ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the twenty-first edition of ExoPlanet News, an electronic newsletter reporting the latest developments and research outputs in the field of exoplanets. After our experiment with figures in the last issue, we are pleased to include more figures this month where authors have submitted them. This will now become a regular feature!

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 . As ever, we rely on you, the subscribers of the newsletter, to send us your abstracts of recent papers, conference announcements, thesis abstracts, job adverts etc for each edition.

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 September 2009. As for this issue, if you wish to include ONE figure per abstract, please do so.

Best wishes
Andrew Norton & Glenn White
The Open University

2 Abstracts of refereed papers

General Analysis of Type I Planetary Migration with Stochastic Perturbations

Fred C. Adams[1,2] *and Anthony M. Bloch*[1,3]

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Astrophysical Journal, in press, arXive:0906.4030

This paper presents a generalized treatment of Type I planetary migration in the presence of stochastic perturbations. In many planet-forming disks, the Type I migration mechanism, driven by asymmetric torques, acts on a short time scale and compromises planet formation. If the disk also supports MHD instabilities, however, the corresponding turbulent fluctuations produce additional stochastic torques that modify the steady inward migration scenario. This work studies the migration of planetary cores in the presence of stochastic fluctuations using complementary methods, including a Fokker-Planck approach and iterative maps. Stochastic torques have two main effects: [1] Through outward diffusion, a small fraction of the planetary cores can survive in the face of Type I inward migration. [2] For a given starting condition, the result of any particular realization of migration is uncertain, so that results must be described in terms of the distributions of outcomes. In addition to exploring different regimes of parameter space, this paper considers the effects of the outer disk boundary condition, varying initial conditions, and time-dependence of the torque parameters. For disks with finite radii, the fraction of surviving planets decreases exponentially with time. We find the survival fractions and decay rates for a range of disk models, and find the expected distribution of locations for surviving planets. For expected disk properties, the survival fraction lies in the range $0.01 < p_S < 0.1$.

Contact: fca@umich.edu

Radio Interferometric Planet Search I: First Constraints on Planetary Companions for Nearby, Low-Mass Stars from Radio Astrometry

Geoffrey C. Bower[1]*, Alberto Bolatto*[1,2]*, Eric B. Ford*[1,3]*, Paul Kalas*[1]

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Astrophysical Journal, in press (arXiv:0907.1680)

Radio astrometry of nearby, low-mass stars has the potential to be a powerful tool for the discovery and characterization of planetary companions. We present a Very Large Array survey of 172 active M dwarfs at distances of less than 10 pc. Twenty nine stars were detected with flux densities greater than 100 μJy. We observed 7 of these stars with the Very Long Baseline Array at milliarcsecond resolution in three separate epochs. With a detection threshold of 500 μJy in images of sensitivity $1\sigma \sim 100$ μJy, we detected three stars three times (GJ 65B, GJ896A, GJ 4247), one star twice (GJ 285), and one star once (GJ 803). Two stars were undetected (GJ 412B and GJ 1224). For the four stars detected in multiple epochs, residuals from the optically-determined apparent motions have an rms deviation of ~ 0.2 milliarcseconds, consistent with statistical noise limits. Combined with previous optical astrometry, these residuals provide acceleration upper limits that allow us to exclude planetary companions more massive than $3-6$ M_{Jup} at a distance of ~ 1 AU with a 99% confidence level.

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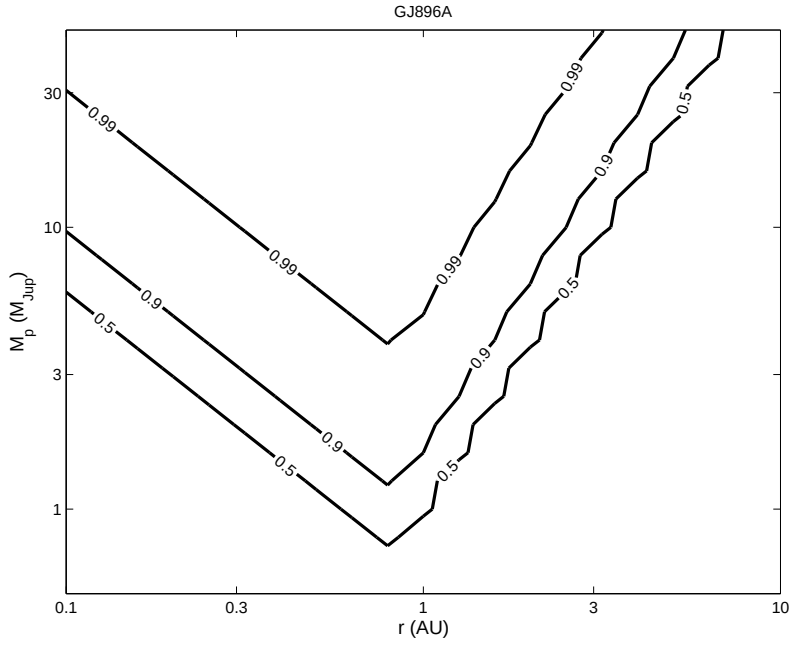

Figure 1: (Bower et al.) Region of planetary mass and radius phase-space rejected by acceleration upper limits for the star GJ 896A. Contours are for parameters for which 99%, 90%, 50%, and 10% of systems would be detected with 3σ confidence. Parameter space above the curves is rejected. Wiggles in the curves are due to logarithmic gridding of the model.

Benefits of Ground-Based Photometric Follow-Up for Transiting Extrasolar Planets Discovered with $Kepler$ and CoRoT

K. D. Colón, E. B. Ford
Department of Astronomy, University of Florida, 211 Bryant Space Science Center, P.O. Box 112055, Gainesville, FL 32611

Astrophysical Journal, in press (arXiv:0907.5193)

Currently, over forty transiting planets have been discovered by ground-based photometric surveys, and space-based missions like $Kepler$ and CoRoT are expected to detect hundreds more. Follow-up photometric observations from the ground will play an important role in constraining both orbital and physical parameters for newly discovered planets, especially those with small radii ($R_p \lesssim 4\ R_\oplus$) and/or intermediate to long orbital periods ($P \gtrsim$ 30 days). Here, we simulate transit light curves from $Kepler$-like photometry and ground-based observations in the near-infrared (NIR) to determine how jointly modeling space-based and ground-based light curves can improve measurements of the transit duration and planet-star radius ratio. We find that adding observations of at least one ground-based transit to space-based observations can significantly improve the accuracy for measuring the transit duration and planet-star radius ratio of small planets ($R_p \lesssim 4\ R_\oplus$) in long-period ($\sim$1 year) orbits, largely thanks to the reduced effect of limb darkening in the NIR. We also demonstrate that multiple ground-based observations are needed to gain a substantial improvement in the measurement accuracy for small planets with short orbital periods ($\sim$3 days). Finally, we consider the role that higher ground-based precisions will play in constraining parameter measurements for typical $Kepler$ targets. Our results can help inform the priorities of transit follow-up programs (including both primary and secondary transit of planets discovered with $Kepler$ and CoRoT), leading to improved constraints for transit durations, planet sizes, and orbital eccentricities.

Download/Website: `http://arxiv.org/abs/0907.5193`

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A Third Exoplanetary System with Misaligned Orbital and Stellar Spin Axes

John Asher Johnson[2,3], Joshua N. Winn[4], Simon Albrecht[4], Andrew W. Howard[5,6], Geoffrey W. Marcy[5], J. Zachary Gazak[2]

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Publications of the Astronomical Society of the Pacific, in press

We present evidence that the WASP-14 exoplanetary system has misaligned orbital and stellar-rotational axes, with an angle $\lambda = 33.1 \pm 7.4$ degrees between their sky projections. The evidence is based on spectroscopic observations of the Rossiter-McLaughlin effect as well as new photometric observations. WASP-14 is now the third system known to have a significant spin-orbit misalignment, and all three systems have "super-Jupiter" planets ($M_P > 3\ \mathrm{M}_{Jup}$) and eccentric orbits. This finding suggests that the migration and subsequent orbital evolution of massive, eccentric exoplanets is somehow different from that of less massive close-in Jupiters, the majority of which have well-aligned orbits.

Download/Website: `http://arxiv.org/abs/0907.5204v1`

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First Results from the CHEPS: Exoplanets and the Discovery of an Eccentric Brown Dwarf in the Desert

J.S. Jenkins[1], H.R.A. Jones[2], K. Gozdziewski[3], C. Migaszewski[3], J.R. Barnes[2], M.I. Jones[1], P. Rojo[1], D.J. Pinfield[2], A.C. Day-Jones[1], S. Hoyer[1]

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MNRAS, in press (arxiv:0905.2985)

We report the discovery of a brown dwarf on an eccentric orbit and with a semimajor axis that places it in the brown dwarf desert region around the star HD191760. The star has a spectral type of G3IV/V and a metallicity ([Fe/H]) of 0.29 dex. HD191760 adds to the small number of metal-rich stars with brown dwarf companions. The brown dwarf (HD191760*b*) is found to have an orbital period of 505.57±0.40 days and semimajor axis of 1.35±0.01 AU, placing it firmly in the brown dwarf desert. The eccentricity of HD191760*b* is found to be 0.64±0.01, meaning it reaches as close as 0.47 AU from the host star. In addition, there is some evidence for a short period (2.11±0.01 days) super-Earth mass planet hidden in the residuals of the large amplitude brown dwarf signature. The signal would have an amplitude of only 2.88±0.01 m/s, giving rise to a planet (HD191760*c*) with a minimum mass of 0.02±0.01 M_J (M sin i∼6 $M_\oplus$), well inside the super Earth regime. Currently the best fit solution gives this planet an eccentricity of 0.43±0.19, which is rather high for such a short period orbit, even considering the tidal interactions from the eccentric brown dwarf, however the radial-velocity data is sparse and of low amplitude, therefore, if confirmed, a circular orbit would be highly probable. HD191760*c* would be the most metal-rich super-Earth hosting star yet discovered. Also, dynamical simulations indicate that no other inner planets could reside at separations beyond ∼0.17 AU due to the disastrous gravity imposed by HD191760*b*. In addition to these first results we also refine the orbits found for the exoplanets around the stars HD48265, HD143361 and HD154672. All 1-planet solutions are in agreement with those previously published by the Magellan Planet Search, however for HD48265 there is merit in employing a 2-planet solution to the dataset, which can give rise to significantly lower values of rms and χ^2_ν.

Download/Website: `http://arxiv.org/abs/0905.2985`

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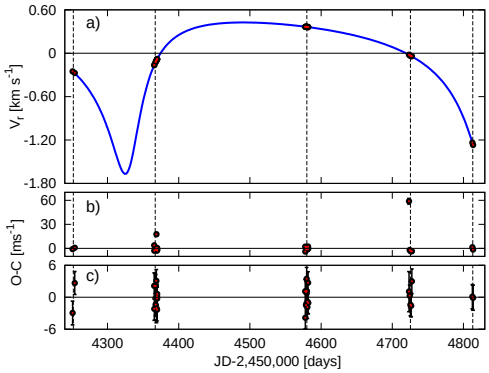

Figure 2: (Jenkins et al.) (a) The best fit Keplerian curve to the radial-velocity dataset *after* a bisector correction has been employed. (b) The residuals to the best fit *before* any bisector correction has been employed and two data points appear far from the fit. (c) The residuals to the best fit shown in (a). This highlights the gain in precision achieved by employing the bisector correction since the two data points far from the fit in (b) have much lower residual velocities.

The Earth-Moon system during the Late Heavy Bombardment period – geochemical support for impacts dominated by comets.

Uffe Graae Jørgensen[1,2], *Peter W.U. Appel*[3], *Yuichi Hatsukawa*[4], *Robert Frei*[5], *Masumi Oshima*[4], *Yosuke Toh*[4], *Atsushi Kimura*[4]

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Icarus, in press; arXiv:0907.4104

The solid planets assembled 4.57 Gyr ago during a period of less than 100 Myr, but the bulk of the impact craters we see on the inner planets formed much later, in a narrow time interval between 3.8 and 3.9 Gyr ago, during the so-called Late Heavy Bombardment (LHB). It is not certain what caused the LHB, and it has not been well known whether the impactors were comets or asteroids, but our present study lend support to the idea that it was comets. Due to the Earth's higher gravity, the impactors will have hit the Earth with ∼twice the energy density that they hit the Moon, and the bombardment will have continued on Earth longer than on the Moon. All solid surface of the Earth will have been completely covered with craters by the end of the LHB.

However, almost nothing of the Earth's crust from even the end of this epoch, is preserved today. One of the very few remnants, though, is exposed as the Isua greenstone belt (IGB) and nearby areas in Western Greenland. During a field expedition to Isua, we sampled three types of metasedimentary rocks, deposited ∼3.8 billion years ago, that contain information about the sedimentary river load from larger areas of surrounding land surfaces (mica-schist and turbidites) and of the contemporaneous seawater (BIF). Our samples show evidence of the LHB impacts that took place on Earth, by an average of a seven times enrichment (150 ppt) in iridium compared to present day ocean crust (20 ppt). The clastic sediments show slightly higher enrichment than the chemical sediments, which may be due to contamination from admixtures of mafic (proto-crustal) sources.

We show that this enrichment is in agreement with the lunar cratering rate and a corresponding extraterrestrial LHB contribution to the Earth's Hadean-Eoarchean crust, provided the bulk of the influx was cometary (i.e., of high velocity and low in CI abundance), but not if the impactors were meteorites (i.e. had velocities and abundances similar to present day Earth crossing asteroids). Our study is a first direct indication of the nature of the LHB impactors, and the first to find an agreement between the LHB lunar cratering rate and the Earth's early geochemical record (and the corresponding lunar record). The LHB comets that delivered the iridium we see at Isua will at the same time have delivered the equivalent of a ∼1 km deep ocean, and we explain why one should expect a cometary ocean to become roughly the size of the Earth's present-day ocean, not only in terms of depth but also in terms of the surface area it covers. The total impacting mass on the Earth during the LHB will have been ∼1000 t/m^2.

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Search for Cold Debris Disks around M-dwarfs. II

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Astronomy and Astrophysics, accepted July 2009 (arXiv:0907.4782)

Although 70% of the stars in the Galaxy are M-dwarfs, thermal emission searches for cold debris disks have been conducted mostly for A-type and solar-type stars. We report on new $\lambda = 1.2$ mm continuum observations of thirty M-dwarfs, using the MAMBO-2 bolometer array camera at the IRAM 30m telescope. For a statistical analysis, we combine these data with our prior SCUBA and MAMBO-2 observations of 20 other M-dwarfs. Our total sample divides in M-dwarfs in moving groups, with relatively young ages, and in nearby M-dwarfs with unknown ages. Only one cold debris disk (GJ842.2) was detected significantly. We compare the implied disk abundance constraints with those found in two comparable submillimeter surveys of 10 to 190 Myr old A- and FGK-type stars. For the 19 youngest (ages less than 200 Myr) M-dwarfs in our sample, we derive a disk fraction of $5.3^{+10.5}_{-5.0}$ %, compared to $15^{+11.5}_{-11.5}$ % for FGK-stars and 22^{+33}_{-20} % for A-stars. Hence, for this age group, there is an apparent trend of fewer cold disks for later stellar types, *i.e.*, lower star masses. Although its statistical significance is marginal, this trend is strengthened by the deeper sensitivity of observations in the M-dwarf sample. We derive a cold disk fraction of < 10 % for the older (likely a few Gyr) M-dwarfs in our sample. Finally, although inconclusively related to a debris disk, we present the complex millimeter structure found around the position of the M1.5 dwarf GJ526 in our sample.

Download/Website: `http://arxiv.org/abs/0907.4782`

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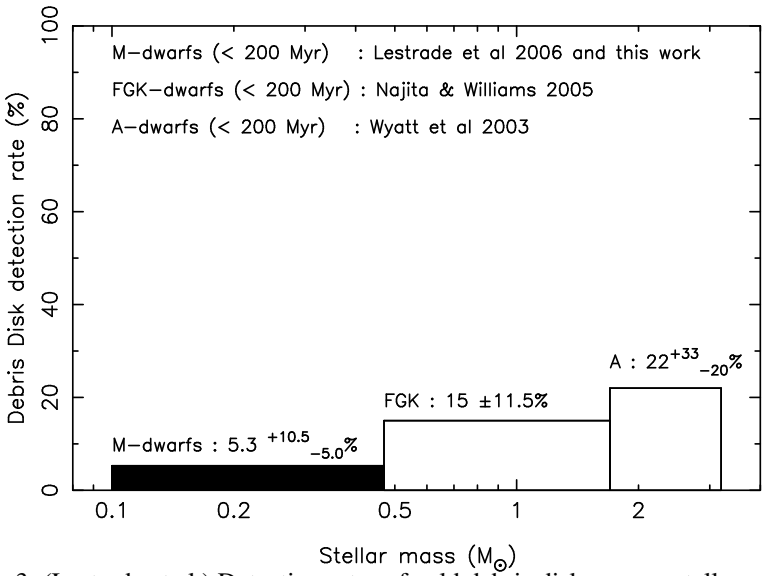

Figure 3: (Lestrade et al.) Detection rates of cold debris disks versus stellar masses (stellar types) for stars younger than 200 Myr.

Transit spectrophotometry of the exoplanet HD189733b. I. Searching for water but finding haze with HST NICMOS

David K. Sing[1], J.-M. Désert[1], A. Lecavelier des Etangs[1], G. E. Ballester[2], A. Vidal-Madjar[1], V. Parmentier[1], G. Hebrard[1], & G. W. Henry[3]

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Astronomy & Astrophysics, in press (arXiv:0907.4991)

We present Hubble Space Telescope near-infrared transit photometry of the nearby hot-Jupiter HD189733b. The observations were taken with the NICMOS instrument during five transits, with three transits executed with a narrowband filter at 1.87 μm and two performed with a narrowband filter at 1.66 μm. Our observing strategy using narrowband filters is insensitive to the usual HST intra-orbit and orbit-to-orbit measurement of systematic errors, allowing us to accurately and robustly measure the near-IR wavelength dependance of the planetary radius. Our measurements fail to reproduce the Swain et al. absorption signature of atmospheric H_2O below $2\mu m$ at a 5σ confidence level. We measure a planet-to-star radius contrast of 0.15498$\pm$0.00035 at 1.66 μm and a contrast of 0.15517$\pm$0.00019 at 1.87 μm. Both of our near-IR planetary radii values are in excellent agreement with the levels expected from Rayleigh scattering by sub-micron haze particles, observed at optical wavelengths, indicating that upper-atmospheric haze still dominates the near-IR transmission spectra over the absorption from gaseous molecular species at least below 2 μm.

Download/Website: `http://arxiv.org/abs/0907.4991`

Contact: `sing@iap.fr`

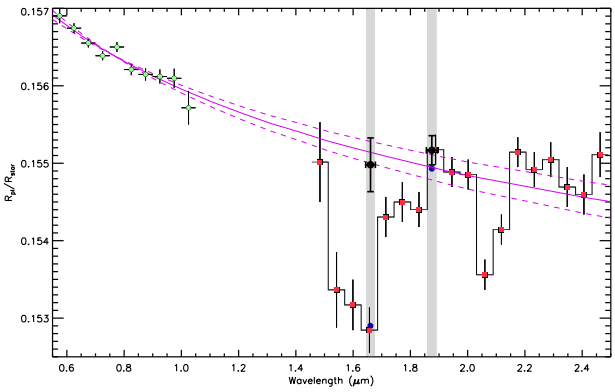

Figure 4: (Sing et al.) Figure. Measured planetary radii for HD189733b at optical and near-infrared wavelengths. Plotted are the results from our NICMOS narrowband photometry (black dots), along with the NICMOS grism spectrum (red squares) from Swain et al. (2008), and ACS grism spectrum (green dots) from Pont et al. (2008). The 1-σ error bars on the fit radii are indicated (y-axis error bars), along with the wavelength range of each observation (x-axis error bars, grey vertical bars). Also plotted (purple) is the prediction by Rayleigh scattering due to haze from Lecavelier et al. (2008a), projected here into the near-infrared along with the 1-σ error on the predicted slope (purple, dashed lines). The NICMOS spectrum from Swain et al. (2008) is quoted as being uncertain in its absolute flux level by $\pm 2\times10^{-4}$ ($\pm$0.00064 $R_{pl}/R_\star$), an offset of -0.00042 $R_{pl}/R_\star$ was applied here for comparison reasons such that the values at 1.87 μm match. Our 1.66μm results are in disagreement with the both the Swain et al. spectra and the expected H_2O atmospheric signature (blue dots), but are in excellent agreement with the predicted planetary radii values from atmospheric haze.

Vertical structure of debris discs

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[2] Astronomy Department, Stockholm University, Sweden

Astronomy & Astrophysics, in press (arXiv:0906.5524)

The vertical thickness of debris discs is often used as a measure of these systems' dynamical excitation and as clues to the presence of hidden massive perturbers such as planetary embryos. However, this argument could be flawed because the observed dust should be naturally placed on inclined orbits by the combined effect of radiation pressure and mutual collisions. We critically reinvestigate this issue and numerically estimate what the "natural" vertical thickness of a collisionally evolving disc is, in the absence of any additional perturbing body. We use a deterministic collisional code, following the dynamical evolution of a population of indestructible test grains suffering mutual inelastic impacts. Grain differential sizes as well as the effect of radiation pressure are taken into account. We find that, under the coupled effect of radiation pressure and collisions, grains naturally acquire inclinations of a few degrees. The disc is stratified with respect to grain sizes, with the smallest grains having the largest vertical dispersion and the bigger ones clustered closer to the midplane. Debris discs should have a minimum "natural" observed aspect ratio $h_{min} \sim 0.04 \pm 0.02$ at visible to mid-IR wavelengths where the flux is dominated by the smallest bound grains. These values are comparable to the estimated thicknesses of many vertically resolved debris discs, as is illustrated with the specific example of AU Mic. For all systems with $h \sim h_{min}$, the presence (or absence) of embedded perturbing bodies cannot be inferred from the vertical dispersion of the disc.

Download/Website: `http://ttt.astro.su.se/~thebault/publist.html/`

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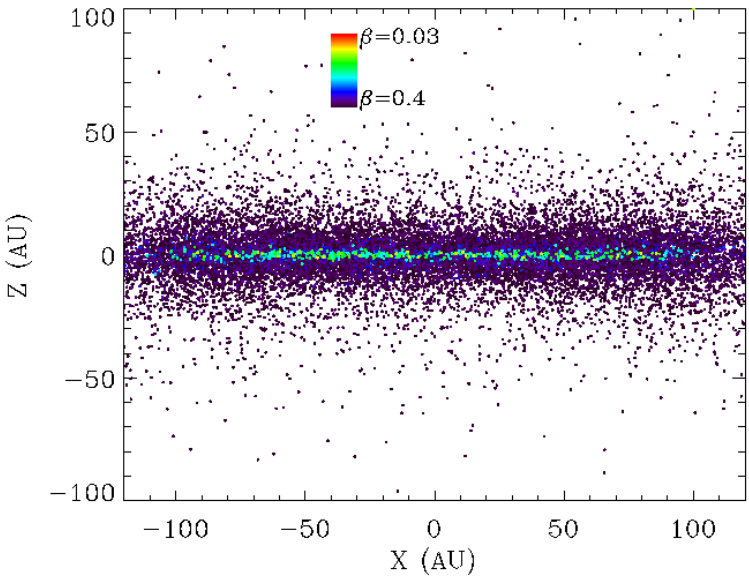

Figure 5: (Thebault) Vertical stratification of a debris disc as a function of dust grain sizes. Sizes are parameterized by β, the ratio of radiation pressure felt by the grain to the stars gravitation ($\beta \geq 0.5$ for unbound grains).

3 Conference announcements

2^{nd} STFC Funded Astrobiology Post-Graduate Summer School

Mark Burchell
Centre for Astrophysics and Planetary Science, Univ. of Kent, Canterbury, Kent, UK

University of Kent, Canterbury, UK, Aug 6 – 11, 2009

The Univ. of Kent will host the 2^{nd} STFC funded post-graduate summer school in astrobiology from Sept. 6^{th} to 11^{th} 2009. Places are available to research students interested in astrobiology even if their thesis topic is not directly related to this. STFC funded research students will receive full funding to attend and partial support may be available for other funded students. Details of the school can be found on the web site http://astro.kent.ac.uk/astrobiologysummerschool2009/ . Or you can email Professor Burchell for details. Applications should be made before August 15^{th}. New PhD students starting in Autumn 2009 are particularly welcome and their supervisors are asked to draw this opportunity to their attention.

Download/Website: `http://astro.kent.ac.uk/astrobiologysummerschool2009/`

Contact: `M.J.Burchell@kent.ac.uk`

4 Jobs and positions

Postdoctoral Research Scientist

Inga Kamp
Kapteyn Astronomical Institute, PO Box 800, 9700 AV Groningen, The Netherlands

Groningen, The Netherlands, send applications before September 15, 2009

The Kapteyn Astronomical Institute in Groningen, The Netherlands, invites applications for a postdoctoral research scientist. The successful candidate will mainly work on Herschel/PACS data. He or she is expected to actively participate in the PACS data analysis and to carry out related research. The candidate will be given the opportunity to pursue independent astrophysical research and to collaborate within Herschel Key Program teams.

The postdoctoral research scientist will encounter a stimulating scientific environment being in the same building as SRON, the PI institute and Instrument Control Center for the HIFI instrument. Staff from the Kapteyn Astronomical Institute and SRON are involved in many galactic and extragalactic Herschel Key Programs such as GASPS ("Gas Evolution in Protoplanetary Systems", PI: Dent), WISH ("Water In Star-forming regions with Herschel", PI: van Dishoeck), HS3F ("HIFI Spectral Surveys of Star Forming Regions", PI: Ceccarelli), WADI ("The warm and dense ISM", PI: Ossenkopf), HEXOS ("Herschel/HIFI Observations of EXtraOrdinary Sources: The Orion and Sagittarius B2 Starforming Regions", PI: Bergin), HERCULES ("A Herschel survey of molecular lines in (U)LIRGs: physical conditions, the nature of the power source, and a benchmark for high-z observations", PI: van der Werf). Thus, there is an exciting range of opportunities to establish new collaborations.

Interested applicants should have a PhD in astrophysics or physics and proven experience in far-infrared observations, including analysis of line data and good knowledge of (molecular) spectroscopy. The ability to work in an international team and a good command of the English language are essential. Experience with the Herschel/PACS

instrument and knowledge of the Python/Jython scripting language are considered an asset.

The University of Groningen offers a salary dependent on qualifications and work experience up to a maximum of EUR 4374 (scale 11) gross per month for a full-time position. The duration of the contract is 2 years with a possible extension to a third year.

Interested candidates should send application material, including a curriculum vitae, a brief statement of past research and future plans, and arrange for three letters of reference to be sent to Dr. Inga Kamp, Kapteyn Astronomical Institute, P.O. Box 800, 9700 AV Groningen, The Netherlands (E-mail address: kamp@astro.rug.nl). Selection of candidates will start **September 15, 2009**, and will continue until the position is filled.

Download/Website: `http://www.astro.rug.nl`
Contact: `kamp@astro.rug.nl`

Postdoctoral Position in Exoplanets

Seth Redfield
Astronomy Department, Van Vleck Observatory, Wesleyan University, Middletown, CT 06459, USA

Middletown, CT, USA, Available immediately

Applications are invited for a postdoctoral position in exoplanets at Wesleyan University. The successful candidate will work in collaboration with Dr. Seth Redfield primarily on high resolution optical spectra of transiting exoplanets obtained with the 9.2-m Hobby-Eberly Telescope. The project is focused on characterizing the atmospheres of extrasolar planets using this rich observational dataset. Other related research areas of mutual interest may include gas absorption in edge-on debris disks and the structure of the local interstellar medium, using ground-based, Hubble, and Spitzer observations. Wesleyan has a Planetary Science Group that includes faculty from several departments. The successful candidate will be encouraged to interact with other faculty and to carry out independent research with full access to observational facilities available to Wesleyan. Experience with data reduction and analysis, high resolution spectroscopy, and observational studies of exoplanets will be helpful. Applicants must have a Ph.D. in astronomy or astrophysics at the start of the appointment.

Wesleyan University is located between New York City and Boston, and has a small but active astronomy program which emphasizes involvement of undergraduate and M.A. students in main-stream astronomical research. We are particularly interested in candidates who feel that they could both contribute to and flourish in this unique educational environment. The postdoc would have the opportunity, if desired, to take advantage of this setting to develop educational skills through mentoring students in research and possibly teaching. The position is available immediately, but the starting date is negotiable. Initial appointment would be for two years, although funding for at least one additional year is available. The salary is competitive, and health and retirement benefits and travel allowance are provided. Applicants should send a cover letter, curriculum vitae, bibliography, statement of research experience and interests, and arrange for three letters of reference to be sent electronically (sredfield@wesleyan.edu) or to the address above by 15 September 2009 for full consideration. Late applications will be considered until the position is filled.

Wesleyan University is an equal opportunity, affirmative action employer M/W/D/V and strongly encourages applications from women and minorities

Download/Website: `http://members.aas.org/JobReg/JobDetailPage.cfm?JobID=25749`
Contact: `sredfield@wesleyan.edu`

5 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during July 2009. 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/0907.0020: **Which Radial Velocity Exoplanets Have Undetected Outer Companions?** by *Timothy J. Rodigas, Philip M. Hinz*

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