COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

No. 123 — May 2006 Editor: Steve Skinner (coolnews@jila.colorado.edu)

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Stellar Abstracts

The Impact of Meridional Circulation on Stellar Butterfly Diagrams and Polar Caps

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Observations of rapidly rotating solar-like stars show a significant mixture of opposite-polarity magnetic fields within their polar regions. To explain these observations, models describing the surface transport of magnetic flux demand the presence of fast meridional flows. Here, we link sub-surface and surface magnetic flux transport simulations to investigate (i) the impact of meridional circulations with peak velocities of $\leq 125\,\mathrm{m}\cdot\mathrm{s}^{-1}$ on the latitudinal eruption pattern of magnetic flux tubes and (ii) the influence of the resulting butterfly diagrams on polar magnetic field properties. Prior to their eruption, magnetic flux tubes with low field strengths and initial cross sections below $\sim 300\,\mathrm{km}$ experience an enhanced poleward deflection through meridional flows (assumed to be poleward at the top of the convection zone and equatorward at the bottom). In particular flux tubes which originate between low and intermediate latitudes within the convective overshoot region are strongly affected. This latitude-dependent poleward deflection of erupting magnetic flux renders the wings of stellar butterfly diagrams distinctively convex. The subsequent evolution of the surface magnetic field shows that the increased number of newly emerging bipoles at higher latitudes promotes the intermingling of opposite polarities of polar magnetic fields. The associated magnetic flux densities are about 20% higher than in the case disregarding the pre-eruptive deflection, which eases the necessity for fast meridional flows predicted by previous investigations. In order to reproduce the observed polar field properties, the rate of the meridional circulation has to be on the order of $100\,\mathrm{m}\cdot\mathrm{s}^{-1}$, and the latitudinal range from which magnetic flux tubes originate at the base of the convective zone ($\leq 50^o$) must be larger than in the solar case ($\leq 35^o$).

Accepted by MNRAS

For preprints contact: vrh1@st-andrews.ac.uk

For preprints via WWW: http://arxiv.org/abs/astro-ph/0604102

Spot Patterns and Differential Rotation in the Eclipsing Pre-cataclysmic Variable Binary, V471 Tau

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We present surface spot maps of the K2V primary star in the pre-cataclysmic variable binary system, V471 Tau. The spot maps show the presence of large high-latitude spots located at the sub-white dwarf longitude region. By tracking the relative movement of spot groups over the course of four nights (eight rotation cycles), we measure the surface differential rotation rate of the system. Our results reveal that the star is rotating rigidly with a surface shear rate, $d\Omega = 1.6 \pm 6\,\mathrm{mrad\,d^{-1}}$. The single active star AB Dor has a similar spectral type, rotation period and activity level as the K star in V471 Tau, but displays much stronger surface shear ($46 < d\Omega < 58$ $\mathrm{mrad\,d^{-1}}$). Our results suggest that tidal locking may inhibit differential rotation; this reduced shear, however, does not affect the overall magnetic activity levels in active K dwarfs.

Accepted by MNRAS

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For preprints via ftp or WWW: http://arxiv.org/abs/astro-ph/0602562

Solar-like Oscillations in the Metal-poor Subgiant ν Indi: Constraining the Mass and Age Using Asteroseismology

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Asteroseismology is a powerful method for determining fundamental properties of stars. We report the first application to a metal-poor object, namely the subgiant star ν Ind. We measured precise velocities from two sites, allowing us to detect oscillations and infer a large frequency separation of $\Delta\nu = 24.25 \pm 0.25\mu$Hz. Combining this value with the location of the star in the H-R diagram and comparing with standard evolutionary models, we were able to place constraints on the stellar parameters. In particular, our results indicate that ν Ind has a low mass ($0.85 \pm 0.04\, M_{\odot}$) and is at least 9 Gyr old.

Accepted by ApJ

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For preprints via WWW: http://arxiv.org/abs/astro-ph/0604453

The Periodic Variations of a White–light Flare Observed with ULTRACAM

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High time resolution observations of a white–light flare on the active star EQ PegB show evidence of intensity variations with a period of ≈10 s. The period drifts to longer values during the decay phase of the flare. If the oscillation is interpreted as an impulsively excited standing acoustic wave in a flare loop, the period implies a loop length of ≈1.7 Mm and ≈3.4 Mm for the case of the fundamental mode and the second harmonic, respectively. However, the small loop lengths imply a very high modulation depth making the acoustic interpretation unlikely. A more realistic interpretation may be that of a fast MHD wave with the modulation of the emission being due to the magnetic field. Alternatively, the variations could be due to a series of reconnection events. The periodic signature may then arise as a result of the lateral separation of individual flare loops or current sheets with oscillatory dynamics (*i.e.*, periodic reconnection).

Accepted by A&A

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Long-term Starspot Evolution, Activity Cycle and Orbital Period Variation of V711 Tauri (HR 1099)

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The long-term optical photometry of V711 Tau (HR 1099) ranging from 1975 to 2001 is analysed with different techniques to provide information on the activity of this widely studied RS CVn-type binary. Pooled variance analysis gives a characteristic time scale of evolution for the photospheric pattern of starspots of the order of 100-200 days, while periodogram analysis of seasonal photometric data reveals that the rotational modulation period is 2.837 ± 0.094 d, without significant changes along the analysed 26 years. Considering subsets of the entire data sequence along which the rotational modulation of the optical flux stays stable, a set of 66 light curves is obtained. They are modelled by means of inversion techniques based on Maximum Entropy and Tikhonov regularizations to derive the distributions in longitude and the total amount of the spotted area on the more luminous K1 IV component that dominates the optical variability of the system. An extensive comparison with published Doppler Imaging maps shows the advantages and drawbacks of inversion techniques based solely on optical photometry. The large scale structure of the longitudinal distribution of the spotted area is correctly reproduced, although individual starspots revealed by Doppler Imaging cannot be detected because of the limited spatial resolution of the photometric imaging. On the other hand, the variation of the total spotted area is best reconstructed from optical photometry and shows an activity cycle with a period of 19.5 ± 2.0 yr upon which a short-term modulation might be superposed having variable amplitude and phase and a mean duration of approximately 3-5 years. The distributions of the spotted area versus longitude show the presence of one dominant preferential longitude from 1975 to 1989; afterwards, two preferential longitudes with comparable spotted areas are detected. Their migration rates with respect to the orbital reference frame are variable versus time, possibly as a consequence of a variable drift rate of the respective non-axisymmetric dynamo modes. The variation of the orbital period of the system appears to be correlated with the magnetic activity of the K1 IV component. Specifically, the decrease of the orbital period occurred around 1990 coincides with a re-configuration of the stellar magnetic field as indicated by the simultaneous variation of its different proxies. In combination with previous studies, these results allow us to discriminate among different theoretical models proposed to explain the connection between magnetic activity and orbital dynamics.

Accepted by A&A

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Solar Abstracts

RHESSI Observations of the Solar Flare Iron-Line Feature at 6.7 keV

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brackets: Analysis of *RHESSI* 3–10 keV spectra for 27 solar flares is reported. This energy range includes thermal free–free and free–bound continuum and two line features, at ~ 6.7 keV and ~ 8 keV, principally due to highly ionized iron (Fe). We used the continuum and the flux in the so-called Fe-line feature at ~ 6.7 keV to derive the electron temperature T_e, the emission measure, and the Fe-line equivalent width as functions of time in each flare. The Fe/H abundance ratio in each flare is derived from the Fe-line equivalent width as a function of T_e. To minimize instrumental problems with high count rates and effects associated with multi-temperature and nonthermal spectral components, spectra are presented mostly during the flare decay phase, when the emission measure and temperature were smoothly varying. We found flare Fe/H abundance ratios that are consistent with the coronal abundance of Fe (i.e. 4 times the photospheric abundance) to within 20% for at least 17 of the 27 flares; for 7 flares, the Fe/H abundance ratio is possibly higher by up to a factor of 2. We find evidence that the Fe XXV ion fractions are less than the theoretically predicted values by up to 60% at $T_e = 12$ MK; the observed $N(\text{Fe XXV})/N(\text{Fe})$ values appear to be displaced from the most recent theoretical values by between 1 and 3 MK.

Accepted by ApJ

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Simple Magnetic Flux Balance as an Indicator of Neon VIII Doppler Velocity Partitioning in an Equatorial Coronal Hole

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We present a novel investigation into the relationship between simple estimates of magnetic flux balance and the Ne VIII Doppler velocity partitioning of a large equatorial coronal hole observed by the Solar Ultraviolet Measurements of Emitted Radiation spectrometer (SUMER) on the *Solar and Heliospheric Observatory* (SOHO) in November 1999. We demonstrate that a considerable fraction of the large scale Doppler velocity pattern in the coronal hole can be qualitatively described by simple measures of the local magnetic field conditions, i.e., the relative unbalance of magnetic polarities and the radial distance required to balance local flux concentrations with those of opposite polarity.

Accepted by ApJL

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Resolved Hubble Space Spectroscopy of Ultracool Binary Systems

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Using the low-resolution mode of the Space Telescope Imaging Spectrograph (STIS) aboard the *Hubble Space Telescope* (HST), we have obtained spatially resolved spectra of 20 ultracool dwarfs. 18 of them belong to 9 known very low-mass binary systems with angular separations in the range 0.37-0.098 arcseconds. We have derived spectral types in the range dM7.5 to dL6 from the PC3 index, and by comparing our STIS spectra with ground-based spectra of similar spectral resolution from Martín et al. (1999). We have searched for H_α emission in each object but it was clearly detected in only 2 of them. We find that the distribution of H_α emission in our sample is statistically different from that of single field dwarfs, suggesting an intriguing anticorrelation between chromospheric activity and binarity for M7–M9.5 dwarfs. We provide measuments of the strength of the main photospheric features and the PC3 index, and we derive calibrations of spectral subclasses versus F814W and K-band absolute magnitudes for a subset of 10 dwarfs in 5 binaries that have known trigonometric parallaxes.

Accepted by A&A

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A Multiwavelength Radial Velocity Search for Planets Around the Brown Dwarf LP 944-20

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The nearby brown dwarf LP 944−20 has been monitored for radial velocity variability at optical and near-infrared wavelengths using the VLT/UVES and the Keck/NIRSPEC spectrographs, respectively. The UVES radial velocity data obtained over 14 nights spanning a baseline of 841 days shows significant variability with an amplitude of 3.5 $\mathrm{km\,s^{-1}}$. The periodogram analysis of the UVES data indicates a possible period between 2.5 hours and 3.7 hours, which is likely due to the rotation of the brown dwarf. However, the NIRSPEC data obtained over 6 nights shows an rms dispersion of only 0.36 $\mathrm{km\,s^{-1}}$ and do not follow the periodic trend. These results indicate that the variability seen with UVES is likely to be due to rotationally modulated inhomogeneous surface features. We suggest that future planet searches around very low-mass stars and brown dwarfs using radial velocities will be better conducted in the near-infrared than in the optical.

Accepted by ApJ Letters

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For preprints via WWW: http://www.iac.es/galeria/ege/

Upcoming Meeting

Cool Stars, Stellar Systems, and the Sun
14th Cambridge Workshop

6 - 10 November 2006

Pasadena, CA USA

http://ssc.spitzer.caltech.edu/mtgs/cs14/

Cool Stars will enter its 26th year with the opening of CS14 in Pasadena, California this November. Topics that have been central to the previous Cool Stars meetings – stellar activity indicators, the solar-stellar connection, pre-main-sequence (PMS) stars and stellar evolution, brown dwarfs, and helio- and asteroseismology – will continue to figure prominently in the agenda for CS14. Enhanced emphasis will also be placed on a few new topics such as mid-IR observations (debris disk evolution; protostar formation) and high-angular resolution observations (PMS disk imaging, binary star orbits, future space astrometry missions).

CS14 is to be jointly hosted by the Spitzer Science Center and the Michelson Science Center.

Topics and confirmed speakers: The SOC has planned sessions on:

* Solar abundance scale, astero- and helioseismology (session in honor of J. Bahcall)
– confirmed speakers include M. Pinsonneault

* Cores to Disks to Stars – confirmed speakers include L. Allen, N. Calvet, L. Hartmann

* Brown Dwarfs – confirmed speakers include S. Leggett, M. Cushing, T. Barman, D. Kirkpatrick

* Solar/Stellar Magnetic Fields and Atmospheric Structure – confirmed speakers include J.- F. Donati, C. Johns-Krull

* Testing Stellar Evolutionary Models – confirmed speakers include A. Boden, P. Kervella, M. Salaris, L. Hillenbrand

* Radial Velocity Planets and Planet Transits – confirmed speakers include G. Laughlin, S. Aigrain, J. Valenti

* Stellar Winds and Angular Momentum Loss – confirmed speakers include S. Cranmer, S. Matt, L. Rebull

Additional information will be posted on our website as it becomes available.

Important Dates:
26 May 2006 Splinter session applications due
21 Jul 2006 Financial support application deadline
6 Sep 2006 Abstract submission deadline
6 Sep 2006 Early registration closes
1 Oct 2006 CS15 application deadline
30 Oct 2006 On-line registration closes (on-site registration will be available)

Details on each of these dates are given below.

Scientific Organizing Committee (SOC): J. Stauffer (Chair), L. Rebull (Deputy Chair), G. van Belle (LOC Chair), R. Akeson, T. Ayres, J. Bouvier, T. Brown, J. Christensen-Dalsgaard, A. Dupree, F. Favata, M. Giampapa, L. Hartmann, L. Hillenbrand, M. Jura, D. Kirkpatrick, R. Pallavicini, M. Pinsonneault, J. Schmitt, C. Schrijver, D. Soderblom, K. Stapelfeldt, K. Strassmeier, J. Valenti, and M. Werner

Local Organizing Committee (LOC): G. van Belle (Chair), B. Ali, D. Ardila, D. Cole, A. Dean, D. Gelino, K. Golden, R. Hurt, P. Lowrance, H. Mycroft, D. Padgett, P. Patterson, R. Scholey, N. Silbermann, A. Tanner, and (ex officio) J. Stauffer, L. Rebull, E. Kennedy

(*continued*→)

Meeting Format: The Workshop will consist of a series of oral and poster sessions. Each oral session will be built around a broad-ranging review talk that focuses on a relevant scientific topic. Contributed talks will be included in each session and will offer opportunities to highlight exciting new results and cover theoretical aspects in more detail. The SOC specifically works to include recent PhDs and young researchers in the mix of speakers. There will also be time for "Splinter Sessions" – parallel, less-formal discussions of hot topics. Please see below for more information.

Mailing List: We have established an informational mailing list for general information about CS14. The total traffic on this mailing list is expected to be very low, consisting of deadlines and general announcements such as this one. Please see our website above for instructions on how to subscribe.

Splinter Sessions: Following the pattern set by previous Cool Stars meetings, the CS14 SOC specifically invites the community to propose splinter sessions on current hot topics. Proposals for splinter sessions can be made by individuals or groups of individuals. At this time, we are planning that six to eight splinter sessions can be accommodated in our schedule, but this number may change in the future. For more information on the application requirements and suggested topics, please see our website above. Deadline for splinter session proposals is 26 May 2006.

We plan to announce accepted splinter sessions by the end of June 2006. Participants willing to contribute in the splinter sessions must make arrangements directly with the convenor.

Registration: Registration for CS14 is now open! The registration fee covers conference attendance, wireless internet access at the conference site, coffee breaks, the conference banquet, and a copy of the conference proceedings. Early registration ($260) deadline is 6 Sep 2006. Registration between 7 Sep and 30 Oct will be $290; on-site registration fee will be $320.

Abstract Submission: Abstracts for contributed talks and posters are now accepted on the CS 14 website. The deadline for abstract submission is 6 Sep 2006. Late abstracts will be accepted on a space-available basis.

Participants are limited to one contribution each. We plan to have posters will be on display throughout the meeting (Monday morning to Friday noon). Proposed oral contributions not selected for talks can be converted to poster presentations at the author's discretion.

Financial Assistance: The CS14 SOC and LOC have set aside a small portion of the conference funding for limited travel support for students of merit. Support must be requested during registration by July 21st for consideration. Please see our website for more information. Deadline for requests is 21 Jul 2006.

Conference Venue and Facilities: The Conference will be held in the recently renovated Pasadena Hilton. A block of rooms has been reserved in this hotel for conference attendees; information on alternate accommodations is available on our website. We will have a large ballroom for plenary sessions, large rooms for poster sessions, and breakout rooms for splinter sessions. We plan to provide wireless internet at the conference site. Special needs can be accommodated if we are notified well in advance.

Travel Information: The City of Pasadena is served by several airports. The largest is Los Angeles International (LAX); the closest is the Bob Hope (Burbank) Airport (BUR). Taxis and shuttles ("Supershuttle") are available from both airports to any hotel in Pasadena. Our website has additional information on Pasadena and environs.

Excursions and Guest Social Program: We are planning several events for conference attendees and their guests. Stay tuned!

(*continued* →)

Weather and Climate: Pasadena is famous for wonderful weather! In early November, the average high temperature is 75 deg F=24 deg C (historical ranges 53 deg to 102 deg F=12 deg to 39 deg C) and the average low temperature is 49 deg F=9 deg C (historical ranges 34 deg to 63 deg F=1 deg to 17 deg C). In the historical record for 420 early November days, there are only 42 rainy days.

Already planning for next time: The SOC now solicits applications to hold the next workshop, CS15. The proposals will be evaluated by the SOC prior to CS14, and you will be asked to make a presentation of your proposal at an SOC meeting during the CS14 workshop. The winning proposal will be announced at the CS14 banquet. The application can be found on our website; the deadline for CS15 applications is 1 Oct 2006.

Questions, Suggestions? If you have any questions or suggestions, please contact us at cs14@ipac.caltech.edu.

See you in Pasadena!!

Cool Stars 14 web page: http://ssc.spitzer.caltech.edu/mtgs/cs14/

CS14-info mailing list: CS14-info@lists.ipac.caltech.edu
https://lists.ipac.caltech.edu/mailman/listinfo/cs14-info

JOB OPENING

Permanent and Postdoctoral Positions

X-ray and Infrared Astronomy

Tata Inst. of Fundamental Research (India)

The X-ray and Infrared Astronomy Groups (Department of Astronomy and Astrophysics, DAA) of Tata Institute of Fundamental Research, Mumbai (Bombay), India, are looking for bright young scientists for permanent academic and post-doctoral positions. The programmes of the groups include X-ray and infrared studies of young and cool stars, chromospherically active stars, RSCVn binaries, algols and cataclysmic variables. The research programmes with satellite-based, and other national and international observatories are also being actively pursued. Three X-ray payloads for India's first Astronomy satellite - ASTROSAT are being built in DAA. The DAA also has a vibrant program of research in various branches of theoretical astrophysics.

Candidates with a Ph.D. and $\sim 1-3$ years of post-doctoral experience with excellent academic record are encouraged to apply for permanent academic positions. Fresh Ph.D.'s will also be considered for a Post-doctoral appointment. Post-doctoral appointments are on yearly basis and renewable for a maximum of three years. The institute offers competitive academic environment, career profiles, on-campus accommodation and health and other family welfare benefits. Interested persons may contact the department's chairperson (E-mail: daa@tifr.res.in). Further details can also be seen by visiting DAA's webpage:
http://www.tifr.res.in/scripts/sitemap.php?id=5.

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` .

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