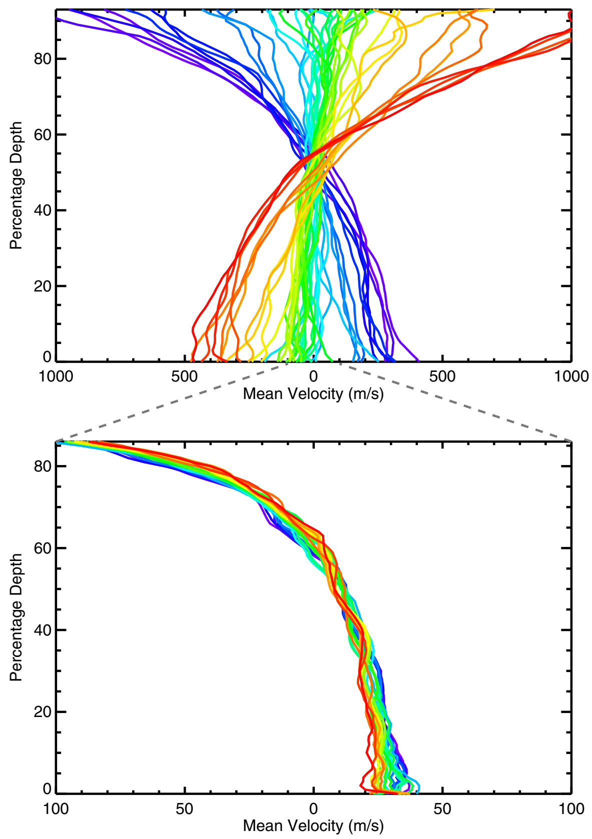

Figure 10: (Wright et al.) CCF-measured line bisectors for MARVELS-1 (top) and standard star σ Dra (bottom). Note the factor of ten difference in the velocity axis range, demonstrating the stability of the σ Dra bisectors and the clear evidence of profile changes in MARVELS-1. Colors indicate the magnitude of the bisector measurement, and for MARVELS-1 are well correlated with the radial velocity anomalies to a sinusoidal fit.

3 Jobs and Positions

Scientist (Astronomer) – 3 positions, Qatar Exoplanet Survey

K.A. Alsubai
Qatar Environment & Energy Research Institute, Member of Qatar Foundation, Doha, Qatar

Doha, Qatar, 1 Sep 2013 / end of the year

The Qatar Exoplanet Survey Project (QES) (www.qatarexoplanet.org) is an all-sky transit survey that aims to detect hot planets in the Neptune-to-Jupiter mass range orbiting low-mass stars. The QES project has been granted exceptional funding from Qatar National Research Fund (QNRF) for expanding its observing stations over 3 continents and for being a major player of exoplanet search. The total duration of the awarded funding is 5 years.
We invite applications for scientist positions to work with Dr. Khalid Alsubai. We seek 3 postdocs with some years of experience to assist with the design of the observing stations and the analysis of the data. While previous experience in instrument design and exoplanet surveys is an asset, exceptional candidates with no such experience will also be considered. We welcome proposals from individuals interested in leading such efforts.
Appointments are for 3 years, with renewals for five years likely, contingent upon satisfactory progress. A very good performance may result in a permanent appointment. Applicants must have a PhD in astronomy or astrophysics and a proven track record in Astronomy research. The applicants should email to Mrs. Huda Alzayed (halzayed@qf.org.qa) the following:

- A cover letter describing the applicant's background and motivation for applying for the job
- A CV with information about previous positions (if applicable)
- List of publications
- Name and contact information for at least two references The application deadline is 31 July 2013.

Compensation:
Compensation will include attractive salary and additional benefits such as furnished accommodation, annual paid leave, medical insurance, etc.

About Qatar Environment & Energy Research Institute (QEERI):
QEERI was announced by His Highness Sheikh Hamad Bin Khalifa Al Thani, Amir of Qatar, in 2007 and was officially launched in 2008. QEERI is a member of Qatar Foundation. Its mission is to conduct and coordinate multidisciplinary research that will address critical national priorities in environment and energy by integrating knowledge of the environment, energy, food, and water resources in ways appropriate for Qatar and the region. QEERI is also conducting basic research in Nanoscience and Astrophysics, which includes special research programmes such as the Qatar Exoplanet Survey (QES).

Qatar Foundation: Qatar Foundation for Education, Science and Community Development is a private, chartered, nonprofit organization, founded in 1995 by His Highness Sheikh Hamad Bin Khalifa Al-Thani, Amir of Qatar. Guided by the principle that a nation's greatest resource is the potential of its people, Qatar Foundation aims to develop that potential through a network of centres devoted to progressive education, research and community welfare.

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

Contact: `halzayed@qf.org.qa`

Postdoc in astrophysics, especially star and planet formation

Rene Liseau
Onsala Space Observatory

Onsala, May 31, 2013

The astronomy and astrophysics group of the Earth and Space Sciences department is located at the Onsala Space Observatory, beautifully situated directly by the sea about 40 km south of Gothenborg. The group shares office space and interacts vividly with members of the observatory staff which is responsible for running the local telescope facilities, but also for the maintenance of APEX in Chile, and the management of the Nordic ALMA Regional Centre node. Being highly motivated by and focussed on science, the group composition is dynamic. The current staffing can be overviewed at http://www.chalmers.se/rss/EN/research/research-groups/radio-astronomy/staff Research topics fall into high energy astrophysics, stellar astrophysics and the physics and chemistry of the interstellar medium of the Milky Way and other galaxies. Presently, the research staff is in rapid expansion, with several new members joining in the coming years.

The postdoc is expected to
- do observational and modelling work of star and planet formation with emphasis on the FIR and submm/mm, including continuum and spectral line analysis also of optically very thick media. Disc modelling would require the capability of at least 2d+, but preferentially 3d.
- collaborate with the group and to provide some limited co-supervision of phd students
- actively partake in the scientific life with seminars and journal clubs
- have expertise in numerical modelling, incl. demonstrated knowledge of at least one major programming languages
- be familar with observational facilities, e.g. Herschel, ALMA, VLT..., and relevant data reduction software
- write observing proposals (e.g., ALMA, VLT etc.)

Included Benefits:
In Sweden, the benefits include medical insurance, parental leave (both maternal and paternal), retirement benefits and annual holidays. The annual salary will be no less than 400 000 SEK (48 0000 EUR, USD 63 000 as of 11 April 2013).

Although the formal deadline has passed, contact R. Liseau before June 15.

Contact: `rene.liseau@chalmers.se`

Download/Website: `http://www.chalmers.se/en/about-chalmers/vacancies/Pages/default.aspx?rmpage=job&rmjob=1282`

Research Fellowship

Nuno Santos

Centro de Astrofísica da Universidade do Porto, 1st of October 2013 – 31st of March 2015

The Centro de Astrofisica da Universidade do Porto (CAUP) opens a call for one Research Fellowship to work in the ExoEarths research group (http://www.astro.up.pt/exoearths/).
The successful candidate is expected to pursue research in the analysis of high resolution near infrared spectra, with particular emphasis on the derivation of precise radial velocities. Expertise in the reduction of spectroscopic data or in telluric line correction (including the use of Earth's atmosphere transmission models) will be highly appreciated. The application deadline is the 30th of June of 2013.

Download/Website: `http://www.astro.up.pt/caup/index.php?WID=141&Lang=uk&CID=1&ID=91`

Contact: `nuno.santos@astro.up.pt`

4 Announcements

Exoplanet White Paper for ESA L2/L3

Vincent Coudé du Foresto
Observatoire Paris - Site de Meudon

ESA L2/L3 white paper, Blue Dots team

Dear Exoplanet White Paper supporters,
The paper was successfully submittted by Andreas Quirrenbach on 24th May. For reference, you can download its final (submitted) version at :
http://www.blue-dots.net/Exoplanet-white-paper-buildup.html
It mentions the backing of 640 scientists – but the count does not stop here! An updated supporter list is maintained on line and you can still sign in at :
http://www.blue-dots.net/Support-the-Exoplanet-white-paper.html
According to the ESA call, the next public event related to the L2/L3 science selection process will be an open workshop to be held next September 2-3 (TBC) at ESTEC. Please consider attending this workshop and note these dates on your agenda. More updates will be distributed via this list when they become available.

Download/Website: `http://www.blue-dots.net/Support-the-Exoplanet-white-paper.html`

Contact: `exoplanet.whitepaper@obspm.fr`

Discussion of Exoplanet Naming Conventions

R. Akeson[1], A. Boss[2], J. Schneider[3], J. Wright[4]
[1] NASA Exoplanet Archive
[2] Chair of the IAU Working Group on Extrasolar Planets (2000-2006)
[3] Extrasolar Planets Encyclopedia
[4] exoplanets.org

An exchange of letters with IAU commission 53 on the issue of exoplanet names, Response

Following the announcement on exoplanet names by IAU Commission 53 (http://www.iau.org/public_press/news/detail/iau1301/) and the ensuing community discussion, we sent a letter to IAU Commission 53 highlighting some of the issues and received the following reply:

Request to Commission 53

To: Alain Lecavelier des Etangs, Thierry Montmerle, and Lars Lindberg Christensen
Re: Naming of Exoplanets

To IAU Commission 53,

We represent 3 of the groups actively engaged in working with the professional astronomical community to maintain lists of exoplanets and their measured and derived characteristics. We welcome and wish to encourage public interest in exoplanets and their names. However, the distinctions between the public names and the names generally used by the professional community need to be understood by all involved. In light of the recent press release and community discussion, we join the chair of the (now defunct) IAU Working Group on Extrasolar Planets in making the following comments:

- The IAU has the authority to give recommendations for the naming process for extrasolar planets (exoplanets). In consultation with its Commission 53 (C53) and other astronomers, it may recommend a naming process for exoplanets in the future. The IAU Working Group on Extrasolar Planets (WGESP) maintained an online list of all exoplanet discoveries, with their names, discovery credits, and priority order, from August 2000 until August 2006, when the WGESP was replaced by C53. While the IAU has never played a more formal, active role in the naming process, by assigning, registering, or vetoing these designations (as it does with, for instance, Solar System bodies), it has the authority to do so.
- In the early years of exoplanet detection, a convention arose amongst discoverers whereby exoplanets were designated by a lowercase letter after a valid name of their host star, beginning with 'b' and increasing alphabetically in the order the exoplanets were discovered around a given star. This convention was formally recognized by the IAU Working Group on Extrasolar Planets (which became Commission 53 in 2006). (The case of multiple names of stars and of planet names according to their discovery instruments (e.g. CoRoT-n b, HAT-P-n b, Kepler-n b etc) deserve a special attention).
- Nearly all of the designations that appear in the professional literature originate from the discoverers of exoplanets assigning designations in the refereed papers or conference proceedings in which they announce the discovery of the exoplanet. These names usually (but not always) follow the generally accepted convention. Occasionally, astronomers will also give exoplanets "popular names" or "nicknames" (in press releases, for instance), but these names are rarely or never used in the professional literature.
- There are many resources, including in the Extrasolar Planets Encyclopedia (http:// exoplanet.eu/), the Exoplanet Orbit Database (http://exoplanets.org), the Exoplanet Archive (http://exoplanetarchive.ipac.caltech.edu/), and others, that maintain lists of exoplanets. The Extrasolar Planets Encyclopedia, in particular, has played an important role in the development of exoplanetary astronomy, and has been mentioned in reports by the Working Group on Extrasolar Planets and Commission 53 as a valid and valuable resource for the astronomical community.
- These resources strive to reflect the scientific literature when listing designations for the exoplanets, and do not currently recognize "popular" names. They each have their own methods of resolving conflicting designations or non-standard names for exoplanets in the literature, and different criteria for inclusion of exoplanets on their lists.
- None of these resources is maintained by the IAU and none of them operates with the imprimatur or preference of the IAU. We would like to work with the IAU and Commission 53 in clarifying these points with the professional astronomical community and the public.

Regards, Jason Wright, Exoplanet Orbit Database
Rachel Akeson, NASA Exoplanet Archive
Jean Schneider, Extrasolar Planets Encyclopedia
Alan Boss, Chair of the IAU Working Group on Extrasolar Planets $(2000 - 2006)$

Repsonse from Commission 53

To: Jason Wright, Rachel Akeson, Jean Schneider and Alan Boss.

The Organizing committee of the Commission 53 has thoroughly read your document regarding how exoplanets acquire their designations and where these designations are recorded. Please find below our comments and answers to it:

- The Organizing Committee recognizes the important involvement of the 3 groups working hard to maintain lists of exoplanets. We strongly concur with your statement that "None of these resources is maintained by the IAU and none of them operates with the imprimatur or preference of the IAU". In short, there is no official IAU catalog.

- Given the excellent quality of the existing catalogs, the Organizing Committee acknowledges that the involvement of the 3 groups is extremely useful to the whole astronomical community.
- The Commission 53 has no material or financial support from the IAU to maintain a list of exoplanets.
- We agree that there should be a distinction between a "public" name and a "nomenclature" name given to an exoplanet. The nomenclature names are used by astronomers to designate uniquely and unambiguously all objects discovered in the Universe. This nomenclature designation has been defined by practice by the discoverers (star name + lowercase letter).
- We support all activities aimed at educating both the astronomical community and the public about the nomenclature convention that is currently universally used by the astronomical community.
- There have never been formal or official recommendations from the IAU about the nomenclature scheme. But it is accepted by the community and in the absence of problems, input from the IAU has not been necessary. Nonetheless, recent discoveries (for instance around binaries) have raised some issues, and the Commission members will be consulted about possible guidelines for the nomenclature.
- If they wish, the catalog architects could include a statement on their web site mentioning that the planet nomenclature names listed are generally accepted by the exoplanet community but are not officially endorsed by the IAU.
- A wide consultation of the Commission 53 is to be organized this year. This consultation will address questions including some on popular names and the nomenclature.

We hope this answers your requests.

Contact: `rla@ipac.caltech.edu`

5 As seen on astro-ph

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

astro-ph/1305.0016: **Retrograde resonance in the planar three-body problem** by *M.H.M. Morais, F. Namouni*
astro-ph/1305.0186 : **The Microlensing Event Rate and Optical Depth Toward the Galactic Bulge from MOA-II** by *T. Sumi, et al.*
astro-ph/1305.0269: **The Role of Core Mass in Controlling Evaporation: the Kepler Radius Distribution and the Kepler-36 Density Dichotomy** by *Eric Lopez, Jonathan Fortney*
astro-ph/1305.0280 : **MARVELS-1: A face-on double-lined binary star masquerading as a resonant planetary system; and consideration of rare false positives in radial velocity planet searches** by *Jason T. Wright, et al.*
astro-ph/1305.0307: **Turbulence-Induced Relative Velocity of Dust Particles I: Identical Particles** by *Liubin Pan, Paolo Padoan*
astro-ph/1305.0542: **Observed Properties of Extrasolar Planets** by *Andrew W. Howard*
astro-ph/1305.0578: **Spectroscopy of Faint Kepler Mission Exoplanet Candidate Host Stars** by *Mark E. Everett, et al.*
astro-ph/1305.0689: **Photophoretic separation of metals and silicates: the formation of Mercury like planets and metal depletion in chondrites** by *Gerhard Wurm, Mario Trieloff, Heike Rauer*
astro-ph/1305.0770: **Protostellar Disk Evolution Over Million-Year Timescales with a Prescription for Magnetized Turbulence** by *Russell Landry, et al.*
astro-ph/1305.0803: **Concentric Maclaurin spheroid models of rotating liquid planets** by *W. B. Hubbard*

astro-ph/1305.0833: **Warm Spitzer Photometry of Three Hot Jupiters: HAT-P-3b, HAT-P-4b and HAT-P-12b** by *Kamen O. Todorov, et al.*
astro-ph/1305.0850: **Elliptic and magneto-elliptic instabilities of disk vortices** by *Wlad Lyra*
astro-ph/1305.0980: **Deuterium Burning in Massive Giant Planets and Low-Mass Brown Dwarfs formed by Core-Nucleated Accretion** by *Peter Bodenheimer, et al.*
astro-ph/1305.1298: **A Posteriori Transit Probabilities** by *Daniel J. Stevens, B. Scott Gaudi*
astro-ph/1305.1322: **Accretion of gas onto gap-opening planets and circumplanetary flow structure in magnetized turbulent disks** by *Ana Uribe, Hubert Klahr, Thomas Henning*
astro-ph/1305.1413: **The dynamical evolution of multi-planet systems in open clusters** by *W. Hao, M.B.N. Kouwenhoven, R. Spurzem*
astro-ph/1305.1643: **Ground-based detections of thermal emission from the dense hot Jupiter WASP-43b in H and Ks-bands** by *Wei Wang, et al.*
astro-ph/1305.1670: **Transmission Spectroscopy of the Hot-Jupiter WASP-12b from 0.7 to 5 microns** by *Kevin B. Stevenson, et al.*
astro-ph/1305.1717: **The effect of planet-planet scattering on the survival of exomoons** by *Yan-Xiang Gong, et al.*
astro-ph/1305.1889: **The Fate of Planetesimals in Turbulent Disks with Dead Zones. I. The Turbulent Stirring Recipe** by *Satoshi Okuzumi, Chris W. Ormel*
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