// COOLNEWS

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Infrared Spectroscopy of Symbiotic Stars. II. Orbits for Five S-type Systems with Two Year Periods

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Infrared radial velocities have been used to determine orbital elements for the cool giants of five well known symbiotic systems, Z And, AG Dra, V443 Her, AX Per, and FG Ser, all of which have orbital periods near the two year mean period for S-type symbiotics. The new orbits are in general agreement with previous orbits derived from optical velocities. From the combined optical and infrared velocities improved orbital elements for the five systems have been determined. Each of the orbital periods has been determined solely from the radial-velocity data. The orbits are circular and have quite small mass functions of 0.001–0.03 solar masses. The infrared velocities of AG Dra do not show the large orbital velocity residuals found for its optical radial velocities.

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Measurements of the General Magnetic Field on the Active Late-Type Stars

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The measurements of the general magnetic field on active late-type stars obtained with the 2.6 m Shajn telescope of the Crimean Astrophysical Observatory are reported. Statistically significant values of the magnetic field on ϵ Eri and 61 Cyg A are detected. According to these measurements the variations of magnetic field are within the range from -10 to 21 G. The substantial values of the general magnetic field on ϵ Eri and 61 Cyg A exceed the amount of the solar magnetic field by an order of magnitude, whereas ϵ Eri is more active than the Sun, and 61 Cyg A has the activity

similar to the Sun. There is reason to suppose that the variation the general magnetic field on these stars is due to the stellar rotation.

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Spectral Imaging maps of AR Lacertae I. Results from IUE Observations in 1994 October.

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In October 1994 the RS CVn eclipsing binary AR Lacertae was monitored by IUE during two orbital cycles. We have used 59 low resolution spectra, acquired in the range 1150-1950 Å, to derive light curves for emission lines formed at different temperatures between about 10,000 and 200,000 K and to study the flare signatures versus temperature of line formation.
We have analyzed a sequence of 59 high resolution Mg II k line profiles using multi-Gaussian fits (the spectral imaging technique) to derive information of the spatial structure of the chromospheres of both stars in the AR Lac system. We discuss the quiet chromospheric emission from both stars, and we show that enhanced Mg II emission is present in extended structures corotating with the K star and close to the system center-of-mass. We also report on evidence for absorbing structures toward both the stars.
This study of AR Lac used the new orbital elements of Marino et al. (1998, IBVS 4599) and spectra reduced and calibrated with NEWSIPS. A comparison between fluxes derived from the analyzed NEWSIPS spectra and from IUESIPS spectra is provided.

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An X-ray Flare from the Lindroos Binary System HD 560

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We report on a large X-ray flare from the Lindroos binary system HD 560 during a pointed *ROSAT* PSPC observation. HD 560 is composed of a B9 and a G5 type star. The late-type component is a post T Tauri Star candidate. From a theoretical point of view strong magnetic activity is expected only for the G star. The system is unresolved in the *ROSAT* image. Therefore, it can not be excluded that the flare has erupted on the B-type primary. We discuss the luminosity and temperature evolution comparing the quiescent and the flare state of HD 560, and present arguments for the G star as host of the flare.

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Mapping Potential Fields on the Surfaces of Rapidly Rotating Stars

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We present a technique that combines Zeeman Doppler imaging (ZDI) principles with a potential field mapping prescription in order to gain more information about the surface field topology of rapid rotators. This technique is an improvement on standard ZDI which can sometimes suffer from the suppression of one vector component due to the effects of stellar inclination, poor phase coverage or lack of flux from dark areas on the surface. Defining a relationship beween the different vector components allows information from one component to compensate for reduced information in another. We present simulations demonstrating the capability of this technique and discuss its prospects.

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Potential of Astrographic Plates for Stellar Flare Detection

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A set of 4 test regions covering a total celestial area of 520 deg^2 at low galactic latitude is investigated on a set of 130 century-old astrographic plates. About 8% of the 2×10^5 stars with apparent B-magnitude 10-14 and with total proper motion component larger than 0.02 arcsec·yr^{-1} show a significant flickering greater than 0.4 magnitude in B over a time scale shorter than 20 minutes. About 25% of these stellar flare candidates concern stars with B-$V \sim 0.2$ (A7 spectral type). A procedure to select pre-main sequence stellar candidates from the distance-limited sample of 16×10^3 disk dwarfs with detected flickering in B-magnitude ≥ 0.4 is presented in view of a mass loss of 10^{-8} M$_\odot$·yr^{-1}, derived from the analysis of the angular momentum distribution of stellar orbits. Follow-up UBV photoelectric photometry at the present epoch of 200 nearby stellar flares along the Vulpecula Rift shows an effect of reddening in (B-V) and of blueing in (U-B) for about 10% of the targets. The detection of optically thin or thick disks around the selected targets is suggested.

The success rate in detecting optical flares in nearby stars of ~1.5 M$_\odot$ with as much as 5×10^{-6} M$_\odot$ dumped onto the central star during the past 100 years, from deep astrographic plates coupled with 1-m class telescope, is estimated to 10% with a kinematical bias that can be dealt with.

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Chemical Abundances in Cool Metal Rich Disk Dwarf Stars

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The present study of spectra of twelve metal-rich cool dwarf stars, carefully selected in order to cover a range of temperatures ($\sim 4400 - 6000$ K), is a follow up on Feltzing & Gustafsson (1998, A&AS, 129q, 237) with the aim to understand the apparent over-ionization and anomalous elemental abundances found by them for the K dwarf stars in their sample.

Our method of analysis employs synthetic spectra of the full spectrum both to constrain the continuum level and to derive abundances. It is shown that by using this method and imposing a strict excitation equilibrium (possible to do because of the care in selection of observed Fe I lines) we are able to show that metal-rich K dwarf stars do not show anomalous stellar abundances, as indicated in Feltzing & Gustafsson (1998), and can, with reasonable efforts, be analyzed in order to increase the number of metal-rich stars with useful chemical abundances.

With abundance analysis by means of spectrum synthesis and assuming Local Thermodynamic Equilibrium (LTE) the abundances of Na, Si, Ca, Sc, Ti, V, Cr, Fe, Co, Ni, and Nd have been derived. Also ionization balance is satisfied for Fe and Cr after correcting the stellar effective temperatures such that both ionization and excitation equilibrium were satisfied.

In addition, spectra from five cool dwarf stars of the Feltzing & Gustafsson (1998) sample have been analyzed with

the methods used in this work. They show essentially the same abundance patterns as the new stars in this sample.

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Self-broadening in Balmer Line Wing Formation in Stellar Atmospheres

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Details of a theory of self-broadening of hydrogen lines are presented. The main features of the new theory are that the dispersive-inductive components of the interaction (van der Waals forces) have been included, and the resonance components have been computed by perturbation theory without the use of the multipole expansion. The theory is applied to lower Balmer lines and the theoretical and observational impact of the new broadening theory is examined. It is shown that this theory leads to considerable differences in the predicted line profiles in cool stars when compared with previous theories which include only resonance interactions. In particular, the effect is found to be very important in metal poor stars. The theory provides a natural explanation for the behaviour of effective temperatures derived from Balmer lines by others using a theory which includes only resonance broadening. When applied to Balmer lines in the solar spectrum the theory predicts an improved agreement between observed and computed profiles for models which also match limb darkening curves and rules out a model which does not. However significant discrepancies still remain which could be due to inadequacies in our theory or the atmospheric model or both.

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Optical Follow-up of ROSAT Discovered Candidate Members of the Open Cluster Coma Berenices

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We have carried out an optical follow-up of twelve ROSAT discovered candidate members of the Coma Berenices open cluster. *VRI* photometry and low resolution (~ 3 Å) spectroscopy in the range 3800–7000 Å were performed to obtain colour-magnitude diagrams, proper motions, spectral types, chromospheric activity levels and radial velocities that allow us to establish whether or not these candidates are reliable cluster members. Only four of these objects show optical photometry marginally compatible with the main sequence delineated by known cluster stars. They also exhibit spectral types corresponding to late-K and early-M, and radial velocities which are not inconsistent with membership in Coma Berenices. The proper motions of these candidates are, however, very high and incompatible with the small value associated with the cluster. Thus, none of the ROSAT candidates can be considered members of Coma Berenices. This result tends to favour the hypothesis that the mass of the cluster and its average mass density are lower than what is required for stability, allowing the cluster dissolution by the escape of the less massive stars.

We discuss the probable nature of these objects on the basis of the available information. From our radial velocity observations we infer that five of them could be formed by multiple stars. In particular, we have discovered one W-type W UMa contact binary system (K6 spectral type) which is, in addition, a visual companion to a cooler star.

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First Light Measurements with the XMM-Newton Reflection Grating Spectrometers: Evidence for an Inverse First Ionisation Potential Effect and Anomalous Ne Abundance in the Coronae of HR 1099

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The RS CVn binary system HR 1099 was extensively observed by the *XMM-Newton* observatory in February 2000 as its first-light target. A total of 570 ks of exposure time was accumulated with the Reflection Grating Spectrometers (RGS). The integrated X-ray spectrum between 5–35Å is of unprecedented quality and shows numerous features attributed to transitions of the elements C, N, O, Ne, Mg, Si, S, Fe, and Ni. We perform an in-depth study of the elemental composition of the average corona of this system, and find that the elemental abundances strongly depend on the first ionisation potential (FIP) of the elements. But different from the solar coronal case, we find an *inverse FIP effect*, i.e., the abundances (relative to oxygen) *increase with increasing FIP*. Possible scenarios, e.g., selective enrichment due to Ne-rich flare-like events, are discussed.

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The *XMM-Newton* View of Stellar Coronae: Coronal Structure in the Castor X-ray Triplet

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We present results of a comprehensive X-ray investigation of the multiple stellar system Castor AB + YY Gem. The observations were obtained with the *XMM-Newton* observatory. We report the first *spatially separated* detection and identification of both Castor A and B as frequently flaring X-ray sources. Spectral modeling of the YY Gem and Castor coronal sources indicates a broad plasma distribution between 2−15 MK. Elemental abundances are found to be below solar photospheric values, with the abundance of Ne being highest ($\sim$ 0.7 times solar photospheric). The abundances increase during a large flare, most notably for Fe. The O VII He-like line triplet indicates average coronal densities of the cooler plasma of a few times 10^{10} cm^{-3} for YY Gem and Castor. The YY Gem light curve shows three deep eclipses, indicating that the coronae of both binary components are similarly active and are relatively compact. A 3-D light curve inversion shows that coronal active regions follow density scale heights compatible with spectroscopically measured temperatures. The dominant densities also agree with spectroscopic values. Most active regions are located between $\pm$50 degrees latitude, in agreement with findings from previous Doppler imaging. We also report the tentative detection of line broadening due to orbital motion.

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The *XMM-Newton* View of Stellar Coronae: Flare Heating in the Coronae of HR 1099

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The RS CVn system HR 1099 was observed by *XMM-Newton* for a time span of 25 days during the commissioning phase. Rotational modulation in the RGS light curve has been detected with maximum flux when the active K1 IV star is in front. Following a quiescent phase of emission, the rise and peak of a large flare were observed. Time-dependent spectroscopy has been performed to derive elemental abundances and their variations during the various stages of the flare. Emission measure distributions have been reconstructed. Two different components are detected: a very hot plasma (up to 100 MK) that evolves rapidly, and a stable quiescent plasma. Low first-ionization-potential elemental (such as Fe and Si) abundances increase significantly during the flare, while the abundance of the high-FIP element Ne stays constant at the quiescent value. We report direct detection of a flux increase in the Fe XXIV X-ray lines during a stellar flare.

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Observational Estimates for the Mass-Loss Rates of α Centauri and Proxima Centauri Using HST Lyα Spectra

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We study H I Lyα absorption observed by the *Hubble Space Telescope* toward the nearby binary system α Cen (G2 V+K0 V) and its distant companion star Proxima Cen (M5.5 Ve). Absorption from heliospheric H I heated by the solar wind/ISM interaction is observed toward both α Cen and Proxima Cen. Absorption from analogous "astrospheric" material surrounding the stars is detected toward α Cen, but not Proxima Cen. The nondetection of astrospheric absorption toward Proxima Cen suggests that the stellar wind of Proxima Cen must be significantly weaker than that of the α Cen system. We use hydrodynamic models of the astrospheres computed assuming different mass-loss rates to predict astrospheric Lyα absorption for comparison with the observations. The model that best matches the α Cen data has a mass-loss rate of $\dot{M} = 2\ \dot{M}_\odot$, and the models suggest an upper limit of $\dot{M} \leq 0.2\ \dot{M}_\odot$ for Proxima Cen. Finally, we note that the heliospheric absorption observed toward Proxima Cen in 2000 May is identical to the heliospheric absorption observed toward α Cen in 1995 May, implying that the structure of the outer heliosphere does not change significantly during the solar activity cycle.

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Modeling the ISM–Stellar Wind Interactions of λ And and ϵ Ind

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A numerical study is presented of the interaction between the partially ionized interstellar medium and the stellar wind of the very active RS CVn-type binary star λ And (G8 IV–III+?). Similar to results found for the heliosphere/ISM interaction, a termination shock, a tangential discontinuity (the "astropause"), and a bow shock are found in the model. More importantly, a hydrogen wall forms in the model, and its neutral density, temperature, and velocity are investigated. As an application, the additional absorption of the Lyα line of λ And due to the hydrogen wall is calculated and compared to high-resolution UV spectra obtained by HST. Variation of stellar wind parameters results in different astrospheres and hydrogen walls, with distinct Lyα absorption. Thus, establishing a good model fit to the HST data is a tool to constrain stellar wind parameters. A second numerical study is undertaken for the nearby star ϵ Ind (K5 V). Again, a hydrogen wall is encountered, and the correction to interstellar Lyα absorption demonstrated.

While ϵ Ind is interesting in that it has a high relative velocity with respect to the ISM, λ And is interesting in that it is a large, extremely active star that we therefore model with a higher mass loss rate than the Sun. The numerous assumptions that are made in the models preclude a definitive measurement of mass loss rates for these stars at this point, but our models suggest that for ϵ Ind the observed Lyα absorption can be reproduced adequately by a wind with roughly the solar mass loss rate. For λ And, a mass loss rate of roughly 10 times solar is suggested, which is actually lower than one might have expected since the star has about 55 times the surface area of the Sun.

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Serendipitous Discovery of an Irregular and a Semi Regular Type Variable in the Field of BY Draconis

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We present new evidence of the optical variability of two red giant stars: HD 172468 and HK Dra, based on photometric and spectroscopic observations. These stars had been included as check stars in our photometric monitoring program of BY Dra and turned out to be variable.

HD 172468, whereas almost constant for most of the time, suddenly started to drop in brightness to such a low level to become undetectable. We suspect that such an abrupt event may be an "obscurational" minimum, that is typical of eruptive RCB stars, or may be due to the variable extinction by circumstellar dust in a young Orion type object.

HK Dra, already known as an irregular variable, is characterised by periodic flux modulation with season-to-season changes of the photometric period, as inferred from a periodogram analysis. It also shows changes of the light curve peak-to-peak amplitude and shape. Such a behaviour in giant stars is commonly found among semi-regular giants (SR) at the Asymptotic Giant Branch (AGB). Our radial velocity measurements rule out that HK Dra may be a close binary system.

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Chandra, EUVE, Hubble, and VLA Multi-Wavelength Campaign on HR 1099: Instrumental Capabilities, Data Reduction, and Initial Results

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In mid-September 1999, a multi-wavelength campaign was carried out on the coronally active RS Canum Venaticorum binary HR 1099 (K1 IV + G5 V; P = 2.84 days), during commissioning of the High Energy Transmission Grating Spectrometer (HETGS) of the *Chandra* X-ray Observatory (*CXO*). The coordinated program involved the Extreme Ultraviolet Explorer (*EUVE*), the *Hubble* Space Telescope Imaging Spectrograph (STIS), and the Very Large Array (VLA). The objective was to study the system in quiescence, across as much of the electromagnetic spectrum as practical, and to catch any flares that might occur.

The *EUVE* 80–180 Å lightcurve of HR 1099, covering the period September 13–22, showed only a single impulsive outburst, which occurred at the very end of the 9-day pointing. The 3–25 Å bremsstrahlung continuum displayed an overall decay during the 1.5-day *Chandra* observation on September 14–16, with a few superimposed mild enhancements. The VLA 3.5 cm and 20 cm radio lightcurves, obtained during a 9 hour period on September 15 immediately before the *HST* pointing, similarly revealed normal quiescent gyrosynchrotron emission and an absence of impulsive

events. In contrast, the 7 hour STIS time series later on September 15 contained two distinct flares. The first was accompanied by intensification of the preexisting broad wings of the medium excitation species (e.g., Si IV $\lambda1393$ and C IV $\lambda1548$); while the second involved primarily the narrow cores of the lines, and even cooler temperatures. The Fe XXI $\lambda1354$ forbidden line showed little response to either flare, consistent with the contemporaneous soft X-ray and EUV lightcurves. The lack of coronal counterparts to the ultraviolet flares is unusual, and suggests that they belong to a separate class of outbursts, sharing some similarities with the "transition zone explosive events" seen on the Sun.

The density sensitive O IV $\lambda1400$ multiplet was not affected by either flare. The density sensitive Si III $\lambda1300$ multiplet showed little response to the first flare, but a dramatic brightening in the second, likely due to the lower peak temperature of that event. The O IV line ratios were near their low density limits, and suggest $n_e \sim 10^{10}$ cm^{-3} for the duration of the *HST* observations. The Si III ratios during the second flare rise indicate $n_e \sim 7 \times 10^{10}$ cm^{-3}. The far-UV diagnostics jointly imply electron pressures of $n_e T \sim 2 \times 10^{15}$ K cm^{-3}, if formed close to their respective ionization equilibrium temperatures. The helium-like triplets of O VII, Ne IX, and Mg XI in the HETGS spectra have forbidden-to-intercombination line ratios consistent with average coronal electron densities of $< 10^{11}$ cm^{-3} at $T \sim 0.3 - 1 \times 10^7$ K over the duration of the *Chandra* pointing. Fe XXI $\lambda102/\lambda128$ and $\lambda142/\lambda128$ ratios from *EUVE* suggest $n_e < 10^{12}$–10^{13} cm^{-3}, near 10^7 K. Thus, the coronal electron pressures could be as much as several orders of magnitude larger than those of the lower atmosphere.

We constructed time-resolved spectra from the HETGS event lists, and measured the centroids of the three brightest X-ray lines of HR 1099 in 60 minute bins. In high-S/N Ne X $\lambda12.1$, we believe that we can see the changing radial velocity of the K1 IV star over the half orbital cycle recorded by *Chandra.* The amplitude of the velocity change is only $\sim$70 km s^{-1} over the 1.5-day interval, a small fraction of the 300–500 km s^{-1} resolution of the HETGS at 12 Å. Ne X $\lambda12.1$ also displayed a transient blueshift of $\sim$60 km s^{-1} immediately prior to the first STIS flare, during which the far-UV lines briefly exhibited blueshifts of similar magnitude. The apparent displacement of Ne X appears independently in the -1 and $+1$ orders of MEG, but there was no confirmation in the redundant High Energy Grating (HEG) band, nor in other X-ray lines. Fe XXI $\lambda1354$ showed a blueshift about 30 minutes later at the beginning of the second *HST* orbit, but only at the 20 km s^{-1} level. Analogous HETGS time series of the brightest lines of comparison star Capella (α Aurigae; G8 III + G1 III) exhibited steady behavior, consistent with measurement uncertainties, without the transient Doppler "bursts" seen in HR 1099. Although the reality of the Ne X Lyα blueshift is in doubt, there is no question that the *Chandra* HETGS velocity scales are stable and free from large systematic errors.

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Chandra Observations of the Open Cluster NGC 2516

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Our analysis of *Chandra* X-ray Observatory data for the open cluster NGC 2516, sometimes referred to as "the southern Pleiades", has yielded over 150 X-ray detections in both HRC and ACIS images of the central region of the cluster. We identify some of the new X-ray sources with photometric cluster members and compare these new *Chandra* results with those of ROSAT. To date, 82 detected X-ray sources (42% of surveyed cluster members) are tentatively identified as cluster members. We also discuss the X-ray properties of late-type members in comparison with those of corresponding stellar types in the more metal rich approximately coeval Pleiades Cluster.

Accepted by ApJ Letters

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Solar Abstracts

Aspects of the Global MHD Equilibria and Filament Eruptions in the Solar Corona

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This is a review of several promising approaches for analyzing the accumulation and release of magnetic energy in filament eruptions and coronal mass ejections in the solar corona. The importance of the magnetic virial theorem for understanding the role of slowly changing boundary conditions in the photosphere is stressed. A possible role of the magnetic expulsion force in the solar filament dynamics is also discussed.

Accepted by Space Science Reviews

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A Multi-Instrument Spacecraft Study of Chromospheric Oscillations

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We analyze time-series data, of between 10 s and 60 s cadence, of the solar atmosphere using the MDI and SUMER instruments on the *SOHO* spacecraft, and the UV channels on the *TRACE* satellite. The combined, co-aligned datasets sample spectral features formed from the photosphere to the middle transition region, in different magnetic environments. The spectral features span five decades in pressure, sampling heights close to 0.2, 0.45, 1 and 2 Mm above the photosphere. We discuss power, phase and coherence spectra, but because Fourier techniques reveal unambiguous signatures of wave properties only under certain conditions, we also make simple comparisons of data in the time domain. For the internetwork atmosphere, we find that oscillations are strongly coupled for frequencies between 2 and 8 mHz. Phase coherences decrease with increasing height, with only occasional periods and locations of observable coherence up to heights where transition region emission lines are formed. The oscillations seen in the middle chromosphere (in the SUMER continua) are several Mm diameter patches of emission with power predominantly in the 5-7 mHz range. All the observed properties point to p-modes as the driver of the dominant observed chromospheric dynamics. The *TRACE* data, formed in the upper photosphere, show smaller scale patterns superimposed on the oscillations, resulting (at least in part) from granulation. Nevertheless, the dominant internetwork chromospheric oscillations clearly arise from regions much larger horizontally than vertically, explaining why earlier 1-D simulations such as those of Carlsson & Stein might be more successful than expected. The chromospheric response to the p-mode driving is, however, intermittent in space and time. Several properties of the data suggest that at least some of the intermittency is caused by the interaction of the upward propagating waves with magnetic fields: suppressed intensities and oscillations near quiet Sun network elements (which we dub "magnetic shadows"); absence of oscillations in internetwork regions neighboring plage magnetic fields; a change in character of the quiet Sun internetwork oscillations between 1 and 1.2 Mm. The latter might reasonably be caused by canopy fields that form between these heights under typical quiet-Sun conditions. Comparisons with a remarkable, SUMER–only dataset reported by Wikstøl et al. reveal that the latter appears to be special, perhaps because of the absence of magnetic effects, with a factor of three more oscillatory power than "normal", and strong coherence extending into the solar transition region. Together, these data support the general picture that the chromosphere oscillates primarily in response to forcing by the p-modes, they are therefore large scale (several Mm across) waves, and they are often strongly influenced by magnetic effects (internetwork fields, or more likely the overlying canopy), before the oscillations even reach the transition region. If this picture is correct, it may influence the interpretation of certain p-mode oscillations.

Submitted to ApJ

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Characteristics of Quiet Sun Cell and Network Brightenings

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Extreme ultraviolet observations of the quiet Sun are made with the Coronal Diagnostic Spectrometer (CDS) on board the Solar and Heliospheric Observatory (SOHO). It has been previously noted that frequent transition region brightenings occur in both the bright network and dark cell regions. Analysing 1125 events, we determined the characteristics of the brightenings in the cell and network regions which include the duration, energy, and intensity increase above the background. Network brightenings are found to be larger than cell events occurring with a mean duration of 150 s and releasing an average of $10^{26.9}$ ergs per event. Cell brightenings, on the other hand, last for an average of 96 s and release $10^{25.8}$ ergs per event. It has also been found that the distribution of energy is a power-law which is different in the cell (γ=2.5) and network (γ=1.5) regions. When the entire quiet Sun region is analysed the value of is 1.7. The number of events per cds pixel is approximately the same, and a histogram of the ratio ([peak value background]/background) shows similar values for both the cell and network. It is important to analyse the cell and network regions separately in the context of coronal heating by such small are-like events.

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Storage of Magnetic Flux at the Bottom of the Solar Convection Zone

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We consider the mechanical equilibrium of a layer of axisymmetric toroidal magnetic field located in a subadiabatically stratified region near the bottom of the solar convection zone, with particular emphasis on the effects of spherical geometry. We determine equilibrium configurations and simulate numerically how these are reached from a non-equilibrium initial situation. While a subadiabatic stratification is essential for suppressing the buoyancy force, the latitudinal component of the magnetic curvature force is balanced by a latitudinal pressure gradient (in the case of a large subadiabaticity, as in the radiative interior) or by the Coriolis force due to a toroidal flow along the field lines (in the case of small subadiabaticity, as in a layer of convective overshoot). The latter case is found relevant for storing the magnetic flux generated by the solar dynamo. The corresponding equilibrium properties are similar to those of isolated magnetic flux tubes. Significant variations of the differential rotation at the bottom of the convection zone in the course of the solar cycle are expected for such a kind of equilibrium.

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EUV Transition Region Line Emission during the Dynamic Formation of Prominence Condensations

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We calculated the emission expected in EUV transition region lines during the process of dynamic formation of prominence condensations in coronal loops, as predicted by the thermal non-equilibrium model of Antiochos et al. We selected some lines emitted by ions of carbon and oxygen, because they are among the most intense and representative in the temperature range corresponding to the solar transition region. We present and discuss the principal characteristics of the line intensities and profiles synthesized from the hydrodynamic model at different times during the loop evolution. The ionization balance is computed in detail and the deviations from the ionization equilibrium caused by plasma flows and variations of temperature and density are accounted for. The atomic physics is treated using the latest atomic coefficients and the collisional-radiative theory approach.

The synthesized carbon and oxygen lines exhibit a behavior significantly dependent on the variations of the plasma parameters inside the magnetic flux tube and therefore are suitable observational signatures of the processes giving rise to prominence condensations. In particular, a sizeable increase of line intensity as well as small blueshifts are expected from the loop footpoints during the first part of the evaporation phase that fills the loop with the material which subsequently condenses into the prominence. Once the condensation appears, line intensities decrease in the footpoints and simultaneously increase at the transition regions between the cool plasma of the condensation and the coronal portion of the loop. Line shifts are quite small in our symmetric model, and during most of the condensation's lifetime, the nonthermal widths are relatively small. These results can be compared with detailed ultraviolet observations of filament/prominence regions obtained by recent space missions in order to test the model proposed for the formation of solar prominences.

Accepted by ApJ

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cd /export/ftp/pub/nla/condensation; mget *.gz

Flare Index During the Rising Phase of Solar Cycle 23

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A brief description and results of the flare index (FI) as a measure of solar activity for cycle 23 are given. The calculation of the daily flare index was determined using the final solar flare tables from the National Geophysical Data Center A. The final data of FI are presented in graphical form over the rising activity phase of solar cycle 23. Daily calculated values are availlable for general use in Kandilli observatory's and NGDC's anonymous ftp servers. The pattern of similar activity indices that arise under different physical conditions during the rising activity phase are compared with the flare index. The north-south asymmetry in the daily flare index data was studied.

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Description of a Procedure to Analyse EUV Loops

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We have developed an IDL procedure to analyse spatial and time evolution of loops observed in the outer solar atmosphere by EUV instruments. The use of this procedure, based on the assumption that loop portions have cylindrical symmetry, allows automatic processing of sequences of images. Our work mainly aims to describe spatial and temporal variations of brightness along the loop length and to determine the following physical parameters: emission measure EM, electron density N_e, pressure P, thermal energy E_{th}, radiative cooling time τ_{rad} and conductive cooling time τ_{cond}. In this paper we describe an application of this procedure on a sequence of TRACE images at 171 Å, in order to study loops interaction during a flare occurred in AR 8421 on December 29, 1998 at $09:41$ UT.

Accepted by Solar Physics

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Accurate Masses of Very Low Mass Stars: III. 16 New or Improved Masses.

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We have obtained adaptive optics images and accurate radial velocities for 7 very low mass objects, in the course of a long term effort to determine accurate masses for very low mass stars ($M<0.6\ M_{\odot}$). We use the new data, together with measurements from the litterature for some stars, to determine new or improved orbits for these 7 systems. They provide masses for 16 very low mass stars with accuracies that range between 0.2% and 5%, and in some cases a very accurate distance as well. This information is used in a companion paper to discuss the Mass-Luminosity relation for the V, J, H and K photometric bands.

Accepted by A&A

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For preprints via WWW: http://xxx.lpthe.jussieu.fr/abs/astro-ph/0010585

Accurate Masses of Very Low Mass Stars: IV. Improved Mass-luminosity Relations

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We present improved visual and near-infrared empirical mass-luminosity relations for very low mass stars ($M<0.6\ M_{\odot}$). These relations make use of all stellar masses in this range known with better than 10% accuracy, most of which are new determinations with 0.2 to 5% accuracy from our own programme, presented in a companion paper.

As predicted by stellar structure models, the metallicity dispersion of the field populations induces a large scatter around the mean V band relation, while the infrared relations are much tighter. The agreement of the observed infrared mass-luminosity relations with the theoretical relations of Baraffe et al. (1998) and Siess et al. (2000) is impressive, while we find an increasingly significant discrepancy in the V band for decreasing masses. The theoretical mass-luminosity relation is insufficiently steep, and has introduced significant errors in the local stellar mass functions derived from V band luminosity functions.

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UPCOMING MEETING

Coronal Heating in the Sun and Late Type Stars

Royal Astronomical Society Discussion Meeting

12 January 2001 (London, UK)

A Royal Astronomical Society discussion meeting on *Coronal Heating in the Sun and Late Type Stars* will be held on 12 January 2001.

Dramatic new insights into the nature of solar coronal heating are currently being investigated using the wealth of data available from the Yohkoh, SOHO and TRACE missions. The evolutionary aspects of coronal heating are also being addressed in cool stars using data from XMM-Newton and Chandra missions.

This meeting aims to examine the current state of knowledge of coronal heating from both the solar and stellar communities with reference to recent observations from the above missions. The meeting will consist of 3 invited talks covering all aspects of theory and observations in solar and stellar corona, contributed talks, and posters.

Details are provided at the following web site:

`http://www.mssl.ucl.ac.uk/www_solar/ras.html`

Abstracts for contributed talks and posters should be sent to Louise Harra (lkh@mssl.ucl.ac.uk) by 11 December 2000 in text format. Please state your preference for a talk or poster.

For any further details please contact Louise Harra (lkh@mssl.ucl.ac.uk) and Len Culhane (jlc@mssl.ucl.ac.uk).

UPCOMING MEETING

The 1st *Eddington* Workshop: Stellar Structure and Habitable Planet Finding

11 - 15 June 2001 (Cordoba, Spain)

Organized by the European Space Agency & Centro de Astrobiología (Madrid, Spain)

Eddington is a 1.2-m space telescope with a wide-field imager for extra-solar planet hunting by transits and for asteroseismic observations, with ample opportunities for parallel and ancillary science. This workshop is an invitation to the wider scientific community to get involved in the refinement of the mission concept, and to participate in the science and technology of the *Eddington* mission. This workshop follows on the recent ESA decision to adopt *Eddington* as a "reserve mission", for a launch in the 2007-2013 time-frame.

Eddington, with a telescope of nominal 1.2-m aperture and a 3 deg field of view with a CCD imager for high-precision photometry, and a five-year life, has two primary goals:

1) to find habitable planets outside of our solar system using the transit method

2) to provide data on the evolution and age of stars using asteroseismic techniques.

There will also be opportunities for parallel imaging and photometric science during the planet and asteroseismology observations, as well as the possibility, for a fraction of the total time, to point at different type of targets, in an "observatory-like" fashion.

The large collecting area of the *Eddington* telescope allows the detection of habitable planets around solar-type stars (out of reach for smaller missions) and provides the data on oscillation frequencies needed to perform asteroseismic investigations of critical phases of stellar evolution, e.g. stars in open clusters and Pop. II stars, thus allowing for a major quantum step in both disciplines. The baseline plan is that these two main investigations will be done in a series of month-long pointings at asteroseismic targets, followed by a three-year pointing at the planet field. The general astronomy pointings will be done within this time-frame.

In the course of 2000 the mission has been the subject of a study leading to a mission concept which was successfully presented to ESA for approval in September 2000. In the next two years detailed studies of the whole mission concept, and in particular of the payload, will be performed. This workshop is an open invitation to the wider scientific community to provide input to the *Eddington* mission concept, and get involved in the following phases of the *Eddington* mission. More information on the *Eddington* baseline design can be obtained at http://astro.esa.int/SA-general/Projects/Eddington/.

The programme will include a presentation of the various aspects of the mission's present baseline and scientific performance, and an overview of the mission's science goals. Contributions are solicited on all aspects of the mission, on both the scientific side as well as the industrial side. A formal call for abstracts will be circulated later this year, together with a preliminary program with a list of invited speakers. An "expression of interest" form is available at http://astro.esa.int/SA-general/Projects/ Eddington/Eddi2001/eddi2001form1.txt to be returned to eddi2001@astro.estec.esa.nl by Nov. 15. Updated information about the Workshop will be made available at the address http://astro.esa.int/SA-general/Projects/Eddington/Eddi2001

Scientific Organizing Committee: C. Aerts (U. Leuven, BE) E. Antonello (Obs. Brera, IT) M. Badiali (IAS-CNR, IT) C. Catala (Obs. Midi-Pyrenees, FR) J. Christensen-Dalsgaard (Aarhus Univ., DK) H. Deeg (IAA, SP) F. Favata (ESA/ESTEC) G. Gilmore (IoA, UK) A. Gimenez (LAEFF, ES) M. Grenon (Obs. Geneve, CH) M. Monteiro (CAUP, PT) A. Penny (RAL, UK) H. Rauer (DLR, DE) I. Roxburgh (QM, Univ. of London, UK – chair) J. Schneider (Obs. Paris, FR) N. Waltham (RAL, UK)

Logistics Cordoba is in the middle of the Spanish southern region of Andalusia, about 120 km northeast of Seville and 160 km northwest of Granada. It has a population of 300 000 and lies at the foot of the Sierra Morena and on the bank of the Guadalquivir River. More information about the conference's logistics are to be found at http://astro.esa.int/SA-general/Projects/Eddington/Eddi2001

Further Information Please contact Fabio Favata (eddi2001@astro.estec.esa.nl) for any additional information.

JOB OPENING

Postdoctoral Fellowships in Astrophysics

Keele University (UK)

Following the award of a PPARC rolling grant to the Astrophysics Group at Keele University, applications are invited for two (possibly three) postdoctoral fellowship positions. These 3-year positions are available immediately, though later start dates can be negotiated.

The Keele group has a forefront observational programme of multiwavelength astrophysics, with current work utilising data from the infra-red (ISO, UKIRT), optical (AAT, WHT, INT), UV (HST) to the X-ray (Chandra, XMM). Keele is also a partner in the VISTA 4-m survey telescope project and the South African SALT project. Current areas of specialism include stellar clusters and associations, low-mass stars and brown dwarfs, light element depletion in cool stars, coronal activity in cool stars; close binaries; accretion onto compact objects and magnetically channeled accretion; and the circumstellar environments of novae and evolved stars.

Applications received by 30th November will receive full attention. For details of how to apply see the web page

`http://www.astro.keele.ac.uk/`

For informal discussions about the posts, contact current faculty:

Dr R.D. Jeffries (rdj@astro.keele.ac.uk)

Dr C. Hellier (ch@astro.keele.ac.uk)

Dr J. Wood (jhw@astro.keele.ac.uk)

Prof. A. Evans (ae@astro.keele.ac.uk).

JOB OPENING

Marie Curie Fellowships

Osservatorio Astronomico di Palermo Giuseppe S. Vaiana

Closing date: 01 March 2001

Osservatorio Astronomico di Palermo Giuseppe S. Vaiana expects to appoint one fellow in the area of X-ray observations of stellar coronae under the European Commission's Marie Curie Development Host Fellowship Scheme.

Osservatorio Astronomico di Palermo has a long tradition in X-ray astronomy and in particular on stellar and solar coronal physics. Part of the recent activity has been centered on the study of stellar coronae considering coeval stellar samples. These studies, initiated with data of the Einstein Observatory and of ROSAT, continue through the access to a large number of X-ray observations of CHANDRA and XMM/NEWTON as part of both guaranteed and guest-observer programs.

The scientific aim of this work is to understand the relationship between the stellar interior structure and the stellar outer atmosphere. The X-ray emitting coronae of late-type stars play a crucial role in stellar evolution from the pre-main sequence phase onward, impacting on a diversity of other areas of astronomy. Coronal properties affect the angular momentum evolution of the stars and hence the dynamo efficiency producing a feedback process with a tight interplay between the properties of the stellar interiors and those of the outer atmospheric layers.

The successful candidate is expected to participate in the analysis of the new X-ray data mainly on open clusters and star forming regions with special emphasis on spectroscopic data.

Candidates should have a PhD in a relevant field or at least four years of full-time research experience at postgraduate level other than doctoral studies. The ability to work in a team and possibly a strong and competitive research program are important skills.

The applicant must be national of a Member State of the European Community (other than Italy) or an Associated State, or otherwise residing in the Community for at least the last five years. The fellow must be of age 35 years or less (allowance is made for time actually served in compulsory military or civil service and for childcare with a maximum of 2 years per child). In addition candidates should not have been resident in Italy for more than 12 months in the two years prior to selection. Gross salary, including all compulsory deductions under italian legislation, is fixed at 3813 Euro per month plus a mobility allowance for the duration of the contract, which is expected to last for 24 months. Female candidates are explicitly encouraged to apply.

Applications, including CV, publication list, description of applicant's research interests/program (all documents above should be signed by the candidate), documents certifying the doctoral degree or a four years of full time research experience and two letters of recommendations should arrive by 1st March 2001 at:

Osservatorio Astronomico di Palermo
Marie Curie Fellowship Selection
Piazza del Parlamento 1
I-90134 Palermo, Italy

For further information contact:
Giusi Micela - giusi@oapa.astropa.unipa.it or http://www.astropa.unipa.it

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), brown dwarfs, 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` .