ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Welcome to the 69th edition of ExoPlanet News. This month's edition has the usual collection of excellent paper abstracts, as well as conference and job vacancy announcements.
Following the recent, very successful, UK Exoplanet Community meeting held in Cambridge that was attended by over 100 participants, it occurred to me that a useful addition to this newsletter could be brief "meeting reports" following successful conferences. If conference organizers would like to send me such items, I'd be pleased to include them in future editions.
The next edition of the newsletter will be sent out at the end of May 2014. Please send anything relevant before then to exoplanet@open.ac.uk, and it will appear in the next edition. 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.

Best wishes
Andrew Norton
The Open University

2 Abstracts of refereed papers

Star-Disc-Binary Interactions in Protoplanetary Disc Systems and Primordial Spin-Orbit Misalignments

Dong Lai
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Monthly Notices of the Royal Astronomical Society, in press

We study the interactions between a protostar and its circumstellar disc under the influence of an external binary companion to determine the evolution of the mutual stellar spin - disc misalignment angle. The gravitational torque on the disc from an inclined binary makes the disc precess around the binary axis, while the star-disc interaction torque due to the rotation-induced quadrupole makes the stellar spin and the disc angular momentum axes precess around each other. A significant star-disc misalignment angle can be generated from a small initial value as the star-disc system evolves in time such that the two precession frequencies cross each other. This "secular resonance" behavior can be understood in a geometric way from the precession dynamics of spin and disc angular momenta. We derive the conditions for such resonance to occur, and find that they can be satisfied for reasonable protostar-disc-binary parameters. The evolution of star-disc inclination is also affected by mass accretion and by magnetic star-disc interaction torques, which can either promote or reduce star-disc misalignment. In general, as long as the initial binary-disc inclination is greater than a few degrees, a variety of star-disc misalignment angles can be generated within the disc lifetimes. We discuss the implications of our results for the stellar spin orientations in binaries, for the alignments/misalignments of protostellar discs and debris discs, and for the stellar obliquities in exoplanetary systems. In particular, if hot Jupiters are produced by the Kozai effect induced by an external stellar companion, then it is likely that "primordial" star-disc misalignments are already generated by the star-disc-binary interactions. Even for systems where the Kozai effect is suppressed, misaligned planets may still be produced during the protoplanetary disc phase.

Download/Website: `http://arxiv.org/abs/1402.1907`

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Carbon monoxide and water vapor in the atmosphere of the non-transiting planet HD 179949 b

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Astronomy & Astrophysics, in press (arXiv:1404.3769)

In recent years, ground-based high-resolution spectroscopy has become a powerful tool for investigating exoplanet atmospheres. It allows the robust identification of molecular species, and it can be applied to both transiting and non-transiting planets. Radial-velocity measurements of the star HD 179949 indicate the presence of a giant planet companion in a close-in orbit. The system is bright enough to be an ideal target for near-infrared, high-resolution spectroscopy. Here we present the analysis of spectra of the system at 2.3 μm, obtained at a resolution of $R \sim 100,000$, during three nights of observations with CRIRES at the VLT. We targeted the system while the exoplanet was near superior conjunction, aiming to detect the planet's thermal spectrum and the radial component of its orbital velocity. Unlike the telluric signal, the planet signal is subject to a changing Doppler shift during the observations. This is due to the changing radial component of the planet orbital velocity, which is on the order of 100-150 km s^{-1} for these hot Jupiters. We can therefore effectively remove the telluric absorption while preserving the planet signal, which is then extracted from the data by cross correlation with a range of model spectra for the planet atmosphere. We detect molecular absorption from carbon monoxide and water vapor with a combined signal-to-noise ratio (S/N) of 6.3, at a projected planet orbital velocity of $K_{\rm P} = (142.8 \pm 3.4)$ km s^{-1}, which translates into a planet mass of $M_{\rm P} = (0.98 \pm 0.04)$ Jupiter masses, and an orbital inclination of $i = (67.7 \pm 4.3)$ degrees, using the known stellar radial velocity and stellar mass. The detection of absorption features rather than emission means that, despite being highly irradiated, HD 179949 b does not have an atmospheric temperature inversion in the probed range of pressures and temperatures. Since the host star is active ($R'_{HK} > -4.9$), this is in line with the hypothesis that stellar activity damps the onset of thermal inversion layers owing to UV flux photo-dissociating high-altitude, optical absorbers. Finally, our analysis favors an oxygen-rich atmosphere for HD 179949 b, although a carbon-rich planet cannot be statistically ruled out based on these data alone.

Download/Website: `http://arxiv.org/abs/1404.3769`

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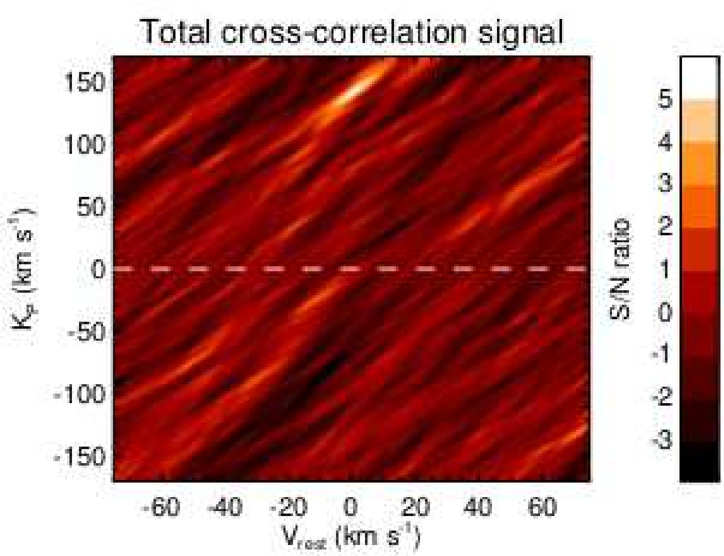

Figure 1: (Brogi et al.) Total cross-correlation signal from the atmosphere of HD 179949 b, shown as a function of rest-frame velocity $V_{\rm rest}$ and planet radial velocity amplitude $K_{\rm P}$. The planet is detected at a signal-to-noise ratio of 6.3 for $K_{\rm P} = (142.8 \pm 3.4)$ km s^{-1}, which translates into a planet mass of $M_{\rm P} = (0.98 \pm 0.04)$ Jupiter masses and an orbital inclination of (67.6 ± 4.3) degrees. The signal is detected by cross correlating with model spectra containing equal abundances of CO and H_2O.

Modeling magnesium escape from HD 209458b atmosphere.

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Astronomy & Astrophysics, in press (arXiv:1404.2120)

Transit observations in the Mg I line of HD 209458b revealed signatures of neutral magnesium escaping the upper atmosphere of the planet, while no atmospheric absorption was found in the Mg II doublet. Here we present a 3D particle model of the dynamics of neutral and ionized magnesium populations, coupled with an analytical modeling of the atmosphere below the exobase. Theoretical Mg I absorption line profiles are directly compared with the absorption observed in the blue wing of the line during the planet transit. Observations are well-fitted with an escape rate of neutral magnesium $\dot{M}_{\mathrm{Mg}^0}$=$2.9^{+0.5}_{-0.9}$ $\times 10^7$ g s^{-1}, an exobase close to the Roche lobe (R_{exo}=$3^{+1.3}_{-0.9}$ R_{p}, where R_{p} is the planet radius) and a planetary wind velocity at the exobase $v_{\mathrm{pl-wind}}$=25 km s^{-1}. The observed velocities of the planet-escaping magnesium up to -60 km s^{-1} are well explained by radiation pressure acceleration, provided that UV-photoionization is compensated for by electron recombination up to $\sim 13\,R_{\mathrm{p}}$. If the exobase properties are constrained to values given by theoretical models of the deeper atmosphere (R_{exo}=2 R_{p} and $v_{\mathrm{pl-wind}}$=10 km s^{-1}), the best fit to the observations is found at a similar electron density and escape rate within 2σ. In all cases, the mean temperature of the atmosphere below the exobase must be higher than $\sim$ 6100 K. Simulations predict a redward expansion of the absorption profile from the beginning to the end of the transit. The spatial and spectral structure of the extended atmosphere is the result of complex interactions between radiation pressure, planetary gravity, and self-shielding, and can be probed through the analysis of transit absorption profiles in the Mg I line.

Download/Website: `http://arxiv.org/abs/1404.2120`

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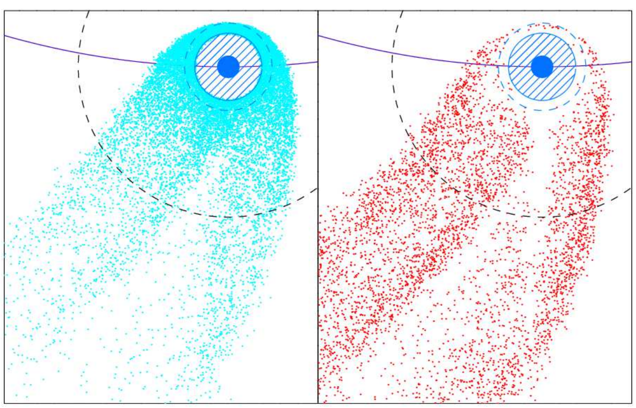

Figure 2: (Bourrier et al.) Distribution of neutral (light blue dots; left panel) and ionized (light red dots; right panel) magnesium atoms in the orbital plane of HD209458b, shown as a deep blue disk. Magnesium atoms that escape at the exobase level (found to be close to the Roche lobe at 3 R_{p}; striped blue disk) are accelerated away from the star by radiation pressure (the star is along the vertical direction toward the top of the plot). UV-photoionization of neutral magnesium is compensated for by electron-recombination, and the escaping cloud is thus mainly neutral up to about 3.9 R_{p} (blue dashed circle). Magnesium atoms keep a high probability to stay in this state until they reach the equilibrium altitude between ionization and recombination at 13.4 R_{p} (black dashed circle), beyond which ionized magnesium does not recombine efficiently anymore. Because of the planet shadow and shielding from the main atmosphere, the inner part of the cometary tail is empty of radiation-pressure accelerated particles.

Planet transit and stellar granulation detection with interferometry

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Astronomy & Astrophysics, in press (arXiv:1404.7049)

Context. Stellar activity, and in particular convection-related surface structures, potentially cause bias in the planet detection and characterisation. In the latter, interferometry can help to disentangle the signal of the transiting planet.
Aims. We used realistic three-dimensional (3D) radiative hydrodynamical (RHD) simulations from the STAGGER-grid and synthetic images computed with the radiative transfer code OPTIM3D to provide interferometric observables to extract the signature of stellar granulation and transiting planets.
Methods. We computed intensity maps from RHD simulations and produced synthetic stellar disk images as a nearby observer would see accounting for the centre-to-limb variations. We did this for twelve interferometric instruments covering wavelengths ranging from optical to infrared. We chose an arbitrary date and arbitrary star with coordinates that ensures observability throughout the night. This optimization of observability allows for a broad coverage of spatial frequencies. The stellar surface asymmetries in the brightness distribution, either due to convection-related structures or a faint companion mostly affect closure phases. We then computed closure phases for all images and compared the system star with a transiting planet and the star alone. We considered the impact of magnetic spots constructing a hypothetical starspots image and compared the resulting closure phases with the system star with a transiting planet.
Results. We analyzed the impact of convection at different wavelengths. All the simulations show departure from the axisymmetric case (closure phases not equal to 0 or $\pm\pi$) at all wavelengths. The levels of asymmetry and inhomogeneity of stellar disk images reach high values with stronger effects from 3rd visibility lobe on. We presented two possible targets (Beta Com and Procyon) either in the visible and in the infrared and found that departures up to 16° can be detected on the 3rd lobe and higher. In particular, MIRC is the most appropriate instrument because it combines good UV coverage and long baselines. Moreover, we explored the impact of convection on interferometric planet signature for three prototypes of planets with sizes corresponding to one hot Jupiter, one hot Neptune, and a terrestrial planet. The signature of the transiting planet on closure phase is mixed with the signal due to the convection-related surface structures, but it is possible to disentangle it at particular wavelengths (either in the infrared or in the optical) by comparing the closure phases of the star at difference phases of the planetary transit. It must be noted that starspots caused by the magnetic field may pollute the granulation and the transiting planet signals. However, it is possible to differentiate the transiting planet signal because the time-scale of a planet crossing the stellar disk is much smaller than the typical rotational modulation of a star.
Conclusions. The detection and characterisation of planets must be based on a comprehensive knowledge of the host star; this includes the detailed study of the stellar surface convection with interferometric techniques. In this context, RHD simulations are crucial to reach this aim. We emphasize that interferometric observations should be pushed at high spatial frequencies by accumulating observations on closure phases at short and long baselines.

Download/Website: `http://arxiv.org/abs/1404.7049`

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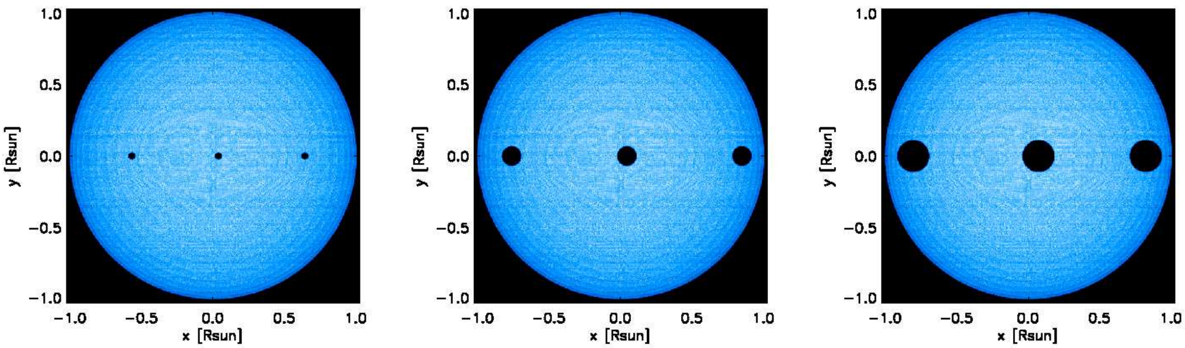

Figure 3: (Chiavassa et al.) Synthetic stellar disk images in PIONIER H band together with three planet transiting phases (black color) for the Sun of Table 1. The prototypes of planet are from Table 4 and are: Kepler-11 f prototype planet (left column), HD 149026 b prototype (central column), and CoRoT-14 b prototype (right column). The purpose is not to reproduce the exact conditions of the planet-star system already detected but to have a statistical approach on the interferometric signature for different stellar parameters hosting planets with different sizes.

Fomalhaut b as a Cloud of Dust: Testing Aspects of Planet Formation Theory

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The Astrophysical Journal, in press (arXiv:1403.5268)

We consider the ability of three models – impacts, captures, and collisional cascades – to account for a bright cloud of dust in Fomalhaut b. Our analysis is based on a novel approach to the power-law size distribution of solid particles central to each model. When impacts produce debris with (i) little material in the largest remnant and (ii) a steep size distribution, the debris has enough cross-sectional area to match observations of Fomalhaut b. However, published numerical experiments of impacts between 100 km objects suggest this outcome is unlikely. If collisional processes maintain a steep size distribution over a broad range of particle sizes (300 μm to 10 km), Earth-mass planets can capture enough material over 1–100 Myr to produce a detectable cloud of dust. Otherwise, capture fails. When young planets are surrounded by massive clouds or disks of satellites, a collisional cascade is the simplest mechanism for dust production in Fomalhaut b. Several tests using HST or JWST data – including measuring the expansion/elongation of Fomalhaut b, looking for trails of small particles along Fomalhaut b's orbit, and obtaining low resolution spectroscopy – can discriminate among these models.

Download/Website: `http://lanl.arxiv.org/abs/1403.5268`

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Planetesimal Formation in Self-Gravitating Discs: The effects of particle self-gravity and back-reaction

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Monthly Notices of the Royal Astronomical Society, in press (arXiv:1404.6953)

We study particle dynamics in self-gravitating gaseous discs with a simple cooling law prescription via two-dimensional simulations in the shearing sheet approximation. It is well known that structures arising in the gaseous component of the disc due to a gravitational instability can have a significant effect on the evolution of dust particles. Previous results have shown that spiral density waves can be highly efficient at collecting dust particles, creating significant local over-densities of particles. The degree of such concentrations has been shown to be dependent on two parameters: the size of the dust particles and the rate of gas cooling. We expand on these findings, including the self-gravity of dust particles, to see how these particle over-densities evolve. We use the PENCIL Code to solve the local shearing sheet equations for gas on a fixed grid together with the equations of motion for solids coupled to the gas through an aerodynamic drag force. We find that the enhancements in the surface density of particles in spiral density wave crests can reach levels high enough to allow the solid component of the disc to collapse under its own self-gravity. This produces many gravitationally bound collections of particles within the spiral structure. The total mass contained in bound structures appears nearly independent of the cooling time, suggesting that the formation of planetesimals through dust particle trapping by self-gravitating density waves may be possible at a larger range of radii within a disc than previously thought. So, density waves due to gravitational instabilities in the early stages of star formation may provide excellent sites for the rapid formation of many large, planetesimal-sized objects.

Download/Website: `http://arXiv.org/abs/1404.6953`

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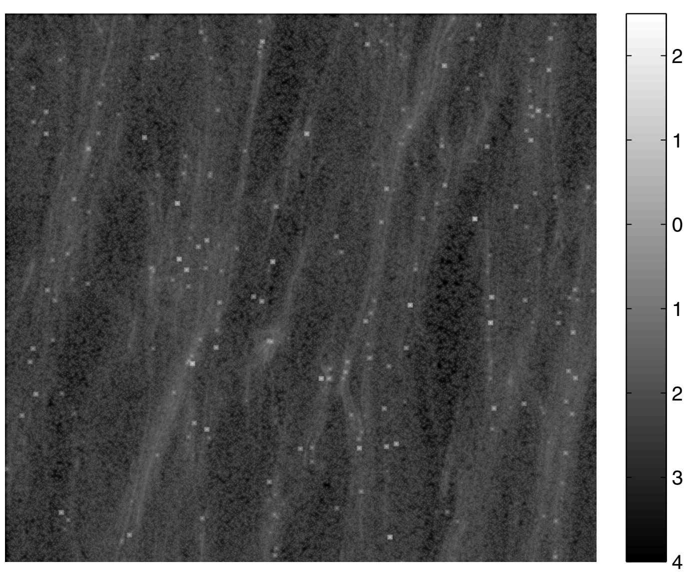

Figure 4: (Gibbons et al.) Logarithmic surface density of the dust particles. Due to the particles' mutual gravitational interaction, the filaments located in density waves in the disc contract, forming very dense bound clumps.

Direct detection of exoplanets in the 3 – 10 micron range with E-ELT/METIS

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International Journal of Astrobiology, http://arxiv.org/abs/1404.0831

We quantify the scientific potential for exoplanet imaging with the Mid-infrared E-ELT Imager and Spectrograph (METIS) foreseen as one of the instruments of the European Extremely Large Telescope (E-ELT). We focus on two main science cases: (1) the direct detection of known gas giant planets found by radial velocity (RV) searches; and (2) the direct detection of small (1 – 4 R_{earth}) planets around the nearest stars. Under the assumptions made in our modeling, in particular on the achievable inner working angle and sensitivity, our analyses reveal that within a reasonable amount of observing time METIS is able to image >20 already known, RV-detected planets in at least one filter. Many more suitable planets with dynamically determined masses are expected to be found in the coming years with the continuation of RV-surveys and the results from the GAIA astrometry mission. In addition, by extrapolating the statistics for close-in planets found by *Kepler*, we expect METIS might detect ∼10 small planets with equilibrium temperatures between 200 - 500 K around the nearest stars. This means that (1) METIS will help constrain atmospheric models for gas giant planets by determining for a sizable sample their luminosity, temperature and orbital inclination; and (2) METIS might be the first instrument to image a nearby (super-)Earth-sized planet with an equilibrium temperature near that expected to enable liquid water on a planet surface.

Download/Website: `http://arxiv.org/abs/1404.0831`

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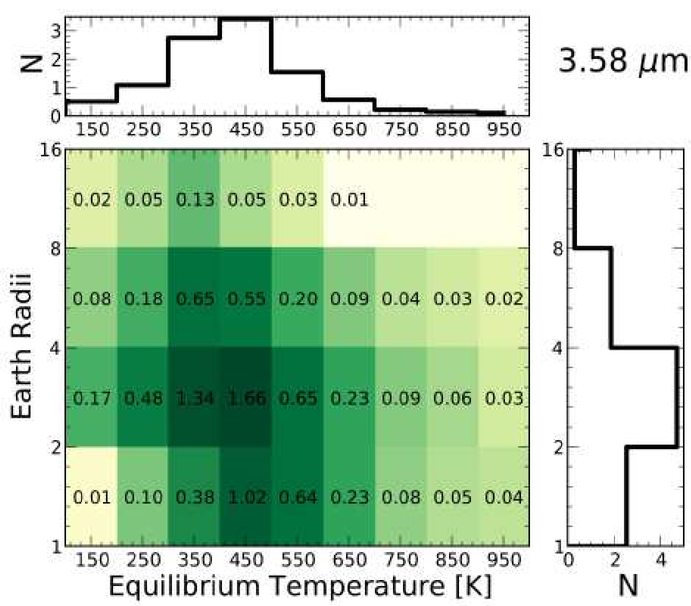

Figure 5: (Quanz et al.) 2-D probability distribution for the number of detectable (small) planets in the L band (3.6 μm) using E-ELT/METIS.

The HARPS search for southern extra-solar planets XXXV. The interesting case of HD41248: stellar activity, no planets?

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Astronomy & Astrophysics, in press (arXiv:1404.6135)

The search for planets orbiting metal-poor stars is of uttermost importance for our understanding of the planet formation models. However, no dedicated searches have been conducted so far for very low mass planets orbiting such objects. Only a few cases of low mass planets orbiting metal-poor stars are thus known. Amongst these, HD 41248 is a metal-poor, solar-type star on which a resonant pair of super-Earth like planets has been announced. This detection was based on 62 radial velocity measurements obtained with the HARPS spectrograph (public data). In the present paper we present a new planet search program that is using the HARPS spectrograph to search for Neptunes and Super-Earths orbiting a sample of metal-poor FGK dwarfs. We then present a detailed analysis of an additional 162 radial velocity measurements of HD 41248, obtained within this program, with the goal of confirming the existence of the proposed planetary system. We analyzed the precise radial velocities, obtained with the HARPS spectrograph, together with several stellar activity diagnostics and line profile indicators. A careful analysis shows no evidence for the planetary system previously announced. One of the signals, with a period of $\sim$25 days, is shown to be related to the rotational period of the star, and is clearly seen in some of the activity proxies. The remaining signal (P$\sim$18 days) could not be convincingly retrieved in the new data set. We discuss possible causes for the complex (evolving) signals observed in the data of HD 41248, proposing that they may be explained by the appearance and disappearance of active regions on the surface of a star with strong differential rotation, or by a combination of the sparse data sampling and active region evolution.

Download/Website: `http://xxx.lanl.gov/abs/1404.6135`

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Stellar magnetism: empirical trends with age and rotation

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Monthly Notices of the Royal Astronomical Society, in press

We investigate how the observed large-scale surface magnetic fields of low-mass stars ($\sim$0.1-2 $\mathrm{M}_\odot$), reconstructed through Zeeman-Doppler imaging (ZDI), vary with age t, rotation period $P_{\rm rot}$, Rossby number Ro and X-ray emission. Our sample consists of 104 magnetic maps of 73 stars, from accreting pre-main sequence to main-sequence objects, spanning ages from ~ 1 Myr to ~ 10 Gyr. For non-accreting dwarfs we empirically find that the unsigned average large-scale surface magnetic field $\langle|B_V|\rangle$ is related to age as $t^{-0.655\pm0.045}$. This relation has a similar power dependency to that identified in the seminal work of Skumanich (1972), which has served as the basis of gyrochronology, whereby stellar ages can be derived from rotation measurements. Our relation could therefore be used as an alternative method to estimate the age of stars ("magnetochronology"). We also find that $\langle|B_V|\rangle \propto P_{\rm rot}^{-1.32\pm0.14}$ and $\langle|B_V|\rangle \propto \mathrm{Ro}^{-1.38\pm0.14}$, supporting the presence of a linear-type dynamo of the large-scale field. The trends we find for large-scale stellar magnetism from ZDI studies are consistent with the trends found from Zeeman broadening measurements, which are sensitive to the unsigned large- and small-scale magnetic field $\langle|B_I|\rangle$. These similarities indicate that the fields recovered from both techniques are coupled to each other, suggesting that small- and large-scale fields could share the same dynamo field generation processes. We also investigate how the small- and large-scale structures contribute to X-ray emission. These contributions have similar slopes within 3σ, but samples with large dynamic range of $\langle|B_I|\rangle$ are required to better constrain this result. For the accreting objects, fewer statistically significant relations are found, with one being a correlation between the unsigned magnetic flux Φ_V and $P_{\rm rot}$, which we attribute to a signature of star-disc interaction, rather than being driven by the dynamo magnetic field generation process.

Download/Website: `http://arxiv.org/abs/1404.2733`

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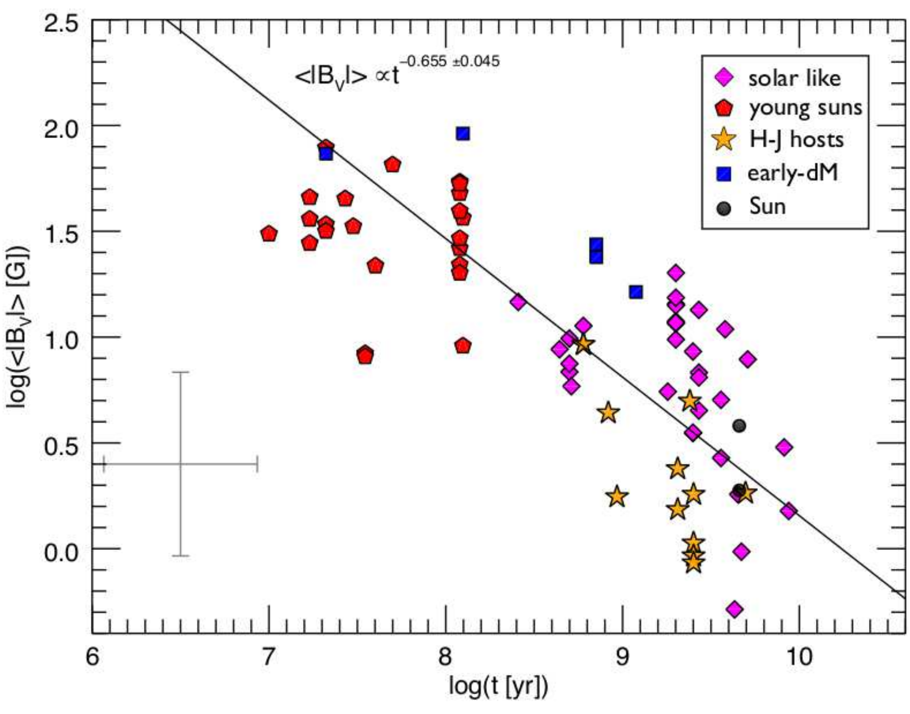

Figure 6: (Vidotto et al.) Correlation between the average large-scale field strength derived from the ZDI technique $\langle|B_V|\rangle$ and age t, for the non-accreting stars in our sample. The trend found (solid line) has a similar age dependence as the Skumanich law ($\Omega_\star \propto t^{-0.5}$). This relation could be used as an alternative method to estimate the age of stars ("magnetochronology").

Will New Horizons see dust clumps in the Edgeworth-Kuiper belt?

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The Astronomical Journal, in press (http://arxiv.org/abs/1404.4196)

Debris disks are thought to be sculptured by neighboring planets. The same is true for the Edgeworth-Kuiper debris disk, yet no direct observational evidence for signatures of giant planets in the Kuiper belt dust distribution has been found so far. Here we model the dust distribution in the outer solar system to reproduce the dust impact rates onto the dust detector onboard the New Horizons spacecraft measured so far and to predict the rates during the Neptune orbit traverse. To this end, we take a realistic distribution of transneptunian objects to launch a sufficient number of dust grains of different sizes and follow their orbits by including radiation pressure, Poynting-Robertson and stellar wind drag, as well as the perturbations of four giant planets. In a subsequent statistical analysis, we calculate number densities and lifetimes of the dust grains in order to simulate a collisional cascade. In contrast to the previous work, our model not only considers collisional elimination of particles, but also includes production of finer debris. We find that particles captured in the 3:2 resonance with Neptune build clumps that are not removed by collisions, because the depleting effect of collisions is counteracted by production of smaller fragments. Our model successfully reproduces the dust impact rates measured by New Horizons out to ≈ 23 AU and predicts an increase of the impact rate of about a factor of two or three around the Neptune orbit crossing. This result is robust with respect to the variation of the vaguely known number of dust-producing scattered disk objects, collisional outcomes, and the dust properties.

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Complex organic molecules in protoplanetary disks

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Protoplanetary disks are vital objects in star and planet formation, possessing all the material, gas and dust, which may form a planetary system orbiting the new star. Small, simple molecules have traditionally been detected in protoplanetary disks; however, in the ALMA era, we expect the molecular inventory of protoplanetary disks to significantly increase. We investigate the synthesis of complex organic molecules (COMs) in protoplanetary disks to put constraints on the achievable chemical complexity and to predict species and transitions which may be observable with ALMA. We have coupled a 2D steady-state physical model of a protoplanetary disk around a typical T Tauri star with a large gas-grain chemical network including COMs. We compare the resulting column densities with those derived from observations and perform ray-tracing calculations to predict line spectra. We compare the synthesised line strengths with current observations and determine those COMs which may be observable in nearby objects. We also compare the predicted grain-surface abundances with those derived from cometary comae observations. We find COMs are efficiently formed in the disk midplane via grain-surface chemical reactions, reaching

peak grain-surface fractional abundances $\sim 10^{-6}$–10^{-4} that of the gas number density. COMs formed on grain surfaces are returned to the gas phase via non-thermal desorption; however, gas-phase species reach lower fractional abundances than their grain-surface equivalents, $\sim 10^{-12}$–10^{-7}. Including the irradiation of grain mantle material helps build further complexity in the ice through the replenishment of grain-surface radicals which take part in further grain-surface reactions. There is reasonable agreement with several line transitions of H_2CO observed towards T Tauri star-disk systems. There is poor agreement with HC_3N lines observed towards LkCa 15 and GO Tau. This could be due to the low column density predicted in our model or the peculiarities of the sources. The synthesised line strengths for CH_3OH are consistent with upper limits determined towards all sources. Our models suggest CH_3OH should be readily observable in nearby protoplanetary disks with ALMA; however, detection of more complex species may prove challenging, even with ALMA 'Full Science' capabilities. Our grain-surface abundances are consistent with those derived from cometary comae observations providing additional evidence for the hypothesis that comets (and other planetesimals) formed via the coagulation of icy grains in the Sun's natal disk.

Download/Website: `http://adsabs.harvard.edu/abs/2014A%26A...563A..33W`

Contact: `cwalshstrw.leidenuniv.nl`

3 Jobs and Positions

Cometary Physicist to participate in the science planning, operation, and scientific data analysis of the OSIRIS cameras

Dr. Holger Sierks
Max-Planck-Institut für Sonnensystemforschung

Göttingen, Germany, Applications should be sent by 15 May 2014

The planetary research group of the Max Planck Institute for Solar System Research (MPS) leads the European consortium that developed and built the scientific imaging system OSIRIS onboard the orbiter of ESA's Rosetta mission to comet 67P/Churyumov-Gerasimenko. We are looking for a Cometary Physicist to participate in the science planning, operation, and scientific data analysis of the OSIRIS cameras.
We need support for the scientific data analysis and the science & operations planning of the OSIRIS cameras in prime mission at the target comet 67P/Churyumov-Gerasimenko. The person in this position will take an active role in the science discussion and in the development of tools and models in preparation of the observation sequences and the scientific analysis of the image data.
Qualifications: University degree in physics and relevant experience in cometary research. It is expected that the candidate will work in close co-operation with the international OSIRIS science team. Experience with the interactive data language IDL is an asset. Fluent command of English is mandatory.
The position is available immediately for an initial period ending December 2016. The salary and benefits will be calculated up to the TVöD-E13 category of the German civil services based on qualification and experience. Moving expenses will be covered.
The Max Planck Society wants to increase the number of women in those areas where they are underrepresented and therefore explicitly encourages women to apply. The Max Planck Society is committed to employing more disabled individuals and especially encourages them to apply.
The application should include the curriculum vitae, list of publications, list of past employers (letter of reference), contact information of three referees, and a short cover letter. Applications should be sent by 15 May 2014 to:
Max-Planck-Institut für Sonnensystemforschung, Dr. Holger Sierks, Justus-von-Liebig-Weg 3, 37077 Göttingen, Germany

Contact: `sierks@mps.mpg.de`

Postdoctoral Researcher in Laser Optics and Frequency Standards

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

Göttingen, starting Jul 01, 2014

The Institute for Astrophysics Göttingen invites applications for the position of a
Postdoctoral Researcher in Laser Optics and Frequency Standards
for applications in astronomical high precision spectroscopy including the search for extrasolar planets. We are searching for an experimental physicist with experience in spectroscopy, semiconductor diode lasers, and frequency locking techniques. Candidates should have a PhD in physics. Regular working hours will be 39.8 hours per week with a limited contract of 2 years (Pay grade 13 TV-L).
The rapidly expanding 'Stellar Activity and Extra-solar Planets' research group at the Institute for Astrophysics at the Georg-August University Göttingen offers a young and dynamic work environment with access to high-precision spectrographs and telescopes in our institute and at international observatories. Research at the IAG combines theoretical and observational work in stellar astrophysics, extra-solar planets, astro and helioseismology, solar physics, instrument development as well as other fields. It is participating in the development of ESO VLT and E-ELT facilities and of the exoplanet survey CARMENES at Calar Alto Observatory. 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 31.05.2014 to
e-mail: sekr@astro.physik.uni-goettingen.de ,
and contact Prof. Ansgar Reiners for questions.

Download/Website: `http://www.uni-goettingen.de/en/postdoctoral-researcher-in-laser-optics-and-frequency-standards/483687.html`

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

Swiss-wide Research Framework: Ph.D Position in Atmospheric Chemistry

Prof. Kevin Heng
University of Bern

Bern, Switzerland, Start date: 1st September 2014

As part of the newly established PlanetS NCCR (National Centers of Competence in Research), we seek to hire an outstanding and highly motivated Ph.D candidate to specialise in the chemistry of exoplanet atmospheres. The successful candidate will be embedded in the Exoplanets & Exoclimes Group (EEG) of Prof. Kevin Heng at the University of Bern. The EEG specialises in the theory and simulation of exoplanetary atmospheres and currently hosts researchers dedicated to atmospheric dynamics, radiation and high-performance computing. In order to link the work with astronomical observations, the candidate will also work closely with exoplanet researchers at Geneva Observatory (Dr. David Ehrenreich, Prof. Francesco Pepe). Our over-arching goal is the modeling, prediction and interpretation of the global structures and emergent spectra of exoplanet atmospheres. The Ph.D position is part of the Planet Formation and Evolution Project of the PlanetS NCCR (Leader: Prof. Willy Benz, Deputy: Prof. Yann Alibert).
Applicants should have a Masters degree in chemistry, physics, astrophysics or mathematics. A background in chemistry is highly desired (but not required) and will be considered a strength. Salaries for Ph.D students are set

by standard Swiss and University of Bern guidelines and are about 40,000-50,000 CHF (Swiss francs) a year. The successful candidate will ideally start on 1st September 2014 (negotiable).
The application should include a CV (up to 2 pages), a statement of interest (1 page) and 3 letters of reference. The statement of interest should explain why the candidate is interested in exoplanet science and his/her long-term career ambitions. The application should be sent directly via email to Prof. Kevin Heng and the title of the email should be ”NCCR Ph.D in Atmospheric Chemistry: [Name of Candidate]”.

Download/Website: http://adonis.unibe.ch/planets/
http://www.exoplanets.ch/nccr-planets/
http://www.exoclime.org/

Contact: kevin.heng@csh.unibe.ch

4 Conference announcements

NASA Exoplanet Exploration Program Analysis Group Meeting 10

Scott Gaudi, Douglas Hudgins

Boston, MA, June 6, 2014

NASA's Exoplanet Exploration Program Analysis Group (ExoPAG) will hold its tenth meeting on Friday, June 6, 2014, just after the 224rd Meeting of the American Astronomical Society, in Boston, MA. ExoPAG meetings are open to the entire scientific community, and offer an opportunity to participate in discussions of scientific and technical issues in exoplanet exploration, and to provide input into NASA's Exoplanet Exploration Program (ExEP). All interested members of the astronomical and planetary science communities are invited to attend and participate.

ExoPAG-10 will continue to focus on soliciting input from the wider exoplanet community on ways in which NASA might facilitate exoplanet research over the next few years, as well as input on how it should prioritize its ExEP activities. There will be reports from the active Study Analysis Groups (SAGs), as well as from the newly-constituted Science Interest Group (SIG) entitled ”Toward a Near-Term Exoplanet Community Plan.”

The most up-to-date agenda, as well as details of the meeting logistics, can be found on the ExoPAG website listed below. Questions and suggestions can be sent to Scott Gaudi, ExoPAG Chair (gaudi@astronomy.ohio-state.edu), and/or Dr. Douglas Hudgins, ExoPAG Executive Secretary (Douglas.M.Hudgins@nasa.gov). General news and information about NASA's ExoPAG can also be found on the website.

Download/Website: http://exep.jpl.nasa.gov/exopag

Contact: gaudi@astronomy.ohio-state.edu

Time Series Data Reduction With Warm IRAC

Spitzer Science Center
Spitzer Science Center, IPAC, Caltech

Boston AAS Splinter Session, June 1, 13:00 - 17:30pm

The Spitzer Science Center is hosting a splinter session on June 1 at the Boston AAS. We invite interested astronomers to participate in an open discussion of instrumental and spacecraft effects and data reduction techniques for warm IRAC high precision photometry of exoplanets and brown dwarfs. The session will start with a set of short talks presenting open questions in data reduction leading to high-precision light curves. Results of the first IRAC high-precision data challenge will be presented and discussed in the second half of the session.
For more information, please see our website (below) or email us at IRACAAS224@ipac.caltech.edu. To attend the session, you have to register for the AAS meeting for at least one day. If you plan on attending, we would appreciate an email sent to the above address.

Download/Website: `http://conference.ipac.caltech.edu/iracaas224/`

Contact: `IRACAAS224@ipac.caltech.edu`

2014 Sagan Summer Workshop: Imaging Planets and Disks

C. Brinkworth
NASA Exoplanet Science Institute, California Institute of Technology, Pasadena, CA, USA

Pasadena, CA, July 20-25, 2014

Registration for the 2014 Sagan Exoplanet Summer Workshop on "Imaging Planets and Disks" hosted by the NASA Exoplanet Science Institute (NExScI) is now available. The workshop will take place on the Caltech campus July 20 - 25, 2014. The workshop is intended for graduate students and postdocs, however all interested parties are welcome to attend.

The 2014 workshop will explore current techniques and technology used to image exoplanets and debris disks, as well as the underlying science driving the modeling of exoplanetary atmospheres and disk structure. Leaders in the field will summarize the current state of the art in science, hardware, and software for both ground and space-based missions and data. Prospects for future space instruments will also be discussed. Attendees will participate in hands-on exercises to gain experience working with imaging data, astrophysical models, and instrument design.

The online submission site for attendee presentations is available on the workshop website. Attendees have the opportunity to present their own work through short presentations (research POPs) and posters.

Important Dates

- June 20: Early on-line registration ends
- July 4: POP/Poster Submission deadline and hotel registration deadline to be eligible for group rate
- July 11: On-line registration closed and final agenda posted
- July 20: Sagan Exoplanet Summer Workshop Opening Reception
- July 21-25: 2014 Sagan Exoplanet Summer Workshop

Download/Website: `http://nexsci.caltech.edu/workshop/2014`

Contact: `sagan_workshop@ipac.caltech.edu`

5 Announcements

Planet Formation Imager (PFI) Project – Call for Participation

S. Kraus[1], *J.D. Monnier*[2], *D. Buscher*[3]

[1] School of Physics, University of Exeter, Stocker Road, Exeter EX4 4QL, UK
[2] Department of Astronomy, University of Michigan, 918 Dennison Building, Ann Arbor, MI 48109, USA
[3] Cavendish Laboratory, University of Cambridge, J.J. Thomson Avenue, Cambridge CB3 0HE, UK

http://www.planetformationimager.org, June 16, 2014

The Planet Formation Imager (PFI) Kick-off Committee announces an Open Call for Participation in PFI Concept Studies. The ambitious goal of PFI is to image planet-forming disks in nearby star-forming regions with high enough spatial resolution to resolve the key physical processes at work, to witness planet formation live as it happens with ~ 0.1 AU resolution or better. Scientists from more than a dozen different institutes in six countries have begun planning for initial Concept Studies, an effort led by Project Director John Monnier (U. Michigan), Project Scientist Stefan Kraus (U. Exeter), and Project Architect David Buscher (U. Cambridge). Our top priorities for the next 12-24 months will be to define the most exciting areas of science to drive the instrument concept and at the same time determine feasible architectures for meeting the science goals. We seek contributions from the international astronomical community and invite participants to join the PFI Science Working Group or the Technical Working Group. For more information and to sign up to participate, please see *http://www.planetformationimager.org* (initial deadline to join working groups is June 16, 2014).

Download/Website: `http://www.planetformationimager.org/`

Contact: `info@planetformationimager.org`

6 As seen on astro-ph

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

astro-ph/1404.0005 : **Water Clouds in Y Dwarfs and Exoplanets** by *Caroline V. Morley, et al.*
astro-ph/1404.0131 : **A First-Look Atmospheric Modeling Study of the Young Directly-Imaged Planet-Mass Companion, ROXs 42Bb** by *Thayne Currie, Adam Burrows, Sebastian Daemgen*
astro-ph/1404.0641 : **Cosmological aspects of planetary habitability** by *Yu. A. Shchekinov, M. Safonova, J. Murthy*
astro-ph/1404.0709 : **Herschel evidence for disk flattening or gas depletion in transitional disks** by *J. T. Keane, et al.*
astro-ph/1404.0824 : **Chemical abundances of stars with brown-dwarf companions** by *D. Mata Sanchez, et al.*
astro-ph/1404.0831 : **Direct detection of exoplanets in the 3 – 10 micron range with E-ELT/METIS** by *Sascha P. Quanz et al.*
astro-ph/1404.1015 : **Spin-Orbit Alignment For 110-Day-Period KOI368.01 From Gravity Darkening** by *John. P. Ahlers, Shayne A. Seubert, Jason W. Barnes*
astro-ph/1404.1073 : **Indications for an influence of Hot Jupiters on the rotation and activity of their host stars** by *K. Poppenhaeger, S.J. Wolk*
astro-ph/1404.1084 : **Transit of Exomoon Plasma Tori: New Diagnosis** by *Lotfi Ben-Jaffel, Gilda Ballester*
astro-ph/1404.1574 : **Search for cool extrasolar giant planets combining coronagraphy, spectral and angular differential imaging** by *A.-L. Maire, et al.*
astro-ph/1404.1923 : **Linear stability of magnetized massive protoplanetary disks** by *Min-Kai Lin*

astro-ph/1404.1931 : **Protoplanetary disc evolution affected by star-disc interactions in young stellar clusters** by *Giovanni P. Rosotti, et al.*
astro-ph/1404.1954 : **On the steady state collisional evolution of debris disks around M dwarfs** by *Etienne Morey, Jean-Francois Lestrade*
astro-ph/1404.1967 : **Detailed Abundances of Planet-Hosting Wide Binaries. I. Did Planet Formation Imprint Chemical Signatures in the Atmospheres of HD 20782/81?** by *Claude E. Mack III et al.*
astro-ph/1404.2112 : **A high precision chemical abundance analysis of the HAT-P-1 stellar binary: constraints on planet formation** by *F. Liu, et al.*
astro-ph/1404.2120 : **Modeling magnesium escape from HD209458b atmosphere** by *V. Bourrier, A. Lecavelier des Etangs, A. Vidal-Madjar*
astro-ph/1404.2552 : **The Solar System and the Exoplanet Orbital Eccentricity - Multiplicity Relation** by *Mary Anne Limbach, Edwin L. Turner*
astro-ph/1404.2960 : **Occurrence and core-envelope structure of 1–4x Earth-size planets around Sun-like stars** by *Geoffrey W. Marcy, et al.*
astro-ph/1404.3157 : **Architectures of Planetary Systems and Implications for their Formation** by *Eric B. Ford*
astro-ph/1404.3213 : **Evaporation and Accretion of Extrasolar Comets Following White Dwarf Kicks** by *Nicholas Stone, Brian Metzger, Abraham Loeb*
astro-ph/1404.3271 : **Near-infrared emission from sublimating dust in collisionally active debris disks** by *R. van Lieshout, et al.*
astro-ph/1404.3430 : **Transiting Planets Orbiting Source Stars in Microlensing Events** by *Krzysztof Rybicki, Lukasz Wyrzykowski*
astro-ph/1404.3502 : **Search for cool giant exoplanets around young and nearby stars - VLT/NaCo near-infrared phase-coronagraphic and differential imaging** by *A.-L. Maire, et al.*
astro-ph/1404.3686 : **Effects of Extreme Obliquity Variations on the Habitability of Exoplanets** by *J. C. Armstrong, et al.*
astro-ph/1404.3769 : **Carbon monoxide and water vapor in the atmosphere of the non-transiting exoplanet HD 179949 b** by *M. Brogi, et al.*
astro-ph/1404.3844 : **The Gaia Survey Contribution to EChO Target Selection and Characterization** by *A. Sozzetti, M. Damasso*
astro-ph/1404.4259 : **On the RZ Draconis Sub-stellar Circumbinary Companions Stability Study of the Proposed Sub-stellar Circumbinary System** by *Tobias C. Hinse, et al.*
astro-ph/1404.4348 : **A comprehensive study of Kepler phase curves and secondary eclipses – temperatures and albedos of confirmed Kepler giant planets** by *Daniel Angerhausen, Emily DeLarme, Jon A. Morse*
astro-ph/1404.4368 : **Formation, tidal evolution and habitability of the Kepler-186 system** by *Emeline Bolmont, et al.*
astro-ph/1404.4381 : **A Consistent Orbital Stability Analysis for the GJ 581 System** by *David A. Joiner, et al.*
astro-ph/1404.4417 : **HAT-P-54b: A hot jupiter transiting a 0.64 Msun star in field 0 of the K2 mission** by *G.A.Bakos, et al.*
astro-ph/1404.4460 : **Earth-like Habitats in Planetary Systems** by *Jörg Fritz, et al.*
astro-ph/1404.4493 : **The Effect of Planetary Illumination on Climate Modelling of Earthlike Exomoons** by *Duncan Forgan, Vergil Yotov*
astro-ph/1404.4514 : **On the origin of stars with and without planets. Tc trends and clues to Galactic evolution** by *V.Zh. Adibekyan, et al.*
astro-ph/1404.4635 : **Near-Infrared Detection and Characterization of the Exoplanet HD 95086 b with the Gemini Planet Imager** by *Raphael Galicher, et al.*
astro-ph/1404.4861 : **Resonance breaking due to dissipation in planar planetary systems** by *J.-B. Delisle, J. Laskar, A.C.M. Correia*
astro-ph/1404.4990 : **N-body Simulations of Terrestrial Planet Formation under the Influence of a Hot Jupiter** by *Masahiro Ogihara, Hiroshi Kobayashi, Shu-ichiro Inutsuka*

astro-ph/1404.4992 : **Strong Dependence of the Inner Edge of the Habitable Zone on Planetary Rotation Rate** by *Jun Yang, et al.*

astro-ph/1404.5292 : **Habitable Zones Around Main-Sequence Stars: Dependence on Planetary Mass** by *Ravi kumar Kopparapu, et al.*

astro-ph/1404.5335 : **An Analysis of the SEEDS High-Contrast Exoplanet Survey: Massive Planets or Low-Mass Brown Dwarfs?** by *Timothy D. Brandt, et al.*

astro-ph/1404.5337 : **Prospects for Detecting Oxygen, Water, and Chlorophyll in an Exo-Earth** by *Timothy D. Brandt, David S. Spiegel*

astro-ph/1404.5360 : **Planets Transiting Non-Eclipsing Binaries** by *David V. Martin, Amaury H.M.J. Triaud*

astro-ph/1404.5377 : **Radial Velocities of Stars with Multiple Co-orbital Planets** by *Anthony R. Dobrovolskis*

astro-ph/1404.5462 : **Planet Traps and First Planets: the Critical Metallicity for Gas Giant Formation** by *Yasuhiro Hasegawa, Hiroyuki Hirashita*

astro-ph/1404.5617 : **On the Abundance of Circumbinary Planets** by *D. J. Armstrong, et al.*

astro-ph/1404.5627 : **Searching for circumplanetary disks around LkCa 15** by *Andrea Isella, et al.*

astro-ph/1404.5667 : **An Earth-sized Planet in the Habitable Zone of a Cool Star** by *Elisa V. Quintana, et al.*

astro-ph/1404.5712 : **Spectroscopic Coronagraphy for Planetary Radial Velocimetry of Exoplanets** by *Hajime Kawahara, et al.*

astro-ph/1404.5817 : **Magnetohydrodynamic Simulations of Hot Jupiter Upper Atmospheres** by *George B. Trammell, Zhi-Yun Li, Phil Arras*

astro-ph/1404.5849 : **Detectability of Glycine in Solar-type System Precursors** by *Izaskun Jimenez-Serra et al.*

astro-ph/1404.6122 : **HSTEP – Homogeneous Studies of Transiting Extrasolar Planets** by *John Southworth*

astro-ph/1404.6135 : **The HARPS search for southern extra-solar planets XXXV. The interesting case of HD41248: stellar activity, no planets?** by *N.C. Santos, et al.*

astro-ph/1404.6144 : **Collisional modelling of the debris disc around HIP 17439** by *Ch. Schüppler, et al.*

astro-ph/1404.6354 : **Transit Timing Analysis in the HAT-P-32 system** by *M. Seeliger, et al.*

astro-ph/1404.6525 : **The Gemini NICI Planet-Finding Campaign: The Offset Ring of HR 4796 A** by *Zahed Wahhaj, et al.*

astro-ph/1404.6531 : **Some inconvenient truths about biosignatures involving two chemical species on Earth-like exoplanets** by *Hanno Rein, Yuka Fujii, David S. Spiegel*

astro-ph/1404.6953 : **Planetesimal formation in self-gravitating discs: the effects of particle self-gravity and back-reaction** by *P. G. Gibbons, G. R. Mamatsashvili, W. K. M. Rice*

astro-ph/1404.7049 : **Planet transit and stellar granulation detection with interferometry** by *Andrea Chiavassa, et al.*

astro-ph/1404.7136 : **Dancing with the Stars: Formation of the Fomalhaut triple system and its effect on the debris disks** by *Andrew Shannon, Cathie Clarke, Mark Wyatt*

astro-ph/1404.7271 : **Effects of radiation transfer on the structure of self-gravitating disks, their fragmentation and evolution of the fragments** by *Yusuke Tsukamoto, et al.*

astro-ph/1404.7462 : **A 4-Planet System Orbiting the K0V Star HD 141399** by *Steven S. Vogt, et al.*