ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Here is the 76th edition of ExoPlanet News. After the (northern hemisphere) winter break, this month's edition is larger than ever with no fewer than ten conference announcements as well as a large number of paper abstracts and several job advertisements. As usual, please share it with your colleagues and encourage them to join the mailing list – or better still submit entries for future editions.

Because this month's edition is so large, in order to keep the newsletter under the 1Mb limit imposed by our mail exploder, I've had to reduce some of the images a bit, but full-resolution images are of course available in the actual papers whose links are included.

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

Best wishes
Andrew Norton
The Open University

2 Abstracts of refereed papers

Planet-vortex interaction: How a vortex can shepherd a planetary embryo

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Astronomy & Astrophysics, published (2014A&A...572A..61A)

Anticyclonic vortices are considered to be a favourable places for trapping dust and forming planetary embryos. On the other hand, they are massive blobs that can interact gravitationally with the planets in the disc. We aim to study how a vortex interacts gravitationally with a planet that migrates toward the vortex or with a planet that is created inside the vortex. We performed hydrodynamical simulations of a viscous locally isothermal disc using `GFARGO` and `FARGO-ADSG`. We set a stationary Gaussian pressure bump in the disc so that a large vortex is formed and maintained as a result of Rossby wave instability (RWI). After the vortex is established, we implanted a low-mass planet ($[5, 1, 0.5] \times 10^{-6}\mathrm{M}_\star$) in the outer disc or inside the vortex and allowed it to migrate. We also examined the effect of vortex strength on the planet migration by doubling the height of the bump and checked the validity of the final result in the presence of self-gravity. We noticed that regardless of the planet's initial position, the planet is finally locked to the RWI-created vortex in a 1:1 resonance or its migration is stopped at a larger orbital distance, in case of a stronger vortex. For the model with the weaker vortex (our standard model), we studied the effect of different parameters such as background viscosity, background surface density, mass of the planet, and different planet positions. In these models, while the trapping time and locking angle of the planet vary for different parameters, the main result, which is the planet-vortex locking, remains valid. We discovered that even a planet with a mass less than $5 \times 10^{-7}\mathrm{M}_\star$ comes out from the vortex and is locked to it at the same orbital distance. For a stronger vortex, both in non-self-gravitating and self-gravitating models, the planet migration is stopped far away from the radial position of the vortex. This effect can make the vortices a suitable place for continual planet formation under the condition that they save their shape during the planetary growth.

Download/Website: `http://adsabs.harvard.edu/abs/2014A%26A...572A..61A`

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Transit spectroscopy with JWST: Systematics, starspots and stitching

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MNRAS, in press (arXiv:1501.06349)

The *James Webb Space Telescope (JWST)* is predicted to make great advances in the field of exoplanet atmospheres. Its 25 m^2 mirror means that it can reach unprecedented levels of precision in observations of transit spectra, and can thus characterise the atmospheres of planets orbiting stars several hundred pc away. Its coverage of the infrared spectral region between 0.6 and 28 μm allows the abundances of key molecules to be probed during the transit of a planet in front of the host star, and when the same planet is eclipsed constraints can be placed on its temperature structure. In this work, we explore the possibility of using low-spectral-resolution observations by *JWST*/NIRSpec and *JWST*/MIRI-LRS together to optimise wavelength coverage and break degeneracies in the atmospheric retrieval problem for a range of exoplanets from hot Jupiters to super Earths. This approach involves stitching together non-simultaneous observations in different wavelength regions, rendering it necessary to consider the effect of time-varying instrumental and astrophysical systematics. We present the results of a series of retrieval feasibility tests

examining the effects of instrument systematics and star spots on the recoverability of the true atmospheric state, and demonstrate that correcting for these systematics is key for successful exoplanet science with *JWST*.

Download/Website: `http://arxiv.org/abs/1501.06349`

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A new view on exoplanet transits: Transit of Venus described using three-dimensional solar atmosphere STAGGER-grid simulations

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Astronomy & Astrophysics, in press (http://arxiv.org/abs/1501.06207)

Context. An important benchmark for current observational techniques and theoretical modeling of exoplanet's atmosphere is the transit of Venus (ToV). Stellar activity and, in particular, convection-related surface structures, potentially cause fluctuations that can affect the transit light curves. Surface convection simulations can help the interpretation of ToV and also other transits outside our Solar System.
Aims. We used realistic three-dimensional (3D) radiative hydrodynamical (RHD) simulation of the Sun from the STAGGER-grid and synthetic images computed with the radiative transfer code OPTIM3D to provide predictions for the transit of Venus (ToV) in 2004 observed by the satellite *ACRIMSAT*.
Methods. We computed intensity maps from RHD simulation of the Sun and produced synthetic stellar disk image as a observer would see, accounting for the centre-to-limb variations. The contribution of the solar granulation has been considered during the ToV. We computed the light curve and compared it to the *ACRIMSAT* observations and also to the light curves obtained with solar surface representations carried out using radial profiles with different limb-darkening laws. We also applied the same spherical tile imaging method used for RHD simulation to the observations of center-to-limb Sun granulation with *HINODE*.
Results. We managed to explain *ACRIMSAT* observations of 2004 ToV and showed that the granulation pattern causes fluctuations in the transit light curve. We compared different limb-darkening models to the RHD simulation and evaluated the contribution of the granulation to the ToV. We showed that the granulation pattern can partially explain the observed discrepancies between models and data. Moreover, we found that the overall agreement between real and RHD solar granulation is good, either in term of depth or Ingress/Egress slopes of the transit curve. This confirms that the limb-darkening and the granulation pattern simulated in 3D RHD Sun represent well what is imaged by *HINODE*. In the end, we found that the Venus's aureole contribution during ToV is $\sim 10^{-6}$ times less intense than the solar photosphere, and thus, accurate measurements of this phenomena are extremely challenging.
Conclusions. The prospects for planet detection and characterization with transiting methods are excellent with access to large a amount of data for stars. Being able to explain consistently the data of 2004 ToV is a new step forward for 3D RHD simulations that are becoming essential for the detection and characterization of exoplanets. They show that the granulation have to be considered as an intrinsic incertitude, due to the stellar variability, on precise measurements of exoplanet transits of, most likely, planets with small diameters. In this context, the importance of a comprehensive knowledge of the host star, including the detailed study of the stellar surface convection is determinant.

Download/Website: `http://arxiv.org/abs/1501.06207`

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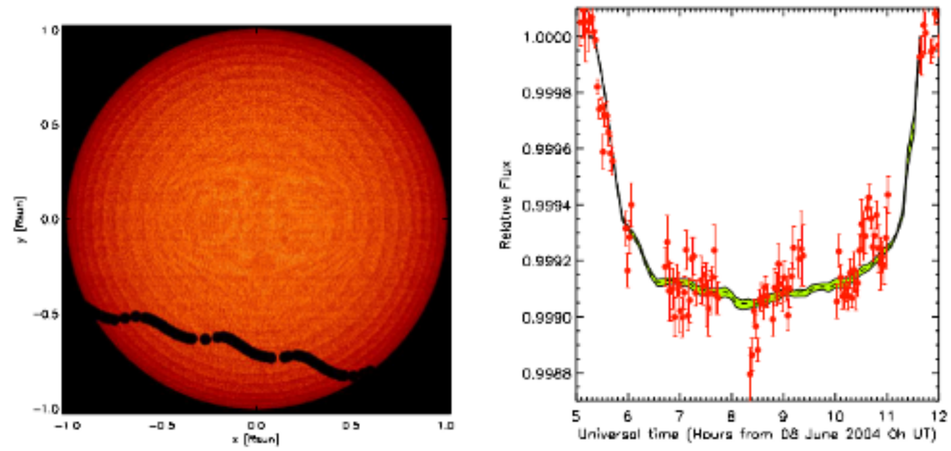

Figure 1: (Chiavassa et al.) Left panel: Synthetic solar disk image in the visible of the radiative hydrodynamical simulation of the with the different positions of Transit of Venus as seen from ACRIMSAT satellite in 2004. The unusual apparent trajectory of Venus is induced by the spacecraft orbit. Right panel: Light curve (black dashed line) for the simulation of the Sun compared to the photometric observations (red dots with error bars, Schneider et al. 2006) taken with ACRIM 3 mounted on ACRIMSAT. The observations have been normalized to 1, dividing the original data (Figure 3 of Schneider et al. 2006) by 1365.88 W m^{-2}. The light curve has been averaged (with the green shade denoting maximum and minimum values) over 50 different synthetic solar disk images to account for granulation changes with respect to time.

First-light LBT nulling interferometric observations: warm exozodiacal dust resolved within a few AU of η Crv

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The Astrophysical Journal, published (2015ApJ...799...42D)

We report on the first nulling interferometric observations with the Large Binocular Telescope Interferometer (LBTI), resolving the N' band (9.81 - 12.41 μm) emission around the nearby main-sequence star η Crv (F2V, 1-2 Gyr). The measured source null depth amounts to 4.40% $\pm$ 0.35% over a field-of-view of 140 mas in radius ($\sim$2.6 AU at the distance of η Crv) and shows no significant variation over 35° of sky rotation. This relatively low

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null is unexpected given the total disk to star flux ratio measured by *Spitzer/IRS* ($\sim$**23%** across the N' band), suggesting that a significant fraction of the dust lies within the central nulled response of the LBTI (79 mas or 1.4 AU). Modeling of the warm disk shows that it cannot resemble a scaled version of the Solar zodiacal cloud, unless it is almost perpendicular to the outer disk imaged by *Herschel*. It is more likely that the inner and outer disks are coplanar and the warm dust is located at a distance of 0.5-1.0 AU, significantly closer than previously predicted by models of the IRS spectrum ($\sim$3 AU). The predicted disk sizes can be reconciled if the warm disk is not centrosymmetric, or if the dust particles are dominated by very small grains. Both possibilities hint that a recent collision has produced much of the dust. Finally, we discuss the implications for the presence of dust at the distance where the insolation is the same as Earth's (2.3 AU).

Download/Website: `http://iopscience.iop.org/0004-637X/799/1/42/pdf/apj_799_1_42.pdf`

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The California Planet Survey IV: A Planet Orbiting the Giant Star HD 145934 and Updates to Seven Systems with Long-Period Planets

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The Astrophysical Journal, accepted (arXiv:1501.00633)

We present an update to seven stars with long-period planets or planetary candidates using new and archival radial velocities from Keck-HIRES and literature velocities from other telescopes. Our updated analysis better constrains orbital parameters for these planets, four of which are known multi-planet systems. HD 24040 *b* and HD 183263 *c* are super-Jupiters with circular orbits and periods longer than 8 yr. We present a previously unseen linear trend in the residuals of HD 66428 indicative on an additional planetary companion. We confirm that GJ 849 is a multi-planet system and find a good orbital solution for the *c* component: it is a $1M_{\rm Jup}$ planet in a 15 yr orbit (the longest known for a planet orbiting an M dwarf). We update the HD 74156 double-planet system. We also announce the detection of HD 145934 *b*, a $2M_{\rm Jup}$ planet in a 7.5 yr orbit around a giant star. Two of our stars, HD 187123 and HD 217107, at present host the only known examples of systems comprising a hot Jupiter and a planet with a well constrained period > 5 yr, and with no evidence of giant planets in between. Our enlargement and improvement of long-period planet parameters will aid future analysis of origins, diversity, and evolution of planetary systems.

Download/Website: `http://arxiv.org/abs/1501.00633`

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Better Than Earth

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Scientific American, (2015SciAm.312a..32H)

DO WE INHABIT THE BEST OF ALL POSSIBLE WORLDS? German mathematician Gottfried Leibniz thought so, writing in 1710 that our planet, warts and all, must be the most optimal one imaginable. Leibniz's idea was roundly scorned as unscientific wishful thinking, most notably by French author Voltaire in his magnum opus, *Candide*. Yet Leibniz might find sympathy from at least one group of scientists the astronomers who have for decades treated Earth as a golden standard as they search for worlds beyond our own solar system.
Over the past two decades astronomers have found more than 1,800 exoplanets, and statistics suggest that our galaxy harbors at least 100 billion more. Of the worlds found to date, few closely resemble Earth. Instead they exhibit a truly enormous diversity, varying immensely in their orbits, sizes and compositions and circling a wide variety of stars, including ones significantly smaller and fainter than our sun. Diverse features of these exoplanets suggest to me and to others that Earth may not be anywhere close to the pinnacle of habitability. In fact, some exoplanets, quite different from our own, could have much higher chances of forming and maintaining stable biospheres. These "superhabitable worlds" may be the optimal targets in the search for extraterrestrial, extrasolar life.

Download/Website: www.nature.com/scientificamerican/journal/v312/n1/full/scientificamerican011

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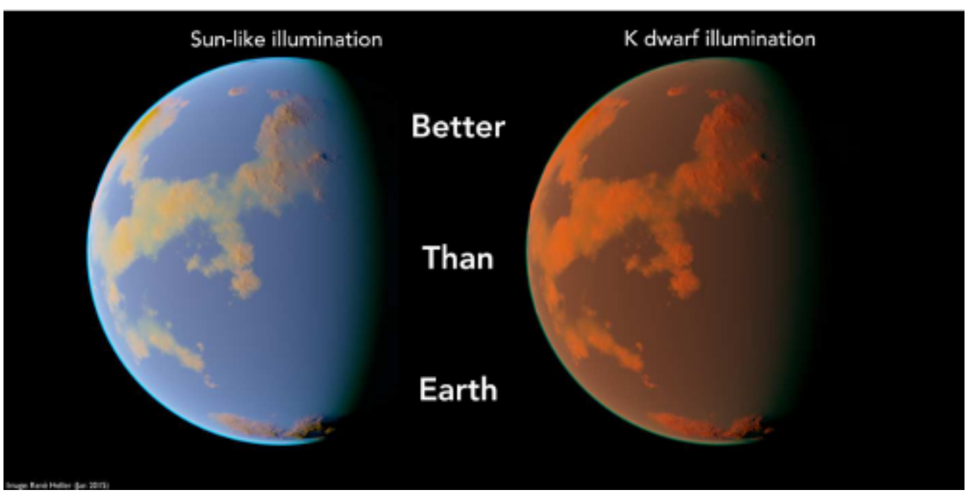

Figure 2: (Heller) While superhabitable worlds might have large amounts of water, their land surfaces could be somewhat more dispersed compared to Earth, thereby supporting biodiversification. They should resemble archipelagos worlds rather than planets dominated by a few, big continents. The right version of this hypothetical superhabitable planet demonstrates how it would be seen by the human eye as it is illuminated by an orange light source, a so-called K dwarf star about 80 percent the mass of the Sun. Such stars live longer than the Sun, increasing the chances for their planets to start evolution in the first place.

High-contrast imaging with *Spitzer*: Deep observations of Vega, Fomalhaut, and ϵ Eridani

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Astronomy & Astrophysics, in press (arXiv:1412.4816)

Stars with debris disks are intriguing targets for direct-imaging exoplanet searches, owing both to previous detections of wide planets in debris disk systems, and to commonly existing morphological features in the disks themselves that may be indicative of a planetary influence. Here we present observations of three of the most nearby young stars, which are also known to host massive debris disks: Vega, Fomalhaut, and ϵ Eri. The *Spitzer* Space Telescope is used at a range of orientation angles for each star to supply a deep contrast through angular differential imaging combined with high-contrast algorithms. The observations provide the opportunity to probe substantially colder bound planets (120–330 K) than is possible with any other technique or instrument. For Vega, some apparently very red candidate point sources detected in the 4.5 μm image remain to be tested for common proper motion. The images are sensitive to $\sim$2 $M_{\rm jup}$ companions at 150 AU in this system. The observations presented here represent the first search for planets around Vega using *Spitzer*. The upper 4.5 μm flux limit on Fomalhaut b could be further constrained relative to previous data. In the case of ϵ Eri, planets below both the effective temperature and the mass of Jupiter could be probed from 80 AU and outward, although no such planets were found. The data sensitively probe the regions around the edges of the debris rings in the systems where planets can be expected to reside. These observations validate previous results showing that more than an order of magnitude improvement in performance in the contrast-limited regime can be acquired with respect to conventional methods by applying sophisticated high-contrast techniques to space-based telescopes, thanks to the high degree of PSF stability provided in this environment.

Download/Website: `http://arxiv.org/abs/1412.4816`

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Modeling giant extrasolar ring systems in eclipse and the case of J1407b: sculpting by exomoons?

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The Astrophysical Journal, in press (arXiv:1501.05652)

The light curve of 1SWASP J140747.93-394542.6, a ∼16 Myr old star in the Sco-Cen OB association, underwent a complex series of deep eclipses that lasted 56 days, centered on April 2007. This light curve is interpreted as the transit of a giant ring system that is filling up a fraction of the Hill sphere of an unseen secondary companion, J1407b. We fit the light curve with a model of an azimuthally symmetric ring system, including spatial scales down to the temporal limit set by the star's diameter and relative velocity. The best ring model has 37 rings and extends out to a radius of 0.6 AU (90 million km), and the rings have an estimated total mass on the order of $100M_{Moon}$. The ring system has one clearly defined gap at 0.4 AU (61 million km), which we hypothesize is being cleared out by a $< 0.8M_{\oplus}$ exosatellite orbiting around J1407b. This eclipse and model implies that we are seeing a circumplanetary disk undergoing a dynamic transition to an exosatellite-sculpted ring structure and is one of the first seen outside our Solar system.

Download/Website: `http://home.strw.leidenuniv.nl/ kenworthy/j1407_exorings`

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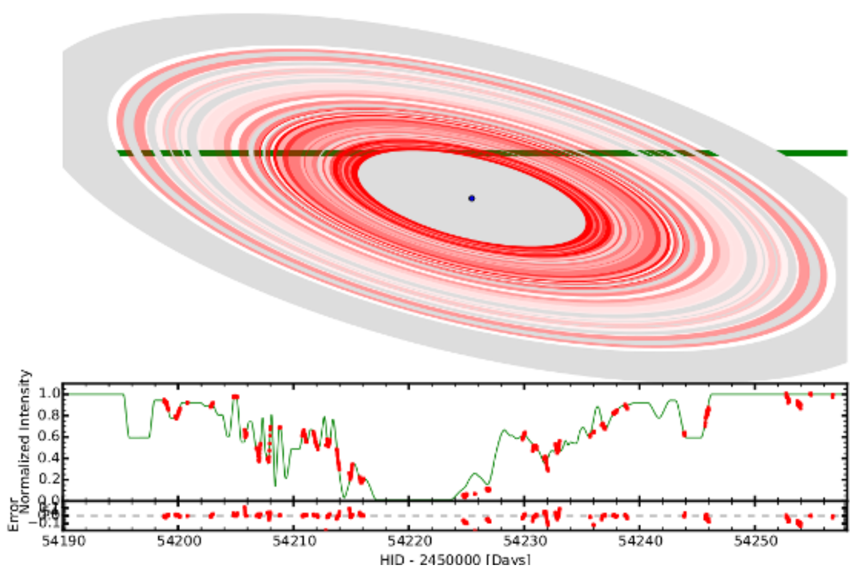

Figure 3: (Kenworthy & Mamajek) Model ring fit to J1407 data. The image of the ring system around J1407b is shown as a series of nested red rings. The intensity of the colour corresponds to the transmission of the ring. The green line shows the path and diameter of the star J1407 behind the ring system. The grey rings denote where no photometric data constrain the model fit. The lower graph shows the model transmitted intensity $I(t)$ as a function of HJD. The red points are the binned measured flux from J1407 normalised to unity outside the eclipse.

Eclipsing binaries and fast rotators in the *Kepler* sample: Characterization via radial velocity analysis from Calar Alto

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Astronomy & Astrophysics, in press (arXiv:1501.05183)

Context.- The *Kepler* mission has provided high-accurate photometric data in a long timespan for more than two hundred thousands stars, looking for planetary transits. Among the thousands of candidates detected, the planetary nature of around 15% has been established or validated by different techniques. But additional data is needed to characterize the rest of the candidates and reject other possible configurations.
Aims.- We started a follow-up program to validate, confirm, and characterize some of the planet candidates. In this paper we present the radial velocity analysis of those presenting large variations, compatible with being eclipsing binaries. We also study those showing large rotational velocities, which prevents us from obtaining the necessary precision to detect planetary-like objects.
Methods.- We present new radial velocity results for 13 *Kepler* objects of interest (KOIs) obtained with the CAFE spectrograph at the Calar Alto Observatory, and analyze their high-spatial resolution (lucky) images obtained with AstraLux and the *Kepler* light curves of some interesting cases.
Results.- We have found five spectroscopic and eclipsing binaries (group A). Among them, the case of KOI-3853 is of particular interest. This system is a new example of the so-called *heartbeat stars*, showing dynamic tidal distortions in the *Kepler* light curve. We have also detected duration and depth variations of the eclipse. We suggest possible scenarios to explain such effect, including the presence of a third substellar body possibly detected in our radial velocity analysis. We also provide upper mass limits to the transiting companions of other six KOIs with large rotational velocities (group B). This property prevents the radial velocity method to obtain the necessary precision to detect planetary-like masses. Finally, we analyze the large radial velocity variations of other two KOIs, incompatible with the presence of planetary-mass objects (group C). These objects are likely to be stellar binaries. However, a longer timespan is needed to complete their characterization.

Download/Website: `http://arxiv.org/abs/1501.05183`

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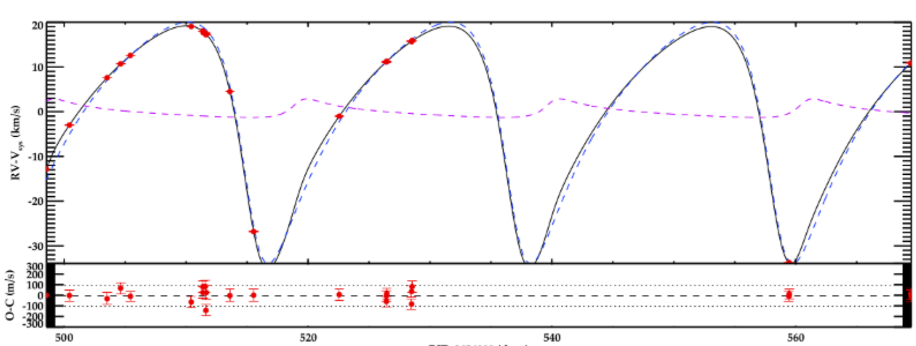

Figure 4: (Lillo-Box et al.) Radial velocity analysis of the detected components of KOI-3853. Radial velocity solution for the whole system (black solid line) and the two contributions of the B component (dashed blue) and the possible C component (dashed purple).

Transiting the Sun: The impact of stellar activity on X-ray and ultraviolet transits

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The Astrophysical Journal, in press (arXiv:1501.04963)

Transits of hot Jupiters in X-rays and the ultraviolet have been shown to be both deeper and more variable than the corresponding optical transits. This variability has been attributed to hot Jupiters having extended atmospheres at these wavelengths. Using resolved images of the Sun from NASA's Solar Dynamics Observatory spanning 3.5 years of Solar Cycle 24 we simulate transit light curves of a hot Jupiter to investigate the impact of Solar like activity on our ability to reliably recover properties of the planet's atmosphere in soft X-rays (94 Å), the UV (131-1700 Å), and the optical (4500 Å). We find that for stars with similar activity levels to the Sun, the impact of stellar activity results in the derived radius of the planet in soft X-ray/EUV to be underestimated by up-to 25% or overestimated by up-to 50% depending on whether the planet occults active regions. We also find that in up-to 70% of the X-ray light curves the planet transits over bright star spots. In the far ultraviolet (1600 & 1700 Å), we find the mean recovered value of $R_p/R_\star$ to be over-estimated by up-to 20%. For optical transits we are able to consistently recover the correct planetary radius. We also address the implications of our results for transits of WASP-12b and HD 189733b at short wavelengths.

Download/Website: `http://arxiv.org/abs/1501.04963`

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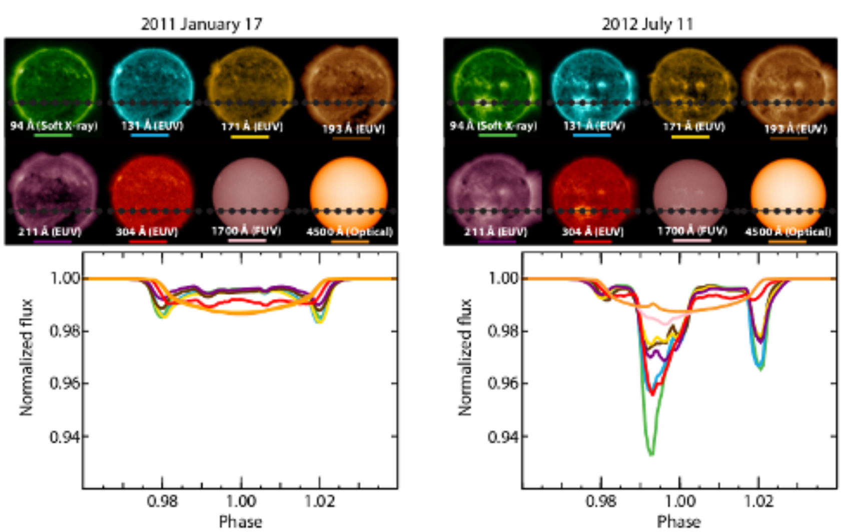

Figure 5: (Llama & Shkolnik) *Top:* Two sets of simultaneous images of the Sun obtained from NASA's SDO spacecraft. Over plotted on each image is the trajectory of a simulated hot Jupiter with $R_p/R_\star = 0.1$ and $b = -0.3$. The left panel shows images where there was little activity along the transit chord, whilst the right panel is an example of when the transit chord intersects active regions. *Bottom:* The resultant transit light curves are color coded by wavelength. At soft X-ray/EUV wavelengths the Sun is limb-brightened and so the transit is much deeper at ingress and egress than mid-transit. The optical transits that intersect active regions (right) show a bump in the light curve. At shorter wavelengths where active regions appear bright, the light curves exhibit a dip as the planet occults an active region.

On the GJ 436 planetary system

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Acta Astronomica, published (2014AcA....64..323M)

The GJ 436 system contains a transiting planet GJ 436 b which is a hot analogue of Neptune on an eccentric orbit. Recently, two additional transiting sub-Earth planets have been postulated in the literature. We observed three transits of GJ 436 b over the course of 3 years using two-meter class telescopes, each with a photometric precision better than one millimagnitude. We studied system dynamics based on the existence of the additional planets. We redetermined system parameters, which were in agreement with those found in the literature. We refined the orbital period of GJ 436 b and found no evidence of transit timing variations. The orbital motion of the GJ 436 c planet candidate was found to be significantly affected by the planet b with variations in transit times at a level of 20 minutes. As the orbital period of the GJ 436 d planet candidate remains unknown, our numerical experiments rule out orbits in low-order resonances with GJ 436 b. The GJ 436 system with the hot Neptune and additional two Earth-like planets, if confirmed, would be an important laboratory for studies of formation and evolution of planetary systems.

Download/Website: `http://www.home.umk.pl/~gmac/TTV`

Contact: `gmac@umk.pl`

Bayesian mass and age estimates for transiting exoplanet host stars

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Astronomy & Astrophysics, in press (arXiv:1412.7891)

The mean density of a star transited by a planet, brown dwarf or low mass star can be accurately measured from its light curve. This measurement can be combined with other observations to estimate its mass and age by comparison with stellar models. Our aim is to calculate the posterior probability distributions for the mass and age of a star given its density, effective temperature, metallicity and luminosity. We computed a large grid of stellar models that densely sample the appropriate mass and metallicity range. The posterior probability distributions are calculated using a Markov-chain Monte-Carlo method. The method has been validated by comparison to the results of other stellar models and by applying the method to stars in eclipsing binary systems with accurately measured masses and radii. We have explored the sensitivity of our results to the assumed values of the mixing-length parameter, $\alpha_{\rm MLT}$, and initial helium mass fraction, Y. For a star with a mass of $0.9\,{\rm M}_{\odot}$ and an age of 4 Gyr our method recovers the mass of the star with a precision of 2% and the age to within 25% based on the density, effective temperature and metallicity predicted by a range of different stellar models. The masses of stars in eclipsing binaries are recovered to within the calculated uncertainties (typically 5%) in about 90% of cases. There is a tendency for the masses to be underestimated by about $0.1\,{\rm M}_{\odot}$ for some stars with rotation periods $P_{\rm rot} < 7$ d. Our method makes it straightforward to determine accurately the joint posterior probability distribution for the mass and age of a star eclipsed by a planet or other dark body based on its observed properties and a state-of-the art set of stellar models.

Download/Website: `sourceforge.net/projects/bagemass`

Contact: `p.maxted@keele.ac.uk`

BGLS: A Bayesian formalism for the generalised Lomb-Scargle periodogram

A. Mortier[1,2], *J.P. Faria*[2,3,4], *C.M. Correia*[2,3], *A. Santerne*[2,3], *N.C. Santos*[2,3,4]

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Astronomy & Astrophysics, published (2015A&A...573A.101M)

Context. Frequency analyses are very important in astronomy today, not least in the ever-growing field of exoplanets, where short-period signals in stellar radial velocity data are investigated. Periodograms are the main (and powerful) tools for this purpose. However, recovering the correct frequencies and assessing the probability of each frequency is not straightforward.
Aims. We provide a formalism that is easy to implement in a code, to describe a Bayesian periodogram that includes weights and a constant offset in the data. The relative probability between peaks can be easily calculated with this formalism. We discuss the differences and agreements between the various periodogram formalisms with simulated examples.
Methods. We used the Bayesian probability theory to describe the probability that a full sine function (including weights derived from the errors on the data values and a constant offset) with a specific frequency is present in the data.
Results. From the expression for our Baysian generalised Lomb-Scargle periodogram (BGLS), we can easily recover the expression for the non-Bayesian version. In the simulated examples we show that this new formalism recovers the underlying periods better than previous versions. A Python-based code is available for the community: https://www.astro.up.pt/exoearths/tools.html

Download/Website: `http://www.aanda.org/articles/aa/abs/2015/01/aa24908-14/aa24908-14.html`

Contact: `am352@st-andrews.ac.uk`

The formation of the solar system

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[9] INAF-Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, I-50125, Firenze, Italy
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Physica Scripta, in press (arXiv:1501.03101)

The solar system started to form about 4.56 Gyr ago and despite the long intervening time span, there still exist several clues about its formation. The three major sources for this information are meteorites, the present solar system structure and the planet-forming systems around young stars. In this introduction we give an overview of the current understanding of the solar system formation from all these different research fields. This includes the question of the lifetime of the solar protoplanetary disc, the different stages of planet formation, their duration, and their relative importance. We consider whether meteorite evidence and observations of protoplanetary discs point in the same direction. This will tell us whether our solar system had a typical formation history or an exceptional

one. There are also many indications that the solar system formed as part of a star cluster. Here we examine the types of cluster the Sun could have formed in, especially whether its stellar density was at any stage high enough to influence the properties of today's solar system. The likelihood of identifying siblings of the Sun is discussed. Finally, the possible dynamical evolution of the solar system since its formation and its future are considered.

Download/Website: `http://arxiv.org/abs/1501.03101`

Contact: `spfalzner@mpifr.de`

Habitable Zones of Pre-Main-Sequence Stars

R. Ramirez & L. Kaltenegger
Cornell University, Department of Astronomy

Astrophysical Journal Letters, in press (arXiv:1412.1764)

We calculate the pre-main-sequence HZ for stars of spectral classes F to M. The spatial distribution of liquid water and its change during the pre-main-sequence phase of protoplanetary systems is important in understanding how planets become habitable. Such worlds are interesting targets for future missions because the coolest stars could provide habitable conditions for up to 2.5 billion years post-accretion. Moreover, for a given star type, planetary systems are more easily resolved because of higher pre-main-sequence stellar luminosities, resulting in larger planet to star separation for cool stars than is the case for the traditional main-sequence (MS) habitable zone (HZ). We use 1D radiative-convective climate and stellar evolutionary models to calculate pre-main-sequence HZ distances for F1 to M8 stellar types. We also show that accreting planets that are later located in the traditional MS HZ orbiting stars cooler than a K5 (including the full range of M-stars) receive stellar fluxes that exceed the runaway greenhouse threshold, and thus may lose substantial amounts of water initially delivered to them. We predict that M-star planets need to initially accrete more water than Earth did or, alternatively, have additional water delivered later during the long pre-main-sequence phase to remain habitable. Our findings are also consistent with recent claims that Venus lost its water during accretion.

Download/Website: `http://arXiv.org/abs/1412.1764`

Contact: `rmr277@cornell.edu`

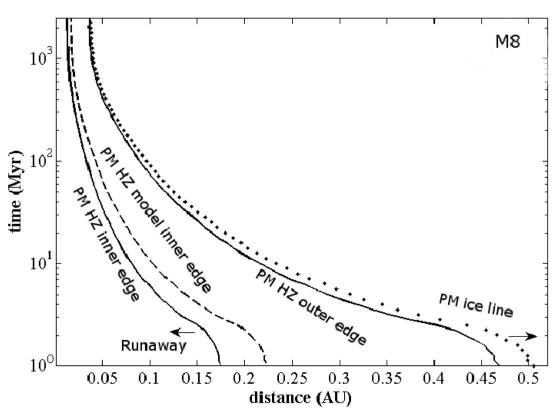

Figure 6: (Ramirez & Kaltenegger) Pre-MS (PM) empirical habitable zone boundaries (solid), modeled boundaries (dashed), and ice lines (dotted curves) for an M8 pre-MS star.

Collisional modelling of the debris disc around HIP 17439

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Astronomy & Astrophysics, published (2014A&A...567A.127S)

We present an analysis of the debris disc around the nearby K2 V star HIP 17439. In the context of the *Herschel* DUNES key programme, the disc was observed and spatially resolved in the far-IR with the *Herschel* PACS and SPIRE instruments. In a previous study, we assumed that the size and radial distribution of the circumstellar dust are independent power laws. There, several scenarios capable of explaining the observations were suggested after exploring a very broad range of possible model parameters. In this paper, we perform a follow-up in-depth collisional modelling of these scenarios to further distinguish between them. In our models we consider collisions, direct radiation pressure, and drag forces, which are the actual physical processes operating in debris discs. We find that all scenarios discussed in the first paper are physically reasonable and can reproduce the observed spectral energy distribution along with the PACS surface brightness profiles reasonably well. In one model, the dust is produced beyond 120 au in a narrow planetesimal belt and is transported inwards by Poynting-Robertson and stellar wind drag. Good agreement with the observed radial profiles would require stellar winds by about an order of magnitude stronger than the solar value, which is not confirmed – although not ruled out – by observations. Another model consists of two spatially separated planetesimal belts, a warm inner and a cold outer one. This scenario would probably imply the presence of planets clearing the gap between the two components. Finally, we show qualitatively that the observations can be explained by assuming the dust is produced in a single, but broad planetesimal disc with a surface density of solids rising outwards, as expected for an extended disc that experiences a natural inside-out collisional depletion. Prospects of distinguishing between the competing scenarios by future observations are discussed.

Download/Website: `http://adsabs.harvard.edu/abs/2014A%26A...567A.127S`

Contact: `christian.schueppler@uni-jena.de`

Combining High-Dispersion Spectroscopy (HDS) with High Contrast Imaging (HCI): Probing rocky planets around our nearest neighbours

I. Snellen[1], R. de Kok[1,2], J. Birkby[1,3,4], M. Brogi[1,5,6], C. Keller[1], M. Kenworthy[1], H. Schwarz[1], R. Stuik[1]

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[6] Hubble Fellow

Astronomy & Astrophysics, in press

Context: Ground-based high-dispersion (R$\sim$100,000) spectroscopy (HDS) is proving to be a powerful technique to characterize extrasolar planets. The planet signal is distilled from the bright starlight, combining spectral and time-differential filtering techniques. In parallel, high-contrast imaging (HCI) is rapidly developing, aimed at spatially separating the planet from the star. Both techniques currently reach planet/star contrast limits down to $\sim 10^{-5}$, albeit for very different types of planetary systems.
Aims: In this work, we discuss a way to combine HDS and HCI. For a planet located at a resolvable angular distance from its host star, the starlight can be reduced up to several orders of magnitude using adaptive optics and/or coronography. In addition, the remaining starlight can be filtered out using high-dispersion spectroscopy, utilizing the significantly different (or Doppler shifted) high-dispersion spectra of the planet and star. In this way, HDS+HCI can *in principle* reach contrast limits of $\sim 10^{-5} \times 10^{-5}$, although in practice this will be limited by photon noise and/or sky-background.
Methods: We present simulations of HDS+HCI observations with the E-ELT, both probing thermal emission from a planet at infrared wavelengths, and starlight reflected off a planet atmosphere at optical wavelengths. For the infrared simulations we use the baseline parameters of the E-ELT and METIS instrument, with the latter combining extreme adaptive optics with an R=100,000 IFS.
Results: One night of HDS+HCI observations with the E-ELT at 4.8 μm ($\Delta\lambda = 0.07\mu$m) can detect a planet orbiting α Cen A with a radius of R=1.5 $R_{\rm earth}$ and a twin-Earth thermal spectrum of $T_{\rm eq}$=300 K at a signal-to-noise (SNR) of 5. In the optical, with a Strehl ratio performance of 0.3, reflected light from an Earth-size planet in the habitable zone of Proxima Centauri can be detected at a SNR of 10 in the same time frame.
Conclusions: The exploration of the planetary systems of our neighbor stars is of great scientific and philosophical value. The HDS+HCI technique has the potential to detect and characterize temperate rocky planets in their habitable zones. Exoplanet scientists should not shy away from claiming a significant fraction of the future ELTs to make such observations possible. [abridged]

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

Contact: `snellen@strw.leidenuniv.nl`

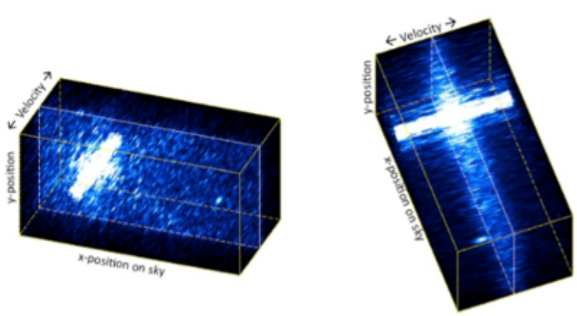

Figure 7: (Snellen et al.) Graphical representation of our model simulations.

Free Collisions in a Microgravity Many-Particle Experiment. IV. - Three-Dimensional Analysis of Collision Properties

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Icarus, in press (arXiv:1412.3236)

The bouncing barrier, a parameter combination at which dust particles in the protoplanetary disk always rebound in mutual collisions, is one of the crucial steps of planet formation. In the past years, several experiments have been performed to determine the mass and velocity regimes at which perfect bouncing does occur and those where there is a chance of the aggregates sticking together. We conducted a microgravity experiment, which allows us to investigate free collisions of millimeter-sized SiO_2 dust aggregates at the relevant velocities. We analyzed 52 collisions in detail with velocities of 3.4×10^{-3} m s^{-1} to 6.2×10^{-2} m s^{-1} and found four of them leading to sticking, while the other aggregates rebounded. Three out of the four sticking collisions occurred at velocities where previously only bouncing had been predicted. Although the probability for sticking is low, this opens a new possibility for growth beyond millimeter sizes. Our setup allowed us to obtain the complete three-dimensional collision information. Since most previous experiments were interpreted based on two-dimensional information, we compare our three-dimensional values with those obtained if only one projection had been available. We find that the error of a two-dimensional analysis of the collision velocity is very small. The distribution of the coefficient of restitution in the two-dimensional view is representative of the real case, but for any given collision its value can be far off. Impact parameters always have to be analyzed three-dimensionally, because the two-dimensional values are not meaningful in any way.

Download/Website: `http://arxiv.org/abs/1412.3236`

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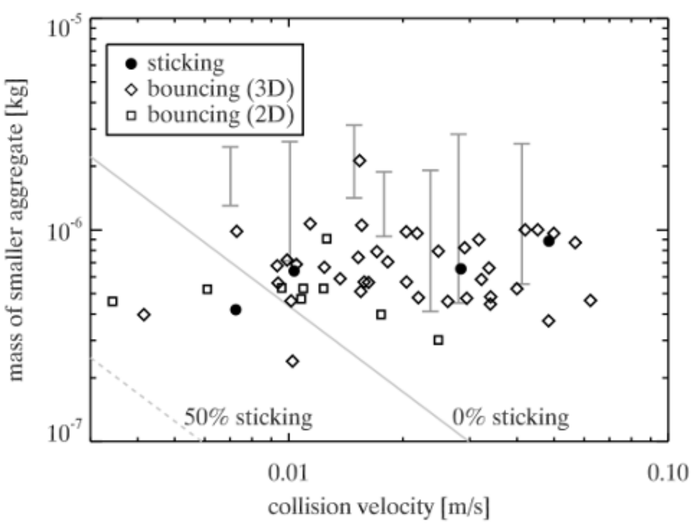

Figure 8: (Weidling & Blum) Collision outcome between dust aggregates. The diamonds and filled black circles denote the mass of the smaller of the two colliding dust aggregates and the three-dimensional collision velocity for the bouncing and sticking cases, respectively. The squares denote additional cases of bouncing dust aggregates for which only two-dimensional information was available. The lines denote the 50% (dashed) and 0% (solid) sticking probability after Kothe et al. (2013). The gray bars mark the bouncing collisions of monomers with dimers, with both the mass of the monomer (lower bound) and dimer (upper bound) marked.

3 Non-refereed papers

Exoplanet Science with the European Extremely Large Telescope. The case for visible and near –IR Spectroscopy at high resolution

S. Udry[1], C. Lovis[1], F. Bouchy[2], A. Collier Cameron[3], T. Henning[4], M. Mayor[1], F. Pepe[1], N. Piskunov[5], D. Pollacco[6], D. Queloz[7,1], A. Quirrenbach[8], H. Rauer[9], R. Rebolo[10], N.C. Santos[11], I. Snellen[12], F. Zerbi[13]

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[3] University of St Andrews (UK)
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[5] Uppsala Astronomical Observatory (Uppsala University, Sweden)
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[7] Cambridge University (UK)
[8] Landessternwarte Heidelberg (Germany)
[9] DLR (Berlin, Germany)
[10] Institute of Astronomy of the Canary Islands (IAC, Spain)
[11] Center for Astrophysics of the University of Porto (CAUP, Portugal)
[12] Leiden Observatory (Leiden University, Netherlands)
[13] Astronomical Observatory of Brera (INAF, Italy)

White Paper, (arXiv:1412.1048)

Exoplanet science is booming. In 20 years our knowledge has expanded considerably, from the first discovery of a Hot Jupiter, to the detection of a large population of Neptunes and super-Earths, to the first steps toward the characterization of exoplanet atmospheres. Between today and 2025, the field will evolve at an even faster pace with the advent of several space-based transit search missions, ground-based spectrographs, high-contrast imaging facilities, and the James Webb Space Telescope. Especially the ESA M-class PLATO mission will be a game changer in the field. From 2024 onwards, PLATO will find transiting terrestrial planets orbiting within the habitable zones of nearby, bright stars. These objects will require the power of Extremely Large Telescopes (ELTs) to be characterized further. The technique of ground-based high-resolution spectroscopy is establishing itself as a crucial pathway to measure chemical composition, atmospheric structure and atmospheric circulation in transiting exoplanets. A high-resolution spectrograph covering the visible and near-IR domains, mounted on the European ELT, will be able to detect molecules such as water vapour, carbon dioxide and oxygen in the atmospheres of habitable planets under favourable circumstances. E-ELT HiRES is the perfect ground-based match to the PLATO space mission and represents a unique opportunity for Europe to lead the world into the era of exploration of exoplanets with habitable conditions. HiRES will also be extremely complementary to other E-ELT planned instruments specialising in different kinds of planets, such as METIS and EPICS.

Download/Website: `http://arxiv.org/abs/1412.1048`

Contact: `Stephane.Udry@unige.ch`

4 Jobs and Positions

Lectureship in Astrophysics (Exoplanets)

Richard Nelson
School of Physics and Astronomy, Queen Mary University of London, UK

Deadline: 6th February 2015, start date: 2015

Queen Mary, University of London is a leading university in the UK, with a breadth of excellence across Science and Engineering, Medicine, and Humanities and Social Sciences. The School of Physics and Astronomy maintains a tradition of outstanding research in ground-breaking fields. Research in the School is internationally excellent, with academic and research staff and students working in dedicated Research Centres in Astronomy, Condensed Matter Physics, Experimental Particle Physics and Theoretical Physics.

The School is seeking to appoint a Lecturer in the area of Exoplanets within the Astronomy Unit (AU). The Astronomy Units current major activities cover cosmology, planetary formation and dynamics, space and solar plasma physics, survey astronomy and helio/asteroseismology. The AU has access to high quality computing resources in the form of local HPC facilities.

The successful candidate will already have shown outstanding research achievements or potential, consistent with their current career point, and have an outstanding proven record of research in the observational study of exoplanets that strengthens, complements and enhances existing research strengths within the Astronomy Unit. The successful candidate will be expected to contribute to the delivery of high-quality teaching and research within the School.

The starting salary will be in the range £39,351 to £45,110 per annum, depending on experience, inclusive of London Allowance. Benefits include 30 days annual leave, defined benefit pension scheme and interest-free season ticket loan.

Candidates are requested to provide an up-to-date publication list, a statement of research plans and the contact details of three academic referees, included as part of the Curriculum Vitae that is uploaded during the on-line application process.

Informal enquiries should be addressed to Prof Richard Nelson at r.p.nelson@qmul.ac.uk or on +44 (0)20 7882 3460.

General information about the School can be found at www.ph.qmul.ac.uk and about the Astronomy Unit at www.astro.qmul.ac.uk.

The closing date for applications is 6 February 2015.

QMUL values diversity and is committed to equality. The University holds an Athena SWAN bronze award and the School of Physics and Astronomy holds IoP JUNO Practitioner status and is actively working towards the JUNO Champion Award. As part of the Schools participation in the JUNO programme we strongly encourage applications from women.

Download/Website: `http://www.jobs.qmul.ac.uk/5317`

Contact: `r.p.nelson@qmul.ac.uk`

Post-doctoral Position in Microlensing Research

R.A. Street[1], *V. Bozza*[2], *R.K. Barry*[3], *Y. Tsapras*[4], *K. Horne*[5], *M. Dominik*[5], *M. Hundertmark*[6]

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[6] Niels Bohr Institute, University of Copenhagen, Juliane Maries vej 30, 2100 Copenhagen, Denmark

LCOGT, From March 2015 onwards

The Las Cumbres Observatory Global Telescope Network, Inc. (LCOGT) and University of California, Santa Barbara seek a postdoctoral scientist to work on the LCOGT Microlensing Program and the creation of open source microlensing modeling software. The ideal candidate should have demonstrated expertise in software development and experience in the theory and/or observation of microlensing events, although candidates from other fields with a strong software background are encouraged.

This position will be funded by a grant from NASA to develop open source, automated software for the modeling of microlensing events and provide community access to this service. The successful candidate will also contribute to the ongoing Microlensing Key Project and the overall mission of the observatory in the creation of a worldwide network of robotic telescopes specializing in time domain astronomy. The candidate will be encouraged and supported to conduct their own research.

LCOGT currently operates ten 1 meter and two 2 meter robotic telescopes. The 2 meter Faulkes Telescopes in Haleakala, Hawaii, and Siding Spring, Australia feature imagers and robotic FLOYDS low-resolution spectrographs. The 1 meter telescopes have imagers and are located at McDonald Observatory in Texas, CTIO in Chile, Siding Spring in Australia, and SAAO in South Africa.

Applicants should submit a CV, cover letter, and research statement, and should arrange to have three letters of reference sent to lcojobslcogt.net. Electronic PDF submissions are preferred. Applications complete by February 1, 2015 will receive full consideration. A Ph.D. in astronomy, physics, or a related discipline is required. The term of this position is 3 years, subject to receiving the funds. The Department of Physics and LCOGT are especially interested in candidates who can contribute to the diversity and excellence of the academic community through research. LCOGT and UCSB are equal opportunity employers.

This position has the option to be held as an employee of UCSB and thus receive the UCSB benefit package for Postdoctoral Scholars or held as a direct employee of LCOGT with similar benefits, but still affiliated to UCSB. For further information on UCSB benefits, go to:
http://hr.ucsb.edu/benefits/postdoctoral-scholars
The desired start date is from March 2015 onwards.

Download/Website: `http://lcogt.net`

Contact: `lcojobs@lcogt.net`

Postdoctoral Researcher in the Doppler Search for extra-solar Planets

Prof. A. Reiners
Institut für Astrophysik Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany

Institut für Astrophysik Göttingen, around June 2015

The Institute for Astrophysics Göttingen invites applications for the position of a **Postdoctoral Researcher in the Doppler Search for extra-solar Planets** for the upcoming experiments CARMENES, CRIRES+, and E-ELT HIRES. Candidates should have a PhD in physics or astronomy, and be experienced in high-precision radial velocity measurements, and preferably have experience in developing instruments for the detection of exoplanets. Regular working hours will be 39.8 hours per week with a limited contract of 2 years (Pay grade 13 TV-L).

The *Stellar Activity and Extra-solar Planets* research group at the Institute for Astrophysics (IAG) at the Georg-August University Göttingen offers a young and dynamic work environment. We are participating in the upcoming spectrograph programs CARMENES and CRIRES+, and in the development of E-ELT HIRES. In our laboratory, we are developing hardware for high-precision wavelength calibration, using a high-resolution Fourier transform spectrograph and local observing facilities. The candidate is expected to participate in the development of new hardware and the analysis of CARMENES data. The IAG hosts the collaborative research center 963 "Astrophysical Flow Instabilities and Turbulence". Göttingen is a historic university city with a vibrant student population situated close to the Harz mountains in central Germany.

The University of Göttingen is an equal opportunities employer and places particular emphasis on fostering career opportunities for women. Qualified women are therefore strongly encouraged to apply. Disabled persons with equivalent aptitude will be favoured.

Please send your application with the usual documents in electronic form by 28.02.2015 to e-mail: `sekr@astro.physik.uni-goettingen.de` ,
and contact Prof. Ansgar Reiners for questions.

Download/Website: `https://jobregister.aas.org/job_view?JobID=50456`

Contact: `sekr@astro.physik.uni-goettingen.de`

Postdoctoral Positions in Astrophysics

Dr. Leonardo Sánchez
Instituto de Astronomía, UNAM, Mexico

México City or Ensenada, Baja California, México, September 2015 start date

The Universidad Nacional Autónoma de México (UNAM) offers postdoctoral fellowships for one year, renewable for a second year depending on performance. Candidates interested in taking up a fellowship at the Instituto de Astronomía (IA) either in México City or Ensenada, Baja California, should apply directly to the IA. Applications should not be made to more than one Institute or Center at UNAM.

Fellows are expected to carry out original research in any area of astrophysics, collaborating with faculty and/or students. People working in exoplanet science are encouraged to apply. The main selection criteria will be outstanding research accomplishments and promise of future achievement. Fellows will have access to the San Pedro Mártir National Astronomical Observatory, Baja California facilities. Astronomers at Mexican institutions can compete for the mexican share of observing time on the 10.4 m Gran Telescopio de Canarias (GTC); they also have competitive access to the EVLA, the VLBA, and to ALMA, via collaboration with the USA National Radio Astronomy Observatory. The IA is a member of SDSS-IV, the High Altitude Water Cerenkov (HAWC) Observatory and the Transneptunian Automated Occultation Survey-II (TAOS-II). The IA has extensive computing facilities on site including a purpose-built high-performance computing center, and access to other UNAM supercomputers. The IA provides funds for publishing, and some support for observing and traveling.

The deadline for applying is 27 February 2015. Please see link for more information.

Download/Website: `http://bit.ly/1JP9sfD`

Contact: `leonardo@astro.unam.mx`

5 Conference announcements

UK Community Exoplanet Conference 2015

Amanda Doyle & Don Pollacco
University of Warwick, UK

University of Warwick, 30th March – 1st April 2015

The UK Community Exoplanet Conference 2015 will take place from 30 March to 1 April 2015 at the University of Warwick. The format will be different from the inaugural meeting which took place in Cambridge in April 2014.

This meeting will be composed of 20 minute talks from senior academic staff regarding the work that their department is doing in the exoplanet area, followed by short talks from PDRAs and PhD students on their research.

Registration is currently open and the registration fee of £300 includes two nights B&B, coffee breaks, lunch, and the conference dinner. A reduced rate of £247.50 is available for the first 50 students and the first 35 postdocs. Day rates are also available. The closing date for registration and abstract submission is 27 February.

Download/Website: `http://www2.warwick.ac.uk/fac/sci/physics/research/astro/research/ukexoplanet2015/`

Contact: `Amanda.Doyle@warwick.ac.uk`

1st Advanced School on Exoplanetary Science: Methods of detecting Exoplanets

Alessandro Sozzetti
INAF – Osservatorio Astrofisico di Torino, Strada Osservatorio, 20, I-10025 Pino Torinese (TO), Italy

Vietri sul Mare, Italy, May 25 – May 29, 2015

Rationale:
The Advanced School on Exoplanetary Science – taking place in the enchanting Amalfi Coast – is aimed at providing a comprehensive, state-of-the-art picture of the rich variety of relevant aspects of the fast-developing, highly interdisciplinary field of extrasolar planets research (both from an observational and theoretical viewpoint). The School is addressed to graduate students and young post-doctoral researchers, and offers the fascinating possibility to interact with world-class experts engaged in different areas of the astrophysics of planetary systems. The May 2015 School will be focused on the exoplanet detection technique that have contributed to the most significant advances in the field to-date: Doppler Spectroscopy, Transit Photometry, Gravitational Microlensing and Direct Imaging.

Organizing Committee:
V. Bozza (University of Salerno), L. Mancini (Max Planck Institute for Astronomy, Heidelberg), A. Sozzetti (INAF - Astrophysical Observatory of Turin)

Confirmed School Lecturers:
Direct Imaging: Dr. Riccardo Claudi, INAF - Astronomical Observatory of Padova, Italy
Planetary Transits: Prof. Andrew Collier Cameron, University of St Andrews, UK
Gravitational Microlensing: Prof. Andrew Gould, Ohio State University, USA
Doppler Spectroscopy: Prof. Artie P. Hatzes, Thuringian State Observatory, Germany

Lecture Notes:
The Lecture Notes of the 1st Advanced School on Exoplanetary Science will be published by Springer in its Astrophysics and Space Science Library series. A copy of the book will be given to each participant.

Fees:
The registration fee is 320 Euro, and includes a copy of the Lecture Notes, conference kit and coffee breaks. Lodging and meals (full-board accommodation at Hotel La Lucertola adjoint to the School venue), for the entire duration of the course (arrival on Sunday May 24, departure in the morning of Saturday May 30, 2015), will be in the order of 540-600 Euro. A limited number of grants, partially covering accommodation expenses, will be available for selected participants. Justified requests for economic support (addressed via email to the Organizing Committee) will have to be accompanied by the submission of a Curriculum Vitae.

Registration and abstract submission:
Registration is now open. There is a limited number of time slots for brief seminars of participants to present their own research. Title/Abstract submission is possible at any later moment after registration by sending an email to the Organizing Committee.

Important Dates:
20th November 2014: First Announcement, Registration Opens
15th January 2015: Second and Final Announcement
1st March 2010: Registration Deadline
1th May 2015: Final School programme
25th-29th May 2015: The School

Download/Website: `http://www.iiassvietri.it/ases2015.html`

Contact: `segreteria@iiassvietri.it`

Exoplanetary Atmospheres and Habitability – Thermodynamics, Disequilibrium and Evolution focus group

Andrea Chiavassa
Laboratoire Lagrange, UMR 7293, Observatoire de la Cote d'Azur, Bd de l'Observatoire, CS 34229 - 06304 Nice Cedex 4, France

Observatoire de la Cote d'Azur, 12 to 16 October 2015

Rationale:
The aim of the workshop is to discuss about chemical disequilibrium and its link to planetary habitability. In particular, the Thermodynamics, Disequilibrium and Evolution focus group seeks to understand how disequilibria are generated in geological / chemical / biological systems, and how these disequilibria can lead to emergent phenomena, such as self-organization and eventually, metabolism.

The prospects for planetary atmosphere characterization are excellent with access to large an amount of data for different kind of stars either with ground- or space-based telescopes supported by accurate modeling of the atmospheric compositions and their corresponding spectra. In particular for many discovered exoplanets (hot and gaseous), a large chemical disequilibrium in the atmosphere has been observed, due to the high vertical temperature gradient. Several new studies are now comparing this of vertical-mixing driven disequilibrium with the chemical disequilibrium characterizing the atmosphere of planet Earth, which is mainly due to the presence of life. However, present research on exoplanet's atmospheric disequilibrium is focused on a very small number of compounds (CH4, CO, CO2, H2O), lacking for a generalized and wider methodology. In this workshop we plan to enlarge these studies to a joint effort between the thermodynamics of habitable conditions to the exoplanetary atmospheres.

Three principal topics will be tackled during the workshop:
1. Icy moons, icy planets and the conditions for the emergence of life
2. The modeling and observations of exoplanetary atmospheres: chemistry and physics
3. The chemical disequilibrium in planetary atmospheres: from hot Jupiters to habitable planets

Invited Speakers:
Icy moons, icy planets and the conditions for the emergence of life: Laurie Barge - JPL, CalTech, Pasadena (USA) Athena Coustenis - Observatoire de Meudon, Meudon (France) Robert Pascal - CNRS and Universit de Montpellier (France)

The modeling and observations of exoplanetary atmospheres: chemistry and physics: Daniel Angerhausen - Goddard Space Flight Center, NASA, Greenbelt (USA) Renyu Hu - Jet Propulsion Laboratory (USA - to be confirmed) Franck Selsis - Observatoire de Bordeaux, Bordeaux (France)

The chemical disequilibrium in planetary atmospheres: from hot Jupiters to habitable planets: Sebastian Danielache - Sophia University, Tokyo (Japan) Tommaso Grassi - Starplan, University of Copenhagen, (Denemark) Eugenio Simoncini - Astrophysical Observatory of Arcetri, INAF, Firenze (Italy)

The Thermodynamic, Disequilibrium and Evolution (TDE) Focus Group is a NASA Astrobiology Institute (NAI) sponsored project aimed to make researchers meet and discuss on the thermodynamic requirements of life emergence and planetary habitability. In particular, since its set up in 2011, the TDE helped in bridging the gap between researchers working on the theory and experimental aspects of the Origin of Life and astronomers. It provided a thermodynamic discussion board for planning future space missions and deciding on future targets for the search for habitability. The TDE concentrates on the entropy and energy requirements for life and planets and how they inform our selection of potentially habitable planets and environments in the cosmos.

The TDE page on the NAI website: https://astrobiology.nasa.gov/focus-groups/current/thermodynamics-disequilibrium-and-evolution-tde/

Important Dates:
December, 2014 : First announcement and web site
December 1st, 2014 : Registration and abtract submission open
April 30th, 2015 : Deadline for financial support request check here for information
June 30th, 2015 : Deadline for registration, fee payment (100 euro) and abstract submission
October 5th, 2015 : The workshop starts

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

Contact: `exoatmo@sciencesconf.org`

In the spirit of Bernard Lyot 2015

René Doyon[1,2], *David Lafrenière*[1,2]
[1] Institut de recherche sur les exoplanètes - iREx - Institut for research on exoplanets
[2] Université de Montréal, C. P. 6128 succ. centre ville, Montréal, Québec, Canada H3C 3J7.

Montréal, Québec, Canada, June 22-26, 2015

Registration is now open for the Lyot 2015 conference to be held in Montréal in June 22-26. The conference will take place at the Hotel Marriott Chateau Champlain (downtown).

Conference purpose and scope:
In the last 20 years, the field of exoplanet studies rapidly evolved to become one of the most active in astronomy. Nearly 2000 planets have now been identified outside of our solar system. The search for and study of these objects occupy a sizeable fraction of observing time on large facilities worldwide, often using instruments built mainly or exclusively for that purpose. In addition, many ambitious new ground- and space-based projects are currently being developed to push the limits even further.

This research field relies on several complementary observational techniques, with indirect studies using radial velocity or photometric monitoring of the stellar hosts being responsible for the vast majority of the data collected so far. But today, after years of developments and the start of operation of a new generation of high contrast "planet finders", direct imaging is emerging as another major contributor to this exciting enterprise. This method will help to develop a more complete picture of the full diversity of exoplanet systems, by exploring longer orbital periods. Direct imaging also provides a unique means to obtain information about the atmospheric properties of young gas giants. The few direct imaging detections accomplished thus far give only a small glimpse of the breakthroughs that are expected in the few years to come.

This conference will be focused on the direct detection and characterization of exoplanets and circumstellar disks, including the following topics:

Current surveys, results & population statistics
Characterization of known imaged planets and systems
Planet mass estimates from luminosity and spectra & independent mass constraints
High-contrast observation and image processing techniques
Planet formation, evolution and atmosphere models in view of current results
Synergy of direct imaging with other techniques (RV, astrometry, transits, etc.)
Wide companions, brown dwarfs and isolated planetary-mass objects
Debris and protoplanetary disks

Planetary system architecture & dynamics, planet-disk interactions
Host star properties (ages, metallicity, rotation, etc.)
New concepts and advances for high-contrast imaging instrumentation
Near- and long-term future projects, space missions, and ELTs

We strongly encourage students to come and will provide some limited grants for student participants.

About this conference series:
Inventor of the coronagraph, Bernard Lyot was a pioneer in the field of high contrast imaging and many of the techniques used today for disks and exoplanets imaging derive from his coronagraph concept. In addition to his instrumentation work, Lyot really focused his activities on scientific research and he made many important discoveries, such as the first detection of spectral lines in the solar corona – which he made using his coronagraph. Thus, Bernard Lyot symbolises the synergy between technical innovation and science breakthroughs that is inherent to our field of research.

The first “In the Spirit of Bernard Lyot” conference was held in Berkeley in 2007 and the second one was held in Paris in 2010. This conference will be the third of this series.

Important dates:
2nd announcement, early registration begins: December 10, 2014
abstract submission deadline: February 2nd, 2015
early registration deadline: February 27th, 2015
late registration: anytime before the conference

Download/Website: `http://craq-astro.ca/lyot2015`

Contact: `lyot2015@astro.umontreal.ca`

Twinkle community workshop

Giovanna Tinetti & the Twinkle consortium
University College London, Dept. of Physics and Astronomy, Office G24, Gower Street, London WC1E 6BT, UK

Royal Astronomical Society, London, UK, 6th February 2015

we kindly invite you to attend the first Twinkle workshop, an event open to the whole UK science community. The one-day workshop will be held at the Royal Astronomical Society on Friday February 6 2015 (11AM - 4:30PM).

Registration is now open: https://www.eventbrite.com/e/twinkle-community-workshop-at-the-royal-astronomical-society-registration-15129374366

With Twinkle, we aim to build and launch within the next 3 to 4 years a small and cost-effective UK built spacecraft into low-Earth orbit, dedicated to the observation of exoplanet atmospheres. Working together with Surrey Satellite Technology Ltd. allows us to achieve this ambitious project by the reuse of an existing platform.

The planets observable with Twinkle will span a range of masses, stellar companions and temperatures. Twinkle will investigate their composition and chemical/physical properties through repeated, simultaneous, multi-wavelength spectroscopic observations.

This first community workshop will provide an overview of the Twinkle science case and the Twinkle instrument design, and will feature discussions outlining the possibilities for contributions. It will also be an opportunity to get on board and join a growing list of partner institutions.

PRELIMINARY AGENDA
11.00: Welcome and Twinkle description session:
Mission overview
Surrey Satellite Technology Ltd - platform
Payload
Programmatic review

12.30: Lunch

13.30: Twinkle science & working groups: opportunities for contributions

14.00: Contributed science talks

15.00: Coffee break

15.30: Contributed science talks

16.00: Discussion

16.30/17.00: Wrap up and end.
Download/Website: `https://www.eventbrite.com/e/twinkle-community-workshop-at-the-royal-astrono`

Contact: `Amanda.Doyle@warwick.ac.uk`

From super-Earths to brown dwarfs: Who's Who?

Didier Quéloz, Chair[1], *Arnaud Cassan, co-Chair*[2], *Guillaume Hébrard, co-Chair*[2]
[1] Cavendish Laboratory, Cambridge, UK
[2] Institut d'Astrophysique de Paris, Paris, France

Paris, France, 29 June – 3 July 2015

The proposal for the 31th annual IAP colloquium to be devoted to exoplanet science was first considered due to the particular meaning of 2015 which marks the 20th anniversary of the announcement of the first planet, 51 Peg b, around a star other than the Sun. This detection has triggered an extraordinary development in exoplanet research all around the world. Through these twenty years, the remarkable increase of the sample size of identified planets, close nowadays of 2000, has revealed an extreme diversity in mass, density, nature, position, orbit and multiplicity. This diversity has led to try to class the detected objects in diverse types.

The colloquium aims to thoroughly examine the definition of planet types, detected by different methods, each of them with its capabilities and its limits, by focusing on the transition from one type to another. Which parameters are controlling these various transitions? It is proposed to analyze from observations and models as well the passage very often ill-defined:

- from Earth-mass planets to super-Earths
- from super-Earths to mini-Neptunes
- from Jupiters to super-Jupiters

- from super-Jupiters to brown dwarfs
- from rocky planets to gas giant planets
- from bound-planets to free-floating planets

For this purpose, the colloquium will be organized in sessions devoted respectively to the main classes of planet up to the brown dwarfs, opened by one or two invited reviews, in which observations and models will be confronted.The opening session will focus on the formation of the Solar System, reviewed at the light of the exoplanet discoveries knowing that these planets are always the point of comparison for the extrasolar systems.

Confirmed invited speakers:
Jérémy Leconte (France), Jim Kasting (USA), David Charbonneau (USA), Masahiro Ikoma (Japan), Natalie Batalha(USA), Adam Showman (USA), Magali Deleuil (France), Gilles Chabrier (France), Kevin Luhman (USA), David Sing(UK)

It is already possible to pre-register and to propose a contribution by going for more details to the official website of the 2015 IAP Colloquium. Early registration is encouraged, as the number of participants will be limited to approximately 120.

Download/Website: `http://www.iap.fr/col2015/`

Contact: `conferenceIAP2015@iap.fr`

Atmosphere Science in the Context of CHEOPS, TESS, K2 and PLATO

John Lee Grenfell
DLR Institute of Planetary Research, Berlin, Germany

Berlin, Germany, 2–4 March 2015

The workshop will focus on how the four missions above will further our knowledge of exoplanetary atmospheres. Central science themes include:

- determining the range of atmospheric composition and planetary albedo for hot Jupiters, mini-Neptunes and (hot) Super-Earths;
- constraining the presence of clouds and aerosols;
- determining what processes (outgassing, escape etc.) influence atmospheric evolution and how they correlate with age, stellar type etc;
- determining interactions between the interior and atmosphere in terms of compositional interrelations between solid and liquid interior reservoirs and exoplanet atmospheres and their corresponding host stars;
- deciding the best targets for follow-up spectroscopy missions.

Note: Contributions will be favoured which can demonstrate a specific link with data to-be-collected by one of the four missions. As an example - theoretical studies calculating atmospheric spectra which investigate what the proposed PLATO 2.0 ”blue” and ”red” colour filters will tell us about exoplanetary atmospheres.

Registration and abstract deadline: February 6th 2015
Participation is limited to a total of 80 guests. Oral or poster contributions will be considered.

SOC: John Lee Grenfell, Kevin Heng, Helmut Lammer, Nicolas Iro
LOC: Barbara Stracke, Mareike Godolt, Ruth Titz, Claudia Dreyer, Ulrike Stiebeler, John Lee Grenfell
Download/Website: `http://www.oact.inaf.it/plato/PPLC/PLATO_Meetings/Entries/2015/3/2_PLATO_2015.`

Contact: `PLATO_atmospheres@dlr.de`

Exoplanets in Lund 2015

Anders Johansen, Katrin Ros, Michiel Lambrechts
Lund Observatory, Lund University, Sweden

Lund Observatory, Lund, Sweden, 15–17 May 2013

The meeting **Exoplanets in Lund 2015** will be held at Lund Observatory 6-8 May 2015 and will cover exoplanet-related science, in particular connected to the CHEOPS satellite mission. A general theme of the meeting is formation, migration and collisions of tightly packed inner planetary systems.

The meeting will start on the morning of Wednesday 6 May and finish on Friday 8 May before lunch, allowing participants to fly back (from Copenhagen Airport) on Friday afternoon.

The programme will have the following sessions:

- Exoplanet surveys
- Debris discs
- Migration and planetary formation
- Planetary collisions and planetary system dynamics
- Planetary structure

Confirmed invited speakers include Clement Baruteau, Tristan Guillot, Zoe Leinhardt, Nikku Madhusudhan, Giampaolo Piotto, Ignasi Ribas, Mark Wyatt.

Registration closes 20 March 2015.

Scientific organising committee:
Melvyn B. Davies (SOC chair; Lund University)
Willy Benz (University of Bern)
Alexis Brandeker (Stockholm University)
Anders Johansen (Lund University)
Giampaolo Piotto (University of Padoa)
Mark Wyatt (University of Cambridge)

Local organising committee:
Anders Johansen (LOC chair; Lund University)
Bertram Bitsch (Lund University)
Alex Mustill (Lund University)

Download/Website: `http://www.astro.lu.se/lundexoplanets2015`

Contact: `anders@astro.lu.se`

2015 Sagan Summer Workshop: Exoplanetary System Demographics: Theory and Observation

D. Gelino
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, July 27-31, 2015

Registration for the 2015 Sagan Exoplanet Summer Workshop on ”Exoplanetary System Demographics: Theory and Observation” hosted by the NASA Exoplanet Science Institute (NExScI) will be available in early Feburary. The workshop will take place on the Caltech campus July 27 - 31, 2015. The workshop is intended for graduate students and postdocs, however all interested parties are welcome to attend. There is no registration fee for the workshop and attendance will be capped at 150 attendees.

The 2015 Sagan Summer Workshop will explore exoplanetary systems through the combined lens of theory and observations. Several observational techniques have now detected and characterized exoplanets, resulting in a large population of known systems. Theoretical models, meanwhile, can synthesize populations of planetary systems as a function of the input physics. Differences between the predicted and the observed distributions of planets provide strong constraints on the physical processes that determine how planetary systems form and evolve, ruling out some old theories while suggesting new ones. Leaders in the field will summarize the current state of the art in exoplanet observations and planet formation theory. Observations needed to discriminate between competing theories will be discussed and compared against the expected improvements in exoplanet detection limits.

We have very limited funding for financial assistance to cover local expenses (e.g. shared hotel room, meals), however, this year we are not able to provide any airfare support. The on-line application for financial support will be available in early February. Each application must be accompanied by an advisor’s letter of support that specifically addresses financial need. Attendees who are awarded lodging support will be asked to share a hotel room at the workshop hotel.

Attendees will participate in hands-on exercises in which population synthesis models are tuned to match observations. Attendees will also have the opportunity to present their own work through short presentations (research POPs) and posters.

Important Dates

- February 5, 2015: On-line Registration and Financial Support application period open
- March 5, 2015: Financial Support application due
- March 30, 2015: Financial Support decisions announced via email
- April 6, 2015: POP/Poster/Talk submission period open
- July 10, 2015: On-line Registration closed; final agenda posted
- July 27-31, 2015: Sagan Exoplanet Summer Workshop

Download/Website: `http://nexsci.caltech.edu/workshop/2015`
Contact: `sagan_workshop@ipac.caltech.edu`

Spectroscopy of Exoplanets: ExoMol conference

Jonathan Tennyson[1], France Allard[2], Attila Császár[3], Sergey Yurchenko[1], Laura McKemmish[1], Giovanna Tinetti[1]
[1] Department of Physics & Astronomy, University College London, Gower Street, London, UK
[2] CRAL-ENS, 46, Allée d'Italie, Lyon Cedex 07, France
[3] Eötvös University, Pázmány Péter sétány 1/A, H-1117 Budapest, Hungary

Cumberland Lodge, The Great Park Windsor, Berkshire, SL4 2HP, UK, 24 – 26 July 2015

After four years of the ExoMol project we will be holding a conference 'Spectroscopy of Exoplanets' at Cumberland Lodge near to London. The conference will begin in the morning on 24 July and running through to the evening of 26 July 2015 (departing after breakfast the following day).
Cumberland Lodge is a 17th Century house located in Great Windsor Park. It offers easy access to Heathrow and is close to Windsor Castle, which is the oldest and largest occupied castle in the world and the official residence of Her Majesty the Queen. We would aim to visit the castle during the course of the conference. You may like to look at the Cumberland Lodge website: `http://www.cumberlandlodge.ac.uk/`
The provisional programme includes sessions on: Existing sources of opacity data, New opacity data, Advances in understanding brown dwarf atmospheres, characterising exoplanet atmospheres, Modelling the transitions between cool stars to brown dwarfs to planetary mass objects, and Observational issues.
We have gaps for 20 minute talks and posters if you want to present work.
You will find further details including: a registration form, details of payments and abstract submissions on the Conference website.
We very much hope that you will be able to attend the conference.

Download/Website: `http://www.exomol.com/conference/2015/`

Contact: `s.yurchenko@ucl.ac.uk`

6 Announcements

ARIEL: an exoplanet spectroscopy mission for the ESA M4 programme

Enzo Pascale & the ARIEL Consortium
School of Physics and Astronomy, Cardiff University, Queen's Buildings, The Parade Cardiff CF24 3AA

ESA M4 programme, 15 January 2015

In response to the call for a medium size mission opportunity in ESA's science programme (M4), we will submit a proposal to implement the ARIEL space mission: Atmospheric Remote-sensing Infrared Exoplanet Large-survey. If you are interested in learning more about ARIEL, want to express your interest in this mission or want to contribute by joining the UK-led consortium of world-leading academic institutes and industry in Europe, please replay to this email.

The proposal is due on January 15 2015. We would also like to organise an open meeting, but because of the tight deadline we were unfortunately unable to do this before submission. An open meeting will be organised later this year.

This mission will be devoted to observing spectroscopically in the IR a large population (hundreds to one thousand) of known transiting planets in our Galaxy, opening a new discovery space in the field of extrasolar planet exploration and enabling a quantum leap in the understanding of the physics and chemistry of these far away worlds.

ARIEL is based around a 0.9 m diameter telescope and a spectrometer covering the band from 1.95 to 7.8 micron, in addition to photometry in the visible. It will launch in 2025. This mission will study a large population of extrasolar planets, discovered by ESA (GAIA, Cheops, PLATO) and NASA (Kepler II, TESS) missions and from the ground, which will include gas-giants, Neptunes and large terrestrial planets, in orbits close to their parent stars.

Please, send your enquiry by replying to the email below if you would like to receive further information , or want to contribute by joining the ARIEL consortium.

Contact: `enzo.pascale@astro.cf.ac.uk`

7 As seen on astro-ph

The following list contains all the entries relating to exoplanets that we spotted on astro-ph during December 2014 and January 2015. If you see any that we missed, please let us know and we'll include them in the next issue.

December 2014

astro-ph/1412.0014 : **How Low Can You Go? The Photoeccentric Effect for Planets of Various Sizes** by *Ellen M. Price, et al.*

astro-ph/1412.0167 : **Debris Distribution in HD 95086 - A Young Analog of HR 8799** by *Kate Y. L. Su et al.*

astro-ph/1412.0284 : **Dynamics of exoplanetary systems, links to their habitability** by *Emeline Bolmont, Sean N. Raymond, Franck Selsis*

astro-ph/1412.0451 : **The properties of XO-5b and WASP-82b redetermined using new high-precision transit photometry and global data analyses** by *A. M. S. Smith*

astro-ph/1412.0674 : **Nature or nurture of coplanar Tatooines: the aligned circumbinary Kuiper belt analogue around HD 131511** by *Grant M. Kennedy*

astro-ph/1412.0675 : **Exo-zodi modelling for the Large Binocular Telescope Interferometer** by *Grant M. Kennedy, et al.*

astro-ph/1412.0930 : **Influence of different parameters on the chemical composition of warm neptunes** by *Olivia Venot, et al.*

astro-ph/1412.1048 : **Exoplanet Science with the European Extremely Large Telescope. The Case for Visible and Near-IR Spectroscopy at High Resolution** by *S. Udry, et al.*

astro-ph/1412.1118 : **Dynamics and Habitability in Binary Star Systems** by *Siegfried Eggl, Nikolaos Georgakarakos, Elke Pilat-Lohinger*

astro-ph/1412.1129 : **Fomalhaut b as a Dust Cloud: Frequent Collisions within the Fomalhaut Disk** by *S. M. Lawler, S. Greenstreet, B. Gladman*

astro-ph/1412.1137 : **Photophoresis in protoplanetary disks: a numerical approach** by *Nicolas Cuello, Francesco C. Pignatale, Jean-Francois Gonzalez*

astro-ph/1412.1302 : **On the abundance of extraterrestrial life after the Kepler mission** by *Amri Wandel*

astro-ph/1412.1510 : **Transient chaos and fractal structures in planetary feeding zones** by *Tamas Kovacs, Zsolt Regaly*

astro-ph/1412.1546 : **Can the masses of isolated planetary-mass gravitational lenses be measured by terrestrial parallax?** by *M. Freeman, et al.*

astro-ph/1412.1731 : **On the Occurrence Rate of Hot Jupiters in Different Stellar Environments** by *Ji Wang, et al.*

astro-ph/1412.1764 : **The Habitable Zones of Pre-Main-Sequence Stars** by *Ramses M. Ramirez, Lisa Kaltenegger*

astro-ph/1412.1824 : **Depletion of molecular gas by an accretion outburst in a protoplanetary disk** by *A. Banzatti, et al.*

astro-ph/1412.1827 : **Reduced Light Curves from Campaign 0 of the K2 Mission** by *Andrew Vanderburg*
astro-ph/1412.2135 : **Fast Modes and Dusty Horseshoes in Transitional Disks** by *Tushar Mittal, Eugene Chiang*
astro-ph/1412.2175 : **An ALMA Disk Mass for the Candidate Protoplanetary Companion to FW Tau** by *Adam L. Kraus, et al.*
astro-ph/1412.2757 : **CO mass upper limits in the Fomalhaut ring - the importance of NLTE excitation in debris discs and future prospects with ALMA** by *L. Matra, et al.*
astro-ph/1412.2992 : **Improving Planet-Finding Spectrometers** by *Justin R. Crepp*
astro-ph/1412.2996 : **Detection of the secondary eclipse of WASP-10b in the Ks-band** by *Patricia Cruz, et al.*
astro-ph/1412.3307 : **Detectability of substellar companions around white dwarfs with Gaia** by *Roberto Silvotti, et al.*
astro-ph/1412.3380 : **XUV-driven mass loss from extrasolar giant planets orbiting active stars** by *J. M. Chadney, et al.*
astro-ph/1412.3412 : **Spiral arms in scattered light images of protoplanetary discs: Are they the signposts of planets?** by *Attila Juhasz, et al.*
astro-ph/1412.3560 : **Shallow Cavities in Multiple-Planet Systems** by *Paul C. Duffell, Ruobing Dong*
astro-ph/1412.3593 : **Erosion and the limits to planetesimal growth** by *Sebastiaan Krijt, C et al.*
astro-ph/1412.4145 : **Near-Infrared Image of the Debris Disk around HD 15115** by *Shoko Sai, et al.*
astro-ph/1412.4440 : **The Formation of Super-Earths and Mini-Neptunes with Giant Impacts** by *Niraj K. Inamdar, Hilke E. Schlichting*
astro-ph/1412.4632 : **Shadows cast by a warp in the HD 142527 protoplanetary disk** by *Sebastian Marino, Sebastian Perez, Simon Casassus*
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