COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Coolnews on the Web

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Stellar Abstracts

Atmospheric Parameters and Chemical Properties of Red Giants in the CoRoT Asteroseismology Fields

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A precise characterisation of the red giants in the seismology fields of the CoRoT satellite is a prerequisite for further in-depth seismic modelling. High-resolution FEROS and HARPS spectra were obtained as part of the ground-based

follow-up campaigns for 19 targets holding great asteroseismic potential. These data are used to accurately estimate their fundamental parameters and the abundances of 16 chemical species in a self-consistent manner. Some powerful probes of mixing are investigated (the Li and CNO abundances, as well as the carbon isotopic ratio in a few cases). The information provided by the spectroscopic and seismic data is combined to provide more accurate physical parameters and abundances. The stars in our sample follow the general abundance trends as a function of the metallicity observed in stars of the Galactic disk. After an allowance is made for the chemical evolution of the interstellar medium, the observational signature of internal mixing phenomena is revealed through the detection at the stellar surface of the products of the CN cycle. A contamination by NeNa-cycled material in the most massive stars is also discussed. With the asteroseismic constraints, these data will pave the way for a detailed theoretical investigation of the physical processes responsible for the transport of chemical elements in evolved, low- and intermediate-mass stars.

Accepted by A&A

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For preprints via WWW: http://www.astro.ulg.ac.be/∼morel/articles/aa22810-13.pdf

Looking for Activity Cycles in Late-Type *Kepler* Stars Using Time–Frequency Analysis

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We analyse light curves covering four years of 39 fast-rotating ($P_{rot} < 1d$) late-type active stars from the *Kepler* database. Using time–frequency analysis (Short-Term Fourier-Transform), we find hints for activity cycles of 300–900 days at 9 targets from the changing typical latitude of the starspots, which, with the differential rotation of the stellar surface change the observed rotation period over the activity cycle. We also give a lowest estimation for the shear parameter of the differential rotation, which is ≈ 0.001 for the cycling targets. These results populate the less studied, short period end of the rotation–cycle length relation.

Accepted by MNRAS

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For preprints WWW: http://adsabs.harvard.edu/abs/2014arXiv1404.4359V

Stellar Magnetism: Empirical Trends With Age and Rotation

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We investigate how the observed large-scale surface magnetic fields of low-mass stars (∼0.1-2 $M_\odot$), 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 $\langle|B_V|\rangle \propto {\rm Ro}^{-1.38\pm0.14}$, 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.

Accepted by MNRAS, in press

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For preprints via WWW: http://arxiv.org/abs/1404.2733

Solar Abstracts

Solar Flare Composition and Thermodynamics from RESIK X-ray Spectra

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Previous estimates of the solar flare abundances of Si, S, Cl, Ar, and K from the RESIK X-ray crystal spectrometer on board the *CORONAS-F* spacecraft were made on the assumption of isothermal X-ray emission. We investigate the effect on these estimates by relaxing this assumption and instead determining the differential emission measure (DEM) or thermal structure of the emitting plasma by re-analyzing RESIK data for a *GOES* class M1.0 flare on 2002 November 14 (SOL2002-11-14T22:26) for which there was good data coverage. The analysis method uses a maximum-likelihood (Withbroe–Sylwester) routine for evaluating the DEM. In a first step, called here AbuOpt, an optimized set of abundances of Si, S, Ar, and K is found that is consistent with the observed spectra. With these abundances, the differential emission measure evolution during the flare is found. The abundance optimization leads to revised abundances of silicon and sulfur in the flare plasma: $A({\rm S}) = 6.94 \pm 0.06$ and $A({\rm Si}) = 7.56 \pm 0.08$ (on a logarithmic scale with $A({\rm H}) = 12$). Previously determined abundances of Ar, K, and Cl from an isothermal assumption are still the preferred values. During the flare's maximum phase, the X-ray-emitting plasma has a basically two-temperature structure, with the cooler plasma with approximately constant temperature (3–6 MK) and a hotter plasma with temperature $16 - 21$ MK. Using imaging data from the *RHESSI* hard X-ray spacecraft, the emission volume of the hot plasma is deduced from which lower limits of the electron density N_e and the thermal content of the plasma are given.

Accepted by ApJ

For preprints contact: bs@cbk.pan.wroc.pl

Cross-Listed Abstracts (Pre-Main Sequence Stars)

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

The Effect of Starspots on the Radii of Low-Mass Pre-Main Sequence Stars

R. J. Jackson[1] **and R. D. Jeffries**[1]

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A polytropic model is used to investigate the effects of dark photospheric spots on the evolution and radii of magnetically active, low-mass ($M < 0.5\,M_{\odot}$), pre-main sequence (PMS) stars. Spots slow the contraction along Hayashi tracks and inflate the radii of PMS stars by a factor of $(1-\beta)^{-N}$ compared to unspotted stars of the same luminosity, where β is the equivalent covering fraction of dark starspots and $N \simeq 0.45 \pm 0.05$. This is a much stronger inflation than predicted by the models of Spruit & Weiss (1986) for main sequence stars with the same β, where $N \sim 0.2$–0.3. These models have been compared to radii determined for very magnetically active K- and M-dwarfs in the young Pleiades and NGC 2516 clusters, and the radii of tidally-locked, low-mass eclipsing binary components. The binary components and ZAMS K-dwarfs have radii inflated by ~ 10 per cent compared to an empirical radius-luminosity relation that is defined by magnetically inactive field dwarfs with interferometrically measured radii; low-mass M-type PMS stars, that are still on their Hayashi tracks, are inflated by up to ~ 40 per cent. If this were attributable to starspots alone, we estimate that an effective spot coverage of $0.35 < \beta < 0.51$ is required. Alternatively, global inhibition of convective flux transport by dynamo-generated fields may play a role. However, we find greater consistency with the starspot models when comparing the loci of active young stars and inactive field stars in colour-magnitude diagrams, particularly for the highly inflated PMS stars, where the large, uniform temperature reduction required in globally inhibited convection models would cause the stars to be much redder than observed.

Accepted by MNRAS

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For preprints via WWW: http://arxiv.org/abs/1404.0683

Upcoming Meeting

Polarimetry: From the Sun to Stars and Stellar Environments

30 Nov. - 5 Dec. 2014

Punta Leona, Costa Rica

SECOND ANNOUNCEMENT (IAU Symposium 305)

Registration is OPEN. Please go to:

https://www2.hao.ucar.edu/events/IAUS305

then select the Registration tab.

The registration deadline is 12 September 2014.

FINANCIAL SUPPORT APPLICATIONS ARE DUE BY 1 JUNE 2014. Financial assistance is available via grants from the IAU and also the Metcalf Travel Awards Program. Details may be found at the above website under the tab Financial Support.

ABSTRACT SUBMISSION DEADLINE: 2 September 2014. See the Submit Abstract tab.

For more information or questions, please direct inquiries to: info_IAUS305@hao.ucar.edu

18th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun
9-13 June 2014; Flagstaff, AZ
http://www2.lowell.edu/workshops/coolstars18/

Solar and Stellar Flares: Observations, Simulations, and Synergies
23-27 June 2014; Prague, Czech Republic
http://solarflares2014.cz/

Nucleosynthesis in Asymptotic Giant Branch Stars
14-18 July 2014; Bonn, Germany
http://www.astro.uni-bonn.de/agb_bonn2014/index.html

Why Galaxies Care About AGB Stars III
28 July - 1 August 2014; Vienna, Austria
http://www.univie.ac.at/galagb/

Physics and Evolution of Magnetic and Related Stars
25-31 August 2014; Nizhniy Arkhyz, Russia
http://www.sao.ru/hq/lizm/conferences/2014/en/index.html

Binary Systems: Their Evolution and Environments
1-5 September 2014; Ulaan Baatar, Mongolia
http://mongolia.csp.escience.cn/

Living Together: Planets, Host Stars, and Binaries
8-12 September 2014; Litomysl, Czech Republic
http://astro.physics.muni.cz/kopal2014/

Towards Other Earths II: The Star-Planet Connection
15-19 September 2014; Porto, Portugal
http://www.astro.up.pt/toe2014

Physics of the Solar Atmosphere
22-26 September 2014; Zagreb, Croatia
http://oh.geof.unizg.hr/index.php/en/xiii-hac

The Early Life of Stellar Clusters: Formation and Dynamics
3-7 November 2014; Copenhagen, Denmark
http://www.nbia.dk/nbia-clusters-2014

Triple Evolution and Dynamics in Stellar and Planetary Systems
15-21 November 2014; Haifa, Israel
http://trendy-triple.weebly.com/

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.***