COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

Spectroscopic Properties of Cool Ursa Major Group Members

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Until now, most members of the Ursa Major (UMa) group of stars have been identified by means of kinematic criteria. However, in many cases kinematic criteria alone are insufficient to ascertain, whether an individual star is really a member of this group. Since photometric criteria are ineffective in the case of cool dwarf members, one must use spectroscopic criteria. Nevertheless, resulting membership criteria are inconclusive.

We reanalyse spectroscopic properties of cool UMa group dwarfs. In particular, we study the distribution of iron abundance, the strength of the Li I absorption at 6708 Å and the Li abundance, and the infilling of the core of the Hα line.

Twenty-five cool and northern bona-fide members are carefully selected from the literature. Homogeneously measured stellar parameters and iron abundances are given for all Sun-like stars selected, based on spectra of high resolution and high signal-to-noise ratio. In addition, we measure the Li equivalent width and abundance as well as the relative intensity of the Hα core and the corresponding chromospheric flux.

The studied stars infer an average Ursa Major group iron abundance of -0.03 ± 0.05 dex, which is higher by about 0.06 dex than determined elsewhere. The Li abundance derived of Ursa Major group dwarf stars is higher than in the Hyades at effective temperatures cooler than the Sun, but lower than in the younger Pleiades, a result which is independent of the exact value of the effective temperature adopted. The Sun-like and cooler dwarfs also display chromospheric infilling of the Hα core. We present spectroscopic criteria that may be used to exclude non-members.

Accepted by A&A (continued →)

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For preprints via ftp or WWW: http://arxiv.org/abs/0910.5913

The Origin of Enhanced Activity in the Suns of M67

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We report the results of the analysis of high resolution photospheric line spectra obtained with the UVES instrument on the VLT for a sample of 15 solar-type stars selected from a recent survey of the distribution of H and K chromospheric line strengths in the solar-age open cluster M67. We find upper limits to the projected rotation velocities that are consistent with solar-like rotation (i.e., $v \sin i$ <2–3 $\mathrm{km\,s^{-1}}$) for objects with Ca II chromospheric activity within the range of the contemporary solar cycle. Two solar-type stars in our sample exhibit chromospheric emission well in excess of even solar maximum values. In one case, Sanders 1452, we measure a minimum rotational velocity of $v \sin i = 4 \pm 0.5\,\mathrm{km\,s^{-1}}$, or over twice the solar equatorial rotational velocity. The other star with enhanced activity, Sanders 747, is a spectroscopic binary. We conclude that high activity in solar-type stars in M67 that exceeds solar levels is likely due to more rapid rotation rather than an excursion in solar-like activity cycles to unusually high levels. We estimate an upper limit of 0.2 % for the range of brightness changes occurring as a result of chromospheric activity in solar-type stars and, by inference, in the Sun itself. We discuss possible implications for our understanding of angular momentum evolution in solar-type stars, and we tentatively attribute the rapid rotation in Sanders 1452 to a reduced braking efficiency.

Accepted by ApJ

For preprints via ftp or WWW: http://arxiv.org/abs/0911.0424

Solar Abstracts

Flow Instabilities in Magnetic Flux Tubes IV. Flux Storage in the Solar Overshoot Region

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We consider the effects of material flows on the dynamics of toroidal magnetic flux tubes located close to the base of the solar convection zone, initially within the overshoot region. The problem is to find the physical conditions in which magnetic flux can be stored for periods comparable to the dynamo amplification time, which is of the order of a few years. We carry out nonlinear numerical simulations to investigate the stability and dynamics of thin flux tubes subject to perpendicular and longitudinal flows. We compare the simulations with the results of simplified analytical approximations. We determine ranges of the flow parameters for which a linearly Parker-stable magnetic flux tube is stored in the middle of the overshoot region for a period comparable to the dynamo amplification time. The residence time for magnetic flux tubes with fluxes of 2×10^{21} Mx in the convective overshoot layer is comparable to the dynamo amplification time, provided that the average speed and the duration of the downflow do not exceed about 50 m s $^{-1}$ and 100 days, respectively, and that the lateral extension of the flow is smaller than about 10 degrees.

Accepted by A&A

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For preprints via ftp or WWW: http://arxiv.org/abs/0910.3858

Small-scale Swirl Events in the Quiet Sun Chromosphere

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Recent progress in instrumentation enables solar observations with high resolution simultaneously in the spatial, temporal, and spectral domains. We use such high-resolution observations to study small-scale structures and dynamics in the chromosphere of the quiet Sun. We analyse time series of spectral scans through the Ca II 854.2 nm spectral line obtained with the CRISP instrument at the Swedish 1-m Solar Telescope. The targets are quiet Sun regions inside coronal holes close to disc-centre. The line core maps exhibit relatively few fibrils compared to what is normally observed in quiet Sun regions outside coronal holes. The time series show a chaotic and dynamic scene that includes spatially confined "swirl" events. These events feature dark and bright rotating patches, which can consist of arcs, spiral arms, rings or ring fragments. The width of the fragments typically appears to be of the order of only 0."2, which is close to the effective spatial resolution. They exhibit Doppler shifts of -2 to -4 km/s but sometimes up to -7 km/s, indicating fast upflows. The diameter of a swirl is usually of the order of 2". At the location of these swirls, the line wing and wide-band maps show close groups of photospheric bright points that move with respect to each other. A likely explanation is that the relative motion of the bright points twists the associated magnetic field in the chromosphere above. Plasma or propagating waves may then spiral upwards guided by the magnetic flux structure, thereby producing the observed intensity signature of Doppler-shifted ring fragments.

Accepted by A&A

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Cross-Listed Abstracts (PMS Stars)

REM Near-IR and Optical Photometric Monitoring of Pre-Main Sequence Stars in Orion. Rotation Periods and Starspot Parameters

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We performed an intensive photometric monitoring of the PMS stars falling in a field of about $10' \times 10'$ in the vicinity of the Orion Nebula Cluster (ONC), also containing the BD eclipsing system 2MASS J05352184-0546085. Photometric data were collected between November 2006 and January 2007 with the REM telescope in the $VRIJHK'$ bands. The largest number of observations is in the I band (about 2700 images) and in J and H bands (about 500 images in each filter). From the observed rotational modulation, induced by the presence of surface inhomogeneities, we derived the rotation periods. The long time-baseline (nearly three months) allowed us to detect rotation periods, also for the slowest rotators, with sufficient accuracy ($\Delta P/P < 2\%$). The analysis of the spectral energy distributions and, for some stars, of high-resolution spectra provided us with the main stellar parameters (luminosity, effective temperature, mass, age, and $v \sin i$) which are essential for the discussion of our results. Moreover, the simultaneous observations in six bands, spanning from optical to near-infrared wavelengths, enabled us to derive the starspot properties for these very young low-mass stars.
In total, we were able to determine the rotation periods for 29 stars, spanning from about 0.6 to 20 days. Thanks to the relatively long time-baseline of our photometry, we derived periods for 16 stars and improved previous determinations for the other 13. We also report the serendipitous detection of two strong flares in two of these objects. In most cases, the light-curve amplitudes decrease progressively from the R to H band as expected for cool starspots, while in a few cases, they can only be modelled by the presence of hot spots, presumably ascribable to magnetospheric accretion. The application of our own spot model to the simultaneous light curves in different bands allowed us to deduce the spot parameters and particularly to disentangle the spot temperature and size effects on the observed light curves.

Accepted by A&A (continued →)

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For preprints via ftp or WWW: http://arxiv.org/abs/0911.0760

Announcement (Workshop Proceedings)

Intermediate Mass Stars ↔ Massive Stars. A Workshop Around Causes and Consequences of Differing Evolutionary Paths

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The post-main sequence evolution of stars of intermediate or large masses is notoriously complex. In the recent past, a number of workshops and meetings assive stars. But how well defined is the boundary between these categories of objects defined? How would an observer proceed to classify stars into one or the other category? How do objects near the boundary evolve, die, and contribute to the chemical evolution of their environment?

During this 3-day international workshop, 26 high quality presentations were given by specialists in the relevant fields of astrophysics, and stimulating discussions followed. It is technically impossible to provide an exhaustive census of the results and ideas that emerged. In this brief article, we choose to point to key elements of the workshop, some of which are now the topic of new collaborations and will lead to publications elsewhere. For the sake of brevity, we deliberately cite only the contributors to the workshop and no external references. Many bibliographic references can be found in the original presentations, which can be retrieved through:

http://astro.u-strasbg.fr/observatoire/obs/stars2009/stars2009.html

The programme workshop, which includes the titles of the individual contributions, is provided as an appendix.

Workshop summary. 8 pages, 4 figures

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Upcoming Meeting

Call for Papers
COSPAR Session E23
New Perspectives on the Solar-Stellar Connection
The 38th COSPAR Scientific Assembly

18 - 25 July 2010

Bremen, Germany

Session Organizers:
Main Scientific Organizer: Fabio Reale (University of Palermo, Italy, and INAF)
Deputy Organizer: Paola Testa (Smithsonian Astrophysical Observatory)

Event Description:
The corona of our Sun is, to date, the only stellar corona that can be spatially resolved and studied at a high level of detail. The solar corona is therefore often used as paradigm for the interpretation of the X-ray activity of other solar-like stars of which we can only observe disk-integrated emission. Stars, on the other hand, present an enormous range of ages, and other physical properties, and thus they provide tools for understanding the long-term evolution of solar X-ray activity, as well as offering laboratories for testing detailed models of solar activity in conditions unavailable to the Sun. The proposed session aims at providing the solar and stellar communities with an opportunity for meeting and discussing recent advances in our understanding of the physical processes at work in the X-ray emitting outer atmosphere of the Sun and of stars. The discussion will be particularly focused on recent results of the Hinode and SDO missions on the solar side, and XMM and Chandra on the stellar one.

Confirmed Invited Speakers:
Costanza Argiroffi (University of Palermo, Italy), James Klimchuk (NASA-GSFC, USA), Isabella Pagano (INAF-Osservatorio Astrofisico di Catania, Italy), Jurgen Schmitt (Universitaet Hamburg, Germany), Carolus Schrijver (LMSAL, USA), Sami Solanki (Max-Planck-Institut fr Sonnensystemforschung, Germany)

The 38th COSPAR Scientific Assembly will be held in Bremen, Germany 18-25 July, 2010. Information about COSPAR and forms for registration, accommodations may be found at http://www.cospar-assembly.org/

Abstract Due Date: Friday, **19 February 2010** at the COSPAR website http://www.cospar-assembly.org/

Questions about this session can be addressed to the organizers:
reale@astropa.unipa.it
ptesta@cfa.harvard.edu

Upcoming Meetings

International Workshop on Double and Multiple Stars: Dynamics, Physics, and Instrumentation
10 - 11 Dec. 2009
Astronomical Observatory Ramon Maria Aller, Santiago de Compostela, Spain
http://www.usc.es/astro/ds/ds.html

Seismological Challenges for Stellar Structure
1 - 5 Feb. 2010
Lanzarote (Canary Islands), Spain
http://www.iac.es/congreso/helas4

The Origin and Fate of the Sun: Evolution of Solar-mass Stars Observed with High Angular Resolution
2 - 5 March 2010
Garching, Germany
http://www.eso.org/sci/meetings/stars2010

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.***