COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

Infrared Spectroscopy of Symbiotic Stars. VII. Binary Orbit and Long Secondary Period Variability of CH Cygni

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High-dispersion spectroscopic observations are used to refine orbital elements for the symbiotic binary CH Cyg. The current radial velocities, added to a previously published 13 year time series of infrared velocities for the M giant in the CH Cyg symbiotic system, more than double the length of the time series to 29 years. The two previously identified velocity periods are confirmed. The long period, revised to 15.6 $\pm$ 0.1 yr, is shown to result from a binary orbit with a 0.7 solar mass white dwarf and 2 solar mass M giant. Mass transfer to the white dwarf is responsible for the symbiotic classification. CH Cyg is the longest period S-type symbiotic known. Similarities with the longer period D-type systems are noted. The 2.1 year period is shown to be on Wood's sequence D, which contains stars identified as having long secondary periods (LSP). The cause of the LSP variation in CH Cyg and other stars is unknown. From our review of possible causes, we identify g-mode non-radial pulsation as the leading mechanism for LSP variation in CH Cyg. If g-mode pulsation is the cause of the LSPs, a radiative region is required near the photosphere of pulsating AGB stars.

Accepted by ApJ

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The Chromospherically Active Binary Star EI Eridani II. Long-term Doppler Imaging

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Data from 11 years of continuous spectroscopic observations of the active RS CVn-type binary star EI Eridani – gained at NSO/McMath-Pierce, KPNO/Coudé Feed and during the MUSICOS 98 campaign – were used to obtain 34 Doppler maps in three spectroscopic lines for 32 epochs, 28 of which are independent of each other. Various parameters are extracted from our Doppler maps: average temperature, fractional spottedness, and longitudinal and latitudinal spot-occurrence functions. We find that none of these parameters show a distinct variation nor a correlation with the proposed activity cycle as seen from photometric long-term observations. This suggests that the photometric brightness cycle may not necessarily be due to just a cool spot cycle. The general morphology of the spot pattern remains persistent over the whole period of 11 years. A large cap-like polar spot was recovered from all our images. A high degree of variable activity was noticed near latitudes of ≈60–70° where the appendages of the polar spot emerged and dissolved.

Accepted by AN (Astronomical Notes)

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For preprints via ftp or WWW: http://www.aip.de/~wasi/preprint/AN2009_Washuettl_EIEri2.pdf

Giants in the Globular Cluster ω Centauri: Dust Production, Mass Loss and Distance

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We present spectral energy distribution modelling of 6875 stars in ω Centauri, obtaining stellar luminosities and temperatures by fitting literature photometry to state-of-the-art MARCS stellar models. By comparison to four different sets of isochrones, we provide a new distance estimate to the cluster of 4850 ± 200 (random error) ± 120 (systematic error) pc, a reddening of $E(B-V) = 0.08 \pm 0.02$ (random) ± 0.02 (systematic) mag and a *differential* reddening of $\Delta E(B-V) < 0.02$ mag for an age of 12 Gyr. Several new post-early-AGB candidates are also found. Infra-red excesses of stars were used to measure total mass-loss rates for individual stars down to $\sim 7 \times 10^{-8}$ M$_\odot$ yr^{-1}. We find a total dust mass-loss rate from the cluster of $1.3 \pm^{0.8}_{0.5} \times 10^{-9}$ M$_\odot$ yr^{-1}, with the total gas mass-loss rate being $> 1.2 \pm^{0.6}_{0.5} \times 10^{-6}$ M$_\odot$ yr^{-1}. Half of the cluster's dust production and 30% of its gas production comes from the two most extreme stars – V6 and V42 – for which we present new Gemini/T-ReCS mid-infrared spectroscopy, possibly showing that V42 has carbon-rich dust. The cluster's dust temperatures are found to be typically > 550 K. Mass loss apparently does not vary significantly with metallicity within the cluster, but shows some correlation with barium enhancement, which appears to occur in cooler stars, and especially on the anomalous RGB. Limits to outflow velocities, dust-to-gas ratios for the dusty objects and the possibility of short-timescale mass-loss variability are also discussed in the context of mass loss from low-metallicity stars. The ubiquity of dust around stars near the RGB-tip suggests significant dusty mass loss on the RGB; we estimate that typically 0.20–0.25 M$_\odot$ of mass loss occurs on the RGB. From observational limits on intra-cluster material, we suggest the dust is being cleared on a timescale of $< 10^5$ years.

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For preprints via ftp or WWW: http://xxx.arxiv.org/abs/0812.0326

Magnetic Activity in the Photosphere of CoRoT-Exo-2a. Active Longitudes and Short-term Spot Cycle in a Young Sun-like Star

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The space experiment CoRoT has recently detected transits by a hot Jupiter across the disc of an active G7V star (CoRoT-Exo-2a) that can be considered as a good proxy for the Sun at an age of approximately 0.5 Gyr. We present a spot modelling of the optical variability of the star during 142 days of uninterrupted observations performed by CoRoT with unprecedented photometric precision. We apply spot modelling approaches previously tested in the case of the Sun by modelling total solar irradiance variations, a good proxy for the optical flux variations of the Sun as a star. The best results in terms of mapping of the surface brightness inhomogeneities are obtained by means of maximum entropy regularized models. To model the light curve of CoRoT-Exo-2a, we take into account the photometric effects of both cool spots and solar-like faculae, adopting solar analogy. Two active longitudes initially on opposite hemispheres are found on the photosphere of CoRoT-Exo-2a with a rotation period of 4.522 ± 0.024 days. Their separation changes by $\approx 80^{\circ}$ during the time span of the observations. From this variation, a relative amplitude of the surface differential rotation lower than ~ 1 percent is estimated. Individual spots form within the active longitudes and show an angular velocity ~ 1 percent lower than that of the longitude pattern. The total spotted area shows a cyclic oscillation with a period of 28.9 ± 4.3 days, which is close to 10 times the synodic period of the planet as seen by the rotating active longitudes. We discuss the effects of solar-like faculae on our models, finding indications of a facular contribution to the optical flux variations of CoRoT-Exo-2a being significantly smaller than in the present Sun. The implications of such results for the internal rotation of CoRoT-Exo-2a are discussed, based on solar analogy. A possible magnetic star-planet interaction is suggested by the cyclic variation of the spotted area. Alternatively, the 28.9-d cycle may be related to Rossby-type waves propagating in the subphotospheric layers of the star.

Accepted by A&A

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For preprints via ftp or WWW: //web.ct.astro.it/preprints/ or arXiv:0811.0461

Correlation Between the Spatial Distribution of Circumstellar Disks and Massive Stars in the Young Open Cluster NGC 6611. II: Cluster Members Selected with Spitzer/IRAC.

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Context: the observations of the proplyds in the Orion Nebula Cluster, showing clear evidence of ongoing photoevaporation, have provided a clear proof about the role of the externally induced photoevaporation in the evolution of circumstellar disks. NGC 6611 is an open cluster suitable to study disk photoevaporation, thanks to its large population of massive members and of stars with disk. In a previous work, we obtained evidence of the influence of the strong UV field generated by the massive cluster members on the evolution of disks around low-mass Pre-Main Sequence members. That work was based on a multi-band BVIJHK and X-ray catalog purposely compiled to select the cluster members with and without disk.

Aims: in this paper we complete the list of candidate cluster members, using data at longer wavelengths obtained with Spitzer/IRAC, and we revisit the issue of the effects of UV radiation on the evolution of disks in NGC 6611.

Methods: we select the candidate members with disks of NGC 6611, in a field of view of $33' \times 34'$ centered on the cluster, using IRAC color-color diagrams and suitable reddening-free color indices. Besides, using the X-ray data to select Class III cluster members, we estimate the disks frequency vs. the intensity of the incident radiation emitted by massive members.

Results: we identify 458 candidate members with circumstellar disks, among which 146 had not been revealed in our previous work. Comparing of the various color indices we used to select the cluster members with disk, we claim that they detect the excesses due to the emission of the same physical region of the disk: the inner rim at the dust sublimation radius. Our new results confirm that UV radiation from massive stars affects the evolution of nearby circumstellar disks.

Accepted by A&A

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First Measurement of the Magnetic Field on FK Com and Its Relation to the Contemporaneous Starspot Locations

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In this study we present simultaneous low-resolution longitudinal magnetic field measurements and high-resolution spectroscopic observations of the cool single giant FK Com. The variation of the magnetic field over the rotational period of 2.4 days is compared with the starspot location obtained using Doppler imaging techniques, V-band photometry and V-I colours. The chromospheric activity is studied simultaneously with the photospheric activity using high resolution observations of the Hα, Hβ and Hγ line profiles. Both the maximum (272$\pm$24 G) and minimum (60$\pm$17 G) in the mean longitudinal magnetic field, $\langle B_z \rangle$, are detected close to the phases where cool spots appear on the stellar surface. A possible explanation for such a behaviour is that the active regions at the two longitudes separated by 0.2 in phase have opposite polarities.

Accepted by MNRAS

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Solar-like Oscillations in the G8 V Star τ Ceti

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We used HARPS to measure oscillations in the low-mass star τ Cet. Although the data were compromised by instrumental noise, we have been able to extract the main features of the oscillations. We found τ Cet to oscillate with an amplitude that is about half that of the Sun, and with a mode lifetime that is slightly shorter than solar. The large frequency separation is 169 μHz, and we have identified modes with degrees 0, 1, 2, and 3. We used the frequencies to estimate the mean density of the star to an accuracy of 0.45% which, combined with the interferometric radius, gives a mass of $0.783 \pm 0.012\,M_\odot$ (1.6%).

Accepted by A&A

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For preprints via ftp or WWW: http://arxiv.org/abs/0811.3989

The Radius and Other Fundamental Parameters of the F9 V Star β Virginis

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We have used the Sydney University Stellar Interferometer (SUSI) to measure the angular diameter of the F9 V star β Virginis. After correcting for limb darkening and combining with the revised Hipparcos parallax, we derive a radius of $1.703 \pm 0.022\,R_\odot$ (1.3 per cent). We have also calculated the bolometric flux from published measurements which, combined with the angular diameter, implies an effective temperature of 6059 ± 49 K (0.8 per cent). We also derived the luminosity of β Vir to be $L = 3.51 \pm 0.08\,L_\odot$ (2.1 per cent). Solar-like oscillations were measured in this star by Carrier et al. (2005) and using their value for the large frequency separation yields the mean stellar density with an uncertainty of about 2 per cent. Our constraints on the fundamental parameters of β Vir will be important to test theoretical models of this star and its oscillations.

Accepted by MNRAS

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For preprints via ftp or WWW: http://arxiv.org/abs/0811.1804

Nonlinear Prediction of Solar Cycle 24

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Sunspot activity is highly variable and challenging to forecast. Yet forecasts are important, since peak activity has profound effects on major geophysical phenomena including space weather (satellite drag, telecommunications outages) and has even been correlated speculatively with changes in global weather patterns. This paper investigates trends in sunspot activity, using new techniques for decadal-scale prediction of the present solar cycle (cycle 24). First, Hurst exponent H analysis is used to investigate the autocorrelation structure of the putative dynamics; then the Sugihara-May algorithm is used to predict the ascension time and the maximum intensity of the current sunspot cycle. Here we report $H = 0.86$ for the complete sunspot number dataset (1700-2007) and $H = 0.88$ for the reliable sunspot data set (1848-2007). Using the Sugihara-May algorithm analysis, we forecast that cycle 24 will reach its maximum in December 2012 at approximately 87 sunspots units.

Accepted by ApJ

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Upcoming Meeting

The Twelfth International Conference on the Solar Wind

21 - 26 June 2009

Saint-Malo, France

Call for Pre-Registration and Abstract submissions

Dear Colleagues:

The *Twelfth International Conference on the Solar Wind*, organized by the Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA) of the Paris Observatory, will be held at the Palais du Grand Large in Saint-Malo, France, from 21 to 26 June 2009.

The meeting, covering all aspects of solar wind physics, will comprise both invited and contributed papers. Check out the program and the preliminary list of invited speakers at http://www.lesia.obspm.fr/SW12 .

For all participants, pre-registration is required:

http://www.lesia.obspm.fr/SW12/pages/inscript.html

and the abstracts of both contributed and invited papers may be submitted using the following link:

http://www.lesia.obspm.fr/SW12/pages/Absub.html

For the Solar Wind 12 SOC and LOC,

M. Maksimovic

Upcoming Meeting

Space Climate School and Space Climate Symposium-3

15 - 22 March 2009

Hotel Riekonlinna, Lapland, Finland

Dear Colleagues:

The *Space Climate School and Space Climate Symposium-3* will be held in Hotel Riekonlinna, Finnish Lapland, Finland 15.-18. March, 2009 (School), and 18.-22. March, 2009 (Symposium) hosted by the University of Oulu, Finland.

Space Climate School aims to introduce under-graduate and post-graduate students, young space researchers and any other interested to the basics of the key topics of Space Climate, including Earth's climate and Sun-climate relations, in a friendly, encouraging and inspiring atmosphere. Lecturers include, e.g., J. Beer, J. Haigh, D. Marsh, A. Ferriz Mas, J. Moore, K. Mursula, E. Priest, E. Rodrguez Camino, W. Schmutz and I. Usoskin.

Space Climate Symposium review speakers include, e.g., P. Charbonneau, K. Georgieva, A. Kosovichev, D. Nandi, V. Obridko, E. Priest, J.-P. Rozelot, A. Rouillard, A. Ruzmaikin, N. Shaviv, E. Smith, S. Solanki, B. Tinsley, and B. Tsurutani.

For registration and information on program, travel, accommodation etc., see:

http://spaceweb.oulu.fi/spaceclimate/

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Sincerely Yours,

Kalevi Mursula, for the LOC

JOB OPENING

Postdoctoral Position

Low-Mass Stars and Brown Dwarfs

Univ. of Hawaii

Ref.: http://members.aas.org/JobReg/JobDetailPage.cfm?JobID=25084

The Institute for Astronomy (IfA) at the University of Hawaii invites applications for a postdoctoral research position located in Honolulu, Hawaii. The successful applicant will collaborate with Dr. Michael Liu (mliu@ifa.hawaii.edu) on research related to low-mass stars and brown dwarfs, based on observing programs carried out with premier ground-based and space-based telescopes. Applicants with interest and experience in these areas are encouraged to apply.

The successful applicant will have access to optical and IR telescopes on the summit of Mauna Kea through the IfA's guaranteed share of observing time. The IfA is also the lead institution in the Pan-STARRS-1 wide-field optical telescope, scheduled to begin science operations at the start of 2009. Applicants with interests in science from multi-band, multi-epoch all-sky surveys are especially encouraged to apply.

By the starting date, candidates should have obtained a PhD degree in astronomy, physics or equivalent area relevant to the science themes described above.

The appointment is for up to three years, subject to annual performance and funding. The position is available immediately, but the start date is flexible and can be anytime in 2009. The annual salary will be approximately $56,500 per year and will include support for research activities.

Applications received by the closing date of January 7, 2009 will receive full consideration. Please submit the following: resume/CV; cover letter including Recruitment ID#; statement of research, referral source, narrative of your qualifications for position and salary history; names, phone numbers and addresses of three supervisory references and copy of degree(s)/transcripts/certificate(s) to Director of Human Resources, Research Corporation of the University of Hawaii, 2530 Dole Street, Sakamaki Hall D-100, Honolulu, HI 96822 or by fax to (808) 956-5022. Please also arrange for three letters of recommendation to be sent by the closing date. You may apply online at www.rcuh.com or mail/fax your application by the closing date. If you have questions on the application process and/or need assistance, please call (808)956-3100.

For complete information and application requirements, please go to www.rcuh.com and click on *Employment*. Please reference ID #28551.

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.***