

COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Editor: Steve Skinner (coolnews@jila.colorado.edu)

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Coolnews on the Web

The current and previous issues of *Coolnews* are available on the following web page in pdf, postscript, and Latex format: <http://casa.colorado.edu/~skinnners/coolnews.html>

Stellar Abstracts

Solar-type Dynamo Behaviour in Fully Convective Stars Without a Tachocline

Nicholas J. Wright¹ and Jeremy J. Drake²

¹ Astrophysics Group, Keele University, Keele, ST5 5BG, UK

² Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

In solar-type stars (with radiative cores and convective envelopes), the magnetic field powers star spots, flares and other solar phenomena, as well as chromospheric and coronal emission at ultraviolet to X-ray wavelengths. The dynamo responsible for generating the field depends on the shearing of internal magnetic fields by differential rotation^{1,2}. The shearing has long been thought to take place in a boundary layer known as the tachocline between the radiative core and the convective envelope³. Fully convective stars do not have a tachocline and their dynamo mechanism is expected to be very different⁴, although its exact form and physical dependencies are not known. Here we report observations of four fully convective stars whose X-ray emission correlates with their rotation periods in the same way as in Sun-like stars. As the X-ray activity rotation relationship is a well-established proxy for the behaviour of the magnetic dynamo, these results imply that fully convective stars also operate a solar-type dynamo. The lack of a tachocline in fully convective stars therefore suggests that this is not a critical ingredient in the solar dynamo and supports models in which the dynamo originates throughout the convection zone.

Published by Nature (28 July 2016)

For preprints contact: nick.nwright@gmail.com

About Exobiology: The Case for Dwarf K Stars

M. Cuntz¹ and E. F. Guinan²

¹ Department of Physics, University of Texas at Arlington, Arlington, TX 76019, USA

² Department of Astrophysics and Planetary Science, Villanova University, Villanova, PA 19085, USA

One of the most fundamental topics of exobiology concerns the identification of stars with environments consistent with life. Although it is believed that most types of main-sequence stars might be able to support life, particularly extremophiles, special requirements appear to be necessary for the development and sustainability of advanced life forms. From our study, orange main-sequence stars, ranging from spectral type late-G to mid-K (with a maximum at early-K), are most promising. Our analysis considers a variety of aspects, including (1) the frequency of the various types of stars, (2) the speed of stellar evolution their lifetimes, (3) the size of the stellar climatological habitable zones (CLI-HZs), (4) the strengths and persistence of their magnetic dynamo generated X-ray–UV emissions, and (5) the frequency and severity of flares, including superflares; both (4) and (5) greatly reduce the suitability of red dwarfs to host life-bearing planets. The various phenomena show pronounced dependencies on the stellar key parameters such as effective temperature and mass, permitting the assessment of the astrobiological significance of various types of stars. Thus, we developed a “Habitable-Planetary-Real-Estate Parameter” (HabPREP) that provides a measure for stars that are most suitable for planets with life. Early K stars are found to have the highest HabPREP values, indicating they may be “Goldilocks” stars for life-hosting planets. Red dwarfs are numerous, having long lifetimes, but their narrow CLI-HZs and hazards from magnetic activity make them less suitable for hosting exolife. Moreover, we provide X-ray–FUV irradiances for G0 V – M5 V stars over a wide range of ages.

Accepted by ApJ

For preprints contact: cuntz@uta.edu

For preprints via WWW: <http://arxiv.org/abs/1606.09580>

Near Infrared Spectroscopy of M Dwarfs. IV. A preliminary survey on the carbon isotopic ratio in M dwarfs

Takashi Tsuji¹

¹ Institute of Astronomy, School of Science, The University of Tokyo, 3-21-1 Osawa, Mitaka-shi, Tokyo, 181-0015 Japan

Based on the medium resolution near infrared spectra ($\lambda/\Delta\lambda \approx 20000$) of ^{13}CO (3,1) band, carbon isotopic ratios are estimated in 48 M dwarfs, for which we had shown that the carbon and oxygen abundances can be determined rather accurately from molecular lines of CO and H₂O, respectively. We find clear evidence for the presence of a ^{13}CO feature for the first time in the spectra of M dwarfs, and this fact opens a possibility to discuss the isotopic abundances simultaneously with the elemental abundances in the same object. Spectral resolution of our observed data, however, is not high enough to analyze the ^{13}CO feature directly. Instead, we compare observed spectrum with synthetic spectra assuming $^{12}\text{C}/^{13}\text{C} = 10, 25, 50, 100, \text{ and } 200$ for each of 48 M dwarfs and estimate the best possible $^{12}\text{C}/^{13}\text{C}$ ratio by the chi-square analysis. The resulting $^{12}\text{C}/^{13}\text{C}$ ratios in M dwarfs distribute from 39 to a lower limit of 200. The mean value of 31 M dwarfs for which $^{12}\text{C}/^{13}\text{C}$ ratios are determined (i.e., excluding those with the lower limit only) is $(^{12}\text{C}/^{13}\text{C})_{\text{dM}} = 87 \pm 21$ (p.e.), and that of 48 M dwarfs including those with the lower limit of 200 is $(^{12}\text{C}/^{13}\text{C})_{\text{dM}} > 127 \pm 41$ (p.e.). These results are somewhat larger than the $^{12}\text{C}/^{13}\text{C}$ ratio of the present interstellar matter (ISM) determined from the molecular lines observed in the millimeter and optical wavelength regions. Since the amount of ^{13}C in the ISM has increased with time due to mass-loss from evolved stars, the $^{12}\text{C}/^{13}\text{C}$ ratios in M dwarfs, reflecting those of the past ISM, should be larger than those of the present ISM. In M dwarfs, $\log^{13}\text{C}/^{12}\text{C}$ plotted against $\log A_{\text{C}}$ shows a large scatter without clear dependence on the metallicity. This result shows a marked contrast to $\log^{16}\text{O}/^{12}\text{C}$ ($= \log A_{\text{O}}/A_{\text{C}}$) plotted against $\log A_{\text{C}}$, which shows a tight correlation with a larger value at the lower metallicity (Tsuji & Nakajima 2016). Such a contrast can be a natural consequence that ^{16}O and ^{12}C are the primary products in the stellar nuclear synthesis while ^{13}C is the secondary product, at least partly.

Accepted by PASJ

For preprints contact: ttsuji@ioa.s.u-tokyo.ac.jp

For preprints via WWW: <https://arxiv.org/abs/1607.07004>

Upcoming Meeting

The Maunder Minimum: How Deep, How Long?

AGU Fall Meeting (Section SH023)

12 - 16 December 2016

San Francisco, CA

Web page: <https://agu.confex.com/agu/fm16/preliminaryview.cgi/Session13490>

Section SH023 highlights the behavior of solar activity over the so-called Maunder minimum and will be a useful forum for the exchange of ideas, for presenting research, and for catalyzing collaborative research.

We invite contributions including direct solar observations and proxies, as well as results of modeling the solar cycle, investigation of the Maunder-like minima on stars.

Themes:

The themes we aim to explore at the Section will include (but not be restricted to)

1. Reconstruction of solar activity in the past
2. Grand minima and maxima
3. Time series analysis
4. Sunspot observation processing and revising observational data
5. Maunder minimum in dynamo
6. Proxy data, ^{14}C , ^{10}Be , Aurora, TSI, etc.
7. Maunder minimum on the stars

The abstract submission site is now open. The deadline for all submissions is Wednesday, 3 August 2016:

<http://fallmeeting.agu.org/2016/abstract-submissions/>

Truly yours,

Nadezhda Zolotova and Leif Svalgaard

Upcoming Meeting

Living around Active Stars

IAU Symposium 328

17-21 October 2016

Mareias, SP, Brazil

Second Announcement

The variable activity of stars such as the Sun is mediated via stellar magnetic fields, radiative and energetic particle fluxes, stellar winds and magnetic storms. This activity influences planetary atmospheres, climate and habitability. Studies of this intimate relationship between the parent star, its astrosphere (i.e., the equivalent of the heliosphere) and the planets that it hosts have reached a certain level of maturity within our own Solar System fuelled both by advances in theoretical modelling and a host of satellites that observe the Sun-Earth system. In conjunction, the first attempts are being made to characterize the interactions between stars and planets and their coupled evolution, which have relevance for habitability and the search for habitable planets. This Symposium will bring together scientists from diverse, interdisciplinary scientific areas such as solar, stellar and planetary physics, atmospheric and climate physics and astrobiology to review the current state of our understanding of solar and stellar environments. The Symposium is expected to fertilize exchange of ideas and identify outstanding issues tackling which necessitates coordinated scientific efforts across disciplines. Scientific themes of the Symposium and an updated list of invited speakers are available at the conference website.

This is the second and final call for abstract submission and registration by the deadline:

* Abstract submission deadline: 31 July 2016 * Early Registration deadline: 31 July 2016

Further details, including registration, abstract submission, and accommodation information are available at the conference website:

<http://www.sab-astro.org.br/IAUS328>

We look forward to hosting you in Mareias, Brazil.

Scientific Organizing Committee: Dibyendu Nandi (Chair), Sarah Gibson (Co-Chair), Pascal Petit (Co-Chair), Margit Haberreiter, Emre Isik, Heidi Korhonen, Kanya Kusano, Duncan Mackay, Cristina Mandrini, Allan Sacha-Brun, Adriana Valio, Aline Vidotto, David Webb

Local Organizing Committee: Adriana Valio (Chair), Gustavo Guerrero (Co-Chair), Alisson Dal Lago, Jorge Melendez, Emilia Correia, Caius L. Selhorst

Contact: iaustars328@gmail.com

Upcoming Meeting

Exploring the X-ray Transient and Variable Sky

21-23 November 2016

Pavia, Italy

Web page: <http://www.extras-fp7.eu/index.php/scientific-community/extras-workshop>

Dear Colleagues:

Registration is now open for *Exploring the X-ray Transient and Variable Sky*. There is no registration fee. The number of participants is restricted to 80.

Abstract submission deadline: September 15, 2016

Registration deadline: October 23, 2016

Scientific Rationale:

In the soft X-rays, a wide panorama of both transient and secular, periodic and aperiodic phenomena yields unique insights into a broad range of hot topics. X-ray variability teaches us a lot about accretion physics at all regimes and strong gravity physics. We can learn about the mechanisms behind massive star explosions, as well as about the progenitors of supernovae and of gravitational-wave events. X-ray variability also allows us to focus on the physics of magnetic-field generation and dynamics in compact objects as well as in normal stars, with impact for our understanding of planetary-system formation and evolution, as well as for understanding our own Sun.

The workshop is aimed at reviewing and discussing variable phenomena in the X-rays, from observations and methods of data analysis, to modelling and theoretical implications/expectations, in all classes of X-ray emitters: - Young stellar objects and stars; - Cataclysmic variables; - Isolated neutron stars; - Low-mass X-ray binaries; - High-mass X-ray binaries; - Ultraluminous X-ray sources; - Active galactic nuclei; - Tidal disruption events; - SNe shock breakout events; - Gamma-ray bursts; - Rare transients. Use of current and future serendipitous X-ray data for time-domain investigations will also be discussed.

The EXTraS Project:

The workshop is organised by the EXTraS consortium. EXTraS (Exploring the X-ray Transient and variable Sky) is a FP7-funded project aimed at extracting and characterising all temporal-domain information buried contained in serendipitous X-ray data collected by the XMM-Newton EPIC instrument. Results and products on hundreds of thousands of sources spanning more than six orders of magnitude in flux and more than nine orders of magnitude in time-scale will be released to the community at the end of 2016.

A detailed presentation of EXTraS products (including hands-on sessions) will be given in the third day of the Workshop. Discussion of possible science cases to be addressed using EXTraS results and products is also expected during all Workshop sessions.

Logistics and Registration:

The workshop will be hosted by IUSS Pavia. No registration fee is requested. The workshop will run in two and a half days and will feature invited talks, contributed talks, contributed posters.

More details on the workshop, including venue, logistics, registration and abstract submission are available at:

<http://www.extras-fp7.eu/index.php/scientific-community/extras-workshop>

If you are interested, we kindly ask to register as soon as possible, because the number of participants, owing to the capacity of the main conference room, will be restricted to 80.

SOC:

A. De Luca (co-chair), P. Evans, J. Greiner, F. Haberl, A. Merloni, P. O'Brien, E. Pian, J. Pye, A. Read, R. Salvaterra, L. Stella, A. Tiengo, S. Vaughan, M. Watson (co-chair), J. Wilms, A. Wolter

LOC:

R. Costa, A. De Luca, G. Lisini, M. Marelli, G. Novara, A. Tiengo (chair), C. Zazzetta

E-mail: workshop@extras-fp7.eu

Upcoming Meeting

The Third Workshop on Extremely Precise Radial Velocities (EPRV III)

7 - 13 August 2017

The Pennsylvania State University

University Park, PA

Dear Colleagues:

This workshop is for teams around the world to share techniques for advancing precise radial velocity work towards 10 cm/s precision in coming years. Building on the success of the first two workshops at Penn State in 2010 and Yale in 2015, the focus on this workshop will be on the performance of the next generation of precise Doppler instruments, including hardware, statistical techniques for signal extraction and interpretation, and stellar jitter modeling and mitigation.

Please send questions or inquiries to:

Dr. Jason Wright (jtw13@psu.edu) .

Announcement

New Journal: Nature Astronomy

Dear Colleagues:

Nature Astronomy is now open for submissions. *Nature Astronomy* is a truly multidisciplinary journal, launching in January 2017. It will represent and foster closer interaction between all of the key astronomy-relevant disciplines. As a Nature Research journal, it will publish the most significant research, review and comment at the cutting edge of astronomy, astrophysics, cosmology and planetary science.

Nature Astronomy will offer a range of content types including original research, Review Articles, Perspectives, Commentaries, News & Views and Research Highlights to explore topical issues as well as showcasing significant advances in the field.

Publication in *Nature Astronomy* is free of charge, and its publication policy allows the posting of submitted manuscripts on preprint servers, and the self-archiving of the published versions of papers six months after publication.

Please visit the *Nature Astronomy* website for more information and to submit a manuscript:

www.nature.com/natureastronomy

Submitted by: Rebecca Buckley (rebecca.buckley@nature.com)

Announcement

Intl. Max Planck Research School for Astronomy & Cosmic Physics (IMPRS-HD)

University of Heidelberg (Germany)

Dear Colleagues:

Applications are invited for the doctoral program of the *International Max Planck Research School for Astronomy & Cosmic Physics* at the University of Heidelberg (IMPRS-HD), starting in summer/autumn 2017.

The scientific environment in Heidelberg provides outstanding research facilities with access to ground-based and space telescopes as well as high-performance computers.

The following institutions of the Max Planck Society and Heidelberg University take part in IMPRS-HD:

- Max Planck Institute for Astronomy, Max Planck Institute for Nuclear Physics, Astronomisches Rechen-Institut, Institute of Theoretical Astrophysics, Landessternwarte Koenigstuhl, and Heidelberg Institute of Theoretical Studies.

IMPRS-HD is an independent part of the Heidelberg Graduate School of Fundamental Physics.

A wide range of astrophysical topics is covered in Heidelberg, among them ** planet & star formation, metal-poor stars ** extrasolar planets & substellar objects ** astrometry ** formation, evolution & dynamics of galaxies ** active galactic nuclei & massive black holes ** gravitational lensing ** cosmology & structure formation ** high energy astrophysics, cosmic rays & search for non-baryonic dark matter ** instrumentation for astronomy & astro-particle physics **

IMPRS-HD offers several fellowships within the graduate program. We invite highly-qualified students aiming for a doctoral degree in astrophysics to apply by:

22 November 2016 for the academic year starting Sept. 2017

An earlier start of the research work is possible.

Applicants are generally required to have or to expect a MSc (or equivalent) in Physics or Astronomy, including a substantial MSc thesis and a very good physics background.

For further information, we refer to our web-site:

<http://www.imprs-hd.mpg.de/>

With kind regards,

Christian Fendt, Coordinating Scientist (imprs-hd@mpia.de)

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.***