ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the sixty second edition of ExoPlanet News. After the (northern hemisphere) summer break, there is a bumper crop of abstracts, conference announcements and other messages in this month's issue.

The next edition of the newsletter is planned for early October 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

An observational correlation between stellar brightness variations and surface gravity

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Nature, published (2013, 500, 427)

Surface gravity is a basic stellar property, but it is difficult to measure accurately, with typical uncertainties of 25 to 50 per cent if measured spectroscopically and 90 to 150 per cent if measured photometrically. Asteroseismology measures gravity with an uncertainty of about 2 per cent but is restricted to relatively small samples of bright stars, most of which are giants. The availability of high-precision measurements of brightness variations for more than 150,000 stars provides an opportunity to investigate whether the variations can be used to determine surface gravities. The Fourier power of granulation on a star's surface correlates physically with surface gravity: if brightness variations on timescales of hours arise from granulation, then such variations should correlate with surface gravity. Here we report an analysis of archival data that reveals an observational correlation between surface gravity and

root mean squared brightness variations on timescales of less than eight hours for stars with temperatures of 4 500 to 6 750 kelvin, log surface gravities of 2.5 to 4.5 (cgs units) and overall brightness variations of less than three parts per thousand. A straightforward observation of optical brightness variations therefore allows a determination of the surface gravity with a precision of better than 25 per cent for inactive Sun-like stars at main-sequence to giant stages of evolution.

Download/Website: `http://arxiv.org/abs/1308.4728`

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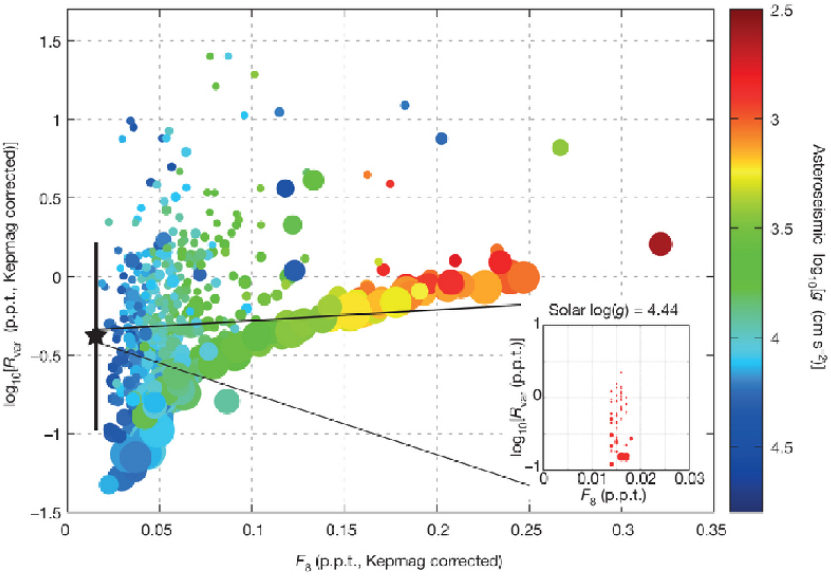

Figure 1: (Bastien et al.) Simple measures of brightness variations reveal a fundamental "flicker sequence" of stellar evolution. We establish the evolutionary states of stars with three simple measures of brightness variations. The abscissa, 8-h flicker (F_8), measures brightness variations on time scales of 8 h or less. The ordinate, R_{var}, yields the largest amplitude of the photometric variations in a 90-d timeframe. The number of zero crossings, X_0 (symbol size; ranging from 0.01 to 2.1 crossings per day), conveys the large-scale complexity of the light curve. We correct both R_{var} and F_8 for their dependence on Kepler magnitude (Kepmag). Colour represents asteroseismically determined surface gravity. We observe two populations of stars: a vertical cloud composed of high-gravity dwarfs and some subgiants, and a tight sequence — the flicker floor — spanning a range of surface gravity from dwarfs to giants. The typically large R_{var} values of stars in the cloud, coupled with their simpler light curves (small X_0), implies brightness variations driven by rotational modulation of spots. In contrast, large X_0 values characterize stars on the sequence. The F_8 values of stars in this sequence increase inversely with surface gravity because the physical source of F_8 is sensitive to surface gravity. R_{var} also increases with F_8 along the floor, because F_8 is a primary contributor to R_{var} (as opposed to starspots above the floor). Stars with a given F_8 value cannot have R_{var} less than that implied by F_8 itself: quiet stars accumulate on the flicker floor because they are prevented from going below it by the statistical definition of the two quantities. Stars above the floor have larger amplitude variations on longer timescales that set R_{var}. The large star symbol with vertical bars and the inset show the Sun's behaviour over the course of its 11-yr magnetic cycle. The Sun's F_8 value is largely invariant over the course of its cycle, just as its surface gravity is invariant. p.p.t., parts per thousand.

Constraining the atmosphere of GJ 1214b using an optimal estimation technique

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1306.6567v1)

We explore cloudy, extended H_2He atmosphere scenarios for the warm super-Earth GJ 1214b using an optimal estimation retrieval technique. This planet, orbiting an M4.5 star only 13 pc from the Earth, is of particular interest because it lies between the Earth and Neptune in size and may be a member of a new class of planet that is neither terrestrial nor gas giant. Its relatively flat transmission spectrum has so far made atmospheric characterization difficult. The Non-linear optimal Estimator for MultivariateE spectral analySIS (NEMESIS) algorithm is used to explore the degenerate model parameter space for a cloudy, H_2He-dominated atmosphere scenario. Optimal estimation is a data-led approach that allows solutions beyond the range permitted by *ab initio* equilibrium model atmosphere calculations, and as such prevents restriction from prior expectations. We show that optimal estimation retrieval is a powerful tool for this kind of study, and present an exploration of the degenerate atmospheric scenarios for GJ 1214b. Whilst we find a family of solutions that provide a very good fit to the data, the quality and coverage of these data are insufficient for us to more precisely determine the abundances of cloud and trace gases given an H_2He atmosphere, and we also cannot rule out the possibility of a high molecular weight atmosphere. Future ground- and space-based observations will provide the opportunity to confirm or rule out an extended H_2He atmosphere, but more precise constraints will be limited by intrinsic degeneracies in the retrieval problem, such as variations in cloud top pressure and temperature.

Download/Website: `http://arxiv.org/abs/1306.6567v1`

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The curiously circular orbit of Kepler-16b

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Monthly Notices of the Royal Astronomical Society, in press (arXiv: 1308.0596)

The recent discovery of a number of circumbinary planets lends a new tool to astrophysicists seeking to understand how and where planet formation takes place. Of the increasingly numerous circumbinary systems, Kepler-16 is arguably the most dynamically interesting: it consists of a planet on an almost perfectly circular orbit ($e = 0.0069$) around a moderately eccentric binary ($e = 0.16$). We present high-resolution 3D smoothed-particle hydrodynamics simulations of a Kepler-16 analogue embedded in a circumbinary disc, and show that the planet's eccentricity is damped by its interaction with the protoplanetary disc. We use this to place a lower limit on the gas surface density in the real disc through which Kepler-16b migrated of $\Sigma_{\rm min} \sim 10$ g cm^{-2}. This suggests that Kepler-16b, and other circumbinary planets, formed and migrated in relatively massive discs. We argue that secular evolution of circumbinary discs requires that these planets likely formed early on in the lifetime of the disc and migrated inwards before the disc lost a significant amount of its original mass.

Download/Website: `http://www.astro.le.ac.uk/users/acd23/K16.html`

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3D model of hydrogen atmospheric escape from HD 209458b and HD 189733b: radiative blow-out and stellar wind interactions

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Astronomy & Astrophysics, accepted for publication, arXiv:1308.0561

Transit observations in the Lyman-α line of the hot-Jupiters HD 209458b and HD 189733b revealed strong signatures of neutral hydrogen escaping the planets' upper atmospheres. Here we present a 3D particle model of the dynamics of the escaping atoms. This model is used to calculate theoretical Lyman-α absorption line profiles, which can be directly compared with the absorption observed in the blue wing of the line during the planets' transit.
For HD 209458b, the observed velocities of the planet-escaping atoms up to -130 km s^{-1} are naturally explained by radiation-pressure acceleration. The observations are well-fitted with an ionizing flux of about 3 – 4 times the solar value and a hydrogen escape rate in the range 10^9 – 10^{11} g s^{-1}, in agreement with theoretical predictions.
For HD 189733b, absorption by neutral hydrogen has been observed in September 2011 in the velocity range -230 to -140 km s^{-1}. These velocities are higher than for HD 209458b and require an additional acceleration mechanism for the escaping hydrogen atoms, which could be interactions with stellar wind protons. We constrain the stellar wind (temperature $\sim 3 \times 10^4$ K, velocity 200$\pm$20 km s^{-1} and density in the range 10^3 – 10^7 cm^{-3}) as well as the escape rate (4×10^8 – 10^{11} g s^{-1}) and ionizing flux (6 – 23 times the solar value). We also reveal the existence of an 'escape-limited' saturation regime in which most of the gas escaping the planet interacts with the stellar protons. In this regime, which occurs at proton densities above $\sim$ 3×10^5 cm^{-3}, the amplitude of the absorption signature is limited by the escape rate and does not depend on the wind density. The non-detection of escaping hydrogen in earlier observations in April 2010 can be explained by the suppression of the stellar wind at that time, or an escape rate of about an order of magnitude lower than in 2011.
For both planets, best-fit simulations show that the escaping atmosphere has the shape of a cometary tail. Simulations also revealed that the radiative blow-out of the gas causes spectro-temporal variability of the absorption profile as a function of time during and after the planetary transit. Because no such variations are observed when the absorbing hydrogen atoms are accelerated through interactions with the stellar wind, this may be used to distinguish between the two scenarios.

Download/Website: `http://arxiv.org/abs/1308.0561`

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Narrow-K-Band Observations of the GJ 1214 System

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The Astrophysical Journal, in press (arXiv:1308.4404)

GJ 1214 is a nearby M dwarf star that hosts a transiting super-Earth-size planet, making this system an excellent target for atmospheric studies. Most studies find that the transmission spectrum of GJ 1214b is flat, which favors either a high mean molecular weight or cloudy/hazy hydrogen (H) rich atmosphere model. Photometry at short wavelengths ($<$ 0.7 μm) and in the K-band can discriminate the most between these different atmosphere models for GJ 1214b, but current observations do not have sufficiently high precision. We present photometry of seven transits of GJ 1214b through a narrow K-band (2.141 μm) filter with the Wide Field Camera on the 3.8 m United Kingdom Infrared Telescope. Our photometric precision is typically 1.7×10^{-3} (for a single transit), comparable with other ground-based observations of GJ 1214b. We measure a planet-star radius ratio of 0.1158$\pm$0.0013, which, along with other studies, also supports a flat transmission spectrum for GJ 1214b. Since this does not exclude a scenario where GJ 1214b has a H-rich envelope with heavy elements that are sequestered below a cloud/haze layer,

we compare K-band observations with models of H_2 collision-induced absorption in an atmosphere for a range of temperatures. While we find no evidence for deviation from a flat spectrum (slope s = 0.0016±0.0038), an H_2 dominated upper atmosphere (< 60 mbar) cannot be excluded. More precise observations at < 0.7 μm and in the K-band as well as a uniform analysis of all published data would be useful for establishing more robust limits on atmosphere models for GJ 1214b.

Download/Website: `http://arxiv.org/abs/1308.4404`

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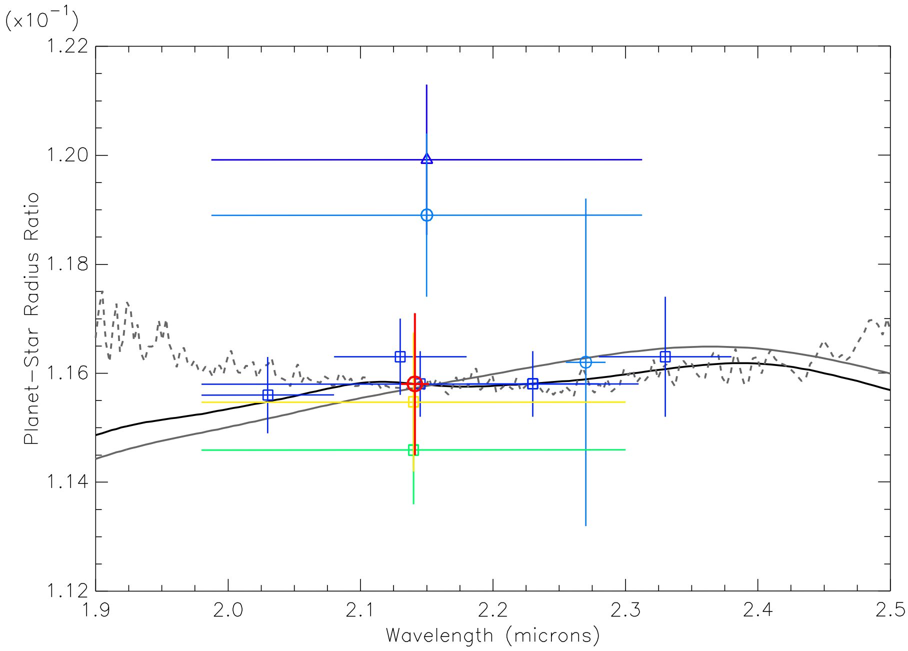

Figure 2: (Cólon & Gaidos) $R_p/R_\star$ from our analysis (red circle) compared to others published in the literature. The symbols are the same as in Figure 1: the blue triangle is from Croll et al. (2011), blue squares are from Bean et al. (2011) , blue circles are from de Mooj et al. (2012), the green square is from Narita et al. (2012), and the yellow square is from Narita et al. (2013). Vertical error bars are one standard deviation. The horizontal error bars on each point indicate the approximate bandpass of the filter used for each observation. The solid black and gray curves are 400 and 1000 K pure H_2 atmosphere models. The models have been offset by a reference radius ratio, $R_0/R_\star$, derived from fitting the models to the data. The 400 and 1000 K models were found to have the lowest and highest χ^2 values [after comparing atmosphere models with different temperatures with the K-band data, excluding the outlying Croll et al. (2011) and de Mooj et al. (2012) K_s-band data]. The 470 K 1% H_2O and 99% N_2 plus haze atmosphere model from Howe & Burrows (2012) shown in Figure 1 as the dark gray curve is also shown here as a dashed gray curve.

A small survey of the magnetic fields of planet-host stars

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1307.6091)

Using spectropolarimetry, we investigate the large-scale magnetic topologies of stars hosting close-in exoplanets. A small survey of ten stars has been done with the twin instruments TBL/NARVAL and CFHT/ESPaDOnS between 2006 and 2011. Each target consists of circular-polarization observations covering 7 to 22 days. For each of the 7 targets in which magnetic field was detected, we reconstructed the magnetic field topology using Zeeman-Doppler imaging. Otherwise, a detection limit has been estimated. Three new epochs of observations of τ Boo are presented, which confirm magnetic polarity reversal. We estimate that the cycle period is 2 years, but recall that a shorter period of 240 days can not still be ruled out. The result of our survey is compared to the global picture of stellar magnetic field properties in the mass-rotation diagram. The comparison shows that these giant planet-host stars tend to have similar magnetic field topologies to stars without detected hot-Jupiters. This needs to be confirmed with a larger sample of stars.

Download/Website: `http://arxiv.org/abs/1307.6091`

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A Detailed Dynamical Investigation of the Proposed QS Virginis Planetary System

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1307.7893)

In recent years, a number of planetary systems have been proposed to orbit evolved binary star systems. The presence of planets is invoked to explain observed variations in the timing of mutual eclipses between the primary and secondary components of the binary star system. The planets recently proposed orbiting the cataclysmic variable system QS Virginis are the latest in this on-going series of "extreme planets".
The two planets proposed to orbit QS Virginis would move on mutually crossing orbits – a situation that is almost invariably unstable on very short timescales. In this work, we present the results of a detailed dynamical study of the orbital evolution of the two proposed planets, revealing that they are dynamically unstable on timescales of less than one thousand years across the entire range of orbital elements that provide a plausible fit to the observational data, and regardless of their mutual orbital inclination. We conclude that the proposed planets around the cataclysmic variable QS Virginis simply cannot exist.

Download/Website: `http://arxiv.org/ftp/arxiv/papers/1307/1307.7893.pdf`

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An HST Optical to Near-IR Transmission Spectrum of the Hot Jupiter WASP-19b: Detection of Atmospheric Water and Likely Absence of TiO

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1307.2083)

We measure the transmission spectrum of WASP-19b from 3 transits using low-resolution optical spectroscopy from the HST Space Telescope Imaging Spectrograph (STIS). The STIS spectra cover a wavelength range of 0.29-1.03 μm, with resolving power $R = 500$. The optical data are combined with archival near-IR data from the HST Wide Field Camera 3 (WFC3) G141 grism, covering the wavelength range from 1.087 to 1.687 μm, with resolving power $R = 130$. We obtain the transmission spectrum from 0.53-1.687 μm with S/N levels between 3,000 and 11,000 in 0.1 μm bins.
WASP-19 is known to be a very active star, with the optical stellar flux varying by a few per cent over time. We correct the transit light curves for the effects of stellar activity using ground-based activity monitoring with the Cerro Tololo Inter-American Observatory (CTIO). While we were not able to construct a transmission spectrum using the blue optical data due to the presence of large occulted star spots, we were able to use the spot crossings to help constrain the mean stellar spot temperature.
Our measurements rule out TiO features predicted for a planet of WASP-19b's equilibrium temperature (2050 K) in the transmission spectrum at the 2.7-2.9 σ confidence level, depending on atmospheric model formalism. The WFC3 transmission spectrum shows strong absorption features due to the presence of H_2O, which is detected at the 4 σ confidence level between 1.1 and 1.4 μm. The results indicate that WASP-19b is a planet with no or low levels of TiO and without a high C/O ratio. The lack of observable TiO features is possibly due to rainout, breakdown from stellar activity or the presence of other absorbers in the optical.

Download/Website: `http://adsabs.harvard.edu/abs/2013arXiv1307.2083H`

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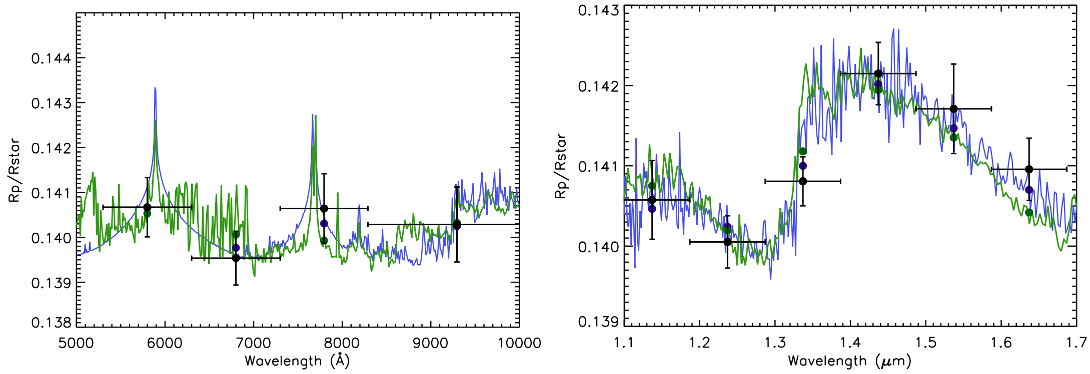

Figure 3: (Huitson et al.) HST data for STIS (left) and WFC3 (right). Also shown are pre-calculated models with TiO opacities removed from Fortney et al. (2008;2010) (blue) and Burrows et al. (2010); Howe & Burrows (2012) (green). Due to the fact that the CTIO monitoring did not cover the time of the WFC3 observations, we cannot correct that data for unocculted starspots, meaning that there is an unknown offset in continuum $R_P/R_\star$ between the two datasets.

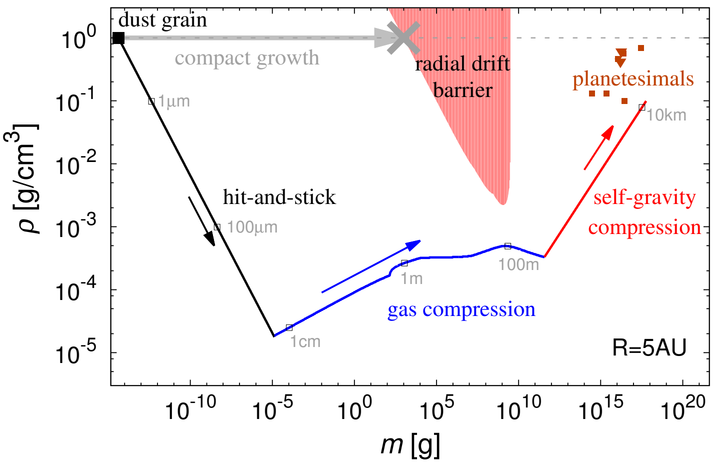

Figure 4: (Kataoka et al.) A pathway in the planetesimal formation in the minimum mass solar nebula model. The gray line shows the constant density evolutional track, which corresponds to the compact growth. The black, green, blue, and red lines are the evolutional track through dust coagulation via fluffy aggregates. Each line represents different mechanisms of dust coagulation, which are hit-and-stick, collisional compression, gas compression, and self-gravity compression. The red shaded region represents where the radial drift timescale is less than the growth timescale, which is equivalent to radial-drift region. The brown squares indicate the properties of comets, and the triangles represent their upper limit. The radii of dust aggregates for 1 μm, 1 cm, 1 m, 100 m, and 10 km are also written.

Fluffy dust forms icy planetesimals by static compression

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Astronomy & Astrophysics Letters, published (2013A&A...557L...4K)

Several barriers have been proposed in planetesimal formation theory: bouncing, fragmentation, and radial drift problems. Understanding the structure evolution of dust aggregates is a key in planetesimal formation. Dust grains become fluffy by coagulation in protoplanetary disks. However, once they are fluffy, they are not sufficiently compressed by collisional compression to form compact planetesimals. Using the compressive strength formula, we analytically investigate how fluffy dust aggregates are compressed by static compression due to ram pressure of the disk gas and self gravity of the aggregates in protoplanetary disks. We reveal the pathway of the porosity evolution from dust grains via fluffy aggregates to form planetesimals, circumventing the barriers in planetesimal formation. The aggregates are compressed by the disk gas to a density of $10^{-3}\mathrm{g/cm^3}$ in coagulation, which is more compact than is the case with collisional compression. Then, they are compressed more by self-gravity to $10^{-1}\mathrm{g/cm^3}$ when the radius is 10 km. Although the gas compression decelerates the growth, the aggregates grow rapidly enough to avoid the radial drift barrier when the orbital radius is < 6 AU in a typical disk. In conclusion, we propose a fluffy dust growth scenario from grains to planetesimals. It enables icy planetesimal formation in a wide range beyond the snowline in protoplanetary disks. This result proposes a concrete initial condition of planetesimals for the later stages of the planet formation.

Download/Website: `http://www.aanda.org/articles/aa/abs/2013/09/aa22151-13/aa22151-13.html`

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A Systematic Search for Trojan Planets in the *Kepler* data

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The Astrophysical Journal, in press (arXiv:1307.7161)

Trojans are circumstellar bodies that reside in characteristic 1:1 orbital resonances with planets. While all the trojans in our Solar System are small ($<\sim$100 km), stable planet-size trojans may exist in extrasolar planetary systems, and the *Kepler* telescope constitutes a formidable tool to search for them. Here we report on a systematic search for extrasolar trojan companions to 2244 known *Kepler* Objects of Interest (KOIs), with epicyclic orbital characteristics similar to those of the Jovian trojan families. No convincing trojan candidates are found, despite a typical sensitivity down to Earth-size objects. This fact can however not be used to stringently exclude the existence of trojans in this size range, since stable trojans need not necessarily share the same orbital plane as the planet, and thus may not transit. Following this reasoning, we note that if Earth-sized trojans exist at all, they are almost certainly both present and in principle detectable in the full set of *Kepler* data, although a very substantial computational effort would be required to detect them. On the same token, we also note that some of the existing KOIs could in principle be trojans themselves, with a primary planet orbiting outside of the transiting plane. A few examples are given for which this is a readily testable scenario.

Download/Website: `http://arxiv.org/abs/1307.7161`

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LIDT-DD: A new self-consistent debris disc model including radiation pressure and coupling dynamical and collisional evolution

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Astronomy & Astrophysics, in press (arXiv:1308.6502)

In most current debris disc models, the dynamical and the collisional evolutions are studied separately, with N-body and statistical codes, respectively, because of stringent computational constraints. In particular, incorporating collisional effects (especially destructive collisions) into an N-body scheme has proven a very arduous task because of the exponential increase of particles it would imply. We present here LIDT-DD, the first code able to mix both approaches in a fully self-consistent way. Our aim is for it to be generic enough so as to be applied to any astrophysical cases where we expect dynamics and collisions to be deeply interlocked with one another: planets in discs, violent massive breakups, destabilized planetesimal belts, bright exozodiacal discs, etc.

The code takes its basic architecture from the LIDT3D algorithm developed by Charnoz et al.(2012) for protoplanetary discs, but has been strongly modified and updated in order to handle the very constraining specificities of debris discs physics: high-velocity fragmenting collisions, radiation-pressure affected orbits, absence of gas that never relaxes initial conditions, etc. It has a 3D Lagrangian-Eulerian structure, where grains of a given size at a given location in a disc are grouped into ”super-particles”, or ”tracers”, whose orbits are evolved with an N-body code and whose mutual collisions are individually tracked and treated using a particle-in-a-box prescription designed to handle fragmenting impacts. To cope with the wide range of possible dynamics for same-sized particles at any given location in the disc, and in order not to lose important dynamical information, tracers are sorted and regrouped into dynamical families depending on their orbits. A complex reassignment routine, looking for redundant tracers into each family and reassigning them where they are needed, prevents the number of tracers from diverging.

The LIDT-DD code has been successfully tested on simplified cases for which robust results have been obtained in past studies: we retrieve the classical features of particle size distributions in unperturbed discs, as well as the outer radial density profiles in $\sim r^{-1.5}$ outside narrow collisionally active rings, and the depletion of small grains in ”dynamically cold” discs.

The potential of the new code is illustrated with the test case of the violent breakup of a massive planetesimal within a debris disc. Preliminary results show that, for the first time, we are able to quantify the timescale over which the signature of such massive break-ups can be detected. In addition to the study of such violent transient events, the main potential future applications of the code are planet/disc interactions, and more generally any configurations where dynamics and collisions are expected to be intricately connected.

Download/Website: `http://arxiv.org/abs/1308.6502`

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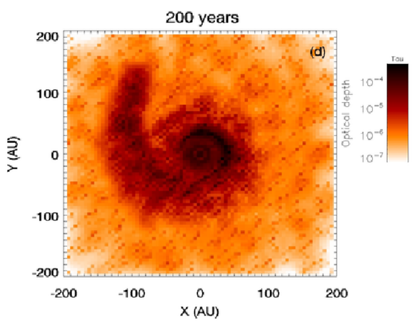

Figure 5: (Kral et al.) Total smoothed vertical geometrical optical depth in the case of a massive planetesimal breakup within a debris disc.

Star-planet magnetic interaction and evaporation of planetary atmospheres

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Astronomy & Astrophysics, 2013A&A...557A..31L

Stars interact with their close-in planets through radiation, gravitation, and magnetic fields. We investigate the energy input to a planetary atmosphere by reconnection between stellar and planetary magnetic fields and compare it to the energy input of the extreme ultraviolet (EUV) radiation field of the star. We quantify the power released by magnetic reconnection at the boundary of the planetary magnetosphere that is conveyed to the atmosphere by accelerated electrons. We introduce simple models to evaluate the energy spectrum of the accelerated electrons and the energy dissipated in the atmospheric layers in the polar region of the planet upon which they impinge. A simple transonic isothermal wind flow along field lines is considered to estimate the increase in mass loss rate in comparison with a planet irradiated only by the EUV flux of its host star. We find that energetic electrons can reach levels down to column densities of $10^{23} - 10^{25}$ m^{-2}, comparable with or deeper than EUV photons, and increase the mass loss rate up to a factor of $30 - 50$ in close-in (< 0.10 AU), massive (≥ 1.5 Jupiter masses) planets. Mass loss rates up to $(0.5 - 1.0) \times 10^9$ kg s^{-1} are found for atmospheres heated by electrons accelerated by magnetic reconnection at the boundary of planetary magnetospheres. On the other hand, average mass loss rates up to $(0.3 - 1.0) \times 10^{10}$ kg s^{-1} are found in the case of magnetic loops interconnecting the planet with the star. The star-planet magnetic interaction provides a remarkable source of energy for planetary atmospheres, generally comparable with or exceeding that of stellar EUV radiation for close-in planets. Therefore, it must be included in models of chemical evolution or evaporation of planetary atmospheres as well as in modelling of light curves of transiting planets at UV wavelengths.

Download/Website: `http://www.aanda.org/articles/aa/abs/2013/09/aa21790-13/aa21790-13.html`

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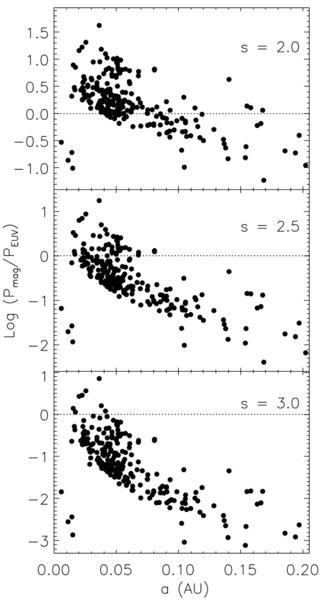

Figure 6: (Lanza) Upper panel: The ratio of the magnetic power to that of the EUV irradiation $P_{\rm mag}/P_{\rm EUV}$ on top of the planetary atmosphere vs. the orbital semimajor axis a for the known transiting planets computed for a stellar radial magnetic field ($s = 2$). The dotted horizontal line corresponds to $P_{\rm mag} = P_{\rm EUV}$. Middle panel: the same as the upper panel, but for $s = 2.5$ corresponding to a non-linear force-free stellar field. Lower panel: the same as the upper panel, but for $s = 3$, corresponding to a potential dipole stellar field.

An interferometric study of the Fomalhaut inner debris disk. III. Detailed models of the exozodiacal disk and its origin

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Astronomy & Astrophysics, published (2013A&A...555A.146L / arXiv:1306.0956)

Debris disks are thought to be extrasolar analogs to the solar system planetesimal belts. The star Fomalhaut harbors a cold debris belt at 140 AU comparable to the Edgeworth-Kuiper belt, as well as evidence of a warm dust component, unresolved by single-dish telescopes, which is suspected of being a bright analog to the solar system's zodiacal dust. Interferometric observations obtained with the VLTI/VINCI instrument and the Keck Interferometer Nuller have identified near- and mid-infrared excesses attributed respectively to hot and warm exozodiacal dust residing in the inner few AU of the Fomalhaut environment. We aim to characterize the properties of this double inner dust belt and to unveil its origin. We performed parametric modeling of the exozodiacal disk ("exozodi") using the GRaTeR radiative transfer code to reproduce the interferometric data, complemented by mid- to far-infrared photometric measurements from *Spitzer* and *Herschel*[1]. A detailed treatment of sublimation temperatures was introduced to explore the hot population at the size-dependent sublimation rim. We then used an analytical approach to successively testing several source mechanisms for the dust and suspected parent bodies. A good fit to the multiwavelength data is found by two distinct dust populations: (1) a population of very small (0.01 to 0.5 μm), hence unbound, hot dust grains confined in a narrow region ($\sim$0.1 – 0.3 AU) at the sublimation rim of carbonaceous material; (2) a population of bound grains at $\sim$ 2AU that is protected from sublimation and has a higher mass despite its fainter flux level. We propose that the hot dust is produced by the release of small carbon grains following the disruption of dust aggregates that originate from the warm component. A mechanism, such as gas braking, is required to further confine the small grains for a long enough time. *In situ* dust production could hardly be ensured for the age of the star, so we conclude that the observed amount of dust is triggered by intense dynamical activity. Fomalhaut may be representative of exozodis that are currently being surveyed at near and mid-infrared wavelengths worldwide. We propose a framework for reconciling the "hot exozodi phenomenon" with theoretical constraints: the hot component of Fomalhaut is likely the "tip of the iceberg" since it could originate from the more massive, but fainter, warm dust component residing near the ice line. This inner disk exhibits interesting morphology and can be considered a prime target for future exoplanet research.

Download/Website: `http://www.aanda.org/articles/aa/abs/2013/07/aa21415-13/aa21415-13.html`

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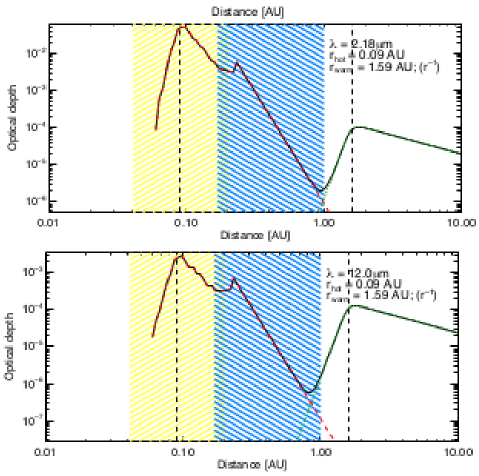

Figure 7: (Lebreton et al.) Optical depth profile of the Fomalhaut inner debris disk at $\lambda = 2.18\mu$m (upper panel) and $\lambda = 12\mu$m (lower panel). A double-ring model is used that best fits the Keck Interferometer nulls in N-band, the VLTI/VINCI excess in K-band and complementary spectro-photometric data (red: hot ring; green: warm belt). The dashed regions represent the grain size-dependent sublimation zones of silicates (blue) and carbons (yellow).

Spectroscopic direct detection of reflected light from extra-solar planets

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1308.6516)

At optical wavelengths, an exoplanet's signature is essentially reflected light from the host star - several orders of magnitude fainter. Since it is superimposed on the star spectrum its detection has been a difficult observational challenge. However, the development of a new generation of instruments like ESPRESSO and next generation telescopes like the E-ELT put us in a privileged position to detect these planets' reflected light as we will have access to extremely high signal-to-noise ratio spectra. With this work, we propose an alternative approach for the direct detection of the reflected light of an exoplanet. We simulated observations with ESPRESSO@VLT and HIRES@E-ELT of several star+planet systems, encompassing 10h of the most favourable orbital phases. To the simulated spectra we applied the Cross Correlation Function to operate in a much higher signal-to-noise ratio domain than when compared with the spectra. The use of the Cross-Correlation Function permitted us to recover the simulated the planet signals at a level above $3\,\sigma_{noise}$ significance on several prototypical (e.g., Neptune type planet with a 2 days orbit with the VLT at $4.4\,\sigma_{noise}$ significance) and real planetary systems (e.g., 55 Cnc e with the E-ELT at $4.9\,\sigma_{noise}$ significance). Even by using a more pessimistic approach to the noise level estimation, where systematics in the spectra increase the noise 2-3 times, the detection of the reflected light from large close-orbit planets is possible. We have also shown that this kind of study is currently within reach of current instruments and telescopes (e.g., 51 Peg b with the VLT at $5.2\,\sigma_{noise}$ significance), although at the limit of their capabilities.

Download/Website: `http://arxiv.org/abs/1308.6516`

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Grain growth in Brown Dwarf disks

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Astrophysical Journal Letters, in press (arXiv:1307.3708)

We perform coagulation and fragmentation simulations using the new physically-motivated model by Garaud et al. (2013) to determine growth locally in brown dwarf disks. We show that large grains can grow and that if brown dwarf disks are scaled down versions of T Tauri disks (in terms of stellar mass, disk mass and disk radius) growth at an equivalent location with respect to the disk truncation radius can occur to the same size in both disks. We show that similar growth occurs because the collisional timescales in the two disks are comparable. Our model may therefore potentially explain the recent observations of grain growth to millimeter sizes in brown dwarf disks, as seen in T Tauri disks.

Download/Website: `http://arxiv.org/abs/1307.3708`

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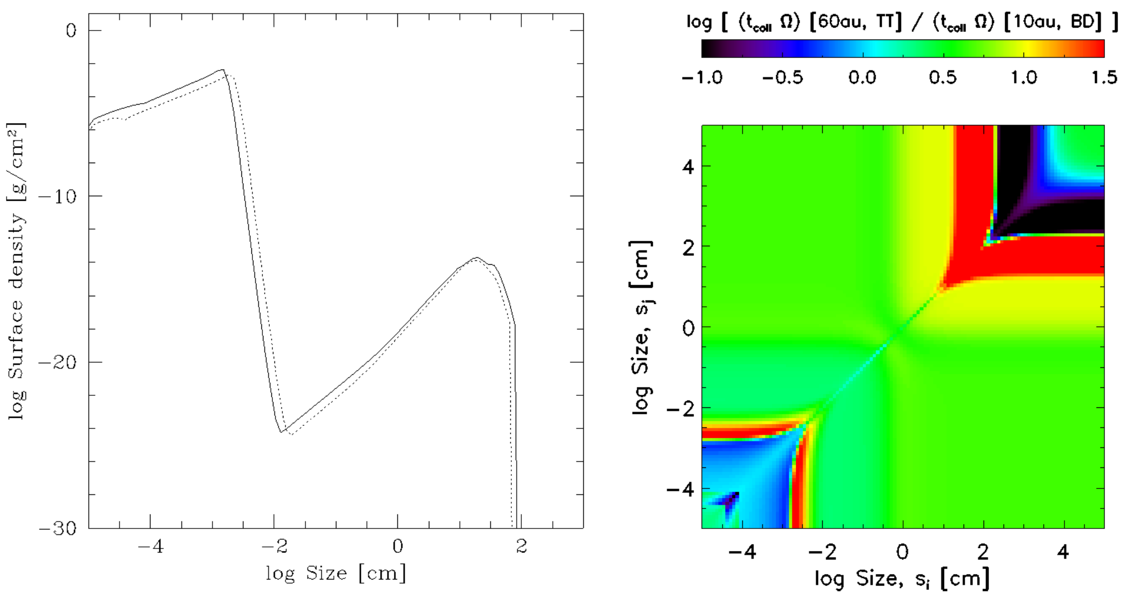

Figure 8: (Meru et al.) Surface mass density (left panel) of aggregates against particle size for the brown dwarf disk at 10au (solid line) and the T Tauri disk at 60au (dotted line). The outer radii of the brown dwarf and T Tauri disks are 15au and 90au, respectively, i.e. growth is modeled at radii of 2/3 of the distance to the truncation radius in both disks. The right panel shows the ratio of the collisional timescales (in units of the orbital timescales) of these two simulations. Growth at equivalent locations in the two disks occurs to the same size because the collisional timescales are similar for many of the particle sizes.

Growth and fragmentation of centimetre-sized dust aggregates: the dependence on aggregate size and porosity

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1308.0825)

We carry out three-dimensional Smoothed Particle Hydrodynamics simulations of spherical homogeneous SiO_2 dust aggregates to investigate how the mass and the porosity of the aggregates affects their ability to survive an impact at various different collision velocities (between $1 - 27.5$ m/s). We explore how the threshold velocities for fragmentation vary with these parameters. Crucially, we find that the porosity plays a part of utmost importance in determining the outcome of collisions. In particular, we find that aggregates with filling factors $\geq$ 37% are significantly weakened and that the velocity regime in which the aggregates grow is reduced or even non-existent (instead, the aggregates either rebound off each other or break apart). At filling factors less than $\approx$ 37% we find that more porous objects are weaker but not as weak as highly compact objects with filling factors $\geq$ 37%. In addition we find that (for a given aggregate density) collisions between very different mass objects have higher threshold velocities than those between very similar mass objects. We find that fragmentation velocities are higher than the typical values of 1 m/s and that growth can even occur for velocities as high as 27.5 m/s. Therefore, while the growth of aggregates is more likely if collisions between different sized objects occurs or if the aggregates are porous with filling factor $<$ 37%, it may also be hindered if the aggregates become too compact.

Download/Website: `http://arxiv.org/abs/1308.0825`

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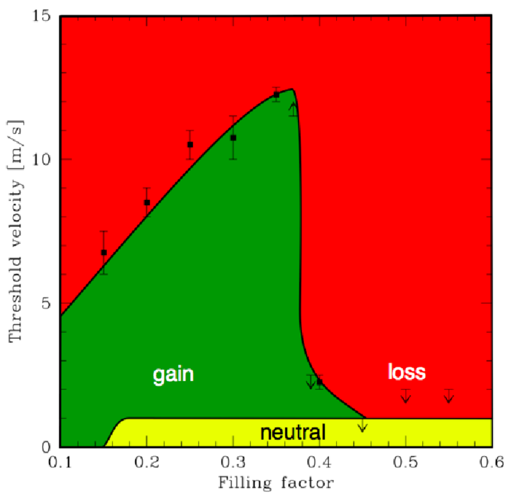

Figure 9: (Meru et al.) Schematic diagram showing which regions of the collision velocity-filling factor parameter space are expected to result in mass gain, mass loss or a neutral regime upon a collision of two dust aggregates with similar filling factors. The diagram combines the results presented in this paper (using target and projectile radii of 10 and 6 cm, respectively) with those of Geretshauser et al. (2011), Geretshauser et al. (2012) and Beitz et al. (2011). At a filling factor of $\approx$ 37%, a steep drop in the threshold velocity occurs as a larger proportion of the aggregates are unable to dissipate energy by plastic compaction. As a result, compact aggregates are far more easily disrupted.

Origin Scenarios for the Kepler 36 Planetary System

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MNRAS, in press(arxiv:1304.6124)

We explore scenarios for the origin of two different density planets in the Kepler 36 system in adjacent orbits near the 7:6 mean motion resonance. We find that fine tuning is required in the stochastic forcing amplitude, the migration rate and planet eccentricities to allow two convergently migrating planets to bypass mean motion resonances such as the 4:3, 5:4 and 6:5, and yet allow capture into the 7:6 resonance. Stochastic forcing can eject the system from resonance causing a collision between the planets, unless the disk causing migration and the stochastic forcing is depleted soon after resonance capture.
We explore a scenario with approximately Mars mass embryos originating exterior to the two planets and migrating inwards toward two planets. We find that gravitational interactions with embryos can nudge the system out of resonances. Numerical integrations with about a half dozen embryos can leave the two planets in the 7:6 resonance. Collisions between planets and embryos have a wide distribution of impact angles and velocities ranging from accretionary to disruptive. We find that impacts can occur at sufficiently high impact angle and velocity that the envelope of a planet could have been stripped, leaving behind a dense core. Some of our integrations show the two planets exchanging locations, allowing the outer planet that had experienced multiple collisions with embryos to become the innermost planet. A scenario involving gravitational interactions and collisions with embryos may account for both the proximity of the Kepler 36 planets and their large density contrast.

Download/Website: `http://arxiv.org/abs/1304.6124`

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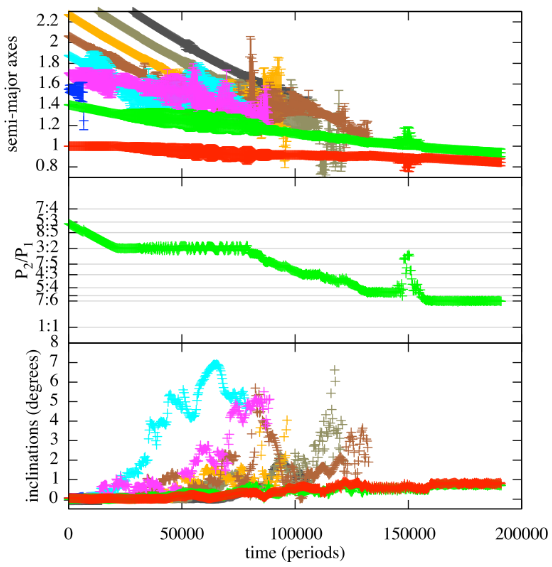

Figure 10: (Quillen et al.) An integration with two drifting planets and 7 embryos showing that the final result can be two planets in the 7:6 resonance. The innermost planet experienced two collisions with two different embryos (grey and brown points) at $t \approx 1.2$ and 1.3×10^5 periods. If the planet was stripped during a collision, a dense core could have been left behind, accounting for the high density of Kepler 36b.

Astrometric orbit of a low-mass companion to an ultracool dwarf

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Astronomy & Astrophysics, in press (arxiv:1306.3225)

Little is known about the existence of extrasolar planets around ultracool dwarfs. Furthermore, binary stars with Sun-like primaries and very low-mass binaries composed of ultracool dwarfs show differences in the distributions of mass ratio and orbital separation that can be indicative of distinct formation mechanisms. Using FORS2/VLT optical imaging for high precision astrometry we are searching for planets and substellar objects around these dwarfs to investigate their multiplicity properties for very low companion masses. Here we report astrometric measurements with an accuracy of two tenths of a milli-arcsecond over two years that reveal orbital motion of the nearby L1.5 dwarf DENIS-P J082303.1-491201 located at 20.77 ± 0.08 pc caused by an unseen companion that revolves about its host on an eccentric orbit in 246.4 ± 1.4 days. We estimate the L1.5 dwarf to have 7.5 ± 0.7 % of the Sun's mass, which implies a companion mass of 28 ± 2 Jupiter masses. This new system has the lowest mass ratio (0.36 ± 0.02) of known very low-mass binaries with characterised orbits. With this discovery we demonstrate 200 micro-arcsecond astrometry over an arc-minute field and over several years that is sufficient for discovering sub-Jupiter mass planets around ultracool dwarfs. We also show that the achieved parallax accuracy of < 0.4 % makes it possible to remove distance as a dominant source of uncertainty in the modelling of ultracool dwarfs.

Download/Website: `http://arxiv.org/abs/1306.3225`

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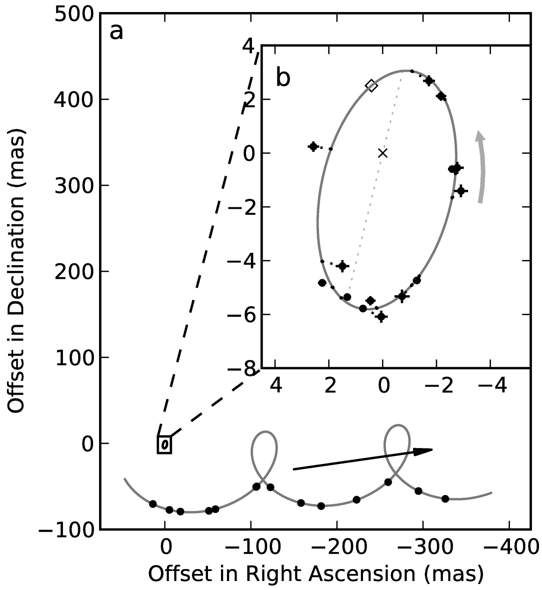

Figure 11: (Sahlmann et al.) Astrometric motion of DENIS-P J082303.1-491201 and its barycentric orbit. Panel a shows proper and parallactic motion relative to the field of reference stars. The astrometric observations and the model are shown as black circles and grey curve, respectively. Panel b is a close-up of the barycentric orbit caused by the gravitational pull of the orbiting brown dwarf.

SWEET-Cat: A catalogue of parameters for Stars With ExoplanETs

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Astronomy & Astrophysics, published (2013A&A...556A.150S)

Thanks to the importance that the star-planet relation has to our understanding of the planet formation process, the precise determination of stellar parameters for the ever increasing number of discovered extra-solar planets is of great relevance. Furthermore, precise stellar parameters are needed to fully characterize the planet properties. It is thus important to continue the efforts to determine, in the most uniform way possible, the parameters for stars with planets as new discoveries are announced.

In this paper we present new precise atmospheric parameters for a sample of 48 stars with planets. We then take the opportunity to present a new catalogue of stellar parameters for FGK and M stars with planets detected by radial velocity, transit, and astrometry programs.

Stellar atmospheric parameters and masses for the 48 stars were derived assuming Local Thermodynamic Equilibrium (LTE) and using high-resolution and high signal-to-noise spectra. The methodology used is based on the measurement of equivalent widths for a list of iron lines and making use of iron ionization and excitation equilibrium principles. For the catalogue, and whenever possible, we used parameters derived in previous works published by our team, using well-defined methodologies for the derivation of stellar atmospheric parameters. This set of parameters amounts to over 65% of all planet host stars known, including more than 90% of all stars with planets discovered through radial velocity surveys. For the remaining targets, stellar parameters were collected from the literature.

The stellar parameters for the 48 stars are presented and compared with previously determined literature values. For the catalogue, we compile values for the effective temperature, surface gravity, metallicity, and stellar mass for almost all the planet host stars listed in the Extrasolar Planets Encyclopaedia. This data will be updated on a continuous basis. The compiled catalogue is available online. The data can be used for statistical studies of the star-planet correlation, as well as for the derivation of consistent properties for known planets.

Download/Website: `https://www.astro.up.pt/resources/sweet-cat`

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Conservation of Total Escape from Hydrodynamic Planetary Atmospheres

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Earth and Planetary Science Letters, accepted

Atmosphere escape is one key process controlling the evolution of planets. However, estimating the escape rate in any detail is difficult because there are many physical processes contributing to the total escape rate. Here we show that as a result of energy conservation the total escape rate from hydrodynamic planetary atmospheres where the outflow remains subsonic is nearly constant under the same stellar XUV photon flux when increasing the escape efficiency from the exobase level, consistent with the energy limited escape approximation. Thus the estimate of atmospheric escape in a planet's evolution history can be greatly simplified.

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Forever alone? Testing single eccentric planetary systems for multiple companions

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The Astrophysical JournalSupplement, in press (arXiv:1307:0894)

Determining the orbital eccentricity of an extrasolar planet is critically important for understanding the system's dynamical environment and history. However, eccentricity remains the most poorly-determined orbital element due to irregular sampling of radial-velocity measurements. Some systems previously thought to contain a single, moderate-eccentricity planet have been shown, after further monitoring, to host two planets on nearly-circular orbits. We investigate published apparent single-planet systems to see if the available data can be better fit by two lower-eccentricity planets. We identify nine promising candidate systems and perform detailed dynamical tests to confirm the stability of the potential new multiple-planet systems. Finally, we compare the expected orbits of the single- and double-planet scenarios to better inform future observations of these interesting systems.

Download/Website: `http://arxiv.org/pdf/1307.0894.pdf`

3 PhD theses

Dynamical Aspects of Exoplanetary Systems

G. Campanella
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PhD Thesis, accepted

The detection of more than 130 multiple planet systems makes it necessary to interpret a broader range of properties than are shown by our Solar system. This thesis covers aspects linked to the proliferation in recent years of multiple extrasolar planet systems.
A narrow observational window, only partially covering the longest orbital period, can lead to solutions representing unrealistic scenarios. The best-fit solution for the three-planet extrasolar system of HD 181433 describes a highly unstable configuration. Taking into account the *dynamical stability* as an additional observable while interpreting the RV data, I have analysed the phase space in the neighbourhood of the statistical best-fit. The two giant companions are found to be locked in the 5:2 MMR in the stable best-fit model.
I have analysed the dynamics of the system HD 181433 by assessing different scenarios that may explain the origin of these eccentric orbits, with particular focus on the innermost body. A scenario is considered in which the system previously contained an additional giant planet that was ejected during a period of dynamical instability among the planets. Also considered is 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. If additional short-period low mass planets are present in the system, I find that mutual scattering can release planet b from the secular resonance, leading to a system with orbital parameters similar to those observed today.
Finally, I have studied the evolution of low mass planets interacting with a gas-giant planet embedded in a gaseous disc. The transit timing method allows the detection of non-transiting planets through their gravitational perturbations. I have investigated the detectability of low mass planets neighbouring short-period giants after protoplanetary disc dispersal.

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4 Jobs and Positions

PhD Position at Leiden Observatory: From Disks to Exoplanets: exploring the astrochemistry of planet formation

Dr. C. Walsh & Prof. E. F. van Dishoeck
Leiden Observatory, Leiden University, P. O. Box 9513, 2300 RA Leiden, The Netherlands

Leiden Observatory, deadline for applications, October 10, 2013

A 4-yr PhD position is available at Leiden Observatory. The research concerns the simulation of chemical processes in the planet-forming regions of protoplanetary disks and will explore the link between disk physical structure and chemistry and the eventual composition of (exo)planetary atmospheres. This research project will make use of state-of-the-art computational modelling, astrochemical methods, and laboratory data to simulate both the physics and chemistry of protoplanetary disks and the formation of gas-giant planets within these objects.
The focus of this PhD research will be coupling chemical models of protoplanetary disks around young stars with evolutionary tracks of forming planets to identify physical and chemical parameters which influence the resulting planetary atmosphere composition. These simulations will be compared with astronomical observations of nearby protoplanetary disks with the Atacama Large Millimeter/Submillimeter Array and observations of molecules in the atmospheres of exoplanets and the Solar System gas giant planets. The research will be directed by Dr. C. Walsh and supervised by Prof. E. F. van Dishoeck.
We are looking for an enthusiastic and motivated person with a background in astrophysics, astrochemistry, physical chemistry, or computational chemistry/physics.
Applications should include a curriculum vitae (with a list of grades for exams), as well as a brief statement of research and programming experience. Applicants should arrange for two letters of reference to be uploaded to the website. Review of applications will start on October 10, 2013 and will continue until the position is filled The starting date for the position is flexible, and can be anytime up to summer 2014. The position is open to students of all nationalities with the equivalent of a Masters degree in astronomy, physics, chemistry or mathematics.
Information about Leiden Observatory can be found at: http://www.strw.leidenuniv.nl/
Information about the present astrochemistry program is available from:
http://www.strw.leidenuniv.nl/ ewine
http://www.strw.leidenuniv.nl/WISH
http://www.laboratory-astrophysics.eu

Download/Website: `http://jobs.strw.leidenuniv.nl/2013/dishoeckPhD/`

Contact: `cwalsh@strw.leidenuniv.nl or ewine@strw.leidenuniv.nl`

2014 Sagan Fellowship Program

Dr. Dawn M. Gelino
NASA Exoplanet Science Institute

Applications Due: Nov. 7, 2013, 4 pm PDT,

The NASA Exoplanet Science Institute announces the 2014 Sagan Postdoctoral Fellowship Program and solicits applications for fellowships to begin in the Fall of 2014.

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 on or after January 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 funds.

The Announcement of Opportunity, which includes detailed program policies and application instructions is available at the web site: http://nexsci.caltech.edu/sagan/fellowship.shtml

Applicants must follow the instructions given in this Announcement. Applications must be submitted electronically through the above website. Inquiries about the Sagan Fellowships may be directed to saganfellowship@ipac.caltech.edu

The deadline for both applications and letters of reference is Thursday, November 7, 2013. Offers will be made before February 1, 2014 and new appointments are expected to begin on or about September 1, 2014.

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

Contact: `saganfellowship@ipac.caltech.edu`

5 Conference announcements

18th International Conference on Gravitational Microlensing

R.A. Street

LCOGT, 6740 Cortona Drive, Suite 102, Goleta, CA 93117, USA

Santa Barbara, California, USA, 20–24th January, 2014

LCOGT is pleased to invite the worldwide microlensing community to beautiful Santa Barbara, California for the 18th International Conference in 20–24th January, 2014. For details on scientific contributions and planning your trip, please visit lcogt.net/microlensing18. Don't forget to register by 1st October, 2013!

Download/Website: `http://lcogt.net/microlensing18`

Contact: `rstreet@lcogt.net`

Characterizing Planetary Systems Across the HR Diagram

Jay Farihi, Mark Wyatt, Christopher Tout

Institute of Astronomy, Cambridge, UK

Cambridge, England, 28 July – 1 August 2014

The University of Cambridge Institute of Astronomy will host a 5 day scientific meeting to further our understanding of the formation and evolution of planetary systems. The meeting will focus on the full lifetime of planetary systems, from pre- to post-main sequence host star stages, and the connections that can be made by viewing these evolutionary stages as parts of a whole. In this way, the program aims to provide an integrative approach rather than focusing on each stellar stage separately.

We will bring together participants from the growing diversity of planetary science disciplines: star-planet formation, solar system studies, exoplanets, debris disks, host star abundances and atmospheric pollution, stellar evolution, and planetary dynamics. The conference can accommodate up to 150 people.

The overall goal of the meeting is to generate discussion and increase scientific interactions among the diverse communities interested in the formation, architecture, and evolution of planetary systems. Two themes that represent the spirit of the meeting are:

1. The physical and chemical connections between evolved planetary systems, their main-sequence counterparts, and those forming in proto-planetary disks.
2. The scientific potential for extracting planetary system frequency, structure, chemistry, and dynamics at different evolutionary phases and stellar populations.

Session Topics will include:

- Proto-planetary disk and planetary atmosphere chemistry
- Planetesimal and solid planet compositions
- Planet and debris populations
- Host star elemental abundances and pollution
- Planetary system and host star evolution

Download/Website: `http://www.ast.cam.ac.uk/meetings/2013/AcrossHR`

Contact: `acrosshr@ast.cam.ac.uk`

A011. Atmospheric Modeling of Extrasolar Planets: American Geophysical Union (AGU) 2013 Fall Meeting

Jeremy Schnittman, Warren Wiscombe
NASA Goddard Space Flight Center

San Francisco, CA, 9–13 December 2013

The number of exoplanets, both confirmed and candidates, is over 4000 as of July 2013. As the size and diversity of this population grows, Earth-sized planets around other stars are proving to be common, far outnumbering the Jupiter-sized planets that were initially discovered. The latest estimate is that there are 17 billion Earth-sized planets in our galaxy. Several research groups are now developing atmospheric models to predict what spectral and other features might be detectable in future observations of nearby Earth-sized exoplanets. Many of these models have been adapted from 1D radiative-convective models and 3D global climate models originally developed for Earth. This session will focus on the results of recent exoplanet atmosphere modeling, with a particular emphasis on the challenges involved in adapting Earth theories and parameterizations to exoplanets.

ABSTRACT DEADLINE: AUGUST 6, 2013

Download/Website: `http://fallmeeting.agu.org/2013/`

Contact: `jeremy.d.schnittman@nasa.gov, Warren.J.Wiscombe@nasa.gov`

Second Kepler Science Conference

Hosted by NASA Ames Research Center and the NASA Exoplanet Science Institute
NASA

November 4–8, 2013, Mountain View, CA,

Join us for the Second Kepler Science Conference at the NASA Ames Research Center in Mountain View, California, from November 4 to 8, 2013.

You may also attend virtually, viewing the conference at your desk or at mirror sites where the conference will be broadcast. Mirror site locations will be posted in the coming weeks; if you're interested in hosting a mirror site, please contact us at KeplerII@ipac.caltech.edu

Topics to be covered include:

- Exoplanet Statistics, False Positives, and Completeness Corrections
- Earth Analogues and Super-Earths
- Multiple Planets and Multiple Star Systems
- Planet Formation and Migration Theories
- Habitable Zone
- Characterizing Transiting Planets
- Stellar Activity, Rotation, Ages, Metallicity
- Eclipsing and Interacting Binaries
- Future Exoplanet Telescopes and Instrumentation
- Asteroseismology
- Galactic and Extragalactic Astrophysics

Important Dates

- September 6: Abstract Submission Deadline
- September 20: Foreign National Registration Deadline
- October 25: US Citizen On-line Registration Deadline

Download/Website: `http://nexsci.caltech.edu/conferences/KeplerII/index.shtml`
Contact: `KeplerII@ipac.caltech.edu`

NASA Exoplanet Exploration Program Analysis Group Meeting 8

Scott Gaudi[1], *Douglas Hudgins*
[1] Ohio State

Denver, CO, October 5-6, 2013

NASA's Exoplanet Exploration Program Analysis Group (ExoPAG) will hold its eighth meeting on Saturday-Sunday, October 5-6, 2013, just prior to, and at the same venue as, the AAS-DPS Meeting in Denver, CO. ExoPAG meetings are open to the entire scientific community, and offer an opportunity to participate in discussions of scientific and technical issues in exoplanet exploration, and to provide input into NASA's Exoplanet Exploration Program (ExEP). All interested members of the astronomical and planetary science communities are invited to attend and participate.

ExoPAG-8 will continue to focus on expanding the inclusiveness of NASA's Exoplanet Exploration Program (ExEP) to the wider exoplanet community. Preliminary agenda topics include the progress toward a coronagraph/occulter in space, and progress toward establishing a robust estimate of the frequency of potentially habitable planets. In addition, there will be reports from the active Study Analysis Groups (SAGs), including SAG-9, which is considering the science requirements for an exoplanet probe to medium-scale direct-imaging mission.

Questions and suggestions can be sent to Scott Gaudi, ExoPAG Chair (gaudi@astronomy.ohio-state.edu), and/or Dr. Douglas Hudgins, ExoPAG Executive Secretary (Douglas.M.Hudgins@nasa.gov). News and information about NASA's ExoPAG and the ExoPAG-8 meeting, including hotel information, can be found on the ExoPAG web site below.

Download/Website: `http://exep.jpl.nasa.gov/exopag`

Contact: `gaudi@astronomy.ohio-state.edu`

6 Announcements

Fizeau exchange visitors program in optical interferometry - call for applications

European Interferometry Initiative

www.european-interferometry.eu, application deadline: Mar. 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). Applicants are strongly encouraged to seek also partial support from their home or host institutions.

The deadline for applications is March 15. Fellowships can be awarded for missions starting in May 2013.
Applications for attending the VLTI school 2013 will be considered but funding will be coordinated with the school organizers.

Further informations and application forms can be found at: www.european-interferometry.eu and vltischool.sciencesconf.org

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 2013. If you see any that we missed, please let us know and we'll include them in the next issue.

July

astro-ph/1307.0416 : **Transmission spectrum of Earth as a transiting exoplanet - from the ultraviolet to the near-infrared** by *Y. Betremieux, L. Kaltenegger*

astro-ph/1307.0463 : **ALMA and CARMA observations of Brown Dwarfs disks: testing the models of dust evolution** by *L. Ricci, et al.*

astro-ph/1307.0515 : **Stabilizing Cloud Feedback Dramatically Expands the Habitable Zone of Tidally Locked Planets** by *Jun Yang, Nicolas B. Cowan, Dorian S. Abbot*

astro-ph/1307.0713 : **Migration and gas accretion scenarios for the Kepler 16, 34 and 35 circumbinary planets** by *Arnaud Pierens, Richard P. Nelson*

astro-ph/1307.0823 : **Future Direct Spectroscopic Detection of Hot Jupiters with IGRINS** by *Kevin Gullikson, Michael Endl*

astro-ph/1307.0894 : **Forever alone? Testing single eccentric planetary systems for multiple companions** by *Robert A. Wittenmyer, et al.*

astro-ph/1307.0983 : **LIDT-DD: A new self-consistent debris disc model including radiation pressure and coupling dynamical and collisional evolution** by *Q. Kral, P. Thebault, S. Charnoz*

astro-ph/1307.1076 : **Placing Limits On The Transit Timing Variations Of Circumbinary Exoplanets** by *D. Armstrong, et al.*

astro-ph/1307.1133 : **Detection of water absorption in the dayside atmosphere of HD 189733 b using ground-based high-resolution spectroscopy at 3.2 microns** by *J. L. Birkby, et al.*

astro-ph/1307.1161 : **Flux and polarization signals of spatially inhomogeneous gaseous exoplanets** by *T. Karalidi, D. M. Stam, D. Guirado*

astro-ph/1307.1404 : **Atmospheric Retrieval Analysis of the Directly Imaged Exoplanet HR 8799b** by *Jae-Min Lee, Kevin Heng, Patrick G.J. Irwin*

astro-ph/1307.1649 : **The Densities of Planets and the Masses of Host Stars** by *Eike W. Guenther, CoRoT-Team*

astro-ph/1307.1660 : **High angular resolution imaging and infrared spectroscopy of CoRoT candidates** by *E.W. Guenther, et al.*

astro-ph/1307.1735 : **Signpost of Multiple Planets in Debris Disks** by *Kate Y. L. Su, George H. Rieke*

astro-ph/1307.1822 : **A new scenario for the origin of the 3/2 resonant system HD45364** by *J. A. Correa-Otto, T. A. Michtchenko, C. Beaugé*

astro-ph/1307.2003 : **The contribution of secondary eclipses as astrophysical false positives to exoplanet transit surveys** by *A. Santerne, et al.*

astro-ph/1307.2012 : **Is there plenty of metal-poor stars with planets in the Galactic thick disk?** by *V. Zh. Adibekyan, et al.*

astro-ph/1307.2033 : **The Effect of Composition on the Evolution of Giant and Intermediate-Mass Planets** by *A. Vazan, et al.*

astro-ph/1307.2083 : **An HST Optical to Near-IR Transmission Spectrum of the Hot Jupiter WASP-19b: Detection of Atmospheric Water and Likely Absence of TiO** by *C. M. Huitson, et al.*

astro-ph/1307.2249 : **A highly inclined orbit for the 110-day period M-dwarf companion KOI-368.01** by *George Zhou, Chelsea X. Huang*

astro-ph/1307.2341 : **Star-planet magnetic interaction and evaporation of planetary atmospheres** by *A. F. Lanza*

astro-ph/1307.2886 : **Direct Imaging of a Cold Jovian Exoplanet in Orbit around the Sun-like Star GJ 504** by *M. Kuzuhara, et al.*

astro-ph/1307.2897 : **Making systems of Super Earths by inward migration of planetary embryos** by *Christophe Cossou, Sean N. Raymond, Arnaud Pierens*

astro-ph/1307.3034 : **Impact of photoevaporative mass loss on masses and radii of water-rich sub/super-Earths** by *Kenji Kurosaki, Masahiro Ikoma, Yasunori Hori*

astro-ph/1307.3178 : **Constraints on Planet Occurrence around Nearby Mid-to-Late M Dwarfs from the MEarth Project** by *Zachory K. Berta, Jonathan Irwin, David Charbonneau*

astro-ph/1307.3239 : **The Deep Blue Color of HD189733b: Albedo Measurements with Hubble Space Telescope/Space Telescope Imaging Spectrograph at Visible Wavelengths** by *Thomas M. Evans, et al.*

astro-ph/1307.3308 : **Very Low Mass Stellar and Substellar Companions to Solar-like Stars From MARVELS IV: A Candidate Brown Dwarf or Low-Mass Stellar Companion to HIP 67526** by *Peng Jiang, et al.*

astro-ph/1307.3441 : **On Lloyd's "The Mass Distribution of Subgiant Planet Hosts" (arXiv:1306.6627v1)** by *John Asher Johnson, Jason T. Wright*

astro-ph/1307.3708 : **Growth of grains in Brown Dwarf disks** by *Farzana Meru, Marina Galvagni, Christoph Olczak*

astro-ph/1307.3770 : **Steady state of dust distributions in disk vortices: Observational predictions and applications to transitional disks** by *Wladimir Lyra, Min-Kai Lin*

astro-ph/1307.3908 : **Configurations of Bounded and Free-floating Planets in Very Young Open Clusters** by *Hui-Gen Liu, Hui Zhang, Ji-Lin Zhou*

astro-ph/1307.4080 : **The Roche limit for close-orbiting planets: Minimum density, composition constraints, and application to the 4.2-hour planet KOI 1843.03** by *Saul Rappaport, et al.*

astro-ph/1307.4084 : **Super-massive planets around late-type stars - the case of OGLE-2012-BLG-0406Lb** by *Radoslaw Poleski, et al.*

astro-ph/1307.4117 : **An Astrometric Search for a Sub-stellar Companion of the M8.5 Dwarf TVLM 513-46546 Using Very Long Baseline Interferometry** by *Jan Forbrich, Edo Berger, Mark J. Reid*

astro-ph/1307.4425 : **Hα Absorption in Transiting Exoplanet Atmospheres** by *Duncan Christie, Phil Arras, Zhi-Yun Li*

astro-ph/1307.4624 : **Rotational Synchronization May Enhance Habitability for Circumbinary Planets: Kepler Binary Case Studies** by *Paul A. Mason et al.*

astro-ph/1307.4753 : **Examining the broadband emission spectrum of WASP-19b: A new z band eclipse detection** by *George Zhou, et al.*

astro-ph/1307.4760 : **Habitability of Exomoons at the Hill or Tidal Locking Radius** by *Natalie R. Hinkel, Stephen R. Kane*

astro-ph/1307.4761 : **Secular Behavior of Exoplanets: Self-Consistency and Comparisons with the Planet-Planet Scattering Hypothesis** by *Miles Timpe, et al.*

astro-ph/1307.4811 : **Do Giant Planets Survive Type II Migration?** by *Yasuhiro Hasegawa, Shigeru Ida*

astro-ph/1307.4864 : **Theoretical models of planetary system formation: mass vs semi-major axis** by *Y. Alibert, et al.*

astro-ph/1307.4874 : **Are the Kepler Near-Resonance Planet Pairs due to Tidal Dissipation?** by *Man Hoi Lee, D. Fabrycky, D. N. C. Lin* astro-ph/1307.5450 : **Chemical Kinetics on Extrasolar Planets** by *Julianne I. Moses*

astro-ph/1307.5842 : **The same frequency of planets inside and outside open clusters of stars** by *Soren Meibom, et al.*

astro-ph/1307.5849 : **The TRENDS High-Contrast Imaging Survey. IV. The Occurrence Rate of Giant Planets around M-Dwarfs** by *Benjamin T. Montet, et al.*

astro-ph/1307.5874 : **Simultaneous follow-up of planetary transits: revised physical properties for the planetary systems HAT-P-16 and WASP-21** by *S. Ciceri, et al.*

astro-ph/1307.5916 : **Formation of sharp eccentric rings in debris disks with gas but without planets** by *W. Lyra, M. Kuchner*

astro-ph/1307.6335 : **Microlensing Discovery of a Tight, Low Mass-ratio Planetary-mass Object around an Old, Field Brown Dwarf** by *C. Han, et al.*

astro-ph/1307.6450 : **Toward a Deterministic Model of Planetary Formation VII: Eccentricity Distribution of Gas Giants** by *S. Ida, D. N. C. Lin, M. Nagasawa*

astro-ph/1307.6532 : **Discovery of WASP-65b and WASP-75b: Two Hot Jupiters Without Highly Inflated Radii** by *Y. Gomez Maqueo Chew, et al.*

astro-ph/1307.6722 : **Search for a habitable terrestrial planet transiting the nearby red dwarf GJ 1214** by *M. Gillon, et al.*

astro-ph/1307.6806 : **Detection of Earth-mass and Super-Earth Trojan Planets Using Transit Timing Variation Method** by *Nader Haghighipour, Stephanie Capen, Tobias C. Hinse*

astro-ph/1307.6857 : **WASP-12b and HAT-P-8b are Members of Triple Star Systems** by *Eric B. Bechter et al.*

astro-ph/1307.6959 : **Investigation of systematic effects in Kepler data: Seasonal variations in the light curve of HAT-P-7b** by *V. Van Eylen, et al.*

astro-ph/1307.6984 : **Bayesian analysis of radial velocity data of GJ667C with correlated noise: evidence for no more than 3 planets** by *Farhan Feroz, Mike Hobson*

astro-ph/1307.7161 : **A Systematic Search for Trojan Planets in the Kepler data** by *Markus Janson*

astro-ph/1307.7279 : **Line-profile variations in radial-velocity measurements: Two alternative indicators for planetary searches** by *P. Figueira, et al.*

astro-ph/1307.7330 : **Optimizing the search for transiting planets in long time series** by *Aviv Ofir*

astro-ph/1307.7640 : **Secretly Eccentric: The Giant Planet and Activity Cycle of GJ 328** by *Paul Robertson et al.*

astro-ph/1307.7870 : **New and updated stellar parameters for 71 evolved planet hosts. On the metallicity - giant planet connection** by *A. Mortier, et al.*

astro-ph/1307.7893 : **A Detailed Dynamical Investigation of the Proposed QS Virginis Planetary System** by *Jonathan Horner, et al.*

astro-ph/1307.7984 : **Fluffy dust forms icy planetesimals by static compression** by *Akimasa Kataoka, et al.*

astro-ph/1307.8038 : **Magnetically Controlled Circulation on Hot Extrasolar Planets** by *Konstantin Batygin, Sabine Stanley, David J. Stevenson*

astro-ph/1307.8119 : **First order resonance overlap and the stability of close two planet systems** by *Katherine M. Deck, Matthew Payne, Matthew J. Holman*

astro-ph/1307.8128 : **Kepler-63b: A Giant Planet in a Polar Orbit around a Young Sun-like Star** by *Roberto Sanchis-Ojeda, et al.*

astro-ph/1307.0354 : **SWEET-Cat: A catalogue of parameters for Stars With ExoplanETs I. New atmospheric parameters and masses for 48 stars with planets** by *N.C. Santos, et al.*

astro-ph/1307.0506 : **A Pan-STARRS + UKIDSS Search for Young, Wide Planetary-Mass Companions in Upper Scorpius** by *Kimberly M. Aller, et al.*

astro-ph/1307.0818 : **The Gemini NICI Planet-Finding Campaign: The Frequency of Giant Planets Around Debris Disk Stars** by *Zahed Wahhaj, et al.*

astro-ph/1307.1622 : **Can a planet explain different cavity sizes for small and large dust grains in transition disks?** by *Antonio Garufi, Henning Avenhaus, Sascha Patrick Quanz*

astro-ph/1307.1687 : **Planet gaps in the dust layer of 3D proto-planetary disks: Observability with ALMA** by *Jean-Franois Gonzalez et al.*
astro-ph/1307.2240 : **Testing protoplanetary disc dispersal with radio emission** by *James E. Owen, Anna M. M. Scaife, Barbara Ercolano*
astro-ph/1307.2565 : **Small hydrocarbon molecules in cloud-forming Brown Dwarf and giant gas planet atmospheres** by *Camille Bilger, Paul Rimmer, Christiane Helling*
astro-ph/1307.2585 : **Long-term Evolution of Photoevaporating Protoplanetary Disks** by *Jaehan Bae, et al.*
astro-ph/1307.2944 : **The NASA Exoplanet Archive: Data and Tools for Exoplanet Research** by *R.L. Akeson, et al.*
astro-ph/1307.3257 : **Ionization in atmospheres of Brown Dwarfs and extrasolar planets IV. The Effect of Cosmic Rays** by *Paul Rimmer, Christiane Helling*
astro-ph/1307.4704 : **Galactic cosmic ray induced radiation dose on terrestrial exoplanets** by *Dimitra Atri, B. Hariharan, Jean-Mathias Griessmeier*
astro-ph/1307.6910 : **Formation, orbital and thermal evolution, and survival of planetary-mass clumps in the early phase of circumstellar disk evolution** by *Yusuke Tsukamoto, Masahiro N. Machida, Shuichiro Inutsuka*
astro-ph/1307.7174 : **A SCUBA-2 850 micron survey of protoplanetary discs in the sigma Orionis cluster** by *Jonathan P. Williams, et al.*
astro-ph/1307.7439 : **Imaging of the CO Snow Line in a Solar Nebula Analog** by *Chunhua Qi, et al.*

August

astro-ph/1308.0009 : **Efficient, uninformative sampling of limb darkening coefficients for two-parameter laws** by *David M. Kipping*
astro-ph/1308.0016 : **It takes a village to raise a tide: nonlinear multiple-mode coupling and mode identification in KOI-54** by *Ryan M. O'Leary, Joshua Burkart*
astro-ph/1308.0337 : **ULTRACAM z'-band Detection of the Secondary Eclipse of WASP-12b** by *D. Föhring, et al.*
astro-ph/1308.0511 : **Conservation of Total Escape from Hydrodynamic Planetary Atmospheres** by *F. Tian*
astro-ph/1308.0561 : **3D model of hydrogen atmospheric escape from HD209458b and HD189733b: radiative blow-out and stellar wind interactions** by *Vincent Bourrier, Alain Lecavelier des Etangs*
astro-ph/1308.0562 : **Structure of Surface-H2O Layers of Ice-covered Planets with High-pressure Ice** by *S. Ueta, T. Sasaki*
astro-ph/1308.0596 : **The curiously circular orbit of Kepler-16b** by *Alex Dunhill, Richard Alexander*
astro-ph/1308.0599 : **An Exoplanet's Response to Anisotropic Stellar Mass-Loss During Birth and Death** by *Dimitri Veras, John D. Hadjidemetriou, Christopher A. Tout*
astro-ph/1308.0607 : **New developments for modern celestial mechanics. I. General coplanar three-body systems. Application to exoplanets** by *Rosemary A. Mardling*
astro-ph/1308.0629 : **Measurement of Spin-Orbit Misalignment and Nodal Precession for the Planet around Pre-Main-Sequence Star PTFO 8-8695 From Gravity Darkening** by *Jason W. Barnes, et al.*
astro-ph/1308.0825 : **Growth and fragmentation of centimetre-sized dust aggregates: the dependence on aggregate size and porosity** by *Farzana Meru, et al.*
astro-ph/1308.0882 : **Investigating Close-in Exoplanets through Transit Observations** by *Ing-Guey Jiang, et al.*
astro-ph/1308.0899 : **The dependence of the ice-albedo feedback on atmospheric properties** by *P. von Paris, et al.*
astro-ph/1308.0921 : **Accretion through the inner edges of protoplanetary disks by a giant solid state pump** by *Thorben Kelling, Gerhard Wurm*
astro-ph/1308.0996 : **8 Planets in 4 Multi-planet Systems via TTVs in 1350 Days** by *Yang Ming, et al.*
astro-ph/1308.1379 : **A Survey for Very Short-Period Planets in the Kepler Data** by *Brian Jackson, et al.*

astro-ph/1308.1585 : **The Starspots - Transit Depth Relation of the Evaporating Planet Candidate KIC 12557548b** by *Hajime Kawahara, et al.*
astro-ph/1308.1670 : **Utility of the Weak Temperature Gradient Approximation for Earth-Like Tidally Locked Exoplanets** by *Sean M. Mills, Dorian S. Abbot*
astro-ph/1308.1736 : **Clumps and Axisymmetric Features in Debris Discs** by *Ing-Guey Jiang, Li-Chin Yeh*
astro-ph/1308.1791 : **Planet formation in evolving protoplanetary discs** by *Richard Alexander*
astro-ph/1308.1845 : **Stellar Rotation Periods of the Kepler Objects of Interest: A Dearth of Close-in Planets around Fast Rotators** by *Amy McQuillan, Tsevi Mazeh, Suzanne Aigrain*
astro-ph/1308.2106 : **Hubble Space Telescope hot Jupiter Transmission Spectral Survey: detection of water in HAT-P-1b from Wide Field Camera 3 near-infrared spatial scan observations** by *H. R. Wakeford, et al.*
astro-ph/1308.2223 : **A Trend Between Cold Debris Disk Temperature and Stellar Type: Implications for the Formation and Evolution of Wide-Orbit Planets** by *Nicholas P. Ballering, et al.*
astro-ph/1308.2252 : **KeSeF - Kepler Self Follow-up Mission** by *Aviv Ofir*
astro-ph/1308.2296 : **KELT-6b: A P 7.9 d Hot Saturn Transiting a Metal-Poor Star with a Long-Period Companion** by *Karen A. Collins, et al.*
astro-ph/1308.2456 : **Possible Transit Timing Variations of the TrES-3 Planetary System** by *Ing-Guey Jiang, et al.*
astro-ph/1308.2596 : **Making giant planet cores: convergent migration and growth of planetary embryos in non-isothermal discs** by *Arnaud Pierens, Christophe Cossou, Sean Raymond*
astro-ph/1308.2937 : **HAT-P-44b, HAT-P-45b, and HAT-P-46b: Three Transiting Hot Jupiters in Possible Multi-Planet Systems** by *J. D. Hartman, et al.*
astro-ph/1308.3547 : **Disk Inhomogeneities and the Origins of Planetary System Architectures and Observational Properties** by *Yasuhiro Hasegawa, Ralph E. Pudritz*
astro-ph/1308.3549 : **Dynamical Constraints on Exoplanets** by *Jonti Horner, et al.*
astro-ph/1308.3751 : **Frequency of Close Companions among Kepler Planets - a TTV study** by *Ji-Wei Xie, Yanqin Wu, Yoram Lithwick*
astro-ph/1308.3859 : **Characterization of the gaseous companion κ Andromedae b: New Keck and LBTI high-contrast observations** by *M. Bonnefoy, et al.*
astro-ph/1308.4147 : **The First Circumstellar Disk Imaged in Silhouette with Adaptive Optics: MagAO Imaging of Orion 218-354** by *Katherine B. Follette, et al.*
astro-ph/1308.4184 : **Detection of Exomoons Through Their Modulation of Exoplanetary Radio Emissions** by *Joaquin P. Noyola, Suman Satyal, Zdzislaw E. Musielak*
astro-ph/1308.4402 : **Stability of Satellites in Closely Packed Planetary Systems** by *Matthew J. Payne, et al.*
astro-ph/1308.4404 : **Narrow-K-Band Observations of the GJ 1214 System** by *Knicole D. Colon, Eric Gaidos*
astro-ph/1308.4688 : **Overstable Librations can account for the Paucity of Mean Motion Resonances among Exoplanet Pairs** by *Peter Goldreich, Hilke E. Schlichting*
astro-ph/1308.4726 : **Hot methane line lists for exoplanet and brown dwarf atmospheres** by *R. J. Hargreaves, et al.*
astro-ph/1308.4968 : **Viscoelastic Tidal Dissipation in Giant Planets and Formation of Hot Jupiters Through High-Eccentricity Migration** by *Natalia I Storch, Dong Lai*
astro-ph/1308.4986 : **Molecular Detectability in Exoplanetary Emission Spectra** by *Tessenyi Marcell, et al.*
astro-ph/1308.5105 : **Tensile & shear strength of porous dust agglomerates** by *Alexander Seizinger, Roland Speith, Wilhelm Kley*
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