COOLNEWS

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A Doppler image of the young K2V star LQ Hya is presented for March 1995 and is compared with earlier images taken in 1991 and 1993. Comparison is also made with a recently completed image of EK Dra, another young star that is more nearly one solar mass than LQ Hya. The image for 1995 seems to show a consistent pattern of spot concentration to the equatorial region in either a continuous wide band of features averaging only about 600 K cooler than photospheric or perhaps a double band symmetrically located either side of the equator like the solar pattern. A weak polar feature is evident but it is apparently a somewhat less pronounced depression in temperature than seen in 1991 and of reduced area. The polar feature is less pronounced than that of EK Dra and the spot pattern at the equator of LQ Hya does not extend to latitudes as far toward the poles as does the pattern of spots at the equatorial and mid-latitudes of EK Dra. When these results are compared with theoretical predictions for the location of spots on such young stars of solar mass, it appears surprising that the observations for LQ Hya and EK Dra are not reversed given that LQ Hya is apparently significantly less massive than EK Dra.

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Doppler Imaging of Stellar Surface Structure. VIII. The Effectively Single and Rapidly Rotating G8-giant HD 51066 = CM Cam

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We present first Doppler images of HD 51066 from observations in 1994, 1995, 1996 and 1997, and find evidence for a vanishing polar spot in accordance with the system's long-term brightness increase. Several small spots with $\Delta T \approx 500$ K appear also at low latitudes. Our cross-correlation maps indicate a latitude-dependent phase-shift pattern between annual maps. New and continuous BVRI photometry from 1996 to 1998 is presented and suggest a photometric period of 16.053±0.004 days, that we interpret to be the stellar rotation period. Additional optical spectroscopy and the Hipparcos data are used to obtain absolute stellar parameters for HD 51066. A comparison with evolutionary tracks and the assumption of angular-momentum and magnetic-flux conservation suggest that the main-sequence progenitor was a very rapidly-rotating Bp star with a several kiloGauß magnetic field. We also examine the Hα line profiles in this star and find some evidence that its equivalent width is modulated with the stellar rotation period in phase with the photospheric starspots. Our radial velocities indicate that HD 51066 is likely a long-period ($\approx$10 yrs) spectroscopic binary and a preliminary orbit is presented. We emphasize that HD 51066 is an interesting target for studies of evolutionary angular-momentum loss because it is effectively single, significantly evolved but still rapidly rotating.

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Latitude Distributions and Lifetimes of Starspots on G Dwarfs in the α Persei Cluster

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We present a set of maximum entropy reconstructions of the starspot distributions on two rapidly rotating G dwarfs in the α Persei Cluster, from spectra taken at the William Herschel Telescope on three nights in 1996 October and November. Since these stars are too faint for conventional Doppler imaging, which makes use of only one or a few lines, we take the large number of photospheric metal lines available in an echelle spectrum, and deconvolve them into a single, high S:N profile. We show that this technique results in a typical multiplex gain of 22.5 in S:N for a given spectrum, the equivalent of using a single line obtained on a 63 m telescope. The image reconstructions demonstrate that both these stars have cool high latitude regions or polar crowns, and low latitude features, in contradiction to the suggestion that only high latitude spots should be present.

Cross-correlation between image reconstructions of He 699, 31 days apart, reveals a lack of correlation between detail ed small scale structures. This places an upper limit for the lifetime of the observed features at less than one month. The Hα profiles are also found to exhibit absorption features indicating the presence of prominence clouds, at or below the co-rotation radius.

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Rotation and Lithium in the Late-type Stars of NGC 2516

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We present CCD photometry and high resolution spectroscopy of low-mass stars in the open cluster NGC 2516, which has an age of about 150 Myr and may have a much lower metallicity than the Pleiades. Twenty four probable F to early K type, single cluster members have been identified from their photometry and radial velocities, along with three possible spectroscopic binaries. The projected equatorial velocities are measured and compared with younger and older clusters. Several fast rotating late G /early K stars are seen, but all hotter stars have $v \sin i < 20 \mathrm{km\,s^{-1}}$. The data are consistent with angular momentum loss models with spindown timescales that increase from tens of Myr for G stars to hundreds of Myr for K stars. The observed X-ray activity is consistent with the currently accepted rotation-activity paradigm. Lithium abundances are derived from the Li I 6708Å line. The pattern of Li depletion is indistinguishable from that in the Pleiades, including a spread in the ~K0 stars, where the most rapid rotators suffer the least Li depletion. The observations argue *either* in favour of a metallicity in the range $-0.1 <$[Fe/H]< 0.0 for NGC 2516, or a lower metallicity and extra Li depletion through non-standard mixing modes which occurs on timescales of only ~ 50 Myr. Neither our low signal to noise spectroscopy or our photometry can constrain [Fe/H] sufficiently to decide between these possibilities. A detailed spectroscopic chemical abundance analysis is urgently required.

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X-ray Emission and Low Mass Stars in the Young Open Cluster NGC 2547

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We present the results of deep ROSAT High Resolution Imager X-ray observations and broad band BVI$_{\rm C}$ CCD photometry of the young, open cluster NGC 2547. We have been able to find cluster counterparts for the majority of the 102 significant X-ray sources detected, confirming the power of high spatial resolution X-ray observations to find low mass, magnetically active members of distant open clusters. The age of the cluster has been determined by fitting the main sequence turn-off and the positions of low mass stars on their pre-main sequence tracks. The two methods yield 55 ± 25 Myr and 14 ± 4 Myr respectively, but we consider the lower age to be more reliable because of the comparatively large number of low-mass stars that constrain the fit. We deduce that any age spread among the low mass stars is < 10 Myr and any small spread that exists could be attributable to binarity and starspots.

The distribution of X-ray activity levels in the solar type stars of NGC 2547 lies considerably above our threshold of sensitivity and it is probable that our X-ray selected sample is complete at these masses. For lower mass stars our sample is likely to be incomplete. Comparison with initial mass functions indicates there are still of order 100, low activity M dwarfs yet to be found. When X-ray activity is gauged in terms of X-ray to bolometric flux, $L_{\rm x}/L_{\rm bol}$, we find that there are G stars in the older (age 52 Myr) α Per cluster which are less active than their least active counterparts in NGC 2547. This is consistent with the current rotation-activity paradigm if there is modest angular momentum loss between 14 and 52 Myr. There are no G or early K stars in NGC 2547 which reach the saturated level $L_{\rm x}/L_{\rm bol} = 10^{-3}$, seen in older clusters, whereas saturated late K and M stars are observed. From this, we deduce that there are no fast rotating G and early K stars in NGC 2547 with equatorial velocities $> 20 \mathrm{km\,s^{-1}}$. If this is confirmed, then even with no angular momentum loss, the fastest rotating NGC 2547 stars could not evolve into the fastest rotating stars in the α Per cluster. These results cast doubt on the assumption that rotation rates and magnetic activity seen in one cluster are representative of similar stars at the same age. We hypothesize that the solar-type stars of NGC 2547 either still possess, or have recently lost, circumstellar accretion disks which regulate their angular momentum. This would require longer disk lifetimes than commonly measured or assumed for other young stars, and we speculate on possible reasons for this.

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Near-Term Detectability of Terrestrial Extrasolar Planets: TEP Network Observations of CM Draconis

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Results from a photometric search for extrasolar planetary transits across the eclipsing binary CM Dra are presented. The TEP (Transits of Extrasolar Planets) network has observed this star since 1994, and a lightcurve with 617 hours of coverage has been obtained. The data give a complete phase coverage of the CM Dra system at each of the 3 years of observations, with a noise of less than 5 mmag. New epoch and period values for CM Dra are derived, and a low flare rate of 0.25 hr^{-1} has been confirmed. The absence of periodic variations in eclipse minimum times excludes the presence of very massive planets with periods of less than a few years. The lightcurve was visually scanned for the presence of unusual events which may be indicative of transits of extrasolar planets with 'massive earth' sizes. Six suspicious events were found which are being followed up for future transits, by planets with sizes between 1.5 and 2.5 R_E (Earth Radii). However, none of these events has amplitudes compatible with planets larger than 2.5 R_E. Coplanar planets larger than 2.5 R_E and with orbital periods of less than 60 days can therefore be ruled out with a confidence of about 80%. Planets smaller than 1.5 R_E cannot be detected in the data without a sub-noise detection algorithm. A preliminary signal detection analysis shows that there is a 50% detection confidence for 2 R_E planets with a period from 10 to 30 days with the current data. This data-set demonstrates that it is possible to detect terrestrial sized planets with ground based photometry, and that strong constraints on the sizes of planets orbiting in the plane of the CM Dra system can be set.

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Microlensing of Circumstellar Envelopes I. Simplified considerations for diagnosing radial and azimuthal flow

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This paper presents first results on the line profile shapes from a circumstellar envelope in bulk motion as modified by a microlensing event. Only geometrically and optically thin spherical shells in uniform expansion or rotation are considered here so as to emphasise the information content available in the profile shapes. In particular it is demonstrated that for the case of expansion, the line emission can increase by significant factors and the time variation of the profile shape is *symmetric* about line centre. For uniform rotation the line emission also increases significantly, but the time evolution of the profile shape is distinctly *asymmetric*. Thus, microlensing is seen to yield information about the velocity field in the extended envelope. We elaborate on (a) the observational advantages of tailoring microlensing programs toward detecting extended circumstellar envelopes, (b) the use of multiline observations to infer other properties of the envelopes, such as the ionization stratification, (c) the use of the continuum excess emission at infrared wavelengths as a means of probing the envelope structure, and (d) the use of polarisation for constraining the properties of "clumpy" winds.

Submitted to Astronomy and Astrophysics

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Infrared Colors at the Stellar/Substellar Boundary

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We present new infrared JHK photometry for 61 halo and disk stars around the stellar/substellar boundary. We also present some new L′ photometry. These data are combined with other available data to produce color–color and absolute magnitude–color diagrams. The disk and halo sequences are compared to the predictions of the latest model atmospheres and structural models. We find good agreement between observation and theory except for known problems in the V and H passbands probably due to incomplete molecular data for TiO, metal hydrides and H_2O. The metal–poor M subdwarfs are well matched by the models as oxide opacity sources are less important in this case. The known extreme M subdwarfs have metallicities about one–hundredth solar, and the coolest subdwarfs have $T_{eff} \sim 3000$ K with masses $\sim$0.09$M/M_\odot$. The grainless models are not able to reproduce the flux distributions of disk objects with $T_{eff} < 2500$ K, however a preliminary version of the NextGen–Dusty models which includes homogeneous formation and extinction by dust grains *is* able to match the colors of these very cool objects. The least luminous objects in this sample are GD165B, three DENIS objects — DBD0205, DBD1058 and DBD1228 — and Kelu-1. These have $T_{eff} \sim 2000$ K and are at or below the stellar limit with masses $\leq$0.075$M/M_\odot$.

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Oxygen Abundances in Unevolved Metal-poor Stars from Near-UV OH Lines

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We have performed a detailed oxygen abundance analysis of 23 metal-poor ($-3.0<$[Fe/H]< -0.3) unevolved halo stars and one giant through the OH bands in the near UV, using high-resolution echelle spectra. Oxygen is found to be overabundant with respect to iron in these stars, with the [O/Fe] ratio increasing from 0.6 to 1 between [Fe/H]=-1.5 and -3.0. The behavior of the oxygen overabundance with respect to [Fe/H] is similar to that seen in previous works based on O I IR triplet data (Abia & Rebolo 1989; Tomkin et al. 1992; Cavallo, Pilachowski, & Rebolo 1997). Contrary to the previously accepted picture, our oxygen abundances, derived from low-excitation OH lines, agree well with those derived from high-excitation lines of the triplet. For nine stars in common with Tomkin et al. we obtain a mean difference of 0.00$\pm$0.11 dex with respect to the abundances determined from the triplet using the same stellar parameters and model photospheres. For four stars in our sample we have found measurements of the [O I] λ 6300 Å line in the literature, from which we derive oxygen abundances consistent (average difference 0.09 dex) with those based on OH lines, showing that the long standing controversy between oxygen abundances from forbidden and permitted lines in metal-poor unevolved stars can be resolved. Our new oxygen abundances show a smooth extension of the Edvardsson et al.'s (1993) [O/Fe] versus metallicity curve to much lower abundances, with a slope -0.31 ± 0.11 (taking into account the error bars in both oxygen abundances and metallicities) in the range $-3<$[Fe/H]< -1. The extrapolation of our results to very low metallicities indicates that the first Type II SNe in the early Galaxy provided oxygen to iron ratios [O/Fe]$\geq$1. The oxygen abundances of unevolved stars when compared with values in the literature for giants of similar metallicity imply that the latter may have suffered a process of oxygen depletion. As a result, unevolved metal-poor stars shall be considered better tracers of the early evolution of oxygen in the Galaxy. The higher [O/Fe] ratios we find in dwarfs has an impact on the age determination of globular clusters, suggesting that current age estimates have to be reduced by about 1–2 Gyr.

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Fundamental Stellar Parameters for Nearby Visual Binary Stars : η *Cas*, ξ *Boo*, 70 *Oph* and 85 *Peg* – Helium abundance, age and mixing length parameter for low mass stars

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The calibration of nearby visual binary stars on the HR diagram is used to determine the helium abundance, age and mixing length parameter for stars other than the Sun. Four Population I low mass systems with high-quality data are analysed by means of standard evolutionary stellar models : η Cas, 70 Oph, ξ Boo and 85 Peg.

Complementing these results with those for the Sun and α Centauri it is shown that in the framework of the mixing-length formalism to describe convection, a unique value of the mixing-length parameter, equal to the solar one can be used to model these objects. Except for the 85 Pegasi system, which cannot be explained by means of standard stellar evolutionary models, the helium abundance is determined with a precision of 0.02 (p.e.) and the age with a precision of 2 Gyr (p.e.). A concomitant positive relation between metallicity and helium abundance is found for these stars, corresponding to a mean value of about $\Delta Y/\Delta Z \approx 3 \pm 2$ (relative helium-to-heavier-elements enrichment parameter) but there is no clear correlation between age and metallicity. The consequences of the results of the use of the new parallaxes from the HIPPARCOS mission are briefly discussed.

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The Chromosphere of II Peg: Multi-line Modelling of an RS Canum Venaticorum Star

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We present the first simultaneous multi-line fitting of a semi-empirical atmospheric model with a chromosphere and transition region to the H I and Ca II spectra of an RS CVn star (II Peg). The static component of the Hα emission core, the line profile of Hβ, the apparent absence of Hγ and Hδ, and the emission core profiles of Ca II K and two of the Ca II IR^3 lines are all approximately fitted by a static $1D$ model with the following properties: $\log m$ at the onset of the transition region is ≈ -2.85, and a 6000 K plateau in the upper chromosphere that spans the $T_{\rm min}$ region, whereas the other diagnostics arise from layers well above $T_{\rm min}$, and it is postulated that this may be the cause of the discrepancy. There has very recently been evidence from other investigators that the metallicity of II Peg may be sub-solar, and we find that models with $[\frac{A}{H}] = -0.4$ provide a somewhat better fit to all the lines considered.

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Chromospheric Modelling of the Hα and Na I D Lines in Five M dwarfs of Low to High Activity Level

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We have obtained simultaneous high resolution Hα and Na I D spectra of five dwarf M stars that span a wide range in chromospheric activity level. The observed Na I D lines exhibit behavior vity level. However, the Hα line systematically indicates a value for the mass loading at the onset of the transition region and the location of $T_{\rm min}$ that is 0.4 dex lower

in column mass density than that indicated by Na I D. Therefore, the profile of both lines cannot be simultaneously well fit for all but one of our stars. We also find, in agreement with the pioneering study of Andretta *et al.*, that for dMe stars the shape of the Na I D emission cores is a much more sensitive indicator of chromospheric thickness (or, equivalently, chromospheric steepness) than is Hα, and, therefore, provides a powerful diagnostic complement to Hα. Finally, we investigate the dependence of the predicted line profiles on the values of the stellar parameters and conclude that the inferred chromospheric pressure is sensitive to the choice of $T_{\rm eff}$ and $\log g$, especially among dMe stars. Specifically, among dMe stars, a model in which the value of $T_{\rm eff}$ is too small or too large by approximately 200 K, or in which the value of $\log g$ is too large or too small by 0.5 dex, will give rise to closest fit values of the column mass density at the location of the Transition Region and $T_{\rm min}$ that are too small or too large, respectively, by approximately 0.3 dex. As a result, discrepancies between the stellar parameters of our photospheric model and those of the program objects allow us to extract only upper or lower limits for the values of the column mass density at critical points in the chromospheric structure.

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Spatially Resolved HST Spectra of α Orionis' Chromosphere

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Spatially resolved UV spectra of the supergiant α Orionis (Betelgeuse) obtained in 1995 March with the Goddard High Resolution Spectrograph (GHRS) on board the Hubble Space Telescope (HST) show that the chromospheric emission in the Mg II h and k (around λ280 nm) lines reaches a diameter of at least $\sim$ 270 milliarcsecond (mas), about twice the size of ultraviolet continuum images obtained at the same time with the HST Faint Object Camera (FOC), and about five times the star's optical diameter. The signature of the unresolved bright spot observed in the 1995 March FOC images Gilliland & Dupree (1996, ApJ 463, L29) occurs in the spectrum as an asymmetry in the intensity measured across the disk at constant wavelength. Because the spectra were obtained scanning across the stellar image, it is possible to measure a differential line shift across the disk of the star which can be interpreted as being due to rotation. If this interpretation is correct we can determine the axis of rotation of Betelgeuse and estimate its rotational speed to be 1.2×10^{-8} rad s^{-1}, corresponding to a rotation period of 17 year. In addition, it is plausible that the 1995 March bright spot is congruent with the pole of the star suggesting that star's angle of inclination is $\sim 20^\circ$ to the line of sight.

Considering the small number of bright spots that are present at any one time on the surface of Betelgeuse, and the signature of the 1995 March spot in the Mg II resonance lines as observed with the GHRS, it appears that such spots are not the consequence of convective flows. Differences in the spatial distribution of the flux emerging from different layers of the atmosphere and the line asymmetries of the Mg II h and k lines suggest that the spot is the signature of an outwardly propagating shockwave in an atmosphere modified by rotation.

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Heating Events in the Quiet Solar Corona

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Sensitive observations of the quiet Sun observed by EIT on the SoHO satellite in high-temperature iron line emission originating in the corona are presented. The thermal radiation of the quiet corona is found to fluctutate significantly even on the shortest time scale of 2 minutes and in the faintest pixels. The power spectrum of the emission measure time variations is approximately a power law with an exponent of 1.79±0.08 for the brightest pixels and 1.69±0.08 for the average and the faintest pixels. The more prominent enhancements are identified with previously reported X-ray network flares (Krucker et al. 1997a) above the magnetic network of the quiet chromosphere. In coronal EUV iron lines they are amenable to detailed analysis suggesting that the brightenings are caused by additional plasma injected from below and heated to slightly higher temperature than the preexisting corona. Statistical investigations are consistent with the hypothesis that the weaker emission measure enhancements originate from the same parent population. The power input derived from the impulsive brightenings is linearly proportional to the radiative loss in the observed part of the corona. The absolute amount of impulsive input is model dependent. It cannot be excluded that it can satisfy the total requirement for heating. These observations give strong evidence that a significant fraction of the heating in quiet coronal regions is impulsive.

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Energy Distribution of Heating Processes in the Quiet Solar Corona

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We have determined the variations in emission measure of the solar corona using EIT/SoHO observations of iron lines in a quiet region of the Sun. The emission measure is found to vary significantly in at least 85% of all the pixels within 42 minutes. The variations are interpreted as heating events bringing chromospheric material above the one million degree threshold of the observed lines and cooling of coronal plasma below that limit. A method to assess heating events has been developed. The thermal energy input by such microflares is calculated from the observed increases in emission measure and the derived temperature. Heating events have been found in the range from 8×10^{24}erg to $1.6{\times}10^{26}$erg. The energy input by $\geq 3\sigma$ events of emission measure increase amounts to about 16% of the average radiated power of the coronal plasma in the quiet corona. The frequency distribution of microflares is an approximate power-law of the form $f(E) = f_0 E^{-\delta}$ with a power-law index δ between 2.3 and 2.6. As the low-energy cutoff is due to sensitivity limitations and the power-law index is steeper than 2, these observations demonstrate the possibility that microflares dominate the energy input into the quiet corona. The observed power law would have to continue to about 3×10^{23}erg to match the observed minimum heating requirement.

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Ph.D. Thesis Abstract

On the Rotation of the Solar Green Corona

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Ph.D degree awarded: June 1998

We have determined the behaviour of the rotation of the green corona during four solar cycles, making use of all available patrol obssrvations of the FeXIV 530.3 nm coronal emission line. The data set of Rybanský and Rušin (1992, 1994), created from green line observations of the world-wide coronagraphic network, was used for this purpose. An optimized correlation analysis was applied on the data in order to reveal the rotational behaviour with the highest possible temporal and latitudinal resolutions over the domain under study. The analysis is based on a monitoring of a given tracer – repeated brightenings of the emission line above the solar limb due to the rotation of emission features in the corona.

One of principal findings is that in order to get reasonable results it is inevitable to perform a more detailed searching for reliable green coronal tracers. Although we did such a search, we were unable to find sufficiently reliable tracers over the whole domain. Therefore, a new independent reliability test was used to determine a relative uncertainty of the inferred rotational information. Strictly separate handling of the east and west limb green line data was exploited for estimation of the errors of the inferred rotational period errors during the whole work. The results, acquired under conditions when an application of the methodology chosen was unappropriate, were finally omitted.

Sufficiently reliable rotational information, available in more than 80% of the investigated domain, clearly revealed a time-latitudinal dependence of the rotation of the green corona on the phase of solar cycle. An interesting feature is that while the green corona rotates almost rigidly few years before and during the cycle minima, this pattern is rapidly replaced by a differential one soon after the onset of a new solar cycle. This differential rotational profile extends up to the beginning of a descending phase of the cycle, when a slow return to the rigid profile was detected.

The investigation of general rotational characteristics reveal a selection effect of the more pronounced tracers and of the quality of tracers affecting these characteristics. Large variations in the green corona rotation between the above-mentioned two extremes allow us to conclude that computations of overall latitudinal and temporal averages of the rotational information is not a physically correct procedure. So, it is only rotational information related to a specific point in the time-latitude domain, without any significant averaging of it, that matters most. In spite of all this, the local maxima of the overall latitudinal profile of the rotational period around $40° - 60°$ were found to be artefacts.

The rotation of polar traces and the equatorial belt were studied separately in order to determine possible systematic trends in their rotation. No such phenomena were detected close to the solar equator. The most reliable polar tracers confirm large variations of the rotational periods from $27 - 28$ days up to $31 - 32$ days from the solar minima to the phases of enhanced magnetic activity of the Sun, respectively.

The physical interpretation of the inferred time-latitudinal behaviour of the green corona rotation was made on the basis of the configuration, intensity and distributions of coronal magnetic field structures, appearing during the solar cycle. The evolutional relations of these coronal magnetic configurations to the emergence and distribution of the photospheric magnetic flux were emphasized using the flux-transport model and the magnetic field extrapolation to the corona.

The results were then compared with the previous ones, and possible tracks how to compare these with rotational information, acquired from white-light observations, coronal holes and the computations of the coronal magnetic fields, were outlined. Finally, we stress an urgent need for new data of higher spatial and temporal resolution, which could provide sufficiently reliable rotational information from the different coronal components and features.

Thesis-related Publications: A.S.P.Conf.Ser., 109, 157

Ph.D. Thesis Abstract

Long- and Short-term Photometric Variability of Late-type Stars

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Ph.D degree awarded: May 1998

Results are presented on long- and short-term optical variability of late-type stars, based on time-series ground-based photometric observations of a representative sample of single and binary stars of different mass, rotation rate and age.
- *Long-term photometric variability*
The long-term behaviour results from the areal variation of the uniformly distributed photospheric spotted regions. The light curve amplitude, which is produced by asymmetrically distributed regions, is almost independent on the cycle phase. As for the case of chromospheric cycles, different classes of long-term behaviour result: a) *flat*: no long-term variability; b) *flat periodic*: 5-yr periodicity but without apparent longer term trend; c) *single periodic*: single periodicity with duration comparable to or longer than a decade; d) *double periodic*: both a 5-yr periodicity and a long-term cyclic trend with period comparable to or longer than a decade. Fast rotating ($P_{rot} < 6^d$) and slow rotating ($P_{rot} > 6^d$) stars behave differently suggesting an underlying different dynamo action. The photometric periods show a tendency to decrease towards the cycle minimum (maximum spot coverage); the differential rotation, as detected in most of the stars through rotation period changes and light curve minimum migration, tends to increase with decreasing angular momentum. The detected photospheric cycles show the same length and are almost perfectly specular to chromospheric cycles (from "H&K program"), indicating a positive temporal correlation between magnetic structures in the photosphere and in the chromosphere.
-*Short-term photometric variability*
The light curve maximum amplitude (ΔV_{max}) from our time series of light curves is found to be a reliable indicator of the star's maximum spottedness, and, therefore, of the maximum magnetic flux density. ΔV_{max} appears to be a suitable parameter to test the dependence of the dynamo action on the global stellar parameters. It is a decreasing function of the rotation period (P) and displays different behaviours in the following four different rotation regimes:
$0.0 < P < 0.5^d$; $0.5 < P < 1.0^d$; $1.0 < P < 6.0^d$; $6.0 < P < 22.0^d$.
The existence of these discontinuities may reside in different behaviours of the dynamo action, each of them effectively operating only in a limited rotation range. ΔV_{max} results to be: *a)* age dependent: the slope of ΔV_{max} versus rotation period is a decreasing function of the age, even holding constant the rotation rate; *b)* color dependent; *c)* equivalent to other activity indicators in the flux-flux relations; and *d)* well correlated to the covering fraction of bright photospheric regions.

Thesis-related Publications: IBVS 4286, 4576; A&A 281, 756; 320, 586; BAAS 186, 189; Astron. Astrophys. Trans. 17, 1

Job Announcement

RESEARCH FELLOW
The Queen's University of Belfast
School of Mathematics and Physics

This post, funded by PPARC, is available from the 1 October 1998 for 2 years, to support a programme of research on high temperature magnetically-confined tokamak plasmas and their relation to astrophysical plasmas. Applicants must have an honours degree or equivalent qualification in physics, theoretical physics or a related subject, and hold, or be about to obtain a relevant PhD. Research experience in laboratory and/or astrophysical plasmas is essential, while experience of spectroscopy and/or MHD modelling is desirable.

Commencing salary range: 15,735 - 17,570 pounds per annum, placing depending on age, experience and qualifications.

Applicants, quoting Ref. 98/F281C, may obtain further particulars from the Personnel Office, The Queen's University of Belfast, BT7 1NN, Northern Ireland. Tel: (01232) 273044/273246 or answering machine 273854 or Fax 324944.

Closing date: 14 August 1998

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, or M) 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

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