COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

MOVES II. Tuning in to the Radio Environment of HD189733b

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We present stellar wind modelling of the hot Jupiter host HD189733, and predict radio emission from the stellar wind and the planet, the latter arising from the interaction of the stellar wind with the planetary magnetosphere. Our stellar wind models incorporate surface stellar magnetic field maps at the epochs Jun/Jul 2013, Sep 2014, and Jul 2015 as boundary conditions. We find that the mass-loss rate, angular momentum-loss rate, and open magnetic flux of HD189733 vary by 9%, 40%, and 19% over these three epochs. Solving the equations of radiative transfer, we find that from 10 MHz–100 GHz the stellar wind emits fluxes in the range of 10^{-3}–5 μJy, and becomes optically

thin above 10 GHz. Our planetary radio emission model uses the radiometric Bode's law, and neglects the presence of a planetary atmosphere. For assumed planetary magnetic fields of 1–10 G, we estimate that the planet emits at frequencies of 2–25 MHz, with peak flux densities of $\sim 10^2$ mJy. We find that the planet orbits through regions of the stellar wind that are optically thick to the emitted frequency from the planet. As a result, unattenuated planetary radio emission can only propagate out of the system and reach the observer for 67% of the orbit for a 10 G planetary field, corresponding to when the planet is approaching and leaving primary transit. We also find that the plasma frequency of the stellar wind is too high to allow propagation of the planetary radio emission below 21 MHz. This means a planetary field of at least 8 G is required to produce detectable radio emission.

Accepted by MNRAS

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For preprints via WWW: https://arxiv.org/abs/1903.01809

The Stellar CME-Flare Relation: What Do Historic Observations Reveal?

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Solar CMEs and flares have a statistically well defined relation, with more energetic X-ray flares corresponding to faster and more massive CMEs. How this relation extends to more magnetically active stars is a subject of open research. Here, we study the most probable stellar CME candidates associated with flares captured in the literature to date, all of which were observed on magnetically active stars. We use a simple CME model to derive masses and kinetic energies from observed quantities, and transform associated flare data to the GOES 1–8 Å band. Derived CME masses range from $\sim 10^{15}$ to 10^{22} g. Associated flare X-ray energies range from 10^{31} to 10^{37} erg. Stellar CME masses as a function of associated flare energy generally lie along or below the extrapolated mean for solar events. In contrast, CME kinetic energies lie below the analogous solar extrapolation by roughly two orders of magnitude, indicating approximate parity between flare X-ray and CME kinetic energies. These results suggest that the CMEs associated with very energetic flares on active stars are more limited in terms of the ejecta velocity than the ejecta mass, possibly because of the restraining influence of strong overlying magnetic fields and stellar wind drag. Lower CME kinetic energies and velocities present a more optimistic scenario for the effects of CME impacts on exoplanets in close proximity to active stellar hosts.

Submitted to ApJ

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Solar Abstracts

Explicit IMF B_y-effect Maximizes at Subauroral Latitudes (Dedicated to the Memory of Eigil Friis-Christensen)

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The most important parameter in the coupling between solar wind and geomagnetic activity is the

B_z-component of the interplanetary magnetic field (IMF). However, recent studies have shown that IMF B_y is an additional, independent driver of geomagnetic activity. We use here local geomagnetic indices from a large network of magnetic stations to study how IMF B_y affects geomagnetic activity at different latitudes for all solar wind and, separately during coronal mass ejections (CMEs). We show that geomagnetic activity, for all solar wind, is 20% stronger for $B_y > 0$ than for $B_y < 0$ at subauroral latitudes of about 60° corrected geomagnetic (CGM) latitude. During CMEs, the B_y-effect is larger, about 40%, at slightly lower latitudes of about 57° (CGM) latitude. These results highlight the importance of the IMF B_y-component for space weather at different latitudes and must be taken into account in space weather modeling.

Accepted by: Journal of Geophysical Research (Space Physics)

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For preprints via WWW: https://arxiv.org/abs/1904.04568

On the Saturation of Acoustic Mode Frequencies at High Solar Activity

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Acoustic mode frequencies obtained by applying spherical harmonic decomposition to HMI, MDI and GONG observations were analysed throughout the solar cycle. Evidence of a deviation from a linear relation with solar radio flux was found indicating a saturation effect at high solar activity. The Gompertz model, which is one of the most frequently used sigmoid functions to fit growth data, is used. It is shown that its fitting to MDI and GONG data are statistically significant and a median saturation of four-hundred sfu is estimated. This saturation level is 50hence the small effect observed in the minimum-to-maximum frequency shift. However, as shown here, it should not be disregarded.

Accepted by MNRAS

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For preprints via WWW: http://adsabs.harvard.edu/doi/10.1093/mnras/stz1005

A Search for High-Frequency Coronal Brightness Variations in the 21 August 2017 Total Solar Eclipse

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We report on a search for short-period intensity variations in the green-line (FeXIV 530.3 nm) emission from the solar corona during the 21 August 2017 total eclipse viewed from Idaho in the United States. Our experiment was performed with a much more sensitive detection system, and with better spatial resolution, than on previous occasions (1999 and 2001 eclipses), allowing fine details of quiet coronal loops and an active-region loop system to be seen. A guided 200-mm-aperture Schmidt–Cassegrain telescope was used with a state-of-the-art CCD camera having 16-bit intensity discrimination and a field-of-view ($0.43° \times 0.43°$) that encompassed approximately one third

of the visible corona. The camera pixel size was 1.55 arcseconds, while the seeing during the eclipse enabled features of ≈ 2 arcseconds (1450 km on the Sun) to be resolved. A total of 429 images were recorded during a 122.9 second portion of the totality at a frame rate of $3.49\,s^{-1}$. In the analysis, we searched particularly for short-period intensity oscillations and travelling waves, since theory predicts fast-mode magneto-hydrodynamic (MHD) waves with short periods may be important in quiet coronal and active-region heating. Allowing first for various instrumental and photometric effects, we used a wavelet technique to search for periodicities in some 404, 000 pixels in the frequency range $0.5 - 1.6$ Hz (periods 2 second to 0.6 second). We also searched for travelling waves along some 65 coronal structures. However, we found no statistically significant evidence in either. This negative result considerably refines the limit that we obtained from our previous analyses, and it indicates that future searches for short-period coronal waves may be better directed towards Doppler shifts as well as intensity oscillations.

Accepted by Solar Physics

For preprints via WWW: https://arxiv.org/abs/1903.06076

Low-Mass and Substellar Abstracts

ALMA Reveals a Pseudo-Disc in a Proto-Brown Dwarf

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We present the observational evidence of a pseudo-disc around the proto-brown dwarf Mayrit 1701117, the driving source of the large-scale HH 1165 jet. Our analysis is based on ALMA ^{12}CO (2-1) line and 1.37 mm continuum observations at an angular resolution of $\sim 0.4''$. The pseudo-disc is a bright feature in the CO position-velocity diagram (PVD), elongated in a direction perpendicular to the jet axis, with a total (gas+dust) mass of ~ 0.02 $M_\odot$, size of 165-192 AU, and a velocity spread of ± 2 km s^{-1}. The large velocity gradient is a combination of infalling and rotational motions, indicating a contribution from a pseudo-disc and an unresolved inner Keplerian disc. There is weak emission detected in the H_2CO (3-2) and N_2D^+ (3-2) lines. H_2CO emission likely probes the inner Keplerian disc where CO is expected to be frozen, while N_2D^+ possibly originates from an enhanced clump at the outer edge of the pseudo-disc. We have considered various models (core collapse, disc fragmentation, circum-binary disc) that can fit both the observed CO spectrum and the position-velocity offsets. The observed morphology, velocity structure, and the physical dimensions of the pseudo-disc are consistent with the predictions from the core collapse simulations for brown dwarf formation. From the best model fit, we can constrain the age of the proto-brown dwarf system to be $\sim$30,000-40,000 yr. A comparison of the H_2 column density derived from the CO line and 1.37 mm continuum emission indicates that only about 2% of the CO is depleted from the gas phase.

Accepted by MNRAS

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For preprints via WWW: https://arxiv.org/abs/1904.06418

Editor's Note: The abstracts below are being cross-listed with the *Star Formation Newsletter.*

Photometric Determination of the Mass Accretion Rates of Pre-main Sequence Stars. VI. The Case of LH 95 in the Large Magellanic Cloud

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We report on the accretion properties of low-mass stars in the LH 95 association within the Large Magellanic Cloud (LMC). Using non-contemporaneous wide-band optical and narrow-band Hα photometry obtained with the *Hubble Space Telescope*, we identify 245 low-mass pre-main sequence (PMS) candidates showing Hα excess emission above the 4σ level. We derive their physical parameters, including effective temperatures, luminosities, masses ($M_\star$), ages, accretion luminosities, and mass accretion rates ($\dot{M}_{\rm acc}$). We identify two different stellar populations: younger than $\sim$8 Myr with median $\dot{M}_{\rm acc} \sim 5.4 \times 10^{-8} M_\odot {\rm yr}^{-1}$ (and $M_\star \sim 0.15 - 1.8\,M_\odot$) and older than $\sim$8 Myr with median $\dot{M}_{\rm acc} \sim 4.8 \times 10^{-9} M_\odot {\rm yr}^{-1}$ (and $M_\star \sim 0.6 - 1.2\,M_\odot$). We find that the younger PMS candidates are assembled in groups around Be stars, while older PMS candidates are uniformly distributed within the region without evidence of clustering. We find that $\dot{M}_{\rm acc}$ in LH 95 decreases with time more slowly than what is observed in Galactic star-forming regions (SFRs). This agrees with the recent interpretation according to which higher metallicity limits the accretion process both in rate and duration due to higher radiation pressure. The $\dot{M}_{\rm acc}$-$M_\star$ relationship shows different behaviour at different ages, becoming progressively steeper at older ages, indicating that the effects of mass and age on $\dot{M}_{\rm acc}$ cannot be treated independently. With the aim to identify reliable correlations between mass, age, and $\dot{M}_{\rm acc}$, we used for our PMS candidates a multivariate linear regression fit between these parameters. The comparison between our results with those obtained in other SFRs of our Galaxy and the Magellanic Clouds confirms the importance of the metallicity for the study of the $\dot{M}_{\rm acc}$ evolution in clusters with different environmental conditions.

Accepted by ApJ

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For preprintsvia WWW: https://arxiv.org/abs/1903.07610

Job Opening

Postdoctoral Position
Evolved Stars Research
Chalmers University of Technology (Sweden)

A two-year post-doctoral position is available in the Evolved Stars group of the Department of Space, Earth and Environment at Chalmers University of Technology in Gothenburg, Sweden. The position will be hosted within the Galactic astronomy unit of the Astronomy and Plasma Physics division, in the research group of Dr. Elvire De Beck.

The project will make use of instruments such as ALMA, APEX, OSO 20m, and IRAM 30m in the millimeter/sub-millimeter, as well as the Herschel Space Observatory in the far-infrared. The research will focus on the physical and chemical properties of high- and low-mass stars in the late stages of their evolution, primarily through studies of molecular line observations. The successful applicant will be expected to lead the work in close collaboration with the other members of the group and partner institutes.

The group is active in observational astronomy at all wavelengths, with a focus on millimeter and submillimeter facilities, as well as radiative transfer modelling of molecular line emission and dust, and chemical modelling. The group has close connections to the Onsala Space Observatory, which is the Swedish national facility for Radio Astronomy. The observatory operates telescopes in Sweden, shares in the APEX telescope in Chile, and hosts the Nordic ALMA Regional Center (ARC). The research topics of the division cover a broad range of topics including formation and evolution of galaxies, the birth and death of stars, astrochemistry, and exoplanets.

Application details can be found via the online application submission form.

http://
www.chalmers.se/en/about-chalmers/Working-at-Chalmers/Vacancies/Pages/default.aspx?rmpage=job&rmjob=7284&rmlang=UK

[www.chalmers.se]

Included Benefits: A competitive salary and benefits package are offered at Chalmers. Fellows are eligible for social security benefits, including health insurance, paid leave, and retirement benefits. The position also includes travel funds and opportunities for dissemination, networking, and international collaboration will be available.

Application Deadline: Wednesday, May 1, 2019

For further inquiries please contact elvire.debeck@chalmers.se

Upcoming Meeting

Extreme Solar Systems IV

19 - 23 August 2019

Reykjavik, Iceland

On the web: **https://sites.northwestern.edu/iceland2019/**

This conference, the fourth in a series that began in 2007 (Santorini meeting on Extreme Solar Systems, followed by ExSS II in Jackson Hole, Wyoming, in 2011, and ExSS III in Hawaii, in 2015) will cover all aspects of research on exoplanets. It will take place at the Harpa Center in Reykjavik, Iceland. The dates of the meeting happen to coincide approximately with the 70th birthday of our friend Doug Lin.

Registration is *now open*. See website above.

Abstract Guidelines

Abstracts for *COOLNEWS* are solicited for papers that have been recently accepted by or submitted to refereed journals, and for recent Ph.D. theses. Abstracts for conference proceedings articles are *not* posted in *COOLNEWS*. The subject matter should pertain directly to cool stars (spectral types F,G,K,M or L), substellar objects, or the sun. Both theoretical and observational abstracts are appropriate.

Abstracts dealing with cool pre-main-sequence (PMS) stars will generally not be included in *COOLNEWS*, since they are already covered by the *Star Formation Newsletter*. Exceptions to this rule will be considered if the subject matter is truly cross-disciplinary. If you wish to submit a cross-disciplinary abstract on PMS stars, then first submit it to the *Star Formation Newsletter*. After doing so, submit the abstract to *COOLNEWS* accompanied by a short e-mail stating that it has already been submitted to the *Star Formation Newsletter*, and summarizing why it will be of interest to the cool star/solar community at large.

A bimonthly call for abstracts will be issued. Announcements of general interest to the cool star and solar communities may also be submitted for posting in the newsletter. These might include (but are not restricted to) the following: (i) *Job Openings* directed toward cool star or solar researchers, (ii) announcements of *Upcoming Meetings*, (iii) announcements of *Upcoming Observing Campaigns* for which participation is solicited from the community at large, (iv) reviews of *New Books*, and (v) *General Announcements* that provide or request research-related information. Please send all correspondence to the editor at coolnews@jila.colorado.edu. Abstract templates and back issues can be obtained from the COOLNEWS Web-page at

`http://casa.colorado.edu/~skinners/coolnews.html .`

*** Please send abstracts in the body of the message and *not* as attachments.***