ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Here is the 75th edition of ExoPlanet News containing the usual mix of excellent papers, enticing upcoming conferences and attractive job openings. Please share it with your colleagues and encourage them to join the mailing list – or better still submit entries for future editions.

Remember that past editions of this newsletter, submission templates and other information can be found at the ExoPlanet News website: http://exoplanet.open.ac.uk. Although note that my updates to the website only become live over-night. So if you want to get the newsletter as soon as it is ready, please subscribe and get it by email on the day it's released.

I hope to see some of you later this week at the PLATO meeting in Sicily.

Best wishes
Andrew Norton
The Open University

2 Abstracts of refereed papers

Possible planet formation in the young, low-mass, multiple stellar system GG Tau-A

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Nature, published (2014Natur.514..600D)

Forming planets around binary stars may be more difficult than around single stars. In a close binary star (< 100 au separation), theory predicts the presence of circumstellar discs around each star, and an outer circumbinary disc surrounding a gravitationally cleared inner cavity. As the inner discs are depleted by accretion onto the stars on timescales of few 10^3 yr, replenishing material must be transferred from the outer reservoir in order to fuel planet formation (which occurs on timescales of $\sim$1 Myr). Gas flowing through disc cavities has been detected in single star systems. A circumbinary disc was discovered around the young low-mass binary system GG Tau-A, which has recently been proven to be a hierarchical triple system. It has one large inner disc around the southern single star and shows small amounts of shocked H_2 gas residing within the central cavity, but other than a weak detection, hitherto the distribution of cold gas in this cavity or in any other binary or multiple star system has never been determined. Here we report imaging of massive CO-emitting gas fragments within the GG Tau-A cavity. From the kinematics we conclude that the flow appears capable of sustaining the inner disc beyond the accretion lifetime, leaving time for planet formation to occur.

Download/Website: `https://hal.archives-ouvertes.fr/L3AB/hal-01078717`

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Planets Around Low-Mass Stars (PALMS). IV. The Outer Architecture of M Dwarf Planetary Systems

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The Astrophysical Journal Supplement, in press (arXiv:1411.3722)

We present results from a high-contrast adaptive optics imaging search for giant planets and brown dwarfs ($>$1 $M_{\rm Jup}$) around 122 newly identified nearby ($<$40 pc) young M dwarfs. Half of our targets are younger than 135 Myr and 90% are younger than the Hyades (620 Myr). After removing 44 close stellar binaries (implying a stellar companion fraction of $>$35.4 $\pm$ 4.3% within 100 AU), 27 of which are new or spatially resolved for the first time, our remaining sample of 78 single M dwarfs makes this the largest imaging search for planets around young low-mass stars (0.1–0.6 $M_\odot$) to date. Our H- and K- band coronagraphic observations with Keck/NIRC2 and Subaru/HiCIAO achieve typical contrasts of 12–14 mag and 9–13 mag at 1$''$, respectively, which corresponds to limiting planet masses of 0.5–10 $M_{\rm Jup}$ at 5–33 AU for 85% of our sample. We discovered four young brown dwarf companions: 1RXS J235133.3+312720 B (32 $\pm$ 6 $M_{\rm Jup}$; L0$^{+2}_{-1}$; 120 $\pm$ 20 AU), GJ 3629 B (64^{+30}_{-23} $M_{\rm Jup}$; M7.5 $\pm$ 0.5; 6.5 $\pm$ 0.5 AU), 1RXS J034231.8+121622 B (35 $\pm$ 8 $M_{\rm Jup}$; L0 $\pm$ 1; 19.8 $\pm$ 0.9 AU), and 2MASS J15594729+4403595 B (43 $\pm$ 9 $M_{\rm Jup}$; M8.0 $\pm$0.5; 190 $\pm$ 20 AU). Over 150 candidate planets were identified; we obtained follow-up imaging for 56% of these but all are consistent with background stars. Our null detection of planets enables strong statistical constraints on the occurrence rate of long-period giant planets around single M dwarfs. We infer an upper limit (at the 95% confidence level) of 10.3% and 16.0% for 1–13 $M_{\rm Jup}$ planets between 10–100 AU for hot-start and cold-start (Fortney) evolutionary models, respectively. Fewer than 6.0% (9.9%) of M dwarfs harbor massive gas giants in the 5–13 $M_{\rm Jup}$ range like those orbiting HR 8799 and β Pictoris between 10–100 AU for a hot-start (cold-start) formation scenario. The frequency of brown dwarf (13–75 $M_{\rm Jup}$) companions to single M dwarfs between 10–100 AU is $2.8^{+2.4}_{-1.5}$%. Altogether we find that giant planets, especially massive ones, are rare in the outskirts of M dwarf planetary systems. Although the first directly imaged planets were found around massive stars, there is currently no statistical evidence for a trend of giant planet frequency with stellar host mass at large separations as predicted by the disk instability model of giant planet formation.

Download/Website: `http://arxiv.org/abs/1411.3722`

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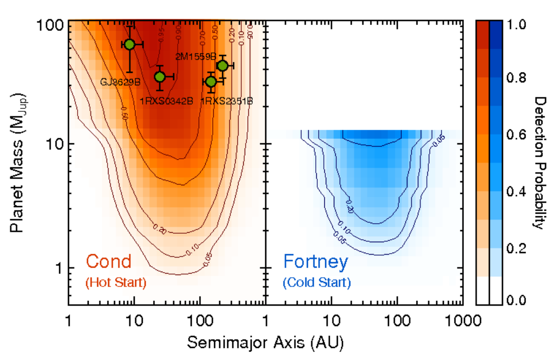

Figure 1: (Bowler et al.) PALMS survey sensitivity map between semi-major axes of 1–1000 AU and masses of 0.5–100 $M_{\rm Jup}$. We discovered four brown dwarf companions (green circles). No planets were found despite being sensitive to masses as low as 1 $M_{\rm Jup}$. Contours show the 5%, 10%, 20%, 50%, 90%, and 95% sensitivity levels from our sample for Cond (left) and Fortney (right) evolutionary models.

Vortex cycles at the inner edges of dead zones in protoplanetary disks

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Astronomy & Astrophysics, Accepted (arXiv:1411.3236)

In protoplanetary disks, the inner boundary between the turbulent and laminar regions is a promising site for planet formation because solids may become trapped at the interface itself or in vortices generated by the Rossby wave instability. The disk thermodynamics and the turbulent dynamics at that location are entwined because of the importance of turbulent dissipation on thermal ionization and, conversely, of thermal ionisation on the turbulence. However, most previous work has neglected this dynamical coupling and have thus missed a key element of the physics in this region.
In this paper, we aim to determine how the the interplay between ionization and turbulence impacts on the formation and evolution of vortices at the interface between the active and the dead zones.
Using the Godunov code RAMSES, we have performed a 3D magnetohydrodynamic global numerical simulation of a cylindrical model of an MRI–turbulent protoplanetary disk, including thermodynamical effects as well as a temperature-dependant resistivity. The comparison with an analogous 2D viscous simulation has been extensively used to help identify the relevant physical processes and the disk's long-term evolution.
We find that a vortex formed at the interface, due to Rossby wave instability, migrates inward and penetrates the active zone where it is destroyed by turbulent motions. Subsequently, a new vortex emerges a few tens of orbits later at the interface, and the new vortex migrates inward too. The sequence repeats itself, resulting in cycles of vortex formation, migration, and disruption. This surprising behavior is successfully reproduced using two different codes. In this paper, we characterize this vortex life cycle and discuss its implications for planet formation at the dead/active interface. Our results also call for a better understanding of vortex migration in complex thermodynamical environments.
Our simulations highlight the importance of thermodynamical processes for the vortex evolution at the dead zone inner edge.

Download/Website: `http://arxiv.org/abs/1411.3236`

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Atmospheres of Brown Dwarfs

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The Astronomy & Astrophysics review, published (arXiv:1410.6029)

Brown Dwarfs are the coolest class of stellar objects known to date. Our present perception is that Brown Dwarfs follow the principles of star formation, and that Brown Dwarfs share many characteristics with planets. Being the darkest and lowest mass stars known makes Brown Dwarfs also the coolest stars known. This has profound implication for their spectral fingerprints. Brown Dwarfs cover a range of effective temperatures which cause brown dwarfs atmospheres to be a sequence that gradually changes from a M-dwarf-like spectrum into a planet-like spectrum. This further implies that below an effective temperature of $\lesssim$2800K, clouds form already in atmospheres of objects marking the boundary between M-Dwarfs and brown dwarfs. Recent developments have sparked the interest in plasma processes in such very cool atmospheres: sporadic and quiescent radio emission has been observed in combination with decaying Xray-activity indicators across the fully convective boundary.

Download/Website: `http://arXiv.org/abs/1410.6029`

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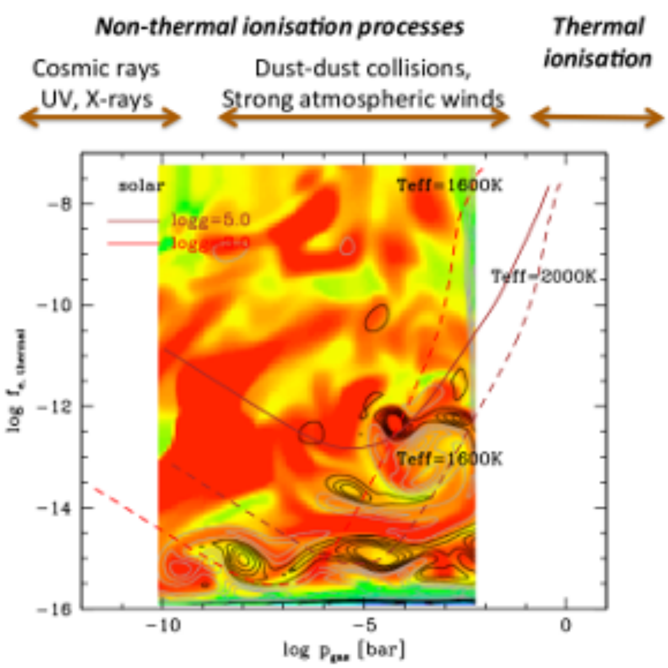

Figure 2: (Helling & Casewell) A brown dwarf atmosphere is not only stratified by its cloud structure (2D colour overlay). Different non-thermal ionization processes occur in brown dwarf atmospheres (boxes: cosmic rays, dust-dust collisions, strong winds) which produce free charges through the atmosphere with varying efficiency. The local degree of thermal ionization (brown solid and dashed lines) is shown in the background for illustration, a 2D simulation of turbulent dust formation indicates where the cloud is located in the atmosphere.

Climate of Earth-like planets with high obliquity and eccentric orbits: Implications for habitability conditions

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Planetary and Space Science, in press (arXiv:1401.5323)

We explore the effects of seasonal variability for the climate of Earth-like planets as determined by the two parameters polar obliquity and orbital eccentricity using a general circulation model of intermediate complexity. In the first part of the paper we examine the consequences of different values of obliquity and eccentricity for the spatio-temporal patterns of radiation and surface temperatures as well as for the main characteristics of the atmospheric circulation. In the second part of the paper we analyse the associated implications for the habitability of planets close to the outer edge of the habitable zone (HZ). The second part focuses in particular on the multistability property of climate, i.e. the parallel existence of both an ice-free and an ice-covered climate state. Our results show that seasonal variability affects both the existence of and transitions between the two climate states. Moreover, our experiments reveal that planets with Earth-like atmospheres and high seasonal variability can have ice-free areas at much larger distance from the host star than planets without seasonal variability, which leads to a substantial expansion of the outer edge of the HZ. Sensitivity experiments exploring the role of azimuthal obliquity and surface heat capacity test the robustness of our results. On circular orbits, our findings obtained with a general circulation model agree well with previous studies based on one dimensional energy balance models, whereas significant differences are found on eccentric orbits.

Download/Website: `http://dx.doi.org/10.1016/j.pss.2014.11.003`

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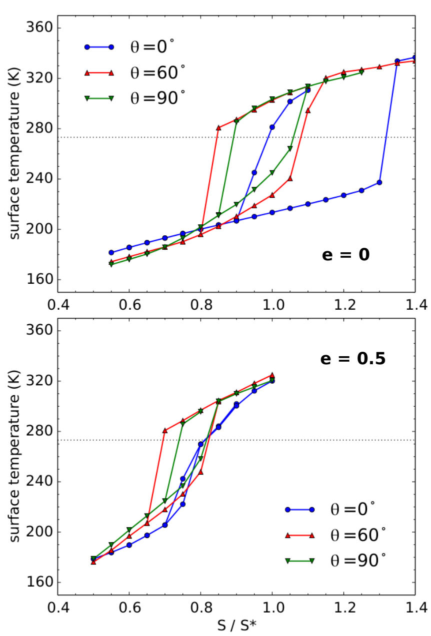

Figure 3: (Linsenmeier, Pascale & Lucarini) Annual and global mean surface temperature versus normalised stellar radiation (or planet-star distance) for Earth-like planets with different obliquities θ and orbit eccentricities e (hysteresis curves); note the variation among the ranges of distances at which the two climate states (ice-free and ice-covered) exist.

Migration and Growth of Protoplanetary Embryos II: Emergence of Proto-Gas-Giants Cores versus Super Earths' Progenitor

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The Astrophysical Journal, in press (arXiv:1410.7952)

Nearly $15-20\%$ of solar type stars contain one or more gas giant planet. According to the core-accretion scenario, the acquisition of their gaseous envelope must be preceded by the formation of super-critical cores with masses ten times or larger than that of the Earth. It is natural to link the formation probability of gas giant planets with the supply of gas and solid in their natal disks. However, a much richer population of super Earths suggests that 1) there is no shortage of planetary building-block material, 2) gas giants' growth barrier is probably associated with whether they can merge into super-critical cores, and 3) super Earths are probably failed cores which did not attain sufficient mass to initiate efficient accretion of gas before it is severely depleted. Here we construct a model based on the hypothesis that protoplanetary embryos migrated extensively before they were assembled into bona fide planets. We construct a Hermite-Embryo code based on a unified viscous-irradiation disk model and a prescription for the embryo-disk tidal interaction. This code is used to simulate 1) the convergent migration of embryos, and 2) their close encounters and coagulation. Around the progenitors of solar-type stars, the progenitor super-critical-mass cores of gas giant planets primarily form in protostellar disks with relatively high ($\gtrsim 10^{-7} M_\odot$ yr^{-1}) mass accretion rates whereas systems of super Earths (failed cores) are more likely to emerge out of natal disks with modest mass accretion rates, due to the mean motion resonance barrier and retention efficiency.

Download/Website: `http://arxiv.org/abs/1410.7952`

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A comprehensive statistical assessment of star-planet interaction

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The Astrophysical Journal, in press (arXiv:1411.3348)

We investigate whether magnetic interaction between close-in giant planets and their host stars produce observable statistical enhancements in stellar coronal or chromospheric activity. New *Chandra* observations of 12 nearby ($d <$ 60 pc) planet-hosting solar analogs are combined with archival *Chandra*, *XMM-Newton*, and *ROSAT* coverage of 11 similar stars to construct a sample inoculated against inherent stellar class and planet-detection biases. Survival analysis and Bayesian regression methods (incorporating both measurements errors and X-ray upper limits; 13/23 stars have secure detections) are used to test whether "hot Jupiter" hosts are systematically more X-ray luminous than comparable stars with more distant or smaller planets. No significant correlations are present between common proxies for interaction strength ($M_{\rm P}/a^2$ or $1/a$) versus coronal activity ($L_{\rm X}$ or $L_{\rm X}/L_{\rm bol}$). In contrast, a sample of 198 FGK main-sequence stars does show a significant ($\sim 99\%$ confidence) increase in X-ray luminosity with $M_{\rm P}/a^2$. While selection biases are incontrovertibly present within the main-sequence sample, we demonstrate that the effect is primarily driven by a handful of extreme hot-Jupiter systems with $M_{\rm P}/a^2 > 450\ M_{\rm Jup}$ AU^{-2}, which here are all X-ray luminous but to a degree commensurate with their Ca2 H and K activity, in contrast to presented magnetic star-planet interaction scenarios that predict enhancements relatively larger in $L_{\rm X}$. We discuss these results in the context of cumulative tidal spin-up of stars hosting close-in gas giants (potentially followed by planetary infall and destruction). We also test our main-sequence sample for correlations between planetary properties and UV luminosity or Ca2 H and K emission, and find no significant dependence.

Download/Website: `http://arxiv.org/abs/1411.3348`

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HST hot-Jupiter transmission spectral survey: detection of potassium in WASP-31b along with a cloud deck and Rayleigh scattering

D. K. Sing[1], H. R. Wakeford[1], A. P. Showman[2], N. Nikolov[1], J. J. Fortney[3], A. S. Burrows[4], G. E. Ballester[2], D. Deming[5], S. Aigrain[6], J.-M. Désert[7], N. P. Gibson[8], G. W. Henry[9], H. Knutson[10], A. Lecavelier des Etangs[11], F. Pont[1], A. Vidal-Madjar[11], M. W. Williamson[9], P. A. Wilson[1]

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1410.7611)

We present *Hubble Space Telescope* optical and near-IR transmission spectra of the transiting hot-Jupiter WASP-31b. The spectrum covers 0.3–1.7 μm at a resolution $R \sim$70, which we combine with *Spitzer* photometry to cover the full-optical to IR. The spectrum is dominated by a cloud-deck with a flat transmission spectrum which is apparent at wavelengths $> 0.52\mu$m. The cloud deck is present at high altitudes and low pressures, as it covers the majority of the expected optical Na line and near-IR H_2O features. While Na I absorption is not clearly identified, the resulting spectrum does show a very strong potassium feature detected at the 4.2-σ confidence level. Broadened alkali wings are not detected, indicating pressures below $\sim$10 mbar. The lack of Na and strong K is the first indication of a sub-solar Na/K abundance ratio in a planetary atmosphere (ln[Na/K]$= -3.3 \pm 2.8$), which could potentially be explained by Na condensation on the planet's night side, or primordial abundance variations. A strong Rayleigh scattering signature is detected at short wavelengths, with a 4-σ significant slope. Two distinct aerosol size populations can explain the spectra, with a smaller sub-micron size grain population reaching high altitudes producing a blue Rayleigh scattering signature on top of a larger, lower-lying population responsible for the flat cloud deck at longer wavelengths. We estimate that the atmospheric circulation is sufficiently strong to mix micron size particles upward to the required 1–10 mbar pressures, necessary to explain the cloud deck. These results further confirm the importance of clouds in hot-Jupiters, which can potentially dominate the overall spectra and may alter the abundances of key gaseous species.

Download/Website: `http://arxiv.org/abs/1410.7611/`

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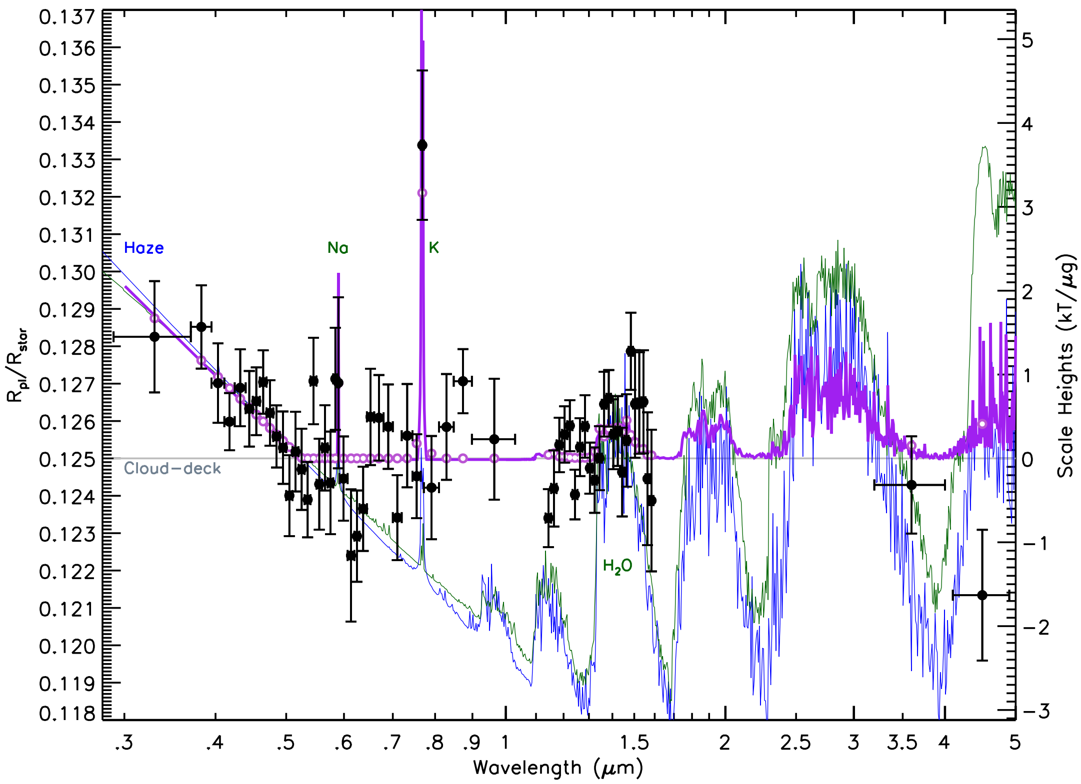

Figure 4: (Sing et al.) Plotted is the broad-band transmission spectral data of WASP-31b along with atmospheric models. Two solar-composition models containing a scattering haze are shown from the modeling suits of Burrows et al. (green) and Fortney et al. (blue). Our best fit model is also plotted (purple) containing a Rayleigh scattering haze, a grey cloud-deck at low pressures, non-pressure broadened Na and K features, and an obscured H_2O feature. The band-averaged model points are indicated with open circles.

HST hot-Jupiter transmission spectral survey: Haze in the atmosphere of WASP-6b

N. Nikolov[1], *D. K. Sing*[1], *A. S. Burrows*[2], *J. J. Fortney*[3], *G. W. Henry*[4], *F. Pont*[1], *G. E. Ballester*[5], *S. Aigrain*[6], *P. A. Wilson*[1,7], *C. M. Huitson*[8], *N. P. Gibson*[9], *J.-M. Désert*[8], *A. Lecavelier des Etangs*[7], *A. P. Showman*[5], *A. Vidal-Madjar*[7], *H. R. Wakeford*[1], *K. Zahnle*[10]

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1411.4567)

We report *Hubble Space Telescope (HST)* optical to near-infrared transmission spectroscopy of the hot Jupiter WASP-6b, measured with the Space Telescope Imaging Spectrograph (STIS) and *Spitzer's* InfraRed Array Camera (IRAC). The resulting spectrum covers the range $0.29 - 4.5\,\mu$m. We find evidence for modest stellar activity of WASP-6 and take it into account in the transmission spectrum. The overall main characteristic of the spectrum is an increasing radius as a function of decreasing wavelength corresponding to a change of $\Delta(\mathrm{R_p}/\mathrm{R_*}) = 0.0071$ from 0.33 to $4.5\,\mu$m. The spectrum suggests an effective extinction cross-section with a power law of index consistent with Rayleigh scattering, with temperatures of 973 ± 144 K at the planetary terminator. We compare the transmission spectrum with hot-Jupiter atmospheric models including condensate-free and aerosol-dominated models incorporating Mie theory. While none of the clear-atmosphere models is found to be in good agreement with the data, we find that the complete spectrum can be described by models that include significant opacity from aerosols including Fe-poor Mg_2SiO_4, $MgSiO_3$, KCl and Na_2S dust condensates. WASP-6b is the second planet after HD 189733b which has equilibrium temperatures near ~ 1200 K and shows prominent atmospheric scattering in the optical.

Download/Website: `http://arxiv.org/abs/1411.4567`

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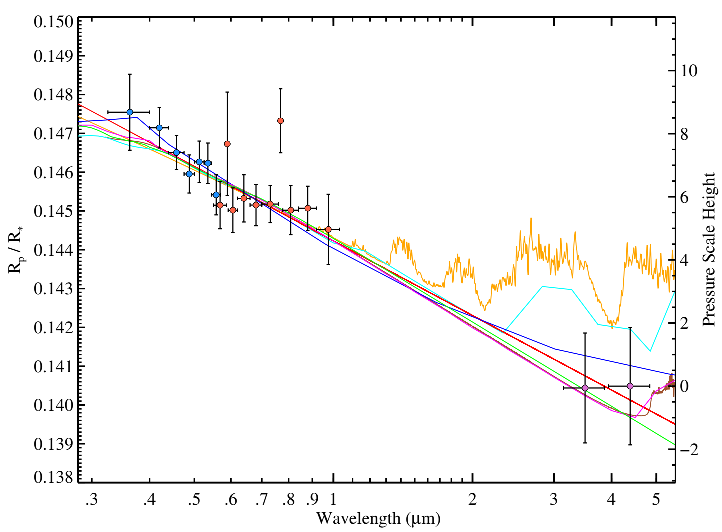

Figure 5: (Nikolov et al.) Broad-band transmission spectrum of WASP-6b compared (without the sodium and potassium measurements) to seven different aerosol models including: Rayleigh scattering (red), Mie scattering KCl (green), $MgSiO_3$ (magenta), Fe-poor Mg_2SiO_4 (brown), a model with enhanced Rayleigh scattering component with a cross-section 10^3 times that of H_2 Fortney.noTiO-EnhancedRayleigh (orange), Na_2S (blue) and Titan tholin (cyan).

Transmission spectral properties of clouds for hot Jupiter exoplanets

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Astronomy & Astrophysics, published (arXiv:1409.7594)

Clouds play an important role in the atmospheres of planetary bodies. It is expected that, like all the planetary bodies in our solar system, exoplanet atmospheres will also have substantial cloud coverage, and evidence is mounting for clouds in a number of hot Jupiters. To better characterise planetary atmospheres, we need to consider the effects these clouds will have on the observed broadband transmission spectra. Here we examine the expected cloud condensate species for hot Jupiter exoplanets and the effects of various grain sizes and distributions on the resulting transmission spectra from the optical to infrared, which can be used as a broad framework when interpreting exoplanet spectra. We note that significant infrared absorption features appear in the computed transmission spectrum, the result of vibrational modes between the key species in each condensate, which can potentially be very constraining. While it may be hard to differentiate between individual condensates in the broad transmission spectra, it may be possible to discern different vibrational bonds, which can distinguish between cloud formation scenarios, such as condensate clouds or photochemically generated species. Vibrational mode features are shown to be prominent when the clouds are composed of small sub-micron sized particles and can be associated with an accompanying optical scattering slope. These infrared features have potential implications for future exoplanetary atmosphere studies conducted with JWST, where such vibrational modes distinguishing condensate species can be probed at longer wavelengths.

Download/Website: `http://adsabs.harvard.edu/abs/2014arXiv1409.7594W`

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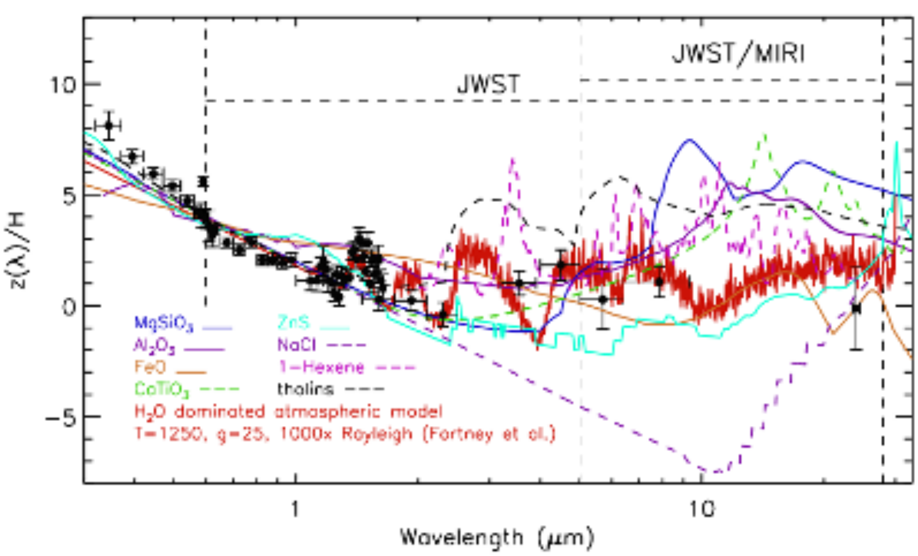

Figure 6: (Wakeford & Sing) Transmission spectrum of HD 189733b (Pont et al. 2013; McCullough et al. 2014) compared to a number of different condensates. Absorption features of the condensates can span multiple scale heights above the expected molecular bands of the abundant gaseous species represented by the H_2O dominated model from Fortney et al. 2010 (red).

HST Rotational Spectral Mapping of Two L-Type Brown Dwarfs: Variability In and Out of Water Bands Indicates High-Altitude Haze Layers

H. Yang[1], *D. Apai*[1,2], *M. S. Marley*[3], *D. Saumon*[4], *C. V. Morley*[5], *E. Buenzli*[6], *E. Artigau*[7], *J. Radigan*[8], *S. Metchev*[9], *A. J. Burgasser*[10], *S. Mohanty*[11], *P. J. Lowrance*[12], *A. P. Showman*[2], *T. Karalidi*[1], *D. Flateau*[2], *A. N. Heinze*[13]

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[11] Imperial College London, 1010 Blackett Lab, Prince Consort Road, London SW7 2AZ, UK
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Astrophysical Journal Letters, in press (arXiv:1411.2911)

We present time-resolved near-infrared spectroscopy of two L5 dwarfs, 2MASS J18212815+1414010 and 2MASS J15074759-1627386, observed with the Wide Field Camera 3 instrument on the *Hubble Space Telescope* (*HST*). We study the wavelength dependence of rotation-modulated flux variations between 1.1 μm and 1.7 μm. We find that the water absorption bands of the two L5 dwarfs at 1.15 μm and 1.4 μm vary at similar amplitudes as the adjacent continuum. This differs from the results of previous *HST* observations of L/T transition dwarfs, in which the water absorption at 1.4 μm displays variations of about half of the amplitude at other wavelengths. We find that the relative amplitude of flux variability out of the water band with respect to that in the water band shows a increasing trend from the L5 dwarfs toward the early T dwarfs. We utilize the models of Saumon & Marley (2008) and find that the observed variability of the L5 dwarfs can be explained by the presence of spatially varying high-altitude haze layers above the condensate clouds. Therefore, our observations show that the heterogeneity of haze layers - the driver of the variability - must be located at very low pressures, where even the water opacity is negligible. In the near future, the rotational spectral mapping technique could be utilized for other atomic and molecular species to probe different pressure levels in the atmospheres of brown dwarfs and exoplanets and uncover both horizontal and vertical cloud structures.

Download/Website: `http://arxiv.org/abs/1411.2911`

Contact: `haoyang@email.arizona.edu`

Migration and Growth of Protoplanetary Embryos I: Convergence of Embryos in Protoplanetary Disks

X. Zhang[1], *B. Liu*[2], *D.N.C. Lin*[1,3], *H.Li*[4]

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The Astrophysical Journal, in press (arXiv:1410.3391)

According to the core-accretion scenario, planets form in protostellar disks through the condensation of dust, coagulation of planetesimals, and emergence of protoplanetary embryos. At a few AU in a minimum mass nebula, embryos' growth is quenched by dynamical isolation due to the depletion of planetesimals in their feeding zone. However, embryos with masses (M_p) in the range of a few Earth masses ($M_\oplus$) migrate toward a transition radius between the inner viscously heated and outer irradiated regions of their natal disk. Their limiting isolation mass increases with the planetesimals surface density. When $M_p > 10 M_\oplus$, embryos efficiently accrete gas and evolve into

cores of gas giants. We use numerical simulation to show that, despite streamline interference, convergent embryos essentially retain the strength of non-interacting embryos' Lindblad and corotation torque by their natal disks. In disks with modest surface density (or equivalently accretion rates), embryos capture each other in their mutual mean motion resonances and form a convoy of super Earths. In more massive disks, they could overcome these resonant barriers to undergo repeated close encounters including cohesive collisions which enable the formation of massive cores.

Download/Website: `http://arxiv.org/abs/1410.3391`

Contact: `xzhang47@ucsc.edu`

3 Jobs and Positions

Postdoc Position in Exoplanet Science at Leiden Observatory

Ignas Snellen
Leiden Observatory, Leiden University, The Netherlands

Deadline: January 15, 2015, start date: Autumn 2015

A two year postdoctoral position funded through the personal NWO VICI grant of Ignas Snellen will become available at Leiden Observatory in the Netherlands. Research in Snellen's group focuses on the characterization of extra-solar planets using a variety of observational methods. In addition, the team develops a new camera-system (MASCARA) to find the brightest transiting planet systems in the sky. The new postdoc is expected to conduct their own line of research within these areas, and play an active role in the research team, e.g. by helping with the guidance of PhD students.

Leiden Observatory, founded in 1633, is the oldest university astronomy department in the world. With about 25 faculty, over 40 postdoctoral associates and about 75 PhD students it is the largest astronomy department in the Netherlands. Leiden is a charming university town with international flair. Most Leiden researchers have an international background. English is the common language.

The appointment will be for two years.The position comes with a competitive salary and full benefits. A starting date no later than October 2015 is preferred. The successful candidate must have a PhD by the starting date.

Further details may be obtained from Prof. Ignas Snellen snellen@strw.leidenuniv.nl

Applicants should submit via email to snellen@strw.leidenuniv.nl:
- a curriculum vitae
- publication list
- a brief statement of research experience and interests
- names of three referees

The deadline is January 15, 2015.

Download/Website: `http://www.strw.leidenuniv.nl/ snellen`

Contact: `snellen@strw.leidenuniv.nl`

Research Fellow in support of PLATO

Don Pollacco
Department of Physics and Astronomy, The University of Warwick, Coventry, UK

Deadline: December 7, 2014, start date: 2015

Applications are invited for a full time Post-doctoral Research Fellow in support of ESAs PLATO M3 Mission jointly funded by UKSpA and the University of Warwick. The position, which is available from December 2014, is initially funded for a period of three years but is expected to last the duration of the PLATO mission (2030+). The successful candidate will hold a PhD degree and have a proven research track record.

The PLATO duties include organisational support of the Science Consortium and there will be other opportunities to become involved with the mission, both technically and scientifically. Opportunities are also available to become scientifically involved in ESAs first S Mission, CHEOPS, due for launch in 2017 and ground based experiments in which Warwick has significant roles (e.g. SuperWASP and NGTS). We expect that, on average, 50% of the post holders time will be available for research, preferably in the area of extra-solar planets with the Astrophysics Group at Warwick.

In addition to the online application form applicants should also submit a covering letter, concise description of research accomplishments, relevant organisational and technical experience (including computing experience), and a CV including a full publication list.

Informal enquiries about this post can be made to: Prof. D.L.Pollacco.

Download/Website: `http://bit.ly/1vsZX0n`

Contact: `d.pollacco@warwick.ac.uk`

4 Conference announcements

The Formation of the Solar System II

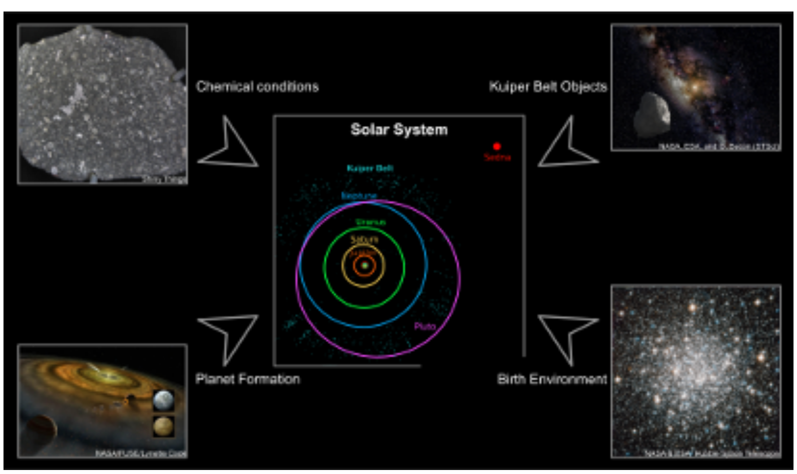
Susanne Pfalzner, Chair
MPIfR, Bonn, Germany

Berlin, 2 – 4 June 2015

Although the solar system formed more than 4.5 Gyr ago there still exist a number of indicators to the conditions at the time of its formation. Meteorites, the composition of the Kuiper belt and even today' s properties of the solar system planets give clues to the solar system's early history. However, there is an ongoing debate on how to interpret these properties.
This second workshop "The Formation of the Solar System II " again has the aim to bring together researchers working in the various fields involved in this quest. It turns out that this is a truly interdisciplinary endeavour, requiring knowledge of super novae explosions, meteorites, cosmochemistry, structure and evolution of circumstellar discs, star cluster dynamics, and the early dynamical evolution of planetary systems. Therefore contributions tackling the following subjects are welcome:

- Cosmochemical constraints on the physical/chemical conditions in the Solar Nebula
- Time scales of the dust and planetesimal growth for the Solar System
- Models of the Kuiper belt formation
- The role of the stellar environment, with emphasis on star cluster dynamics
- Early planetary system development
- Future evolution of the Solar System

Download/Website: `https://indico.mpifr-bonn.mpg.de/FormationOfTheSolarSystem2`
Contact: `spfalzner@mpifr-bonn.mpg.de`



Twenty years of giant exoplanets

Francois Bouchy
Laboratoire d'Astrophysique de Marseille & Observatoire de Genève

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

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

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

- Transiting giant exoplanets
- Jupiter-like planets from long-term radial velocity surveys
- Directly imaged planets
- Atmosphere characterization
- Internal structure modeling
- Dynamics of systems, link from observations to theory
- Formation and migration scenarios
- Star-planet interactions in transiting systems: tides, irradiation

The Observatoire de Haute Provence is located in southern France, near the village of Saint Michel l'Observatoire. It is the discovery place of 51 Peg b in 1995 with the ELODIE spectrograph. The 193-cm telescope is now equipped with SOPHIE, which carries a large contribution to the exoplanet studies. The number of participants is limited to 80. Accommodation will be provided inside and close to the Observatory for the duration of the Colloquium. Students and post-docs are encouraged to participate and contribute their work, and can apply to a travel grant.

Important deadlines:
September 2014: first announcement
1st January - 1st May 2015: registration
1st January - 1st July 2015: abstract submission
5- 9 October 2015: Colloquium
15 January 2016: publication of proceedings

SOC: R. Alonso, I. Boisse (chair), F. Bouchy, D. Fabrycky, K. Heng, J. Laskar, M. Mayor (co-chair), I. Snellen, A. Sozzetti, S. Udry, A. Vigan, P. Wheatley, J. Wright.
LOC: L. Arnold, N. Bressand, M. Deleuil, O. Demangeon, A. Laloge, A. Le Van Suu.

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

Contact: `francois.bouchy@lam.fr`

Pathways Towards Habitable Planets II

Vincent Coudé du Foresto
Observatoire de Paris - LESIA, 5 place Jules Janssen, F-92190 Meudon, France

Bern, Switzerland, 13–17 July 2015

Contributions are sollicited and pre-registration is open for the Pathways Towards Habitable Planets II conference to be held next July 13–17 in Bern, Switzerland.
One of the most exciting scientific challenges of this century is the search of habitable worlds around other stars, and the characterization of their atmospheres with the goal of detecting signs of biological activity. This is a long-term, interdisciplinary endeavor, engaging astrophysicists, biologists, planetary scientists, and instrument scientists. Pathways is dedicated to identifying the steps needed to address those questions. Its aim is to help integrate the prospective efforts in Europe and in the US, build a community around this theme, and bring together several pathways towards that final goal. The conference will be structured around key questions such as :

- Is the habitable zone a well defined concept ?
- Is the Sun-Earth pair a good paradigm for an inhabited system ?
- How do we define meaningful biomarkers ?
- What can we learn from solar system synergies ?
- How do we build synergies between ground and space ?
- What can we expect from approved projects ?
- What future capacity is needed ?

Each question will be introduced by an invited speaker, or more if several viewpoints are deemed necessary. Contributed talks and posters will add material to the debate. Ample time will be left for discussion, while a synthesis will be proposed on the last day. The main session will occur in the morning and late afternoon, while the early afternoon will be left open for poster viewing and satellite meetings which can be proposed by the members of the community. Pathways II follows the tracks of the Pathways Towards Habitable Planets conference held in 2009 in Barcelona (www.pathways2009.net).

Download/Website: `http://www.pathways2015.net`

Contact: `pathways2015@sciencesconf.org`

From Hot Jupiters to Scorched Earths: Understanding the Shortest-Period Exoplanets

Brian Jackson[1], *Roberto Sanchis-Ojeda*[2], *Guillem Anglada-Escudé*[3]
[1] Boise State University, Dept. of Physics, Boise ID USA
[2] University of California, Berkeley CA USA
[3] Queen Mary University of London, London UK

AAS 2015 Winter Meeting, Seattle WA,
Thursday, 8 January 2015, 10:00am – 11:30am, 606 (Convention Center)

From wispy gas giants on the verge of disruption to tiny rocky bodies already falling apart, short-period exoplanets pose a severe challenge to theories of planet formation and evolution, but they dominate observational constraints on planetary composition, internal structure, meteorology, and more.

This special AAS session will gather together experts in detection, characterization, theory of short period planets, and star-planet interactions. The session will link the lessons learned from hot Jupiters to the characterization of the emergent population of small, short period planets.

The session will include invited and contributed talks from Thomas Beatty (PSU), Eugene Chiang (UC Berkeley), Rebekah Dawson (UC Berkeley), Xavier Dumusque (Harvard CfA), Tiffany Kataria (UA/LPL), Laura Kreidberg (Chicago), Eric Lopez (UC Santa Cruz), and Leslie Rogers (Caltech).

Download/Website: `https://sites.google.com/site/spexoplaas225th/`

Contact: `bjackson@boisestate.edu`

5 Announcements

Call for proposals – Pathways satellite meetings

Vincent Coudé du Foresto
Observatoire de Paris - LESIA, 5 place Jules Janssen, F-92190 Meudon, France

Bern, Switzerland, 13–17 July 2015

Proposals are sollicited for satellite meetings to be held in conjunction with Pathways.
Satellite meetings are autonomously organized and advertised, but will benefit from thePathways conference audience and logistics. They can be workshops, round tables, groupmeetings, or take any format that seems fit to their organizers. Participants will need to registerto the main conference even if they attend a satellite meeting only.
Satellite meetings can be held on Monday, Tuesday and/or Wednesday early afternoon (2PM-4:30PM), when the main conference is off (except for extended poster sessions). Timeallocation will be made in the main conference on Friday morning so that summary talks canbe given to the general audience for each satellite meeting.
Proposals for satellite meetings can be made by mail at pathways2015-satmeetings@sciencesconf.org, or from the Pathways website, indicating the topic with a small rationale, type and size of room requested, numberof afternoon sessions requested, and contact info for the responsible person.
The deadline for proposing satellite meetings is March 28th, 2015, although late proposals can be considered if there is still space available.
Three lecture rooms (seating 90, 78 and 56 persons respectively) and three rooms with ”boardmeeting” style seating (capacities 54, 54 and 44), all outfitted wih audiovisual equipment, are available for satellite meetings in the same building as the main conference.

Download/Website: `http://www.pathways2015.net`

Contact: `pathways2015-satmeetings@sciencesconf.org`

6 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during November 2014. If you see any that we missed, please let us know and we'll include them in the next issue.

astro-ph/1411.0003 : **Cloud structure of the nearest brown dwarfs: Spectroscopic variability of Luhman 16AB from the Hubble Space Telescope** by *Esther Buenzli, et al.*

astro-ph/1411.0004 : **Measurement of planet masses with transit timing variations due to synodic "chopping" effects** by *Katherine M. Deck, Eric Agol*

astro-ph/1411.0315 : **Recovery of the Candidate Protoplanet HD 100546 b with Gemini/NICI and Detection of Additional (Planet-Induced?) Disk Structure at Small Separations** by *Thayne Currie, et al.*

astro-ph/1411.0387 : **The MgI line: a new probe of the atmospheres of evaporating exoplanets** by *V. Bourrier, et al.*

astro-ph/1411.0540 : **Water Trapping on Tidally Locked Terrestrial Planets Requires Special Conditions** by *Jun Yang, et al.*

astro-ph/1411.0563 : **Collisions of small ice particles under microgravity conditions** by *C. R. Hill, et al.*

astro-ph/1411.0636 : **Stellar magnetic activity and Star-Planet Interactions (invited review)** by *K. Poppenhaeger*

astro-ph/1411.0671 : **SEEDS Adaptive Optics Imaging of the Asymmetric Transition Disk Oph IRS 48 in Scattered Light** by *Katherine B. Follette, et al.*

astro-ph/1411.0739 : **Chaotic Dynamics of Stellar Spin Driven by Planets Undergoing Lidov-Kozai Oscillations: Resonances and Origin of Chaos** by *Natalia I. Storch, Dong Lai*

astro-ph/1411.0822 : **Finding Hot-Jupiters by Gaia photometry using the Directed Follow-Up strategy** by *Yifat Dzigan, Shay Zucker*

astro-ph/1411.1025 : **Understanding tidal dissipation in gaseous giant planets from their core to their surface** by *M. Guenel, S. Mathis, F. Remus*

astro-ph/1411.1056 : **1D accretion discs around eccentric planets: observable near-infrared variability** by *Alex Dunhill*

astro-ph/1411.1059 : **The 3-dimensional architecture of the Upsilon Andromedae planetary system** by *Russell Deitrick, et al.*

astro-ph/1411.1130 : **Global Analysis of KOI-977: Spectroscopy, Asteroseismology, and Phase-curve Analysis** by *Teruyuki Hirano, et al.*

astro-ph/1411.1173 : **Astrometric exoplanet detection with Gaia** by *Michael Perryman, et al.*

astro-ph/1411.1378 : **Planetary chaotic zone clearing: destinations and timescales** by *Sarah Morrison, Renu Malhotra*

astro-ph/1411.1740 : **Seismology of Giant Planets** by *Patrick Gaulme, et al.*

astro-ph/1411.1754 : **Observations of Transiting Exoplanets with the James Webb Space Telescope** by *Charles Beichman, et al.*

astro-ph/1411.1767 : **Revisiting the correlation between stellar activity and planetary surface gravity** by *P. Figueira, et al.*

astro-ph/1411.1860 : **Deformation and tidal evolution of close-in planets and satellites using a Maxwell viscoelastic rheology** by *Alexandre C.M. Correia, et al.*

astro-ph/1411.1991 : **Processing of formic acid-containing ice by heavy and energetic cosmic ray analogues** by *A. Bergantini, et al.*

astro-ph/1411.2496 : **Formation and evolution of the two 4/3 resonant giants planets in HD 200946** by *M. Tadeu dos Santos, al.*

astro-ph/1411.2587 : **The Structure of Pre-transitional Protoplanetary Disks. II. Azimuthal Asymmetries, Different Radial Distributions of Large and Small Dust Grains in PDS 70** by *J. Hashimoto, et al.*

astro-ph/1411.2629 : **Vulcan Planets: Inside-Out Formation of the Innermost Super-Earths** by *Sourav Chatterjee, Jonathan C. Tan*

astro-ph/1411.2735 : **Planet-induced disk structures: A comparison between (sub)mm and infrared radiation** by *Jan Philipp Ruge, et al.*

astro-ph/1411.2736 : **Gaps, Rings, and Non-Axisymmetric Structures in Protoplanetary Disks - From Simulations to ALMA Observations** by *M. Flock, et al.*

astro-ph/1411.2767 : **High-precision photometry by telescope defocussing. VII. The ultra-short period planet WASP-103** by *John Southworth, et al.*

astro-ph/1411.2859 : **On the Stability of Extrasolar Planetary Systems and other Closely Orbiting Pairs** by *Fred C. Adams, Anthony M. Bloch*

astro-ph/1411.2911 : **HST Rotational Spectral Mapping of Two L-Type Brown Dwarfs: Variability In and Out of Water Bands Indicates High-Altitude Haze Layers** by *Hao Yang, et al.*

astro-ph/1411.3093 : **A Spitzer Five-Band Analysis of the Jupiter-Sized Planet TrES-1** by *Patricio Cubillos et al.*

astro-ph/1411.3190 : **Migration of massive planets in accreting disks** by *Christoph Dürmann, Wilhelm Kley*

astro-ph/1411.3236 : **Vortex cycles at the inner edges of dead zones in protoplanetary disks** by *Julien Faure, et al.*

astro-ph/1411.3255 : **The structure of protoplanetary discs around evolving young stars** by *Bertram Bitsch, et al.*

astro-ph/1411.3621 : **High-resolution Multi-band Imaging for Validation and Characterization of Small Kepler Planets** by *Mark E. Everett, et al.*

astro-ph/1411.3722 : **Planets Around Low-Mass Stars (PALMS). IV. The Outer Architecture of M Dwarf Planetary Systems** by *Brendan P. Bowler, et al.*

astro-ph/1411.3724 : **Miniature Exoplanet Radial Velocity Array (MINERVA) I. Design, Commissioning, and First Science Results** by *Jonathan J. Swift, et al.*

astro-ph/1411.3802 : **Evolution of angular-momentum-losing exoplanetary systems : Revisiting Darwin stability** by *C. Damiani, A. F. Lanza*

astro-ph/1411.3934 : **SOPHIE velocimetry of Kepler transit candidates XIV. A joint photometric, spectroscopic, and dynamical analysis of the Kepler-117 system** by *G. Bruno, et al.*

astro-ph/1411.3950 : **Spin-orbit coupling and chaotic rotation for eccentric coorbital bodies** by *Adrien Leleu, Philippe Robutel, A.C.M. Correia*

astro-ph/1411.4010 : **Ab initio equations of state for hydrogen (H-REOS.3) and helium (He-REOS.3) and their implications for the interior of Brown Dwarfs** by *Andreas Becker, et al.*

astro-ph/1411.4047 : **Characterizing the Cool KOIs. VII. Refined Physics Properties of the Eclipsing Brown Dwarf LHS 6343 C** by *Benjamin T. Montet, et al.*

astro-ph/1411.4336 : **Formation of Multiple-Satellite Systems From Low-Mass Circumplanetary Particle Disks** by *Ryuki Hyodo, Keiji Ohtsuki, Takaaki Takeda*

astro-ph/1411.4666 : **KOI-1299: a red giant interacting with one of its two long period giant planets** by *Samuel N. Quinn, et al.*

astro-ph/1411.4731 : **Three-dimensional Atmospheric Circulation of Warm and Hot Jupiters: Effects of Orbital Distance, Rotation Period, and Non-Synchronous Rotation** by *Adam P. Showman, Nikole K. Lewis, Jonathan J. Fortney*

astro-ph/1411.4751 : **Outward Motion of Porous Dust Aggregates by Stellar Radiation Pressure in Protoplanetary Disks** by *Ryo Tazaki, Hideko Nomura*

astro-ph/1411.5036 : **Evidence for an Anhydrous Carbonaceous Extrasolar Minor Planet** by *M. Jura, et al.*

astro-ph/1411.5261 : **Metal loading of giant gas planets** by *Sergei Nayakshin*

astro-ph/1411.5263 : **Positive metallicity correlation for coreless giant planets** by *Sergei Nayakshin*

astro-ph/1411.5264 : **Tidal Downsizing model. I. Numerical methods: saving giant planets from tidal disruptions** by *Sergei Nayakshin*

astro-ph/1411.5280 : **Astrochemistry of dust, ice and gas: introduction and overview** by *Ewine F. van Dishoeck*
astro-ph/1411.5366 : **Long-lasting dust rings in gas-rich disks: sculpting by single and multiple planets** by *Farzana Meru, et al.*
astro-ph/1411.5374 : **Newly-Discovered Planets Orbiting HD 5319, HD 11506, HD 75784 and HD 10442 from the N2K Consortium** by *Matthew J. Giguere, et al.*
astro-ph/1411.5390 : **Gravitational quantization of exoplanet orbits in 55 Cnc, υ And, Kepler-11, Kepler-20, and Kepler-90** by *Vassilis S. Geroyannis*
astro-ph/1411.5431 : **Alignment of Protostars and Circumstellar Disks During the Embedded Phase** by *Christopher Spalding, Konstantin Batygin, Fred C. Adams*
astro-ph/1411.5517 : **Observational studies of transiting extrasolar planets (invited review)** by *John Southworth*
astro-ph/1411.5564 : **Climate Stability of Habitable Earth-like Planets** by *Kristen Menou*
astro-ph/1411.5638 : **Stellar Diameters and Temperatures VI. High angular resolution measurements of the transiting exoplanet host stars HD 189733 and HD 209458 and implications for models of cool dwarfs** by *Tabetha Boyajian, et al.*
astro-ph/1411.5829 : **Stirring in massive, young debris discs from spatially resolved Herschel images** by *A. Moór, et al.*
astro-ph/1411.5931 : **The JCMT Gould Belt Survey: low-mass proto-planetary discs from a SCUBA-2 census of NGC1333** by *P. Dodds et al.*
astro-ph/1411.6012 : **Detectable close-in planets around white dwarfs through late unpacking** by *Dimitri Veras, Boris T. Gaensicke*
astro-ph/1411.6017 : **A search for TiO in the optical high-resolution transmission spectrum of HD 209458b: Hindrance due to inaccuracies in the line database** by *H.J. Hoeijmakers, et al.*
astro-ph/1411.6063 : **Observational Signatures of Planets in Protoplanetary Disks I: Gaps Opened by Single and Multiple Young Planets in Disks** by *Ruobing Dong, Zhaohuan Zhu, Barbara Whitney*
astro-ph/1411.6875 : **Magnetic moment and plasma environment of HD 209458b as determined from Lyα observations** by *K. G. Kislyakova, et al.*
astro-ph/1411.7028 : **The Possible Moon of Kepler-90g is a False Positive** by *David M. Kipping, et al.*
astro-ph/1411.7048 : **The HARPS search for southern extra-solar planets XXXV. Planetary systems and stellar activity of the M dwarfs GJ 3293, GJ 3341, and GJ 3543** by *N. Astudillo-Defru, et al.*
astro-ph/1411.7061 : **Dynamical Interactions Make Hot Jupiters in Open Star Clusters** by *Michael M. Shara, Jarrod R. Hurley, Rosemary A. Mardling*
astro-ph/1411.7138 : **Where Are The Circumbinary Planets of Contact Binaries?** by *O. Demircan, I. Bulut*
astro-ph/1411.7313 : **The Dynamical Fate of Self-Gravitating Disc Fragments After Tidal Downsizing** by *Duncan Forgan, Richard Parker, Ken Rice*
astro-ph/1411.7378 : **Pathway to the Galactic Distribution of Planets: Combined Spitzer and Ground-Based Microlens Parallax Measurements of 21 Single-Lens Events** by *S. Calchi Novati, et al.*
astro-ph/1411.7404 : **Spitzer Secondary Eclipses of the Dense, Modestly-irradiated, Giant Exoplanet HAT-P-20b Using Pixel-Level Decorrelation** by *Drake Deming, et al.*
astro-ph/1411.7412 : **Extreme Water Loss and Abiotic O_2 Buildup On Planets Throughout the Habitable Zones of M Dwarfs** by *Rodrigo Luger, Rory Barnes*
astro-ph/1411.7618 : **Detections of trans-Neptunian ice in protoplanetary disks** by *M. K. McClure, et al.*
astro-ph/1411.7660 : **Ground-Based Transit Observations of the Super-Earth 55 Cnc e** by *E. J. W. de Mooij, et al.*
astro-ph/1411.7761 : **A dynamical stability study of Kepler Circumbinary Planetary systems with one planet** by *C. E. Chavez, et al.*