COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

HR Diagram and Asteroseismic Analysis of Models for β *Hydri*

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A detailed review of the models for the star β *Hydri* is done by adjusting the evolutionary sequences to the most recent bolometric, spectroscopic and astrometric data. The dependence of the solution on some of the relevant modelling parameters is analysed and the degeneracy of the solution using the HR Diagram analysis discussed.

Recent ground-based observations, and the forthcoming asteroseismic missions, can provide detailed oscillation spectra for this star. The seismic data can be used as a complementary constraint on the models. We analyse the seismic properties of the star and discuss the viability of using such complementary tests in order to clarify some of the degeneracy of the model solutions. Preliminary results on the fundamental parameters of β *Hydri* are presented and the expected seismic behaviour of the star is described.

Accepted by A&A

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CHANDRA-LETGS X-ray Observation of α Centauri: A Nearby (G2V + K1V) Binary System

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A Chandra LETGS X-ray observation of α Centauri with an exposure time of 81.5 ks is presented with the two components (K1V and G2V) spectrally resolved for the first time. We use the emission lines from the individual spectra to determine plasma temperatures and find similar temperatures as for the Sun with higher temperatures for the K1V star than for the G2V star. Global fitting techniques are used in order to construct an emission measure distribution for each star and we find emission measure distributions consistent with what is found from the line ratios. A two-temperature model is used in order to derive abundances normalized to iron and relative to solar photosheric values. For both stars we find a FIP effect with a slight but not significant tendency of a stronger FIP effect for the K1V component.

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Wavelet Analysis of Stellar Differential Rotation III. The Sun in White Light

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Future space projects like KEPLER will deliver a vast quantity of high precision light curves of stars. This paper describes a test concerning the observability of rotation and even differential rotation of slowly rotating stars from such data. Two published light curves of solar total irradiance measures are investigated: the Nimbus-7 Earth Radiation Budget (ERB) observations between 1978 and 1993 and the Active Cavity Radiometer Irradiance Monitor I (ACRIM I) measurements between 1980 and 1989. Light curve analysis show that oscillations on time-scales comparable to solar rotation but of a complex pattern are visible. Neither Fourier analysis nor time-frequency Wavelet analysis yield the true rotation period during the more active phases of the solar cycle. The true rotation period dominates only for a short time during solar minimum. In the light of this study even space-born broad band photometry may turn out an inappropriate instrument to study stellar butterfly diagrams of stars rotating as slow as the Sun. However, it was shown in papers I and II of this series that chromospheric tracers like Lyman α, Mg II h+k and CaII H+K are appropriate instruments to perform this task.

Accepted by A&A

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A Study of Velocity Fields in the Transition Region of ϵ Eri (K2 V)

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Analyses of the widths and shifts of optically thin emission lines in the ultraviolet spectrum of the active dwarf ϵ Eri (K2 V) are presented. The spectra were obtained using the Space Telescope Imaging Spectrograph on the *Hubble Space Telescope* and the *Far Ultraviolet Spectroscopic Explorer*. The line widths are used to find the non-thermal energy density and its variation with temperature from the chromosphere to the upper transition region. The energy fluxes that could be carried by Alfvén and acoustic waves are investigated, to test their possible roles in coronal heating. Acoustic waves do not appear to be a viable means of coronal heating. There is, in principle, ample flux in Alfvén waves, but detailed calculations of wave propagation are required before definite conclusions can be drawn about their viability. The high sensitivity and spectral resolution of the above instruments have allowed two-component Gaussian fits to be made to the profiles of the stronger transition region lines. The broad and narrow components which result share some similarities with those observed in the Sun, but in ϵ Eri the broad component is *redshifted* relative to the

narrow component and contributes more to the total line flux. The possible origins of the two components and the energy fluxes implied are discussed. On balance our results support the conclusion of Wood, Linsky & Ayres, that the narrow component is related to Alfvén waves reaching to the corona, but the origin of the broad component is not clear.

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An X-ray Study of the Open Clusters NGC 2451 A and B

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We have conducted a detailed study of the object NGC 2451, which actually consists of two different open clusters A and B along the same line of sight at 206 pc and 370 pc distance, respectively. Although belonging to the nearest clusters, they have not been much investigated until present due to strong contamination by field stars. ROSAT X-ray observations and optical UBVR photometry are used to identify cluster members by means of X-ray emission and colour-magnitude diagrams. The identified stars concentrate nicely around the expected main sequences in the colour-magnitude diagram at the distances derived from astrometric investigations. Altogether, 39 stars are identified as member candidates of the nearer cluster A, 49 stars as member candidates of the more distant cluster B, and 22 faint stars are probably members of either of the two clusters, but due to large errors it is not clear to which one they belong. Further 40 stars identified with X-ray sources are probably non-members. For the first time, the range of known probable cluster members of NGC 2451 A and B has been extended downwards the main sequence to stars of spectral class M. Isochrone fitting yields an age of 50 to 80 Myrs for NGC 2451 A and ≈50 Myrs for NGC 2451 B, consistent with the X-ray luminosity distribution functions, which are comparable to other clusters in the same age range. Except from the occurence of four flares, the stars of both clusters do not show strong long-term X-ray variability exceeding a factor 5 over a time span of 1 to 3 years.

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Is Praesepe Really Different from the Coeval Hyades Cluster? The XMM-*Newton* View

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The Praesepe open cluster represents a puzzle since it has about the same age as the Hyades, and only slightly different metallicity, yet previous *ROSAT* observations resulted in a detection rate of cluster sources significantly lower than for the Hyades. We present a new 50 ksec observation of Praesepe performed with the EPIC instrument on board XMM-*Newton*, which resulted in the detection of ∼ 200 sources, including 48 cluster members. We detected all solar-type (F–G) stars in the field of view, ∼ 90% of the K stars and ∼ 70% of the M stars. We find that the distribution of X-ray luminosities of solar-type Praesepe members is comparable to that of the Hyades, in contrast with the previous *ROSAT* results; however, the disagreement between the *ROSAT* and XMM-*Newton* results appears to be mostly due to X-ray faint Praesepe members falling outside the XMM-*Newton* field of view, while it is considerably reduced when considering only the subsample of stars in the *ROSAT* survey in common with the present observation. This finding supports the early suggestion that Praesepe may be formed by two merged clusters of different age.

Submitted to A&A

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Investigations of Stellar Coronae with XMM-Newton

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The *XMM-Newton* observatory has given a strong new impetus to the investigations of stellar coronae. It carries high-resolution X-ray spectroscopic instruments that give access to information on the physical conditions in coronal plasmas. Furthermore, its imaging detectors produce high-quality X-ray light curves and images with a large field of view. I review results on stellar coronae obtained with *XMM-Newton* between its launch in late 1999 and the present (late 2002). Among other topics, I discuss the elemental composition of stellar coronae and plasma electron densities in quiescence and during flares. I present evidence for various signatures of the Neupert effect in stars, which provides evidence of chromospheric and coronal heating by flares. Coronal structures based on eclipse mapping inferred from light curve inversion are shown.

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Long-term Monitoring of Active Stars X. Photometry Collected in 1994

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As part of an extensive program focused on the global properties and evolution of active stars, high-precision UBV$(RI)_c$ and UBV photometry of 18 selected stars (BE Cet, HD 7172, BI Cet, BC Phe, BG Psc, CC Eri, BY Cet, HD 18131, ES Eri, YY Men, UX Col, AB Dor, V1321 Ori, V1355 Ori, HY CMa, V1358 ori, AU Mic, FK Aqr) is presented. UBV$(RI)_c$ observations were collected at the European Southern Observatory over the intervals 21-28 September 1994 and 25 November - 05 December 1994. Additional UBV photometry obtained late in 1994 by Catania Astrophysical Observatory Automatic Photoelectric Telescope is also presented. Significant evolution of the light curves, period variations and evidence for long-term variability of the global degree of spottedness are found. Some spectral classifications are revised and photometric parallaxes are compared, whenever possible, with the values measured by the Hipparcos satellite. These observations are finalized to the construction of an extended photometric database, which can give important clues on topics such as the stability of spotted areas, differential stellar rotation, solar-like activity cycles and the correlation between inhomogeneities at different atmospheric levels

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The Discovery of Two Nearby Carbon Dwarfs

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The comparison of optical and Two Micron All Sky Survey near-infrared photometry for large samples of cataloged proper-motion stars has given us the potential to discover previously unrecognized nearby objects of rare type. In this Letter we present the discovery of two new carbon dwarfs, LSR 2105+2514 and LP 758-43, which were drawn from proper motion lists and which lie in a sparsely populated part of optical/near-IR color-color space. Their optical spectra, exhibiting absorptions by C_2 and/or CN, are discussed. LSR 2105+2514 is believed to lie within 200 pc and would have $M_{K_s} \geq 6.7$, making it lower in luminosity than any carbon dwarf with a measured trigonometric parallax. LP 758-43, which is not as red but still probably cooler than the best studied carbon dwarfs, is believed to lie within 360 pc. Using our optical/near-infrared selection technique on published lists of proper motion stars, we hope in the near future to expand further the current sample of carbon dwarfs, which numbers only 31 objects at this writing.

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Doppler Images of the RS CVn Binary HR 1099 (V711 Tau) from the MUSICOS 1998 Campaign

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We present Doppler Images of the RS CVn binary system HR 1099 (V711 Tau) from spectra taken in two different sites, KPNO and MSO, during the MUSICOS 1998 campaign. Contemporaneous APT photometry is used to constrain the Doppler Images. The resulting maximum entropy reconstructions based on the least-squares deconvolved profiles, derived from $\sim$2000 photospheric absorption lines, reveal the presence of starspots at medium-high latitudes. We have obtained maps for both components of the binary system for the first time. The predominant structure in the primary component is an off-centered polar spot, confirming previous works on the same target by using independent codes. The result is verified by using both data sets independently. The lower spectral resolution data set gives a less detailed map for the MSO data set. The images obtained for the secondary component show a low latitude spot around orbital phase 0.7. This spot seems to mirror the structure seen on the primary. It might suggest that tidal forces may influence the spot distribution on this binary system.

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Chasing Coronal X-ray Emission to the End of the Pleiades Main Sequence ... and Beyond?

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We have used a 40-ks *XMM-Newton* observation to examine the X-ray emission of 33 proposed M-type members in the core of the Pleiades. We reach a limiting X-ray luminosity of $L_{\rm X} \approx 2 \times 10^{27}$ erg s^{-1} in the field centre and detect 17 of 19 members with $M_{I_{\rm C}} < 10.5$ (where $M_{I_{\rm C}}$ is absolute magnitude in the Cousins I band), and 2 of 14 fainter members. A further possible detection of the brown dwarf candidate Roque 9 with $\log L_{\rm X} \approx 27.8$ and $\log(L_{\rm X}/L_{\rm bol})$ ≈ -2.5 may be due to a chance alignment with a background source. Although the X-ray luminosity decreases sharply with increasing $M_{I_{\rm C}}$ (later-types, lower-masses), all but 3 members show $L_{\rm X}$ consistent with near-saturated emission and we do not see convincing evidence for a decrease in activity level indicative of a decrease in dynamo efficiency at the spectral type at which stellar structure is expected to become fully-convective.

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Tomography of a Stellar X-Ray Corona: α Coronae Borealis

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We interpret the X-ray light curve obtained by *XMM-Newton* during a total X-ray eclipse in the nearby binary star α Coronae Borealis. This system consists of a G5 V main-sequence star orbiting an X-ray dark A0 star. The secondary G star is a young, active solar analog with an age of a few 100 Myr. As the primary A star eclipses active regions on

the X-ray bright companion, the light curve drops in consecutive steps to zero; as individual active regions reappear during egress, the flux rises in similar steps. The ingress and egress light curves are combined to reconstruct the 2-D distribution of X-ray brightness on and around the G star. Three different methods are applied, and variations due to statistical noise and uncertainties in the binary system parameters are discussed. Although the solutions are non-unique, all reconstructions reveal a similar distribution of X-ray bright regions and large areas with little flux. We present plausible estimates of (lower limits to) the electron densities in the bright regions, obtaining characteristic values between $10^9 - 3 \times 10^{10}$ cm^{-3}.

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Energy Release in Stellar Coronae

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Stellar coronae pose a number of fundamental problems with regard to their high temperatures, their production of high-energy particles, and their stability against several energy loss mechanisms. The solution to most of these problems is likely to be found in the ubiquitous coronal magnetic fields that release the required energy continuously or episodically. Stellar coronal energy losses are predominantly diagnosed by X-ray, extreme-ultraviolet, and radio emissions but they all are secondary products of the actual primary energy release. The present paper discusses evidence and diagnostics for the primary energy release and energy transport, focusing on i) the hypothesis that active stellar coronae are heated by a stochastic sequence of flares, and ii) that these flares involve chromospheric evaporation to increase the coronal temperature, its emission measure, and the electron density. Optical and nonthermal radio emissions point at an important role of accelerated electrons in the primary energy release.

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Chandra X-Ray Observations of the Young Open Cluster NGC 2516

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We present a comprehensive study of the Chandra X-ray observations of the young open cluster NGC 2516. We have analyzed 8 individual Chandra observations. We have combined the data to achieve the greatest sensitivity, reaching down to $\log f_X = -14.56$ (ergs/sec/cm^{-2}), or $\log L_X = 28.69$ (ergs/sec) at the distance of NGC 2516. Out of 284 X-ray sources detected, 155 are identified with photometric cluster members, with very little ambiguity. We have studied the X-ray luminosity functions for the various spectral types, correcting for non-member contamination those for later type stars. We find strong X-ray emission from a couple B stars, that cannot be due to companions. Among A stars, chemically peculiar stars show a detection fraction much larger than normal A stars. The luminosity functions decrease monotonically from F to M stars, and those for K stars are significantly lower than similar stars in the Pleiades, a cluster only slightly younger than NGC 2516. We discuss possible causes of this discrepancy, including differences in age and stellar rotation.

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Solar Abstracts

SOHO/CDS and Ground Based Observations of a Two-Ribbon Flare:Spatially Resolved Signatures of Chromospheric Evaporation

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During a coordinated observing campaign (SOHO JOP 139), we obtained simultaneous spectroheliograms of a solar active region in several spectral lines, sampling levels from the chromosphere to the corona. Ground based spectroheliograms were acquired at the Dunn Solar Tower of NSO/Sacramento Peak in four chromospheric lines, while the Coronal Diagnostic Spectrograph (CDS) aboard SOHO was used to obtain rasters of the active region in transition region (TR) and coronal lines. Such a complete dataset allowed us to compare the development of intensity and velocity fields during a small two-ribbon flare in the whole atmosphere. In particular, we obtained for the first time quasi-simultaneous and spatially resolved observations of velocity fields during the impulsive phase of a flare, both in chromosphere and upper atmosphere. In this phase, strong downflows (up to 40 km s^{-1}) following the shape of the developing ribbons are measured at chromospheric levels, while strong upward motions are instead measured in TR (up to -100 km s^{-1}) and coronal lines (-160 km s^{-1}). The spatial pattern of these velocities have a common area about 10 arcsec wide. This is the first time that opposite directed flows at different atmospheric levels are observed in the same spatial location during a flare. These signatures are highly suggestive of the chromospheric evaporation scenario predicted in theoretical models of flares.

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Eruption of a Helically Twisted Prominence

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In this paper we analyze the eruption of a prominence, characterized by a helical-like structure and by a non-linear rising motion. We approximated the prominence as a cylindrical curved flux tube and estimated the behaviour of several geometrical parameters during the activation and the eruption phases. We determined that, at the onset of the activation, the number N of turns of a magnetic field line over the whole length of the prominence was ~ 5.0, while the value of the ratio P/r_0 between the pitch of the magnetic field lines and the prominence width was ~ 0.45. These values are in good agreement with those predicted by the kink mode instability. Moreover, we found a decrease of the total twist of one helical thread from $\Phi \sim 10\pi$ to $\Phi \sim 2\pi$ during the prominence eruption, indicating a relaxation of the magnetic field towards a less twisted configuration. We conclude that the prominence was initially destabilized by the kink mode instability and, not succeeding in finding a new equilibrium configuration, it erupted.

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Observational Evidence for Mode-Coupling in the Chromospheric Network

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Oscillations in Network Bright Points (NBPs) are studied at a variety of chromospheric heights. In particular, the three-dimensional variation of NBP oscillations is studied using image segmentation and cross-correlation analysis between images taken in the light of Ca II K_3, Hα core, Mg I b_2, and Mg I $b_1-0.4$ Å. Wavelet analysis is used to isolate wave-packets in time, and to search for height-dependent time delays which result from upward- or downward-directed travelling waves. In each NBP studied, we find evidence for kink mode waves (1.3 mHz, 1.9 mHz), travelling up through the chromosphere and coupling with sausage mode waves (2.6 mHz, 3.8 mHz). This provides a means for depositing energy in the upper chromosphere. We also find evidence for other upward and downward propagating waves in the 1.3–4.6 mHz range. Some oscillations do not correspond to travelling waves and we attribute these to waves generated in neighbouring regions. Accepted by ApJ

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The EUV Helium Spectrum in the Quiet Sun: A By-product of Coronal Emission?

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In this paper we test one of the mechanisms proposed to explain the intensities and other observed properties of the solar helium spectrum, and in particular of its Extreme-Ultraviolet (EUV) resonance lines. The so-called Photoionisation-Recombination (P-R) mechanism involves photoionisation of helium atoms and ions by EUV coronal radiation, followed by recombination cascades. We present calibrated measurements of EUV flux obtained with the two CDS spectrometers on board SOHO, in quiescent solar regions. We were able to obtain an essentially complete estimate of the total photoionising flux in the wavelength range below 504 Å (the photoionisation threshold for He I), as well as simultaneous measurements with the same instruments of the intensities of the strongest EUV He I and He II lines: He I λ584, He I λ537, and He II λ304. We find that there are not enough EUV ionising photons to account for the observed helium line intensities. More specifically, we conclude that He II intensities cannot be explained by the P-R mechanism alone. Our results, however, leave open the possibility that the He I spectrum could be formed by the P-R mechanism, with the He II λ304 line as a significant photoionisating source.

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Dynamics of Solar Active Regions I. Photospheric and Chromospheric Oscillations Observed with TRACE

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I present results of an international joint observing campaign, which was carried out in September 1999 and 2000, to study the oscillatory behaviour of active regions (ARs). In this contribution I will concentrate on oscillations in the higher layers of the solar atmosphere as observed with the UV filters of the Transition Region and Coronal Explorer (TRACE). I present the distribution of oscillatory power of two extended active regions. I find a number of well–known chromospheric dynamic phenomena such as running penumbral waves, enhanced 5 min power in the plage and network regions and additional 3 min power in the internetwork. In addition, I find that the 3 min power in the surroundings of the AR is decreased, an effect that has not been observed before. From the topology of the magnetic field I infer that this can be explained by an interaction of the acoustic wavefield with the expanding magnetic field of the active region.

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Precise Reduction of Solar Spectra Obtained with Large CCD Arrays

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A precise procedure suitable for the reduction of solar spectra taken with large CCD arrays and the retrieval of correct spectral characteristics is presented. Various effects, which one should take into account, are considered and several improvements of the standard reduction are introduced. A special flat-field procedure is suggested for the reduction of spectra registered in different flat-field conditions than those when the flat-field matrix was taken. The original flat-field matrix is split into several components to eliminate the influence of the drift of the spectrograph and temporal changes of the flat-field conditions on the reduced spectrum. The importance of every flat-field matrix component is tested and discussed and the noise propagation through data reduction is analyzed. It is documented that the errors of the basic spectral line characteristics, continuum intensity, line centre intensity and full width at the half maxima of the line have variations between 0.5 % and 15 % and the errors of the line centre Doppler velocity and bisectors fluctuate by up to 200 m/s, if derived from imprecise reductions, compared to precise ones.

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Low-Mass and Substellar Abstracts

Brown Dwarfs in the Pleiades Cluster : Clues to the Substellar Mass Function

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We present the results of a 6.4 square degrees imaging survey of the Pleiades cluster in the I and Z-bands. The survey extends up to 3 degrees from the cluster center and is 90% complete down to $I \simeq 22$. It covers a mass range from $0.03 M_\odot$ to $0.48 M_\odot$ and yields 40 brown dwarf candidates (BDCs) of which 29 are new. The spatial distribution of BDCs is fitted by a King profile in order to estimate the cluster substellar core radius. The Pleiades mass function is then derived accross the stellar-substellar boundary and we find that, between $0.03 M_\odot$ and $0.48 M_\odot$, it is well represented by a single power-law, $dN/dM \propto M^{-\alpha}$, with an index $\alpha = 0.60 \pm 0.11$. Over a larger mass domain, however, from $0.03 M_\odot$ to $10 M_\odot$, the mass function is better fitted by a log-normal function. We estimate that brown dwarfs represent about 25% of the cluster population which nevertheless makes up less than 1.5% of the cluster mass. The early dynamical evolution of the cluster appears to have had little effect on its present mass distribution at an age of 120 Myr. Comparison between the Pleiades mass function and the Galactic field mass function suggests that apparent differences may be mostly due to unresolved binary systems.

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Detection of Nine M8.0-L0.5 Binaries: The Very Low Mass Binary Population and its Implications for Brown Dwarf and VLM Star Formation

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Use of the highly sensitive Hokupa'a/Gemini curvature wavefront sensor has allowed direct adaptive optics (AO) guiding on very low mass (VLM) stars with SpT=M8.0-L0.5. A survey of 39 such objects detected 9 VLM binaries (7 of which were discovered for the first time to be binaries). Most of these systems are tight (separation < 5 AU) and have similar masses ($\Delta Ks < 0.8$ mag; $0.85 < q < 1.0$). However, 2 systems (LHS 2397a and 2M2331016-040618) have large $\Delta Ks > 2.4$ mag and consist of a VLM star orbited by a much cooler L7-L8 brown dwarf companion. Based on this flux limited ($Ks < 12$ mag) survey of 39 M8.0-L0.5 stars (mainly from the 2MASS sample of Gizis et al. 2000) we find a sensitivity corrected binary fraction in the range $15 \pm 7\%$ for M8.0-L0.5 stars with separations > 2.6 AU. This is slightly less than the $32 \pm 9\%$ measured for more massive M0-M4 dwarfs over the same separation range (Fischer & Marcy 1992). It appears M8.0-L0.5 binaries (as well as L and T dwarf binaries) have a much smaller semi-major axis distribution peak (~ 4 AU) compared to more massive M and G dwarfs which have a broad peak at larger ~ 30 AU separations. We also find no VLM binary systems (defined here as systems with $M_{tot} < 0.185$ solar masses) with separations > 15 AU.

We briefly explore possible reasons why VLM binaries are slightly less common, nearly equal mass, and much more tightly bound compared to more massive binaries. We investigate the hypothesis that the lack of wide ($a > 20$ AU) VLM/brown dwarf binaries may be explained if the binary components were given a significant differential velocity kick. Such a velocity kick is predicted by current "ejection" theories, where brown dwarfs are formed because they are ejected from their embryonic mini-cluster and therefore starved of accretion material. We find that a kick from a close triple or quadruple encounter (imparting a differential kick of ~ 3 km/s between the members of an escaping binary) could reproduce the observed cut-off in the semi-major axis distribution at ~ 20 AU. However, the estimated binarity ($< 5\%$; Bates et al. 2002) produced by such ejection scenarios is below the $15 \pm 7\%$ observed. Similarly, VLM binaries could be the final hardened binaries produced when a mini-cluster decays. However, the models of Sterzik & Durisen(1998) and Durisen, Sterzik, & Pickett (2001) also cannot produce a VLM binary fraction above $\sim 5\%$. The observed VLM binary frequency could possibly be produced by cloud core fragmentation. Although, our estimate of a fragmentation-produced VLM binary semi-major axis distribution contains a significant fraction of "wide" VLM binaries with $a > 20$ AU in contrast to observation. In summary, more detailed theoretical work will be needed to explain these interesting results which show VLM binaries to be a significantly different population from more massive M & G dwarf binaries.

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For preprints via ftp or WWW: http://xxx.lanl.gov/abs/astro-ph/0301095

Dynamic Activity in the Outer Atmospheres of Late-type Stars Including the Sun

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Ph.D dissertation directed by: C.J. Butler and J.G. Doyle

Ph.D degree awarded: January 2003

Stars of solar type and cooler often display dramatic effects of magnetic fields in their atmosphere. These effects vary from relatively placid phenomena such as the dark photospheric spots and plages where there is enhanced emission in ionised calcium and magnesium to the much more energetic flares which erupt over short time scales. All of these aspects of magnetic activity are linked but their exact location in the atmosphere and the physical mechanism that lead to their existence remain uncertain. In this work we analyse and interpret observations of stellar and solar activity, including observations of flares and other activity-related processes.

We report on spectrophotometric observations of a large flare on AT Mic and several flares on AD Leo. The latter flares were recorded with very high temporal resolution. A detailed analysis of the behaviour of the main chromospheric activity indicators is given. We also present high-resolution spectral observations of a solar flare observed during a multi-wavelength campaign. Hα images, Ca II images and magnetograms obtained at BBSO are also used in the flare analysis. We observe stellar-like behaviour in the main solar chromospheric activity indicators, which show either filling-in or emission during the flare.

We have used observations and models of Balmer decrements to trace the evolution of physical parameters such as the temperature and density of the flare plasma. We also test the reliability of the procedure used. We apply this procedure to several new high temporal resolution flares on AT Mic and AD Leo as well as to flares observed during the MUSICOS 2001 campaign and by other authors, and a medium solar optical flare, observed during our solar campaign. Finally, we search for a dependence between the different physical parameters for all the flares modelled.

We present optical spectroscopic observations of the binary system HR 1099 (V711 Tau) from the MUSICOS 1998 campaign. Contemporary X-ray observations performed during the campaign are also analysed and Doppler images constructed. The resulting maximum entropy reconstructions are based on the least-squares deconvolved line profiles, derived from $\sim$2000 photospheric absorption lines. We have obtained maps for both components of the binary system for the first time. The result is verified by using two data sets independently. We will show that these results are in good agreement with the photometric spot maps, rotational modulation and chromospheric flares obtained from the same data sets. Links between the detection of optical flare events and the Doppler images are shown. We note that most of the observed X-ray events occurred at phases where the Doppler images show active regions, linking the two phenomena.

Thesis-related Publications: A&A 383, 548; A&A 397, 285

Job Opening

Postdoctoral Position
Solar Physics Division
Astrophysical Institute Potsdam (Germany)

The solar physics division of the Astrophysical Institute Potsdam offers a postdoc position for a period of 2.5 years. This position is funded by the European Union within the project 'European Solar Magnetism Network' (ESMN).

The successful candidate will participate in spectropolarimetric observations and their interpretation. The special task will be the development and improvement of inversion techniques for chromospheric lines. Experience in NLTE-calculations of line profiles would be of advantage.

Salary depends on age and family state following the German scale BATIIa-O.

Application rules of the EU are to be kept strictly:

- The applicant must have a doctoral degree in physics or related sciences.
- The applicant must not exceed the age of 35 in the moment of appointment. (exceptions are possible for time spent with childcare, military or civil service.)
- The applicant must be a citizen of a European Union member state except Germany or of an associated state, see:
  http://www.cordis.lu/fp5/src/3rdcountries.htm
  and must not have been living in Germany for more than 12 months within the last two years. Citizens of other states can also apply if they lived since more than five years in the EU but less than 24 months in Germany.

Applications including a CV, a brief statement of research experience, list of publications and names of three referees should be sent before February 28, 2003 (preferred in electronic form) to:

Prof Dr. J. Staude or Dr. H. Balthasar
Astrophysikalisches Institut Potsdam
Telegrafenberg
D-14473 Potsdam (Germany)

email: jstaude@aip.de phone: +49-331-288-2300
or: hbalthasar@aip.de phone: +49-331-288-2306

Job Opening

Postdoctoral Position
Solar Physics
Armagh Observatory (N. Ireland)

Area of emphasis: Solar transient events and their importance of coronal heating and solar wind acceleration.

Applications are invited for a three year postdoctoral research assistantship (PDRA) in Solar Physics to be held at Armagh Observatory beginning April 2003 or as soon as possible thereafter. The PDRA's work activities will be directed towards an extensive data reduction/interpretation programme relating to a range of transient phenomena and their interrelationships, and t heir importance for coronal heating and solar wind acceleration. This will involve the use of data from several different instruments. A knowledge of spectroscopy and atomic processes would be an advantage, although not essential.

Further information about Armagh Observatory, and in particular the current Solar Physics research programme, may be obtained by consulting the Observatory's web-site http://star.arm.ac.uk and in particular the preprint WEB page or via email to Gerry Doyle (jgd@star.arm.ac.uk).

The closing date for applications is 28 February 2003. This project is funded by the UK Particle Physics and Astronomy Research Council. Armagh Observatory have an excellent in-house computing facility plus access to super-computing facilities via the Irish Grid. Prospective applicants should obtain an application pack from the Administrator or it may be downloaded from http://star.arm.ac.uk/~jgd/outgoing/JOB/. The completed application form, together with a full curriculum vitae and bibliography should be sent to: The Administrator, Armagh Observatory, College Hill, Armagh BT61 9DG, N. Ireland. [Tel. +44-(0)28-3752-2928, Fax. +44-(0)28-3752-7174, email lfy@star.arm.ac.uk].

Applicants are asked to ensure that references from three referees should also reach the Administrator by the same date.

Job Opening

Postdoctoral Position in Solar Astrophysics
INAF-Arcetri Astrophysical Observatory
Florence, Italy

The Arcetri Astrophysical Observatory in Florence offers a postdoc position in observational solar physics for a period of 2.5 years available from spring 2003. This position is funded by the European Community within the project 'European Solar Magnetism Network' (ESMN, http://esmn.astro.uu.nl/).

The successful candidate will be part of a group working on high resolution solar studies, both of quiet and active structures (see http://www.arcetri.astro.it/science/solare/). A portion of the postdoc's time should be spent on the testing and utilization of a newly developed double interferometric system (IBIS) as a 2-D polarimeter. Previous experience with spectropolarimetric measurements and large volume data handling is desirable. Work will be conducted under the supervision of Dr. G. Cauzzi and Prof. E. Landi.

Salary will be at the Marie Curie level, adjusted for annual inflation, plus additional resources for relocation and travel expenses. Eligibility rules of the EU must be followed: applicants must be of European nationality, including the Associated States but NOT italian, and below 36 years of age at the time of appointment (excepting allowances for military service or maternity leaves). Further details, both on the scope of the network and on eligibility rules can be found at http://esmn.astro.uu.nl/

Reviewing will start on February 15, 2003 and continue until the position is filled. Applications should include a CV, a brief statement of research experience and research interests, list of publications and names of three references.

Further inquiries and applications (preferably in electronic form) should be addressed to:

Dr. G. Cauzzi
INAF - Osservatorio Astrofisico di Arcetri
L. Enrico Fermi 5
50125 Firenze, Italy

email: gcauzzi@arcetri.astro.it
phone: +39-055-2752200

Interested persons who have already applied to the ESMN-coordinator Dr. R. Rutten (Utrecht) need only contact us referring to that application.

UPCOMING MEETING

IAU Symposium 219: Stars as Suns: Activity, Evolution, and Planets

21 - 25 July 2003
at the IAU General Assembly
Sydney, Australia

DEADLINE FOR ABSTRACTS: FEB 15, 2003
DEADLINE FOR IAU TRAVEL GRANTS: FEB. 15, 2003

(American Astronomical Society Deadline for Travel Grant Application: FEB. 21, 2003)

This Symposium will address solar/stellar magnetic activity, coronal heating and structures in single and binary stars, atmospheric abundance anomalies, flares and transient events, winds and mass loss, and the characteristics of stars hosting planets. New results from RHESSI, SIRTF, XMM-NEWTON, CHANDRA, FUSE, HST, and the SMA will be presented. A prelimnary program has been posted, and many oral presentations will be selected from the Abstracts submitted.

Abstracts must be submitted on the IAU Abstract Form by Feb. 15, 2003 in order to be considered for an IAU Travel Grant (Travel Grant Applications must also be submitted by 15 Feb.). Members of the American Astronomical Society can apply to the AAS directly for Travel Grants: deadline is 21 Feb. 2003. If you are not applying for Travel Grants, the Abstract deadline is 1 Mar. 2003.

The IAU web site contains all the details and forms: http://www.astronomy2003.com/ including a link to the draft program for Symposium 219 http://cfa-www.harvard.edu/sym219/

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.***