ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the twenty-eighth edition of ExoPlanet News, an electronic newsletter reporting the latest developments and research outputs in the field of exoplanets.
Even though we have a rather slimmer edition this month, we hope you enjoy catching up with recent developments in the field. Remember that past editions of this newsletter, submission templates and other information can be found at the ExoPlanet News website: http://exoplanet.open.ac.uk.
Please send anything relevant to exoplanet@open.ac.uk, and it will appear in the next edition which we plan to send out at the beginning of May 2010. As for this issue, if you wish to include ONE .eps figure per abstract, please do so.

Best wishes
Andrew Norton & Glenn White
The Open University

2 Abstracts of refereed papers

Searching for Star-Planet interactions within the magnetosphere of HD 189733

R. Fares[1,2], *J.-F. Donati*[1], *C. Moutou*[2] , *M.M. Jardine*[3], *J.-M. Grießmeier*[4], *P. Zarka*[5], *E. L. Shkolnik*[6], *D. Bohlender*[7], *C. Catala*[5], *A.C. Cameron*[3]

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Monthly Notices of the Royal Astronomical Society, in press (arXive-1003.6027)

HD 189733 is a K2 dwarf, orbited by a giant planet at 8.8 stellar radii. In order to study magnetospheric interactions between the star and the planet, we explore the large-scale magnetic field and activity of the host star.
We collected spectra using the ESPaDOnS and the NARVAL spectropolarimeters, installed at the 3.6-m Canada-France-Hawaii telescope and the 2-m Telescope Bernard Lyot at Pic du Midi, during two monitoring campaigns (June 2007 and July 2008).
HD 189733 has a mainly toroidal surface magnetic field, having a strength that reaches up to 40 G. The star is differentially rotating, with latitudinal angular velocity shear of $d\Omega = 0.146 \pm 0.049$ rad d^{-1}, corresponding to equatorial and polar periods of 11.94 ± 0.16 d and 16.53 ± 2.43 d respectively. The study of the stellar activity shows that it is modulated mainly by the stellar rotation (rather than by the orbital period or the beat period between the stellar rotation and the orbital periods). We report no clear evidence of magnetospheric interactions between the star and the planet.
We also extrapolated the field in the stellar corona and calculated the planetary radio emission expected for HD 189733b given the reconstructed field topology. The radio flux we predict in the framework of this model is time variable and potentially detectable with LOFAR.

Download/Website: `http://arxiv.org/abs/1003.6027`

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Transiting exoplanets from the CoRoT space mission IX. CoRoT-6b: a transiting 'hot Jupiter' planet in an 8.9d orbit around a low-metallicity star

M. Fridlund[1], *G. Hébrard*[2],*R. Alonso*[3,15], *M. Deleuil*[3], *D. Gandolfi*[10], *M. Gillon*[15,19], *H. Bruntt*[5], *A. Alapini*[6], *Sz. Csizmadia*[11], *T. Guillot*[16], *H. Lammer*[13], *S. Aigrain*[6,24], *J.M. Almenara*[9,23], *M. Auvergne*[5], *A. Baglin*[5], *P. Barge*[3], *P. Bordé*[4], *F. Bouchy*[2,22], *J. Cabrera*[11], *L. Carone*[12], *S. Carpano*[1], *H. J. Deeg*[9,23], *R. De la Reza*[17], *R. Dvorak*[18], *A. Erikson*[11], *S. Ferraz-Mello*[20], *E. Guenther*[10,9], *P. Gondoin*[1], *R. den Hartog*[1,7], *A. Hatzes*[10], *L. Jorda*[3], *A. Léger*[4], *A. Llebaria*[3], *P. Magain*[19], *T. Mazeh*[8], *C. Moutou*[3], *M. Ollivier*[4], *M. Pätzold*[12], *D. Queloz*[15], *H. Rauer*[11,21], *D. Rouan*[3], *B. Samuel*[4], *J. Schneider*[14], *A. Shporer*[8], *B. Stecklum*[10], *B. Tingley*[9,23], *J. Weingrill*[13], *G. Wuchterl*[10]

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Astronomy & Astrophysics, in press (2010arXiv1001.1426F)

The CoRoT satellite exoplanetary team announces its sixth transiting planet in this paper. We describe and discuss the satellite observations as well as the complementary ground-based observations – photometric and spectroscopic – carried out to assess the planetary nature of the object and determine its specific physical parameters. The discovery reported here is a 'hot Jupiter' planet in an 8.9d orbit, 18 stellar radii, or 0.08 AU, away from its primary star, which is a solar-type star (F9V) with an estimated age of 3.0 Gyr. The planet mass is close to 3 times that of Jupiter. The star has a metallicity of 0.2 dex *lower* than the Sun, and a relatively high ^7Li abundance. While the light curve indicates a much higher level of activity than, e.g., the Sun, there is no sign of activity spectroscopically in e.g., the [Ca II] H&K lines.

Download/Website: `http://arxiv.org/abs/1001.1426`

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Enstatite-rich Warm Debris Dust around HD165014

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Astrophysical Journal Letters, in press (arXiv:1004.0560)

We present the *Spitzer*/Infrared Spectrograph spectrum of the main-sequence star HD165014, which is a warm (> 200 K) debris disk candidate discovered by the *AKARI* All-Sky Survey. The star possesses extremely large excess emission at wavelengths longer than 5 μm. The detected flux densities at 10 and 20 μm are ~ 10 and ~ 30 times larger than the predicted photospheric emission, respectively. The excess emission is attributable to the presence of circumstellar warm dust. The dust temperature is estimated as 300–750 K, corresponding to the distance of 0.7–4.4 AU from the central star. Significant fine-structured features are seen in the spectrum and the peak positions are in good agreement with those of crystalline enstatite. Features of crystalline forsterite are not significantly seen. HD165014 is the first debris disk sample that has enstatite as a dominant form of crystalline silicate rather than forsterite. Possible formation of enstatite dust from differentiated parent bodies is suggested according to the solar system analog. The detection of an enstatite-rich debris disk in the current study suggests the presence of large bodies and a variety of silicate dust processing in warm debris disks.

Download/Website: `http://arxiv.org/abs/1004.0560`

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Dynamics of two planets in co-orbital motion

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Monthly Notices of the Royal Astronomical Society, in press (arXive-Code)

We study the stability regions and families of periodic orbits of two planets locked in a co-orbital configuration. We consider different ratios of planetary masses and orbital eccentricities, also we assume that both planets share the same orbital plane. Initially we perform numerical simulations over a grid of osculating initial conditions to map the regions of stable/chaotic motion and identify equilibrium solutions. These results are later analyzed in more detail using a semi-analytical model.
Apart from the well known quasi-satellite (QS) orbits and the classical equilibrium Lagrangian points L_4 and L_5, we also find a new regime of asymmetric periodic solutions. For low eccentricities these are located at $(\sigma, \Delta\varpi) = (\pm 60^\circ, \mp 120^\circ)$, where σ is the difference in mean longitudes and $\Delta\varpi$ is the difference in longitudes of pericenter. The position of these *Anti-Lagrangian* solutions changes with the mass ratio and the orbital eccentricities, and are found for eccentricities as high as ~ 0.7.
Finally, we also applied a slow mass variation to one of the planets, and analyzed its effect on an initially asymmetric periodic orbit. We found that the resonant solution is preserved as long as the mass variation is adiabatic, with practically no change in the equilibrium values of the angles.

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Formation of Terrestrial Planets from Protoplanets under a Realistic Accretion Condition

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Astrophysical Journal Letters, in press

The final stage of terrestrial planet formation is known as the giant impact stage where protoplanets collide with one another to form planets. So far this stage has been mainly investigated by N-body simulations with an assumption of perfect accretion in which all collisions lead to accretion. However, this assumption breaks for collisions with high velocity and/or a large impact parameter. We derive an accretion condition for protoplanet collisions in terms of impact velocity and angle and masses of colliding bodies, from the results of numerical collision experiments. For the first time, we adopt this realistic accretion condition in N-body simulations of terrestrial planet formation from protoplanets. We compare the results with those with perfect accretion and show how the accretion condition affects terrestrial planet formation. We find that in the realistic accretion model, about half of collisions do not lead to accretion. However, the final number, mass, orbital elements, and even growth timescale of planets are barely affected by the accretion condition. For the standard protoplanetary disk model, typically two Earth-sized planets form in the terrestrial planet region over about 10^8 years in both realistic and perfect accretion models. We also find that for the realistic accretion model, the spin angular velocity is about 30% smaller than that for the perfect accretion model that is as large as the critical spin angular velocity for rotational instability. The spin angular velocity and obliquity obey Gaussian and isotropic distributions, respectively, independently of the accretion condition.

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Debris Disks: Seeing Dust, Thinking of Planetesimals and Planets (review paper)

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Research in Astronomy and Astrophysics, in press (arXiv:1003.5229)

Debris disks are optically thin, almost gas-free dusty disks observed around a significant fraction of main-sequence stars older than about 10 Myr. Since the circumstellar dust is short-lived, the very existence of these disks is considered as evidence that dust-producing planetesimals are still present in mature systems, in which planets have formed — or failed to form — a long time ago. It is inferred that these planetesimals orbit their host stars at asteroid to Kuiper-belt distances and continually supply fresh dust through mutual collisions. This review outlines observational techniques and results on debris disks, summarizes their essential physics and theoretical models, and then places them into the general context of planetary systems, uncovering interrelations between the disks, dust parent bodies, and planets. It is shown that debris disks can serve as tracers of planetesimals and planets and shed light on the planetesimal and planet formation processes that operated in these systems in the past.

Download/Website: http://arxiv.org/abs/1003.5229

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Evaporation of the planet HD 189733b observed in H I Lyman-α

A. Lecavelier des Etangs[1], *D. Ehrenreich*[2], *A. Vidal-Madjar*[1], *G. E. Ballester*[3], *J.-M. Désert*[1], *R. Ferlet*[1], *G. Hébrard*[1], *D. K. Sing*[1,4], *K.-O. Tchakoumegni*[1,5], *S. Udry*[6]

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Astronomy & Astrophysics, in press (arXiv:1003.2206)

We observed three transits of the extrasolar planet HD 189733b in H I Lyman-α and in a few other lines in the ultraviolet with HST/ACS, in the search for atmospheric signatures. We detect a transit signature in the Lyman-α light curve with a transit depth of 5.05$\pm$0.75%. This depth exceeds the occultation depth produced by the planetary disk alone at the 3.5σ level (statistical). Other stellar emission lines are less bright, and, taken individually, they do not show the transit signature, while the whole spectra redward of the Lyman-α line has enough photons to show a transit signature consistent with the absorption by the planetary disk alone. The transit depth's upper limits in the emission lines are 11.1% for O I λ1305Å and 5.5% for C II λ1335Å lines.
The presence of an extended exosphere of atomic hydrogen around HD 189733b producing 5% absorption of the full unresolved Lyman-α line flux shows that the planet is losing gas. The Lyman-α light curve is well-fitted by a numerical simulation of escaping hydrogen in which the planetary atoms are pushed by the stellar radiation pressure. We constrain the escape rate of atomic hydrogen to be between 10^9 and 10^{11} g s^{-1} and the ionizing extreme UV flux between 2 and 40 times the solar value (1-σ), with larger escape rates corresponding to larger EUV flux. The best fit is obtained for $\mathrm{d}M/\mathrm{d}t$=10^{10} g s^{-1} and an EUV flux $F_{\rm EUV}$=20 times the solar value. HD 189733b is the second extrasolar planet for which atmospheric evaporation has been detected.

Download/Website: `http://arxiv.org/abs/1003.2206`

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Warm dusty discs: Exploring the A star 24μm debris population

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Astronomy & Astrophysics, in press

Studies of the debris disc phenomenon have shown that most systems are analogous to the Edgeworth-Kuiper Belt (EKB). In this study we aim to determine how many of the IRAS 25μm excesses towards A stars, which may be indicative of asteroid belt analogues, are real, and investigate where the dust must lie and so build up a picture of what these systems are like. We observe using ground-based mid-infrared imaging with TIMMI2, VISIR, Michelle and TReCS a sample of A and B-type main sequence stars previously reported as having mid-infrared excess. We combine modelling of the emission spectrum from multi-wavelength photometry with a modelling technique designed to constrain the radial extent of emission in mid-infrared imaging to constrain the possible location of the debris. We independently confirm the presence of warm dust around three of the candidates: HD 3003, HD 80950 and η Tel. For the binary HD3003 a stability analysis indicates the dust is either circumstellar and lying at $\sim$4 AU with the binary orbiting at $>$14AU, or the dust lies in an unstable location; there is tentative evidence for temporal evolution of its excess emission on a $\sim$20 year timescale. For 7 of the targets we present quantitative limits on the location of dust around the star based on the unresolved imaging. We demonstrate that the disc around HD71155 must have multiple spatially distinct components at 2 and 60AU. We model the limits of current instrumentation to

resolve debris disc emission and show that most of the known A star debris discs which could be readily resolved at 18μm on 8m instruments have been resolved, but identify several that could be resolved with deep ($>$8 hours total) integrations (such as HD19356, HD139006 and HD102647). Limits from unresolved imaging can help distinguish between competing models of the disc emission, but resolved imaging is key to an unambiguous determination of the disc location. Modelling of the detection limits for extended emission can be useful for targeting future observational campaigns towards sources most likely to be resolved. MIRI on the JWST will be able to resolve the majority of the known A star debris disc population. METIS on the E-ELT will provide the opportunity to explore the hot disc population more thoroughly by detecting extended emission down to where calibration accuracy limits disc detection through photometry alone, reaching levels below 1 zodi for stars within 10pc.

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3 Conference announcements

In the spirit of Bernard Lyot 2010 – Direct Detection of Exoplanets and Circumstellar Disks

A. Boccaletti et al.
LESIA / CNRS - Paris Observatory

Paris, October 25th to 29th, 2010

The last 15 years have witnessed a rapid development of techniques for the detection and characterization of extra-solar planets. Radial velocity surveys have detected the first bona fide giant planets and are now pushing the limits towards lower masses and longer periods. As of today, the more than 400 known exoplanetary systems and our own Solar System demonstrate a large diversity of physical and chemical properties as various formation mechanisms (core accretion, stellar mechanisms). However, a small fraction of the mass-period diagram has been explored so far.

Recently, two major steps were accomplished with the first direct images of massive giant planets around young stars and the first low resolution spectra of transiting hot-Jupiters, preluding the era of ”spectral characterization”. This field will undergo significant breakthroughs in the next couple of years with the installation of the first ground-based ”planet finders” (SPHERE/VLT, GPI/Gemini, HiCIAO/Subaru) and with the launch of JWST in 2014. In addition to spectral analysis, direct imaging will participate to a more general picture of the planetary systems while exploring longer periods. Observations of giant planets close or beyond the snow line will allow to investigate how they form and evolve.

For the longer term, many ambitious ground-based and space-based projects using smart concepts compete for a major goal, the search and characterization of telluric planets and ultimately the quest for Earth analogs. Improving the understanding of planet formation and evolution in the telluric regime will require new technologies. In that context, many progress have been accomplished in the last years.

In the 1930’s, Bernard Lyot was a pioneer in this field and many of the techniques used today for high contrast imaging derive from his coronagraph concept. In 2007, the ”Lyot Conference” held in Berkeley confronted technological developments with astrophysical requirements. Since then, this field has experienced enough astrophysical and instrumental advances to motivate a second conference. ”In the Spirit of Bernard Lyot 2010” will be held in Paris, in the city where Lyot led his career.

The conference will be focused on direct detection and characterization of exoplanets and circumstellar disks with the following main goals : to cover the astrophysical interests of direct imaging; to provide the status of the current and the next generation of direct imaging instruments (Planet finders, JWST, ...); to build up on this experience for

the planning of new instruments for the next decade (ELTs, space based telescopes, interferometers ...); to explore the synergies with other direct detection techniques, in particular transit spectroscopy.
We encourage students and postdoc to participate and some limited grants will be made available.

Important deadlines :
- 1st announcement : March 9th, 2010
- 2nd announcement : late April, 2010
- abstract submission : June 4th, 2010
- early registration : September 6th, 2010
- late registration : anytime before the conference

SOC :
Anthony Boccaletti (chair) : LESIA / CNRS - Paris Observatory; Paul Kalas : University of California, Berkeley; Motohide Tamura : National Astronomical Observatory of Japan; Claude Aime : FIZEAU / CNRS - University of Nice; Anne-Marie Lagrange : LAOG / CNRS - University Joseph Fourier; Laurent Mugnier : DOTA / ONERA; Markus Kasper : ESO; Ren Doyon : University of Montral; Hans Martin Schmid : ETH Zurich; Giovanna Tinetti : University College of London.

LOC :
Pierre Baudoz : LESIA / CNRS - Paris Observatory; Daniel Rouan : LESIA / CNRS - Paris Observatory; Jean-Luc Beuzit : LAOG / CNRS - University Joseph Fourier; Gal Chauvin : LAOG / CNRS - University Joseph Fourier; Anthony Boccaletti : LESIA / CNRS - Paris Observatory; Grard Rousset : LESIA / CNRS - Paris Observatory; Florence Henry : LESIA / CNRS - Paris Observatory; Sylvain Cnudde : LESIA / CNRS - Paris Observatory; Christle Carette : ONERA.

Download/Website: `http://lyot2010.lesia.obspm.fr`

4 Jobs and positions

PhD positions in the field of extra-solar planets

Nuno Santos
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Porto, Deadline for application 31th May 2010

The Centro de Astrofisica da Universidade do Porto (CAUP) opens a call for 3 PhD student positions. The positions are offered in the context of the Starting Grant ”Extra-solar planets and stellar astrophysics: towards the detection of Other Earths” funded by the European Community/European Research Council under the FP7 Ideas programme. The positions, with a maximum duration of 4 years, are open in the field of extra-solar planets, and are to be started from the 1st of October 2010.
The PhD fellowship (according to the rules of the National Science Foundation FCT) have an yearly income of nearly 12000 euros, tax free. Funds for travelling (conferences, collaborations, observing missions) are also available.
The above mentioned research is to be seen in the context of the participation in the project of the ESPRESSO@VLT instrument (http://espresso.astro.up.pt), a new high resolution ultra stable spectrograph for the VLT/ESO.

Download/Website: `http://www.astro.up.pt/caup/index.php?WID=141&Lang=uk&CID=1&ID=56`

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5 As seen on astro-ph

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

Exoplanets

astro-ph/1003.0277: **The Extraterrestrial Life debate in different cultures** by *Jean Schneider*

astro-ph/1003.0340: **Orbital period variations of hot-Jupiters caused by the Applegate effect** by *C. A. Watson, T. R. Marsh*

astro-ph/1003.0405: **Higher depletion of lithium in planet host stars: no age and mass effect** by *S. G. Sousa, J. Fernandes, G. Israelian et al*

astro-ph/1003.0421: **The Mass of HD 38529 c from Hubble Space Telescope Astrometry and High-Precision Radial Velocities** by *G. Fritz Benedict, Barbara E. McArthur, Jacob L. Bean et al*

astro-ph/1003.0457: **Lack of Transit Timing Variations of OGLE-TR-111b: A re-analysis with six new epochs** by *E. R. Adams, M. Lopez-Morales, J. L. Elliot et al*

astro-ph/1003.0541: **Evaluating the stability of atmospheric lines with HARPS** by *P. Figueira, F. Pepe, C. Lovis et al*

astro-ph/1003.0570: **Stable and habitable systems with two giant planets** by *Vera Dobos, Imre Nagy, Judit Orgovnyi*

astro-ph/1003.0633: **Pervasive Orbital Eccentricities Dictate the Habitability of Extrasolar Earths** by *Ryosuke Kita, Frederic A. Rasio, Genya Takeda*

astro-ph/1003.1169: **Properties of Microlensing Central Perturbations by Planets in Binary Stellar Systems under the Strong Finite-Source Effect** by *Sun-Ju Chung, Byeong-Gon Park*

astro-ph/1003.1207: **Habitable Zones of Host Stars During the Post-MS Phase** by *Jianpo Guo, Fenghui Zhang, Xianfei Zha*

astro-ph/1003.1222: **Habitable Zones and UV Habitable Zones around Host Stars** by *Jianpo Guo, Fenghui Zhang, Xianfei Zhang et al*

astro-ph/1003.1279: **Two new variable stars observed in the field of the extrasolar planet host star WASP-3** by *M. Damasso, A. Carbognani, P. Calcidese et al*

astro-ph/1003.1301: **Photometric observation of transiting extrasolar planet WASP - 10b** by *Tereza Krejcova, Jan Budaj, Viktoria Krus*

astro-ph/1003.1368: **Probability Distribution of Terrestrial Planets in Habitable Zones around Host Stars** by *Jianpo Guo, Fenghui Zhang, Xuefei Ch*

astro-ph/1003.1662: **A simple model of the reflection effect for the interacting binaries and extrasolar planets** by *Jan Budaj*

astro-ph/1003.1762: **Transit Observations of the WASP-10 System** by *Jason A Dittmann, Laird M Close, Louis J Scuderi*

astro-ph/1003.2137: **The Capture of Trojan Asteroids by the Giant Planets During Planetary Migration** by *P. S. Lykawka, J. Horner*

astro-ph/1003.2206: **Evaporation of the planet HD189733b observed in HI Lyman-alpha** by *G. Torres, G. A. Bakos, J. Hartman et al*

astro-ph/1003.2211: **HAT-P-14b: A 2 Jupiter-mass exoplanet transiting a bright F star** by *G. Torres, G. A. Bakos, J. Hartman et al*

astro-ph/1003.2268: **Spin-Orbit Alignment of the TrES-4 Transiting Planetary System and Possible Additional Radial Velocity Variation** by *Norio Narita, Bun'ei Sato, Teruyuki Hirano et al*

astro-ph/1003.2763: **On the Orbit of Exoplanet WASP-12b** by *Christopher J. Campo, Joseph Harrington, Ryan A. Hardy et al*

astro-ph/1003.3032: **A Common Proper Motion Companion to the Exoplanet Host 51 Pegasi** by *J. Greaves*
astro-ph/1003.3308: **The Dynamics of Three-Planet Systems: an Approach from Dynamical System** by *Bungo Shikita, Hiroko Koyama, Shoichi Yamada*
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