COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Editor's Note: Coolnews Web Page

I would like to remind all readers that Coolnews is available in both pdf and postscript formats on the web page at the address below. It is not necessary to compile the latex file that I email out each month.

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

Also, I could use more abstracts. Please consider sending in your journal abstract, PhD thesis abstract, meeting announcements, or postings for job openings related to cool stars, low-mass and substellar objects, and solar research. See the *Abstract Guidelines* on the last page of every issue for more information on suitable material. Thanks to everyone who has continued to support our newsletter over the past 14 years.

Steve Skinner (ed.)

Stellar Abstracts

The Main-sequence Rotation-colour Relation in the Coma Berenices Open Cluster

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We present the results of a photometric survey of rotation rates in the Coma Berenices (Melotte 111) open cluster, using data obtained as part of the SuperWASP exoplanetary transit-search programme. The goal of the Coma survey was to measure precise rotation periods for main- sequence F, G and K dwarfs in this intermediate-age ($\sim$ 600 Myr) cluster, and to determine the extent to which magnetic braking has caused the stellar spin periods to converge. We find a tight, almost linear relationship between rotation period and $J-K$ colour with a root-mean square scatter of only 2 percent. The relation is similar to that seen among F, G and K stars in the Hyades. Such strong convergence can only be explained if angular momentum is not at present being transferred from a reservoir in the deep stellar interiors to the surface layers. We conclude that the coupling timescale for angular momentum transport from a rapidly-spinning radiative core to the outer convective zone must be substantially shorter than the cluster age, and that from the age of Coma onward, stars rotate effectively as solid bodies. The existence of a tight relationship between stellar mass and rotation period at a given age supports the use of stellar rotation period as an age indicator in F, G and K stars of Hyades age and older. We demonstrate that individual stellar ages can be determined within the Coma population with an internal precision of order 9 percent (RMS), using a standard magnetic braking law in which rotation period increases with the square root of stellar age. We find that a slight modification to the magnetic- braking power law, $P \propto t^{0.56}$, yields rotational and asteroseismological ages in good agreement for the Sun and other stars of solar age for which p-mode studies and photometric rotation periods have been published.

Accepted by MNRAS

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For preprints via ftp or WWW: http://arxiv.org/abs/0908.0189

Low-mass Members of the Young Cluster IC 4665 and Pre-main-sequence Lithium Depletion

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We have used fibre spectroscopy to establish cluster membership and examine pre-main-sequence (PMS) lithium depletion for low-mass stars (spectral types F to M) in the sparse young ($\simeq$ 30 Myr) cluster IC 4665. We present a filtered candidate list of 40 stars that should contain 75 per cent of single cluster members with $11.5 < V < 18$ in the central square degree of the cluster. Whilst F- and G-type stars in IC 4665 have depleted little or no lithium, the K- and early M-type stars have depleted more Li than expected when compared with similar stars in other clusters of

known age. An empirical age estimate based on Li-depletion among the late-type stars of IC 4665 would suggest it is older than 100 Myr. This disagrees entirely with ages determined either from the nuclear turn-off, from isochronal matches to low-mass stars or from the re-appearance of lithium previously found in much lower mass stars (the "lithium depletion boundary"). We suggest that other parameters besides age, perhaps composition or rotation, are very influential in determining the degree of PMS Li-depletion in stars with $M > 0.5 M_{\odot}$. Further work is required to identify and assess the effects of these additional parameters, particularly to probe conditions at the interface between the sub-photospheric convection zone and developing radiative core. Until then, PMS Li depletion in F- to early M-type stars cannot be confidently used as a precise age indicator in young clusters, kinematic groups or individual field stars.

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For preprints via ftp or WWW: http://uk.arxiv.org/abs/0908.1317

The Radii of M-dwarfs in the Young Open Cluster NGC 2516

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Using a novel technique, which combines previously determined rotation periods with new spectroscopic determinations of projected rotation velocity, we have determined radii for fast rotating, low-mass (0.2–0.7 $M_{\odot}$) M-dwarfs in the young, solar-metallicity open cluster, NGC 2516. The mean radii are larger than model predictions at a given absolute I or K magnitude and also larger than the measured radii of magnetically inactive M-dwarfs; the difference increases from a few per cent, to 50 per cent for the lowest luminosity stars in our sample. We show that a simple two-temperature starspot model is broadly capable of explaining these observations, but requires spot coverage fractions of about 50 per cent in rapidly rotating M-dwarfs.

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For preprints via ftp or WWW: http://uk.arxiv.org/abs/0908.1406

Age and Mass of Solar Twins Constrained by Lithium Abundance

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We analyze the non-standard mixing history of the solar twins HIP 55 459, HIP 79 672, HIP 56 948, HIP 73 815, and HIP 100 963, to determine as precisely as possible their mass and age. Methods: We computed a grid of evolutionary models with non-standard mixing at several metallicities with the Toulouse-Geneva code for a range of stellar masses assuming an error bar of +-50 K in Teff. We choose the evolutionary model that reproduces accurately the observed low lithium abundances observed in the solar twins. Our best-fit model for each solar twin provides a mass and age solution constrained by their Li content and Teff determination. HIP 56 948 is the most likely solar-twin candidate at the present time and our analysis infers a mass of 0.994 +- 0.004 Msun and an age of 4.71 +- 1.39 Gyr. Non-standard mixing is required to explain the low Li abundances observed in solar twins. Li depletion due to additional mixing in solar twins is strongly mass dependent. An accurate lithium abundance measurement and non-standard models provide more precise information about the age and mass more robustly than determined by classical methods alone.

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A Homogeneous Spectroscopic Analysis of Host Stars of Transiting Planets

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The analysis of transiting extra-solar planets provides an enormous amount of information about the formation and evolution of planetary systems. A precise knowledge of the host stars is necessary to derive the planetary properties accurately. The properties of the host stars, especially their chemical composition, are also of interest in their own right.

Information about planet formation is inferred by, among others, correlations between different parameters such as the orbital period and the metallicity of the host stars. The stellar properties studied should be derived as homogeneously as possible. The present work provides new, uniformly derived parameters for 13 host stars of transiting planets.

Effective temperature, surface gravity, microturbulence parameter, and iron abundance were derived from spectra of both high signal-to-noise ratio and high resolution by assuming iron excitation and ionization equilibria.

For some stars, the new parameters differ from previous determinations, which is indicative of changes in the planetary radii. A systematic offset in the abundance scale with respect to previous assessments is found for the TrES and HAT objects. Our abundance measurements are remarkably robust in terms of the uncertainties in surface gravities. The iron abundances measured in the present work are supplemented by all previous determinations using the same analysis technique. The distribution of iron abundance then agrees well with the known metal-rich distribution of planet host stars. To facilitate future studies, the spectroscopic results of the current work are supplemented by the findings for other host stars of transiting planets, for a total dataset of 50 objects.

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For preprints contact: mammler@uni-goettingen.de (continued →)

For preprints via ftp or WWW: http://de.arxiv.org/abs/0909.0285

Solar Abstracts

A Method for the Treatment of Supergranulation Advection by Giant Cells

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We present a new method for the treatment of the advection of solar supergranulation by giant cells, a large-scale analogue to the observed property of granule advection by supergranules. The proposed method is derived from description of solar convection via spherical harmonics and spectral coefficients, allowing the investigation of the influence of a giant cell component on a realistic supergranule signal. We show that a supergranule pattern derived from real data, as well as a simplified test signal, can be advected by a giant cell component of various sizes. The identified behaviour is in analogy to observed supergranulation patterns, including those based on MDI Dopplergrams, which show wavelike supergranulation patterns, even after the removal of the geometric projection effect. Our method is an important step toward the construction of future models involving supergranule flow patterns advected by a giant cell flow. Nevertheless, additional efforts are required to obtain a final verification of giant cells as a separate component of the solar photospheric convection spectrum.

Accepted by A&A

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Low-Mass and Substellar Abstracts

Evidence for Accretion in a Nearby, Young Brown Dwarf

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We report on the discovery of the young, nearby, brown dwarf 2MASS J0041353−562112. The object has a spectral type of M7.5, it shows Li absorption and signatures of accretion, which implies that it still has a disk and suggests an age below 10 Myr. The space motion vector and position on the sky indicate that the brown dwarf is probably a member of the ∼20 Myr old Tuc-Hor association, or that it may be an ejected member of the ∼12 Myr old β Pic association, both would imply that 2MASS J0041353−562112 may in fact be older than 10 Myr. No accreting star or brown dwarf was previously known in these associations. Assuming an age of 10 Myr, the brown dwarf has a mass of about 30 M_{Jup} and is located at 35 pc distance. The newly discovered object is the closest accreting brown dwarf known. Its membership to an association older than 10 Myr implies that either disks in brown dwarfs can survive as long as in more massive stars, perhaps even longer, or that star formation in Tuc-Hor or β Pic occured more recently than previously thought. The history and evolution of this object can provide new fundamental insight into the formation process of stars, brown dwarfs, and planets.

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For preprints via WWW: http://www.iop.org/EJ/abstract/1538-4357/702/2/L119/

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 monthly call for abstracts will be issued and abstracts received by the last day of the month will usually appear in the following month's newsletter. 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 .`

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