ExoPlanet News
An Electronic Newsletter

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Editors: Andrew J. Norton
Glenn J. White
Dept. of Physics & Astronomy, The Open University, Milton Keynes MK7 6AA, UK
exoplanet@open.ac.uk, http://exoplanet.open.ac.uk/

Contents

1 Editorial

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

This newsletter covers a wide range of related research topics, ranging from discoveries and observations of exoplanets, protostellar disks, theoretical simulations of planet formation, exoplanet atmospheres and interiors, comparative planetology, formation and dynamics of planetary systems, planetary evolution and habitability, instrumentation, techniques and missions, origin and evolution of life on terrestrial planets, co-evolution of life, atmospheres and climate, characterisation of terrestrial planets and detection of biomarkers.

Past editions, submission templates and other information can be found at the ExoPlanet News website: http://exoplanet.open.ac.uk

We do however rely on you, the subscribers of the newsletter, to send us your abstracts of recent papers, conference announcements, thesis abstracts, job adverts etc. Please send anything relevant to exoplanet@open.ac.uk, and it will appear in the next edition which we plan to send out close to the beginning of each calendar month. Please let us know of anything else you would like to see appear in the Newsletter.

This Newsletter follows the announcement by the European Space Agency of candidate missions for further assessment and consideration for launch in 2017/2018, which includes the PLATO (PLAnetary Transits and Oscillations of stars) mission. Other exoplanet missions, such as DARWIN, will remain under technical study for consideration for one of the later launch slots in the programme.

Best wishes
Glenn White & Andrew Norton

2 Abstracts of refereed papers

An $m \sin i = 24$ Earth Mass Planetary Companion To The Nearby M Dwarf GJ 176

M. Endl[1]*, W.D. Cochran*[1]*, R.A. Wittenmyer*[2]*, A.P. Boss*[3]

[1] McDonald Observatory, University of Texas at Austin, USA
[2] Department of Astronomy, University of Texas at Austin, USA
[3] Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, D.C., USA

Astrophysical Journal, in press (arXive:0709.0944)

We report the detection of a planetary companion with a minimum mass of $m \sin i = 0.0771\ \mathrm{M_{Jup}} = 24.5\ \mathrm{M_{\oplus}}$ to the nearby ($d = 9.4$ pc) M2.5V star GJ 176. The star was observed as part of our M dwarf planet search at the Hobby-Eberly Telescope (HET). The detection is based on 5 years of high-precision differential radial velocity (RV) measurements using the High-Resolution-Spectrograph (HRS). The orbital period of the planet is 10.24 d. GJ 176 thus joins the small (but increasing) sample of M dwarfs hosting short-periodic planets with minimum masses in the Neptune-mass range. Low mass planets could be relatively common around M dwarfs and the current detections might represent the tip of a rocky planets population.

Download/Website: `http://austral.as.utexas.edu/planets/gj176/gj176.html`

Contact: `mike@astro.as.utexas.edu`

Five Planets Orbiting 55 Cancri

D.A. Fischer[1], G. Marcy[2], R.P. Butler[3], S.S. Vogt[4], G. Laughlin[4], G.W. Henry[5]

[1] Department of Physics and Astronomy, San Francisco State University, San Francisco, CA, USA 94132
[2] Department of Astronomy, University of California, Berkeley, CA USA 94720-3411
[3] Department of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Rd NW, Washington DC, USA 20015-1305
[4] UCO/Lick Observatory, University of California at Santa Cruz, Santa Cruz, CA, USA 95064
[5] Center of Excellence in Information Systems, Tennessee State University, 3500 John A. Merritt Blvd, Box 9501, Nashville, TN 37209

Astrophysical Journal, in press

We report 18 years of Doppler shift measurements of a nearby star, 55 Cancri, that exhibit strong evidence for five orbiting planets. The four previously reported planets are strongly confirmed here. A fifth planet is presented here, with an apparent orbital period of 260.8 days, placing it 0.783 AU from the star in the large empty zone between two other planets. The velocity wobble amplitude of 4.7 meters/sec implies a minimum planet mass Msini = 45 Earth masses. The orbital eccentricity of 0.07 keeps the planet within the classical habitable zone of the star throughout its orbit. All five planets reside in nearly circular orbits, four having eccentricities under 0.1. The outermost planet orbits 5.8 AU from the star and has a minimum mass, Msini = 3.8 Jupiter masses, making it more massive than the inner four planets combined. Its orbital distance is the largest for an exoplanet with a well defined orbit. The innermost planet has a semi-major axis of only 0.038 AU and has a minimum mass, Msini, of only 10.7 Earth masses, one of the lowest mass exoplanets known. The five known planets (with none more massive within 6 AU) defines a *minimum mass protoplanetary nebula* to compare with the classical minimum mass solar nebula. Numerical N-body simulations show this system of five planets to be dynamically stable and that the planets with periods of 14.6 and 44.3 d are not in a mean-motion resonance. High-precision millimagnitude photometry during 11 years reveals no brightness variations at any of the radial velocity periods, providing support for their interpretation as planetary.

Contact: gmarcy@berkeley.edu

Predicting low-frequency radio fluxes of known extrasolar planets

J.–M. Grießmeier[1], P. Zarka[1], H. Spreeuw[2]

[1] LESIA, Observatoire de Paris, CNRS, UPMC, Université Paris Diderot; 5 Place Jules Janssen, 92190 Meudon, France
[2] Astronomical Institute "Anton Pannekoek", Kruislaan 403, 1098 SJ Amsterdam, Netherlands

Astronomy & Astrophysics, published (2007A&A...475..359G)

Context: Close-in giant extrasolar planets ("Hot Jupiters") are believed to be strong emitters in the decametric radio range. Aims: We present the expected characteristics of the low-frequency magnetospheric radio emission of all currently known extrasolar planets, including the maximum emission frequency and the expected radio flux. We also discuss the escape of exoplanetary radio emission from the vicinity of its source, which imposes additional constraints on detectability. Methods: We compare the different predictions obtained with all four existing analytical models for all currently known exoplanets. We also take care to use realistic values for all input parameters. Results: The four different models for planetary radio emission lead to very different results. The largest fluxes are found for the *magnetic* energy model, followed by the *CME* model and the *kinetic* energy model (for which our results are found to be much less optimistic than those of previous studies). The *unipolar interaction* model does not predict any observable emission for the present exoplanet census. We also give estimates for the planetary magnetic dipole moment of all currently known extrasolar planets, which will be useful for other studies. Conclusions: Our results show that observations of exoplanetary radio emission are feasible, but that the number of promising targets is not very high. The catalog of targets will be particularly useful for current and future radio observation campaigns (e.g. with the VLA, GMRT, UTR-2 and with LOFAR).
Appendices A and B are only available in electronic form at http://www.aanda.org. Table 1 is only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/cgi-bin/qcat?J/A+A/475/359

Download/Website: http://cdsweb.u-strasbg.fr/cgi-bin/qcat?J/A+A/475/359
http://www.aanda.org/articles/aa/pdf/2007/43/aa7397-07.pdf

Contact: jean-mathias.griessmeier@obspm.fr

Formation of Terrestrial Planets from Protoplanets. II. Statistics of Planetary Spin

E. Kokubo[1], *S. Ida*[2]

[1] National Astronomical Observatory of Japan
[2] Tokyo Institute of Technology

Astrophysical Journal, 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. The initial spin state of terrestrial planets is determined at this stage. We statistically investigate the spin parameters of terrestrial planets assembled from protoplanets using N-body simulations. As initial conditions, we adopt the oligarchic growth model of protoplanets. For the standard disk model, typically two Earth-sized planets form in the terrestrial planet region. We find that the spin angular velocity of the planets is well expressed by a Gaussian distribution and their obliquity is well expressed by an isotropic distribution. The typical spin angular velocity is given by the critical spin angular velocity for rotational instability under the assumption of perfect accretion in collisions. We show the dependencies of the spin parameters on the initial protoplanet system parameters. The initial orbital separation and velocity anisotropy of protoplanets barely affect the spin parameters. The bulk density of protoplanets does not affect the obliquity distribution, while the spin angular velocity increases with the bulk density.

Contact: kokubo@th.nao.ac.jp

Long-Term Collisional Evolution of Debris Disks

T. Löhne[1], *A. V. Krivov*[1], *J. Rodmann*[2]

[1] Astrophysikalisches Institut und Universitätssternwarte, Friedrich Schiller Universität Jena, Schillergäßchen 2–3, 07745 Jena, Germany
[2] SCI-SA, Research and Scientific Support Department of ESA, ESTEC, 2200 AG Noordwijk, The Netherlands

Astrophysical Journal, in press (astro-ph/0710.4294)

Infrared surveys indicate a tendency of debris disks to gradually decline with the stellar age. The process is attributed to the long-term collisional depletion of planetesimal populations that produce visible dust through a collisional cascade. We simulated the long-term evolution of debris disks around solar-type (G2V) stars with our collisional code. The numerical results were supplemented by, and interpreted through, a new analytic model. A few general scaling rules for the disk evolution are suggested. The timescale of the collisional evolution is inversely proportional to the initial disk mass and scales with radial distance as $\propto r^{4.3}$ and with eccentricities of planetesimals as $\propto e^{2.3}$. Further, we show that at actual ages of debris disks between $\sim$10 Myr and $\sim$10 Gyr, the decay of the dust mass and the total disk mass follow different laws. The reason is that, in all conceivable debris disks, the largest planetesimals have longer collisional lifetimes than the system's age, and therefore did not have enough time to reach collisional equilibrium. The mass of visible dust at any instant of time is determined by planetesimals of intermediate size, whose collisional lifetime is comparable with the current age of the system, with that "transitional" size gradually increasing with time. The decay rate of the dust mass is primarily determined by the "primordial" size distribution of largest planetesimals, which has been set up at their accretion phase, and by the size distribution of somewhat smaller, yet gravity-dominated, planetesimals that have already undergone sufficient collisional evolution. Under standard assumptions, the dust mass, fractional luminosity, and thermal fluxes all decrease as t^{ξ} with $\xi = -0.3 \ldots -0.4$. Specific decay laws of the total disk mass and the dust mass, including the value of ξ, largely depend on a few model parameters, such as the critical fragmentation energy as a function of size, the "primordial" size distribution

of largest planetesimals, as well as the characteristic eccentricity and inclination of their orbits. Assuming standard material prescriptions and a distribution of disk masses and extents, a synthetic population of disks generated with our analytic model agrees quite well with the observed Spitzer/MIPS statistics of 24 and 70 micron fluxes and colors versus age.

Download/Website: `http://arxiv.org/abs/0710.4294`

Contact: `tloehne@astro.uni-jena.de`

WASP-3b: a strongly-irradiated transitting gas-giant planet

D. Pollacco[1], I. Skillen[7], A. Collier Cameron[2], B. Loeillet[11], H.C. Stempels[2], F. Bouchy[12,13], N.P. Gibson[1], L. Hebb[2], G. Hebrard[12], Y.C. Joshi[1], I. McDonald[5], B. Smalley[5], A.M.S. Smith[2], R.A. Street[1,15], S. Udry[10], R.G. West[3], D.M. Wilson[5], P.J. Wheatley[9], S. Aigrain[6], C.R. Benn[7], V.A. Bruce[2], D.J. Christian[1], W.I. Clarkson[4,14], B. Enoch[4], A. Evans[5], A.Fitzsimmons[1], C.A. Haswell[4], C. Hellier[5], S. Hickey[7,16], S.T. Hodgkin[6], K. Horne[2], M. Hrudkova[7,17], J. Irwin[6], S.R. Kane[7], F.P. Keenan[1], T.A. Lister[2,5,15], P. Maxted[5], M. Mayor[10], C. Moutou[11], A.J. Norton[4], J. P. Osborne[3], N. Parley[4], F. Pont[10], D. Queloz[10], R. Ryans[1], E. Simpson[1]

[1] Astronomy Research Centre, School of Mathematics and Physics, Queen's University Belfast, University Road, Belfast, BT7 1NN, UK
[2] School of Physics & Astronomy, University of St. Andrews, North Haugh, St. Andrews, Fife, KY16 9SS, UK
[3] Department of Physics & Astronomy, University of Leicester, Leicester, LE1 7RH, UK
[4] Department of Physics & Astronomy, The Open University, Milton Keynes, MK7 6AA, UK
[5] Astrophysics Group, School of Chemistry & Physics, Keele University, Staffordshire, ST5 5BG, UK
[6] Institute of Astronomy, University of Cambridge, Madingley Road, Cambridge, CB3 0HA, UK
[7] Isaac Newton Group of Telescopes, Apartado de correos 321, E-38700 Santa Cruz de la Palma, Tenerife, Spain
[8] Department of Astronomy, University of Florida, 211 Bryant Space Center, Gainesville, FL 32611–2055, USA
[9] Department of Physics, University of Warwick, Coventry CV4 7AL, UK
[10] Observatoire de Genève, Université de Genève, 51 Ch. des Maillettes, 1290 Sauverny, Switzerland
[11] Laboratoire d'Astrophysique de Marsailles, BP 8, 13376 Marseille Cedex 12, France
[12] Institute d'Astrophysique de Paris, CNRS (UMR 7095) – Université Pierre et Marie Curie, 98^{bis} bvd. Arago, 75014 Paris, France
[13] Observatoire de Haute-Provence, 04870 St Michel l'Observatoire, France
[14] STScI, 3700 san Martin Drive, Baltimore, MD 21218, USA
[15] Las Cumbres Observatory, 6740 Cortona Dr. Suite 102, Santa Barbara, CA 93117, USA
[16] Centre for Astrophysics, Science and Technology Research Institute, University of Hertfordshire, Hatfield, AL10 9AB, UK
[17] Astronomical Institute, Charles University Prague, V Holesovickach 2, CZ-180 00 Praha, Czech Republic

Monthly Notices of the Royal Astronomical Society, submitted (arXiv:0711.0126)

We report the discovery of WASP-3b, the third transiting exoplanet to be discovered by the WASP and SOPHIE collaboration. WASP-3b transits its host star USNO-B1.0 1256-0285133 every 1.846834 ± 0.000002 days. Our high precision radial-velocity measurements present a variation with amplitude characteristic of a planetary-mass companion and in-phase with the light-curve. Adaptive optics imaging shows no evidence for nearby stellar companions, and line-bisector analysis excludes faint, unresolved binarity and stellar activity as the cause of the radial-velocity variations. We make a preliminary spectroscopic analysis of the host star finding it to have $T_{rmeff} = 6400 \pm 100$ K and $\log g = 4.25 \pm 0.05$ which suggests it is most likely an unevolved main sequence star of spectral type F7-8V. Our simultaneous modelling of the transit photometry and reflex motion of the host leads us to derive a mass of $1.76^{+0.08}_{-0.14}$ M_J and radius $1.31^{+0.07}_{-0.14}$ R_J for WASP-3b. The proximity and relative temperature of the host star suggests that WASP-3b is one of the hottest exoplanets known, and thus has the potential to place stringent constraints on exoplanet atmospheric models.

Download/Website: `http://uk.arxiv.org/abs/0711.0126`

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

On the likelihood of supernova enrichment of protoplanetary disks

J. P. Williams[1,3], *E. Gaidos*[2,3]

[1] Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822
[2] Department of Geology and Geophysics, University of Hawaii, 1680 East-West Road, Honolulu, HI 96822
[3] NASA Astrobiology Institute, University of Hawaii

Astrophysical Journal Letters, published (vol 663, L33-36)

We estimate the likelihood of direct injection of supernova ejecta into protoplanetary disks using a model in which the number of stars with disks decreases linearly with time, and clusters expand linearly with time such that their surface density is independent of stellar number. The similarity of disk dissipation and main sequence lifetimes implies that the typical supernova progenitor is very massive, $\sim 75 - 100\,M_{\odot}$. Such massive stars are found only in clusters with $> 10^4$ members. Moreover, there is only a small region around a supernova within which disks can survive the blast yet be enriched to the level observed in the Solar System. These two factors limit the overall likelihood of supernova enrichment of a protoplanetary disk to $< 1\%$. If the presence of short lived radionucleides in meteorites is to be explained in this way, however, the Solar System most likely formed in one of the largest clusters in the Galaxy, more than two orders of magnitude greater than Orion, where multiple supernovae impacted many disks in a short period of time.

Download/Website: `http://adsabs.harvard.edu/abs/2007ApJ...663L..33W`

Contact: `jpw@ifa.hawaii.edu`

3 Abstracts of theses

Characters of extrasolar planets

David Ehrenreich
Laboratoire d'astrophysique de Grenoble, BP53 38041 Grenoble cedex 9, France

PhD Thesis, published (in French)

In slightly more than ten years, several hundreds of planets have been discovered in orbit around other stars than the Sun. Meanwhile, very little is known about the nature of these exoplanets, at the exception of their masses. Nowadays, we can start characterizing them more precisely: measuring their sizes, thus estimating their mean densities and sketching their internal structures; determining the presence of an atmosphere and its composition. In this thesis, we associate observations obtained with various techniques to theoretical modeling in order to describe different kinds of exoplanets. Comparing observations from the *Spitzer Space Telescope*, which we are analyzing, to a prediction model, we search for atmospheric water vapour in the hot Jupiter HD 189733b. We also obtain accurate measurements of the planetary radius, the stellar radius, and the impact parameter at 3.6 and 5.8 μm. Next, we use internal structure and protoplanetary disk models to constrain the nature of OGLE 2005-BLG-390Lb, a light and cold planet detected through gravitational microlensing. We show that an ocean could have existed underneath an ice shell on this planet, now entirely frozen, and examine the possible composition of the ice. We propose that such properties could be shared by many other worlds throughout the Galaxy. Finally, we describe a limb transmission model to simulate theoretical spectra of transiting Earth-size planets, and conclude that ocean-planets around late-type stars would be the best possible targets for a future space mission aimed at characterizing exoplanets.

Download/Website: `http://tel.archives-ouvertes.fr/tel-00181150/en/thesis.pdf`

Contact: `david.ehrenreich@obs.ujf-grenoble.fr`

4 Conference announcements

Les Houches School announcement

T. Montmerle, A.-M. Lagrange
Laboratoire d'Astrophysique de Grenoble, France

Winter School announcement,

The "Laboratoire d'Astrophysique de Grenoble" (LAOG) is organizing next February a 2-week winter school in Les Houches, near Chamonix in the French Alps, entitled "Physics and Astrophysics of Planetary Systems".
The rapidly increasing number of extrasolar planets detected (more than 250) and the extreme diversity of their known properties (mass, orbits, distribution, metallicities, etc.) shows that our Solar System is anything but typical of planetary systems. This diversity enables an access both to the different stages of the planet formation processes and to a large range of physical conditions prevailing in the evolution of different planetary systems. This includes the evolution of gaseous and dusty circumstellar disks, the migration and accretion phases, or phases corresponding in the Solar System to the primitive Solar nebula and the forming Earth (early atmosphere and oceans).
Our thread is therefore a global approach towards the physical processes governing the formation and evolution of planetary systems, including the Solar System and "lessons learned" from it, up to the first steps towards life. Observations, instrumentation, and, whenever possible, laboratory experiments, are part of this approach.
The audience targeted by the school consists mainly of PhD students, post-docs, and also researchers seeking a complementary culture, or even evolving towards new research topics. In the well-established "Les Houches School of Physics" tradition, we have chosen a 2-week duration to allow a wide coverage of the scientific topics, as well as ample time for discussions.

Download/Website: `http://www-laog.obs.ujf-grenoble.fr/heberges/Houches08/index.htm`

Contact: `houchesplanets@ujf-grenoble.fr`

5 Jobs and positions

PLANETARY SCIENCE - tenure stream positions at University of Toronto, Scarborough

Artymowicz, P.
Department of Physical and Environmental Sciences (DPES), University of Toronto Scarborough, Canada

Job announcement,

The Department of Physical and Environmental Sciences (DPES) at the University of Toronto Scarborough (UTSC) invites applications for two tenure track positions in the field of planetary physics. We seek outstanding applicants from a broad range of disciplines related to the study of solar system objects and planets. The positions will enhance an initiative within the department's Planetary Physics group to expand its research activity in fields related to the structure, dynamics, origin and evolution of planets and planetary systems. Our department is home to chemical, environmental and planetary sciences researchers (cf. http://www.utsc.utoronto.ca/˜physsci/). The applications should reflect how candidates would integrate in this environment. We encourage applications from candidates with theoretical, computational, experimental or combined research interests. High performance computing is supported within the Department through access to the UTSC and other computing grids. The positions are expected to be filled at the level of Assistant Professor. The successful candidates will hold a graduate appointment in the Department of Physics or Astronomy and Astrophysics of U of T. Excellent opportunities for collaboration with these departments

and CITA exist. Salary will be commensurate with qualifications and experience. A negotiable starting date is July 1, 2008.
Applications will be accepted until January 15, 2008. For the full description of the position and application (required documents) please see the DPES page http://www.utsc.utoronto.ca/˜physsci/jobs/faculty.shtml . Informal inquiries are welcome by Prof. P. Artymowicz at pawel@utsc.utoronto.ca.

Download/Website: `http://www.utsc.utoronto.ca/~physsci/jobs/faculty.shtm`

Contact: `pawel@utsc.utoronto.ca`

Reinhardt Postdoctoral Fellowship in Astronomy and Astrophysics at University of Toronto

Jayawardhama, R.
Dept. of Astronomy & Astrophysics, 50 St. George Street, Toronto, ON M5S 3H4 Canada

Job announcement,

The Department of Astronomy and Astrophysics, University of Toronto, invites applications for the Reinhardt Postdoctoral Fellowship in Astronomy and Astrophysics.
The Reinhardt Fellow is expected to carry out original research in astronomy and astrophysics, independently or in collaboration with Toronto faculty, postdoctoral fellows or students. The fellowship includes funds for research and travel expenses.
Exceptional candidates in all areas of astronomy and astrophysics, theoretical, observational, instrumental, and experimental, are encouraged to apply.
The Department is active in BLAST, MOST, BRITE, the Herschel Space Observatory, the Planck Surveyor, SPIDER, and JWST, hosts the Canadian Scientific Centre for the Canada-France-Hawaii Legacy Survey, enjoys access to many national telescopes as well as the Dupont Telescope, and is advancing Canadian plans for a share of a large optical telescope, TMT. The Department has strong ties with the Canadian Institute for Theoretical Astrophysics. Major computing capacity is available in CITA's multi-teraflop cluster and the university's new HPC facility SciNet.
The expected starting date is 1 September 2008. The appointment is for two years, with an expectation of renewal for a third on satisfactory performance. Applicants should send a curriculum vitae, bibliography, and statement of research interests, and arrange to have three letters of recommendation sent to the above address by 1 December 2007. Further information about the University of Toronto can be obtained through the above URL.
Faculty members in Toronto with interests in exoplanet research include Pawel Artymowicz, Ray Jayawardhana, Norm Murray and Yanqin Wu.
The closing date for receipt of applications: 2007 Dec 1
Tel: 416-978-3150; FAX: 416-971-2026

Download/Website: `http://www.astro.utoronto.ca`

Contact: `yuen@astro.utoronto.ca , chair@astro.utoronto.ca`

Postdoctoral Research in Extrasolar Planet Detection and/or Planet Formation Theory

Eric B. Ford
Dept. of Astronomy, University of Florida, 211 Bryant Space Science Center, Gainesville, FL 32611, USA

Job announcement,

Applications are invited for a postdoctoral research position in the Astronomy Department at the University of Florida. The successful applicant will collaborate with Eric Ford on research relating to extrasolar planets and/or planet formation. Possible research programs include formation and evolution of planetary systems, statistical analyses of planetary systems and planet searches, and observational techniques for studying planetary systems. The successful applicant will be encouraged to develop new initiatives in-line with their own research interests and to participate in the department's intellectual activities. Closely related research at UF currently includes exoplanet searches, planetary dynamics, star formation, planetary atmospheres, and instrumentation. UF has deployed a large computer cluster and is a partner in the 10.4m Gran Telescopio Canarias Observatory.
Position includes a competitive salary, health benefits, and research funds. The appointment is expected to begin Fall 2008, with renewal each year contingent on satisfactory performance, needs of the College, and available funding. Candidates should have obtained a Ph.D. in a relevant field by starting date.
Applications should include a CV, publications list, summary of research accomplishments, interests and plans, and names and email addresses of three references. Candidates are responsible for ensuring that their references send a letter of recommendation. All application materials should be mailed or emailed directly to Eric Ford (eford+postdoc08@astro.ufl.edu) and should be received no later than January 4, 2008 to ensure full consideration. Women and underrepresented minorities are strongly encouraged to apply.
The University of Florida is an equal opportunity institution.

Download/Website: `http://www.astro.ufl.edu/~eford/mystuff/jobadford2008.html`

Contact: `eford+postdoc08@astro.ufl.edu`

6 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during October 2007. If you spot any that we missed, let us know and we'll include them in the next issue.

Exoplanets

arXiv:0709.4493: **Searching for Planetary Transits in Star Clusters** by *Weldrake, D.*
arXiv:0710.0378 : **Inflated planets and their low-mass companions** by *Mardling, Rosemary*
arXiv:0710.0898 : **HD 17156b: A Transiting Planet with a 21.2 Day Period and an Eccentric Orbit** by *Barbieri, M. et al.*
arXiv:0710.0686: **Habitability of Planets in Binaries** by *Haghighipour, Nader*
arXiv:0710.1167: **Planetary Stability Zones in Hierarchical Triple Star Systems** by *Verrier, P. and Evans, N.*
arXiv:0710.2318: **Planetesimal Formation with Particle Feedback** by *Youdin, A. & Johansen, A.*
arXiv:0710.2366: **New Worlds on the Horizon: Earth-Sized Planets Close to Other Stars** by *Gaidos, Eric et al.*
arXiv:0710.2894: **HAT-P-6b: A Hot Jupiter transiting a bright F star** by *Noyes, R.W. et al.*
arXiv:0710.2864: **The Outer Cut-Off of the Giant Planet Population and the 6pc-Survey** by *Apai, D. et al.*
arXiv:0710.2558: **A Unified Theory for the Atmospheres of the Hot and Very Hot Jupiters: Two Classes of Irradiated Atmospheres** by *Fortney, Jonathan J. et al.*

arXiv:0710.2930: **Atmospheric Circulation of Hot Jupiters: A Review of Current Understanding** by *Showman, Adam P; Menou, Kristen; Cho, James Y.K.*
arXiv:0710.2904: **Planets Around Massive Subgiants** by *Johnson, John A.*
arXiv:0710.3534: **Influence of stellar X-ray luminosity distribution and its evolution on exoplanetary mass loss** by *Penz, T.; Micela, G.; Lammer, H.*
arXiv:0710.3461: **The Frequency of Large Radius Hot and Very Hot Jupiters in omega Centauri** by *Weldrake, David T.F.; Sackett, Penny D.; Bridges, Terry J.*
arXiv:0710.3730): **Can Terrestrial Planets Form in Hot-Jupiter Systems?** by *Fogg, Martyn J.; Nelson, Richard P.*
arXiv:0710.4068: **Close-up of primary and secondary asteroseismic CoRoT targets and the ground-based follow-up observations** by *Uytterhoeven, K. et al.*
arXiv:0710.4145: **Observations of Extrasolar Planets During the non-Cryogenic Spitzer Space Telescope Mission** by *Deming, Drake; Agol, Eric; Charbonneau, David*
arXiv:0710.4407: **Planetesimal accretion in binary star systems** by *Marzari, Francesco; Thebault, Philippe; Scholl, Hans*
arXiv:0710.4883: **The transiting exoplanet host star GJ 436: a test of stellar evolution models in the lower main sequence, and revised planetary parameters** by *Torres, Guillermo*
arXiv:0710.4941: **Ocean Planet or Thick Atmosphere: On the Mass-Radius Relationship for Solid Exoplanets with Massive Atmospheres** by *Adams, E.R.; Seager, S.; Elkins-Tanton, L.*
arXiv:0710.5028: **The CORALIE survey for southern extra-solar planets XV. Discovery of two eccentric planets orbiting HD4113 and HD156846** by *Tamuz, O. et al.*
arXiv:0710.5294: **Habitable planets around the star Gl 581?** by *Selsis, Franck; Kasting, J.F.; Levrard, B.*
arXiv:0710.5306: **Limits on further planetary companions to OGLE-2005-BLG-390L** by *Kubas, D. et al.*
arXiv:0710.5440: **The long-term stability of extrasolar system HD 37124. Numerical study of resonance effects** by *Gozdziewski, Krzysztof; Breiter, Slawomir; Borczyk, Wojciech*
arXiv:0710.5278: **A transiting planet among 23 new near-threshold candidates from the OGLE survey - OGLE-TR-182** by *Pont, F. et al.*
arXiv:0710.5667: **Giant Planet Formation by Core Accretion** by *Mordasini, Christoph et al.*

Dusty, Debris and Circumstellar Disks

arXiv:0710.0839: **Circumstellar Dust Created by Terrestrial Planet Formation in HD 113766** by *Lisse, C.M. et al.*
arXiv:0710.2807: **Metal-rich debris discs around white dwarfs** by *Gaensicke, B.T.; Marsh, T.R.; Southworth, J.*
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