ExoPlanet News
An Electronic Newsletter

No. 29, May 4th, 2010

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Contents

1 Editorial

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

Although we only have a few abstracts of articles this month, we do have plenty of conference announcements. If you'd like to bring your recent papers to the attention of a wider audience, please submit them to the next and future editions – the newsletter now has a circulation of almost 1000 readers. 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 June 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

H-band thermal emission from the 19-hour period planet WASP-19b

D. R. Anderson[1], *M. Gillon*[2,3], *P. F. L. Maxted*[1], *T. S. Barman*[4], *A. Collier Cameron*[5], *C. Hellier*[1], *D. Queloz*[3], *B. Smalley*[1], *A. H. M. J. Triaud*[3]

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Astronomy & Astrophysics, published (2010A&A...513L...3A)

We present the first ground-based detection of thermal emission from an exoplanet in the H-band. Using HAWK-I on the VLT, we observed an occultation of WASP-19b by its G8V-type host star. WASP-19b is a Jupiter-mass planet with an orbital period of only 19 h, and thus, being highly irradiated, is expected to be hot. We measure an H-band occultation depth of $0.259^{+0.046}_{-0.044}$ %, which corresponds to an H-band brightness temperature of $T_H = 2580 \pm 125$ K. A cloud-free model of the planet's atmosphere, with no redistribution of energy from day-side to night-side, under predicts the planet/star flux density ratio by a factor of two. As the stellar parameters, and thus the level of planetary irradiation, are well-constrained by measurement, it is likely that our model of the planet's atmosphere is too simple.

Download/Website: `http://arxiv.org/abs/1002.1947`

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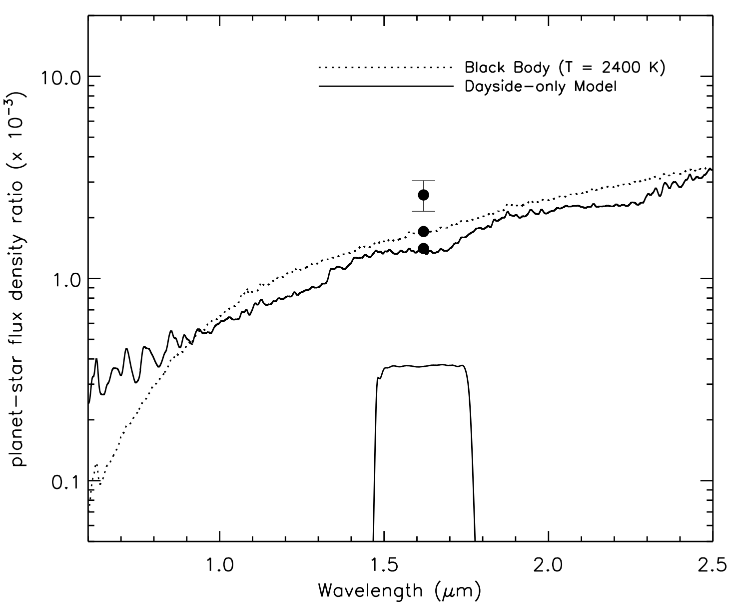

Figure 1: (Anderson et al.) Synthetic planet/star flux ratios of a cloud-free model that assumes solar abundances and no redistribution of incident stellar flux to the night-side (solid line). The effective temperature of the star was taken to be $T_{\rm eff} = 5500$ K (Hebb et al. 2010); all other parameters are taken from Table 1. The flux ratio for a black-body planet (at 2400K) is indicated by a dotted line. Solid symbols are the H-band integrated flux ratios; symbols without error bars correspond to the model points. The HAWK-I H-band filter response curve is also shown.

Studying planet populations by gravitational microlensing

M. Dominik
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General Relativity and Gravitation, in press (DOI:10.1007/s10714-010-0930-7)

The most curious effect of the bending of light by the gravity of stars has evolved into a successful technique unlike any other for studying planets within the Milky Way and even other galaxies. With a sensitivity to cool planets around low-mass stars even below the mass of Earth, gravitational microlensing fits in between other planet search techniques to form a complete picture of planet parameter space, which is required to understand their origin in general, that of habitable planets more particularly, and that of planet Earth especially. Current campaigns need to evolve from first detections to obtaining a sample with well-understood selection bias that allows to draw firm conclusions about the planet populations. With planetary signals being a transient phenomenon, gravitational microlensing is a driver for new technologies in scheduling and management of non-proprietary heterogeneous telescope networks, and can serve to demonstrate forefront science live to the general public.

Download/Website: `http://dx.doi.org/10.1007/s10714-010-0930-7`

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The gravitational bending of light by stars: a continuing story of curiosity, scepticism, surprise, and fascination

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General Relativity and Gravitation, in press (10.1007/s10714-010-0964-x)

Driven entirely by human curiosity, the effect of the gravitational bending of light has evolved on unforeseen paths, in an interplay between shifts in prevailing paradigms and advance of technology, into the most unusual way to study planet populations. The confirmation of the bending angle predicted by Einstein with the Solar Eclipse measurements from 1919 marked the breakthrough of the theory of General Relativity, but it was not before the detection of the double image of the quasar 0957+561 that gravitational lensing really entered the observational era. The observation of a characteristic transient brightening of a star caused by the gravitational deflection of its light by an intervening foreground star, constituting a microlensing event, required even further advance in technology before it could first emerge in 1993. While it required more patience in waiting before Einsteins blip for the first time revealed the presence of a planet orbiting a star other than the Sun, such detections can now be monitored live, and gravitational microlensing is not only sensitive to masses as low as that of the Moon, but can even reveal planets around stars in galaxies other than the Milky Way.

Download/Website: `http://dx.doi.org/10.1007/s10714-010-0964-x`

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Characterizing Habitable Exo-Moons

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ApJL, published (2010ApJ...712L.125K)

We discuss the possibility of screening the atmosphere of exomoons for habitability. We concentrate on Earth-like satellites of extrasolar giant planets (EGP) which orbit in the Habitable Zone (HZ) of their host stars. The detectability of exomoons for EGP in the HZ has recently been shown to be feasible with the Kepler Mission or equivalent photometry using transit duration observations. Transmission spectroscopy of exomoons is a unique potential tool to screen them for habitability in the near future, especially around low mass stars. Using the Earth itself as a proxy we show the potential and limits of spectroscopy to detect biomarkers on an Earth-like exomoon and discuss effects of tidal locking for such potential habitats.

Download/Website: `http://arxiv.org/abs/0912.3484`

Contact: `lkaltene@cfa.harvard.edu`

Where is the warm H_2? A search for H_2 emission from disks around Herbig Ae/Be stars

C. Martin-Zaïdi[1], J-.C. Augereau[1], F. Ménard[1], J. Olofsson[1], A. Carmona[2] C. Pinte[3], and E. Habart[4]
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Astronomy & Astrophysics, in press

Context: Mid-infrared (mid-IR) emission lines of molecular hydrogen (H_2) are useful probes to determine the mass of warm gas present in the surface layers of circumstellar disks. In the past years, numerous observations of Herbig Ae/Be stars (HAeBes) have been performed, but only two detections of H_2 mid-IR emission toward HD 97048 and AB Aur have been reported.
Aims: We aim at tracing the warm gas in the circumstellar environment of five additional HAeBes with gas-rich environments and/or physical characteristics close to those of AB Aur and/or HD 97048, to discuss whether the detections toward these two objects are suggestive of peculiar conditions for the observed gas.
Methods: We search for the H_2 S(1) emission line at 17.035 μm using high-resolution mid-IR spectra obtained with VLT/*VISIR*, and complemented by CH molecule observations with VLT/*UVES*. We gather the H_2 measurements from the literature to put the new results in context and search for a correlation with some disk properties.
Results: None of the five *VISIR* targets shows evidence for H_2 emission at 17.035 μm. From the 3σ upper limits on the integrated line fluxes we constrain the amount of optically thin warm ($> 150\ K$) gas to be less than $\sim 1.4\ M_{\rm Jup}$ in the disk surface layers. There are now 20 HAeBes observed with *VISIR* and *TEXES* instruments to search for warm H_2, but only two detections (HD 97048 and AB Aur) were made so far. We find that the two stars with detected warm H_2 show at the same time high 30/13 μm flux ratios and large PAH line fluxes at 8.6 and 11.3 μm compared to the bulk of observed HAeBes and have emission CO lines detected at $4.7\,\mu$m. We detect the CH 4300.3 $\AA$ absorption line toward both HD 97048 and AB Aur with *UVES*. The CH to H_2 abundance ratios that this would imply if it were to arise from the same component as well as the radial velocity of the CH lines both suggest that CH arises from a surrounding envelope, while the detected H_2 would reside in the disk.
Conclusions: The two detections of the S(1) line in the disks of HD 97048 and AB Aur suggest either peculiar physical conditions or a particular stage of evolution. New instruments such as *Herschel / PACS* should bring significant new data for the constraints of thermodynamics in young disks by observing the gas and the dust simultaneously.

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Exploring the conditions required to form giant planets via gravitational instability in massive protoplanetary discs

Farzana Meru & Matthew R. Bate
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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1004.3766)

We carry out global three-dimensional radiation hydrodynamical simulations of self-gravitating accretion discs to determine if, and under what conditions, a disc may fragment to form giant planets. We explore the parameter space (in terms of the disc opacity, temperature and size) and include the effect of stellar irradiation. We find that the disc opacity plays a vital role in determining whether a disc fragments. Specifically, opacities that are smaller than interstellar Rosseland mean values promote fragmentation (even at small radii, $R < 25$AU) since low opacities allow a disc to cool quickly. This may occur if a disc has a low metallicity or if grain growth has occurred. With specific reference to the HR 8799 planetary system, given its star is metal-poor, our results suggest that the formation of its imaged planetary system could potentially have occurred by gravitational instability. We also find that the presence of stellar irradiation generally acts to inhibit fragmentation (since the discs can only cool to the temperature defined by stellar irradiation). However, fragmentation may occur if the irradiation is sufficiently weak that it allows the disc to attain a low Toomre stability parameter.

Download/Website: `http://arxiv.org/abs/1004.3766`

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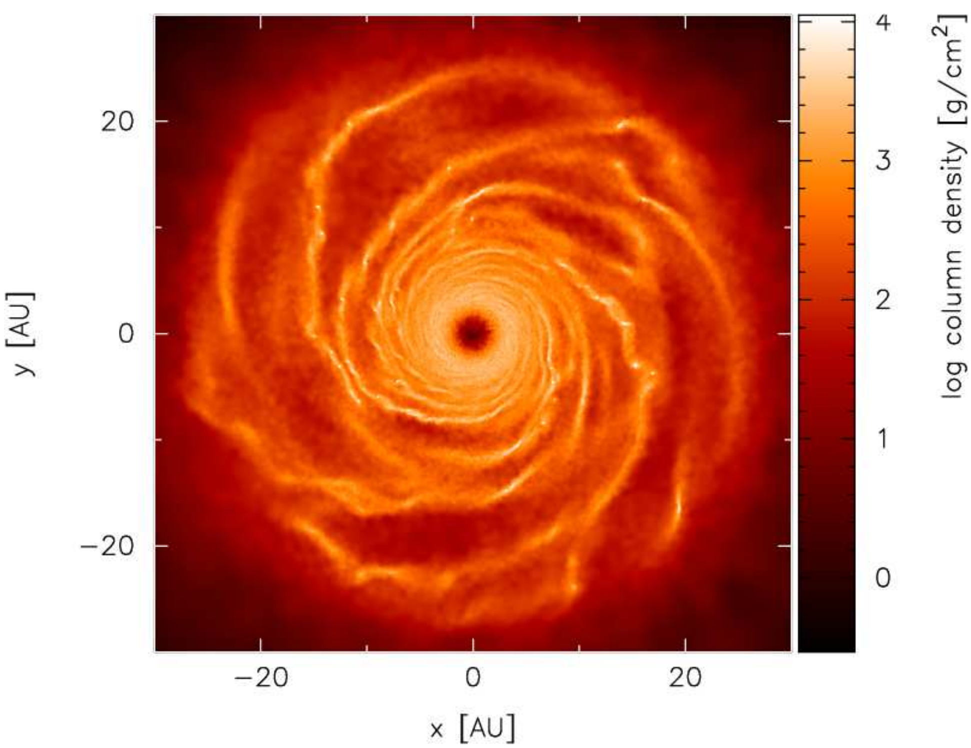

Figure 2: (Meru & Bate) Surface density rendered image of a fragmented disc. The disc not only requires reduced irradiation, but also low opacities are essential for it to cool rapidly enough to fragment.

Photometric exoplanet characterization with angular and spectral differential imaging

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Monthly Notices of the Royal Astronomical Society, in press (arXiv: 1004.4825)

The direct detection of exoplanets has been the subject of intensive research in the recent years. Data obtained with future high-contrast imaging instruments optimized for giant planets direct detection are strongly limited by the speckle noise. Specific observing strategies and data analysis methods, such as angular and spectral differential imaging, are required to attenuate the noise level and possibly detect the faint planet flux. Even though these methods are very efficient at suppressing the speckles, the photometry of the faint planets is dominated by the speckle residuals. The determination of the effective temperature and surface gravity of the detected planets from photometric measurements in different bands is then limited by the photometric error on the planet flux. In this work we investigate this photometric error and the consequences on the determination of the physical parameters of the detected planets. We perform detailed end-to-end simulation with the CAOS-based Software Package for SPHERE to obtain realistic data representing typical observing sequences in Y, J, H and Ks bands with a high contrast imager. The simulated data are used to measure the photometric accuracy as a function of contrast for planets detected with angular and spectral+angular differential methods. We apply this empirical accuracy to study the characterization capabilities of a high-contrast differential imager. We show that the expected photometric performances will allow the detection and characterization of exoplanets down to the Jupiter mass at angular separations of 1.0″ and 0.2″ respectively around high mass and low mass stars with 2 observations in different filter pairs. We also show that the determination of the planets physical parameters from photometric measurements in different filter pairs is essentialy limited by the error on the determination of the surface gravity.

Download/Website: `http://arxiv.org/abs/1004.4825`

Contact: `arthur.vigan@oamp.fr`

NACO-SDI imaging of known companion host stars from the AAPS and Keck planet search surveys

J.S. Jenkins[1], *H.R.A. Jones*[2], *B. Biller*[3], *S.J. O'Toole*[4], *D.J. Pinfield*[2], *L. Close*[5], *C.G. Tinney*[6], *R.P. Butler*[7], *R. Wittenmyer*[6], *B. Carter*[8], *A.C. Day-Jones*[1]

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Astronomy & Astrophysics, refereed journal, in press (arxiv:1003.2430)

Direct imaging of brown dwarfs as companions to solar-type stars can provide a wealth of well-constrained data to "benchmark" the physics of such objects, since quantities like metallicity and age can be determined from their well-studied primaries.

We present results from an adaptive optics imaging program on stars drawn from the Anglo-Australian and Keck Planet Search projects, with the aim of directly imaging known cool companions.
Simulations have modeled the expected contrast ratios and separations of known companions using estimates of orbital parameters available from current radial-velocity data and then a selection of the best case objects were followed-up with high contrast imaging to attempt to directly image these companions.
These simulations suggest that only a very small number of radial-velocity detected exoplanets with consistent velocity fits and age estimates could potentially be directly imaged using the VLT's Simultaneous Differential Imaging system and only under favorable conditions. We also present detectability confidence limits from the radial-velocity data sets and show how these can be used to gain a better understanding of these systems when combined with the imaging data.
For HD32778 and HD91204 the detectabilities help little in constraining the companion and hence almost all our knowledge is drawn from the SDI images. Therefore, we can say that these stars do not host cool methane objects, out to on-sky separations of $\sim 2''$, with contrasts less than 10–11 magnitudes. However, for HD25874, HD120780 and HD145825, the contrasts and detectabilities can rule out a number of possible solutions, particularly at low angular separations, and for the best case, down to strong methane masses of $40 M_J$ at $1''$ separation. The contrast curves constructed for these five stars show 5σ contrasts (ΔF1) of $\sim$9.2–11.5 magnitudes at separations of $\geq 0.6''$, which correspond to contrasts of $\sim$9.7–12.0 magnitudes for companions of mid-T spectral type. Such limits allow us to reach down to $40 M_J$ around fairly old field dwarfs that typically constitute high precision radial-velocity programs. Finally, the analysis performed here can serve as a template for future projects that will employ extreme-AO systems to directly image planets already indirectly discovered by the radial-velocity method.

Download/Website: `http://adsabs.harvard.edu/abs/2010arXiv1003.2430J`

Contact: `jjenkins@das.uchile.cl`

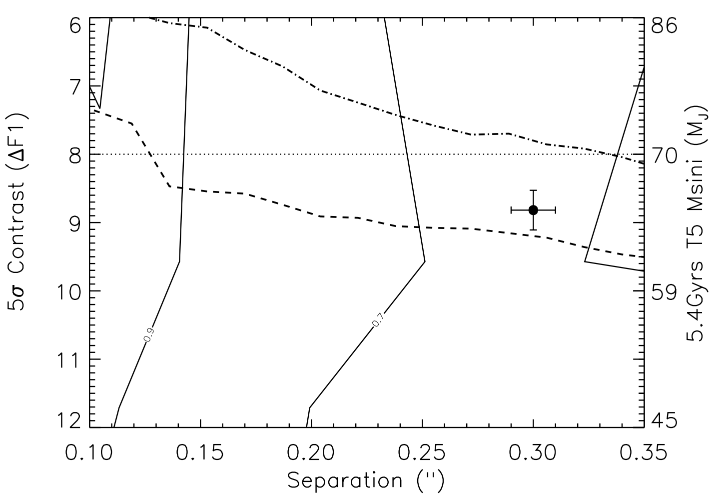

Figure 3: (Jenkins et al.) The plot shows an example contrast curve (ΔF1) for the star HD120780. An SDI reduced contrast of 9.3 magnitudes is reached at $0.3''$, the separation of the potential detection (filled circle). Note the large error bars on the contrast for this candidate since the contrasts were estimated using the other system fluxes since there were no unsaturated acquisition images for this star. The solid curves mark the confidence limits estimated from the radial-velocity timeseries. The right hand y-axis shows the expected mass for a T5 dwarf at the age assumed for these objects. The horizontal line represents the strong methane boundary.

3 Conference announcements

The Origin of Stellar Masses

Matthew Bate
School of Physics, University of Exeter, Stocker Road, Exeter, UK

Tenerife, Canary Islands, Spain, 18 – 22 October 2010

Stars are one of the fundamental building blocks of the Universe: the source of most of the chemical elements; a crucial ingredient in the formation and evolution of galaxies; the progenitors of supernovae, gamma ray bursts, and black holes; the hosts of planetary systems; and the sustainer of life. In some ways, stars are relatively simple objects; the evolution and fate of a star is almost uniquely determined by its mass. However, the formation of a star is anything but simple, involving a complex interplay between gravity, hydrodynamics, magnetic fields, radiation transport, and chemistry. Great progress has been made in delineating the roles of these physical processes through theory and observations, but a fundamental mystery remains, one of the most important questions in astronomy. What determines the masses of stars and how does the distribution of stellar masses arise, the so-called Initial Mass Function (IMF)?

We expect that progress in answering this question will accelerate with the advent of several new instruments operating at (sub-)mm wavelengths and the increasing ability for numerical models to include the relevant physics. The Herschel Space Observatory has just begun science observations, SCUBA-2 on the JCMT has just become operational, and the first early science observations with ALMA should be made in the year following this meeting. On the theoretical side, hydrodynamical simulations of star formation have been able to begin including magnetic fields, radiation transport, and chemistry.

Thus, the time is right for a meeting focussing on the observational and theoretical aspects of the origin of stellar masses, with the programme centred around three topical questions:

- From clouds to core to protostars: what processes are involved in transforming molecular clouds into clusters of protostars?
- The birth and influence of massive stars: how and why do massive stars form and what is their influence on further star formation?
- The physics of the low-mass end of the IMF: how and why do brown dwarfs form, and what is the physics of their atmospheres?

In recognition of the fact that this field is highly active with many young researchers, there will be an emphasis on talks given by young researchers and the programme will include ample time for discussion led by panels of experience researchers.

Invited Speakers include: Lori Allen, Philippe André, Isabelle Baraffe, Shantanu Basu (tbc), Henrik Beuther, Jerome Bouvier, Chris Brunt, Gilles Chabrier, Bruce Elmegreen (tbc), Pavel Kroupa, Kevin Luhman, Lee Hartmann, Phil Myers (tbc), Francesco Palla, Jonathan Tan

Scientific Organizing Committee: Matthew Bate (chair), Philippe André, Isabelle Baraffe, Ian Bonnell, Jérôme Bouvier, Nicolas Lodieu, Ana López Sepulcre, Eduardo Martin, Mark McCaughrean, Michael Meyer, Giusi Micela, Jan Palous, Elaine Winston, João Yun, Hans Zinnecker

Local Organizing Committee: Nicolas Lodieu (chair), Judith de Araoz, Vctor Béjar, Eva Bejarano, Susie Burdett, Tanja Karthaus, Eduardo Martin, Karla Peña Ramirez, Manuel Perger

For registration, contact details, and further information, please visit the website:

Download/Website: http://www.iac.es/congreso/constellation10/

Contact: constellation10@iac.es

2010 Sagan Exoplanet Summer Workshop: Stars as Homes for Habitable Planetary Systems

Dr. Dawn M. Gelino

NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, July 26-30, 2010; Early Registration Deadline: June 5, 2010

The 2010 Sagan Exoplanet Summer Workshop: "Stars as Homes for Habitable Planetary Systems", will take place on the Caltech campus July 26 - 30. With results from missions such as CoRoT and Kepler, we are learning more and more about planetary host stars. This timely workshop will consist of a series of tutorial and scientific lectures covering theory and observations of stars and their potentially habitable planetary systems. In addition, attendees will have the opportunity to present brief summaries of their research through both short oral presentations and electronic posters.

More information, including the agenda and registration, can be found on the workshop website: http://nexsci.caltech.edu/workshop/2010/

All attendees must register for the workshop at the above URL. Register before June 5 to take advantage of the early registration fee!

Registration Fee includes:

- Conference attendance, materials, and internet access
- Transportation between Pasadena Hilton and Workshop on Workshop Dates
- Opening Reception Registration and Snacks
- Light breakfast each day of the workshop
- Box lunches on Monday, Wednesday and Friday
- Snacks and drinks during morning and afternoon breaks each day of the workshop
- 1 ticket to attend tour of Griffith Observatory on Wednesday afternoon (extra tickets will be available for purchase)
- 1 ticket to attend workshop dinner on Thursday (extra tickets will be available for purchase)

Download/Website: http://nexsci.caltech.edu/workshop/2010/index.shtml

Contact: sagan_workshop@ipac.caltech.edu

Exoplanetary magnetic fields and stellar-planetary magnetic interactions: Modelling, Detection, Characterization

M. Khodachenko[1], *J.-M. Grießmeier*[2]

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Rome, Italy, 19-25 September 2010

Dear colleague,
we would like to bring to your attention and invite you to participate to the interdisciplinary session **MG4: Exoplanetary magnetic fields and stellar-planetary magnetic interactions: Modelling, Detection, Characterization** on the oncoming European Planetary Science Congress 2010 at Angelicum Centre - Pontifical University of Saint Thomas Aquinas on Sept. 19-25, 2010, in Rome, Italy.

Being focused on the specifics of exoplanetary magnetism, this session, due to the generality of its subject, welcomes participants from the whole circle of stellar and exoplanetary physics, including the topics like stellar activity, observation and characterization of planetary systems, stellar-planetary relations, planetary evolution, dedicated computational modelling and data analysis. Special emphasis of the session is put on the transfer of the experiences gained in the studies of magnetospheres and magnetism of the solar system planets to the new field of exoplanets, taking into account the specifics of orbital location of exoplanets, stellar activity etc. Implementation of the theoretical/computational predictions to the observational and detection techniques appears as another key topic of the envisaged discussions during the session.

The deadline for submitting a presentation abstract is May 10, 2010. Please feel free to circulate this announcement among your colleagues who may be interested in taking part in the session.

With best regards,
Maxim Khodachenko and Jean-Mathias Griessmeier (Conveners)

Download/Website: `http://meetingorganizer.copernicus.org/EPSC2010/session/3986`

Contact: `maxim.khodachenko@oeaw.ac.at, griessmeier@astron.nl`

Astronomy of Exoplanets with Precise Radial Velocities

Sponsored by: the Penn State Center for Exoplanets and Habitable Worlds (CEHW), the NASA Exoplanet Science Institute (NExScI), and the Penn State Department of Astronomy and Astrophysics

The Pennsylvania State University, University Park, PA, USA, August 16-19, 2010

This workshop will be devoted to a thorough discussion of the current capabilities and a future potential of the radial velocity technique to discover and characterize exoplanets. Emphasis will be placed on future developments in instrumentation, calibration techniques, and data analysis algorithms to further improve the precision of radial velocity measurements at visible and near-infrared wavelengths. A special session is planned to review applications of precise radial velocity measurements beyond exoplanet detection, including asteroseismology and cosmology.
Preregistration and a draft program is available on our website now. A full program and registration will be available soon.

Download/Website: `http://exoplanets.astro.psu.edu/workshop/`

Contact: `SOC chair Alex Wolszczan (alex@astro.psu.edu)`
`LOC chair Jason Wright (jtwright@astro.psu.edu)`
`Dawn Gelino (dawn@ipac.caltech.edu)`

Evolving Theory for Planet Formation

S. Ida[1], E. Kokubo[2], K. Dullemond[3], T. Guillot[4], G. Laughlin[5], and F. Masset[6]
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[2] National Astronomical Observatory Japan
[3] Max Planck Institute for Astronomy
[4] Observatoire de la Cote d'Azur
[5] University of California, Santa Cruz
[6] Laboratoire AIM, CEA/DSM - CNRS

Ishigaki Island, Okinawa, Japan, June 20-26, 2010

Planet formation theories have been stimulated by observations of protoplanetary disks, exoplanets, debris disks, and Saturnian ring. In particular, the diversity of extrasolar planets forces theorists to change and generalize the model for formation of the solar system. Here we summarize the observational constrains, review the current status, and discuss the future perspectives of theories for planet formation.
Ishigaki island has two observatories, VERA (VLBI, radio) and Ishigaki observatory (optical, IR), of National Astronomical Observatory Japan. Every summer Ishigaki enjoys a famous star festival. So, Ishigaki is now known as "an island of stars," as well as a subtropical island with its beautiful nature and traditional culture. Let's enjoy discussion on planet formation on the habitable island!

Download/Website: `http://www.gcoe-earths.org/ishigaki2010/`

Contact: `ishigaki2010@geo.titech.ac.jp`

4 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during April 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/1004.0463: **Is tidal heating sufficient to explain bloated exoplanets? Consistent calculations accounting for finite initial eccentricity** by *Jeremy Leconte, Gilles Chabrier, Isabelle Baraffe et al.*

astro-ph/1004.0692: **A Prograde, Low-Inclination Orbit for the Very Hot Jupiter WASP-3b** by *Anjali Tripathi, Joshua N. Winn, John Asher Johnson*

astro-ph/1004.0790: **Observation of the full 12-hour-long transit of the exoplanet HD80606b. Warm-Spitzer photometry and SOPHIE spectroscopy** by *G. Hebrard, J.-M. Desert, R.F. Diaz et al.*

astro-ph/1004.0836: **The thermal emission of the exoplanets WASP-1b and WASP-2b** by *Peter J. Wheatley, Andrew Collier Cameron, Joseph Harrington et al.*

astro-ph/1004.971: **The Compositional Diversity of Extrasolar Terrestrial Planets: I. In-Situ Simulations** by *Jade C. Bond, David P. O'Brien, Dante S. Lauretta*

astro-ph/1004.1143: **Methods for exomoon characterisation: combining transit photometry and the Rossiter-McLaughlin effect** by *A.E. Simon, Gy.M. Szabo, K. Szatmary et al.*

astro-ph/1004.1396: **Characterizing the thermosphere of HD209458b with UV transit observations** by *T. T. Koskinen, R. V. Yelle, P. Lavvas et al.*

astro-ph/1004.1406: **Planet Formation: Statistics of spin rates and obliquities of extrasolar planets** by *Yamila Miguel, Adrian Brunini*

astro-ph/1004.1421: **Secular Orbital Dynamics of Hierarchical Two Planet Systems** by *Dimitri Veras, Eric B. Ford* astro-ph/1004.1514: **WASP-22 b: A transiting "hot Jupiter" planet in a hierarchical triple system** by *P. F. L. Maxted, D. R. Anderson, M. Gillon et al.*

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