COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

No. 22 — August 1997 Editor: Steve Skinner (coolnews@jila.colorado.edu)

TABLE OF CONTENTS

Stellar Abstracts

Rotation, Activity and Lithium in NGC 6475

David J. James[1], Robin D. Jeffries[2]

[1] School of Physics and Space Research, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK
[2] Department of Physics, Keele University, Keele, Staffordshire, ST5 5BG, UK

Radial and rotational velocities, chromospheric activity and lithium abundances are presented for an X-ray selected sample of stars in the young (220 Myr) open cluster NGC 6475. Low-mass members of the cluster have been identified on the basis of photometric and spectroscopic criteria. The observations show that the rapid spin-down seen amongst solar type stars in the Pleiades is incomplete at 220 Myr, as there are F, G and K stars in NGC 6475 with $v \sin i > 10$ km s^{-1}. Peak rotation rates for G stars are 12-14 km s^{-1} and are robust to uncertain inclination angles, because the magnetic activity of these stars is less than the saturation value observed for fast rotators ($v \sin i > 15$km s^{-1}) in the Pleiades. Two mid-K stars are found with $v \sin i \sim 25$ km s^{-1} and saturated magnetic activity levels, indicating that spin-down time-scales are mass dependent, increasing from ~ 20 Myr for early-G stars to > 75 Myr for mid-K stars. We have compared our rotation data for the most rapidly rotating G and K stars in NGC 6475 and those in young open clusters, to published rotational evolution models incorporating magnetic dynamo saturation at high rotation rates ($> \Omega_{sat}$). Models with interior angular momentum transport are unable to simultaneously fit the rapidly rotating stars of the α Per, Pleiades and NGC 6475 clusters. Likely solutions are a plausible increase in the Pleiades age to 100 Myr, incorporation of centrifugal wind driving in the angular momentum loss treatment or *ad hoc* differences in initial conditions. If an increased Pleiades age is assumed, we find that a mass dependent Ω_{sat} is required, such that dynamo saturation occurs for G and K stars at a Rossby number of ~ 0.4. This value is incompatible with the faster saturation thresholds inferred from coronal X-rays, but Ω_{sat} can be increased if solid body rotation is enforced or centrifugal wind driving is included. Comparisons with such models are favourable for G stars but less so for K stars. This may result from neglecting the evolving moment of inertia at early ages.

All the cool stars exhibit Lithium I 6708 Å absorption features. When compared to Li in the Pleiades and Hyades, it is evident that the G and K stars in the Hyades have experienced substantial Li depletion whilst on the main sequence, between 220 and 600 Myr, and probably at earlier times on the main sequence as well. There is marginal scatter of about 0.1 dex in the Li abundances of G and early-K stars, possibly increasing to 1.0 dex in a few cooler

objects. The data are insufficient to decide whether there is a mechanism to eliminate the scatter in Li abundances of the Pleiades K stars before they reach the Hyades age, or whether the difference reflects different cluster initial conditions. Interpretation is complicated by the X-ray selection bias, favouring the observation of the more rapidly rotating, Li-rich stars. Metallicity may also play a role, but our spectral synthesis estimate of [Fe/H]= $+0.110 \pm 0.034$ is comparable with the Pleiades and Hyades.

Accepted by MNRAS

For preprints contact: djj@star.sr.bham.ac.uk, djj@st-and.ac.uk

For preprints via WWW: http://www.astro.keele.ac.uk/ rdj/

For preprints via ftp: anonymous ftp to sal1.sr.bham.ac.uk, cd /pub/djj/ file - n6475.ps.gz

Chemical Composition of Six K Supergiants in the SMC

V. Hill[1]

[1] Observatoire de Paris, Section de Meudon, DASGAL, URA 335 du CNRS, 92195 Meudon Cedex, France

A sample of six SMC cool stars (K supergiants) are analysed by high resolution spectroscopy in order to investigate their chemical content, which should reflect that of the current interstellar medium within the SMC. The abundance of Na, Al, α-elements, Fe peak and heavy elements are derived through an LTE analysis of the lines, compared to a Galactic "standard" (the well-studied K giant Arcturus) and discussed in terms of chemical evolution of the SMC. The following results were obtained: 1.) All the stars from this sample are metal deficient ([Fe/H] ranges from –0.59 to –0.89 dex). The abundance varies little from star-to-star (0.10 dex r.m.s., comparable with the expected error due to uncertainties on the effective parameters of the stars), in agreement with the very small chemical composition variations among the H II regions within the SMC found by Pagel *et al.* 1978. 2.) Sodium is not strongly enhanced in these stars, and the star-to-star scatter is larger than expected. 3.) At variance with metal-poor stars in our Galaxy, the so-called α-elements do not seem to be enhanced. 4.) Nickel displays a noticeable depletion with respect to iron ([Ni/Fe]≈–0.3 dex), at variance with what is found in the SMC F supergiants and in Arcturus. 5.) Except for PMMR 144, the s and r process elements heavier than Ba are enhanced in all of our stars by $\simeq$+0.4 dex.

Accepted by A&A

For preprints contact: Vanessa.Hill@obspm.fr

For preprints via anonymous ftp: ftp.obspm.fr in transit/hill

Carbon, Nitrogen, Oxygen and Lithium Abundances of Six Cool Supergiants in the SMC

V. Hill[1], **B. Barbuy**[2], **M. Spite**[1]

[1] Observatoire de Paris, Section de Meudon, DASGAL, URA 335 du CNRS, 92195 Meudon Cedex, France
[2] Universidade de São Paulo, IAG, Dept. de Astronomia, CP 9638, São Paulo 01065-970, Brazil

Carbon, nitrogen and oxygen abundances were derived from high-resolution spectra of 6 cool supergiants of the Small Magellanic Cloud. Oxygen-to-iron ratios (mean value $\overline{[\mathrm{O/Fe}]} \approx -0.18$ dex) are found to be similar to those found in young objects in the LMC and the Galaxy. This result is discussed in terms of chemical evolution. A mean deficiency of the carbon-to-iron ratio of $\overline{[\mathrm{C/Fe}]} \approx -0.3$ dex and a nitrogen-to-iron ratio $\overline{[\mathrm{N/Fe}]} \approx +0.22$ dex might imply a mixing signature, which is confirmed by the low $^{12}C/^{13}C$ ratio measured in three stars. In terms of chemical evolution, carbon plus nitrogen abundances have to be considered: in our sample, a mean value of $\overline{[(\mathrm{C+N})/\mathrm{Fe}]} \approx -0.15$ dex indicates a slight deficiency in carbon plus nitrogen with respect to the Sun, similar to the deficiencies found in Galactic supergiants and Orion. Lithium has been detected in all the program stars, reaching ϵ(Li)=0.6 dex for two stars.

Accepted by A&A

For preprints contact: Vanessa.Hill@obspm.fr

For preprints via anonymous ftp: ftp.obspm.fr in transit/hill

Young Cool Stars in the Solar Neighbourhood

Michael F. Sterzik[1] and Jürgen H.M.M. Schmitt[1]

[1]Max-Planck Institut f. Extraterrestrische Physik, 85740 Garching, Germany

We present evidence for a bimodal distribution of the coronal activity for a sample of 802 cool ($B - V > 0.5$) stars within 25 *pc* of the sun. The X-ray data obtained during the ROSAT all-sky survey resemble a characteristic activity gap found in former surveys of Ca II H+K chromospheric emission. Coronal activity as expressed with $\log L_X/L_{bol}$ is shown to correlate with the chromospheric activity indicator R'_{HK}. The coronal most active objects also exhibit the largest Li I equivalent widths and are probably young. Our observations suggest that we can efficiently single out the youngest objects in the vicinity of the sun on the basis of their characteristic levels of coronal activity. Young, late-type stars are abundant in the solar neighbourhood.

Accepted by AJ

For preprints contact: sterzik@mpe-garching.mpg.de

For preprints via ftp or WWW: ftp://hpth03.mpe-garching.mpg.de/pub/gliese

A New Benchmark Brown Dwarf

C.G. Tinney[1], X. Delfosse[2], and T. Forveille[2]

[1] Anglo-Australian Observatory, PO Box 296, Epping. 2121. Australia
[2] Observatoire de Grenoble, 414 rue de la Piscine, Domaine Universitaire de St. Martin d'Hères, F-38041 Grenoble, France

We present optical spectroscopy of three brown dwarf candidates identified in the first 1% of the DENIS sky survey. Low resolution spectra from 6430–9150 Å show these objects to have similar spectra to the uncertain brown dwarf candidate GD 165B. High resolution spectroscopy shows that one of the objects – DBD 1228-1547 – has a strong 2.3±0.05 Å equivalent width absorption line of Li I 6708 Å, and is therefore a brown dwarf with mass below 0.065 $M_\odot$, and age $\lesssim$ 1.5 Gyr. DBD 1228-1547 can now be the considered proto-type for brown dwarfs close to the hydrogen burning limit.

Submitted to ApJ Letters

For preprints contact: cgt@aaoepp.aao.gov.au

For preprints via WWW: http://www.aao.gov.au/local/www/cgt/aaoarea/preprints.html

The Rise and Fall of the NaMgAl Stars

Jocelyn Tomkin[1], Bengt Edvardsson[2], David L. Lambert[1] and Bengt Gustafsson[2]

[1] McDonald Observatory and Department of Astronomy, University of Texas, Austin, Texas 78712-1083, USA
[2] Uppsala Astronomical Observatory, Box 515, S-751 20 Uppsala, Sweden

We have made new abundance determinations for a sample of NaMgAl stars. These stars, which are a subgroup of the nearby metal-rich field F and G disk dwarfs, were first identified by Edvardsson et al. (1993, A&A, 275, 101) on the basis of their apparent enrichment in Na, Mg and Al relative to other elements. The discovery of a planetary companion to the nearby solar type star 51 Peg (Mayor & Queloz, 1995, Nature, 378, 355) combined with Edvardsson et al.'s earlier identification of 51 Peg as a NaMgAl star highlighted the group's potential importance. Our new analysis, which uses new spectra of higher resolution and better wavelength coverage than the analysis of Edvardsson et al., shows that the Na, Mg and Al abundances of the NaMgAl stars are indistinguishable from those of non-NaMgAl stars with otherwise similar properties. The group thus appears to be spurious.

Our study, which includes 51 Peg, also provides the most complete set of abundances for this star available to date. The new Fe abundance, $[Fe/H] = +0.20 \pm 0.07$, of 51 Peg confirms earlier measurements of its metal richness. Abundances for 19 other elements, including C, N and O, reveal a fairly uniform enrichment similar to that of Fe and show no evidence of abnormality compared to other metal rich stars of similar spectral type.

Accepted by A&A

For preprints contact: jt@alexis.as.utexas.edu

X-ray Activity in the Open Cluster IC 4665

Mark S. Giampapa[1], Charles F. Prosser[2] and Thomas A. Fleming[3]

[1] National Optical Astronomy Observatories, National Solar Observatory, P. O. Box 26732, Tucson, AZ 85726-6732 USA

[2] Harvard-Smithsonian Center for Astrophysics, 60 Garden St. MS-66, Cambridge, MA 02138 USA

[3] Steward Observatory, University of Arizona, Tucson, AZ 85721 USA

We present the results of a joint *ROSAT* High Resolution Imager (HRI) and optical investigation of the open cluster IC 4665. The *ROSAT* data-set contains detections for 28 stellar sources in the field, including 22 cluster members and candidate members spanning the color range -0.18 $\leq$ $(B-V)_{\rm o}$ $\leq$ +1.63 ($\sim$ B3 - M3). Upper limits are given for the remaining members (or candidate members) in the HRI field. Keck HIRES spectra have been obtained that yield radial and rotational velocity measures, respectively, for faint, low mass candidate members located within the field of the *ROSAT* HRI observation. In addition, photometry of possible optical counterparts to previously uncatalogued X-ray sources in the HRI field is presented.

The trends in X-ray properties with $(B-V)$ color in IC 4665 are found to be quite similar to that for other, more nearby young clusters such as the Pleiades and α Persei. In particular, a maximum in normalized X-ray luminosity of log (L_x/L_{bol}) $\simeq$ -3 is observed, beginning in the color range of $(B-V)_{\rm o}$ = 0.7 - 0.8. This is similar to the corresponding color range among Pleiades members, in agreement with the earlier estimate by Prosser & Giampapa (1994) that the age of IC 4665 is similar to the age of the Pleiades. The correlation of rotation and X-ray emission levels is consistent with that in other young clusters.

Among the high mass stars in IC 4665, five B stars are detected as X-ray sources. Of these, one is a spectroscopic binary while the remaining objects are apparently single stars. The level of intrinsic X-ray emission observed in the rapidly rotating (v sin$i$ $>$ 200 km s^{-1}), single B stars is consistent with an origin due to shock heating of the ambient medium by radiatively driven, rotationally enhanced winds. On the basis of these observations and the results for other clusters, we argue that observed levels of X-ray emission in high mass stars of log (L_x/L_{bol}) $>$ -6.0 are likely due to intrinsic emission associated with the B star itself rather than emission from a late-type secondary. Finally, our results suggest that the initial angular momentum distributions and the subsequent evolution of rotation, L_x, and (L_x/L_{bol}) occur in practically identical fashions in clusters with ages $\lesssim$ 100 Myr.

Submitted to ApJ

For preprints contact: giampapa@noao.edu

Digging Deeper in the Coronal Graveyard

Thomas R. Ayres[1], Alexander Brown[1], G. M. Harper[1], P. D. Bennett[1], J. L. Linsky[2], K. G. Carpenter[3], and R. D. Robinson[4]

[1] Center for Astrophysics and Space Astronomy, University of Colorado, CB-389 [CASA], Boulder, CO 80309

[2] JILA, University of Colorado, CB-440 [JILA], Boulder, CO 80309

[3] Laboratory for Astronomy and Solar Physics, Code 681, NASA Goddard Space Flight Center, Greenbelt, MD 20771

[4] Astronomy Programs, CSC, Code 681, NASA Goddard Space Flight Center, Greenbelt, MD 20771

Soft X-ray detections of stellar coronae ($T{\sim}10^6$ K) are rare in the giant branch redward of $\sim$K1 III. We have conducted a less direct—but more sensitive—search, using *HST*/GHRS to probe for far-ultraviolet proxies of the hot coronal gas in representative "noncoronal" red giants. In every target so far examined we find weak, but statistically significant, Si IV emission; commonly also C IV, and in some cases N V. Si IV is not affected by the CNO anomalies produced by the first dredge-up which can deplete the carbon abundance and weaken C IV. In the low-activity giants, the λ1393 component of the Si IV doublet must be corrected for sharp absorptions, that we believe are due to carbon monoxide in overlying cool material.

The normalized flux ratios ($\mathcal{R}{\equiv}f/f_{\rm bol}$) of Si IV and X-rays among the "coronal" yellow giants (lying just blueward of the "noncoronal" zone) fall on a uniform track: $\mathcal{R}_{\rm X}{\sim}\mathcal{R}^2_{\rm Si\,IV}$. In the "noncoronal" zone, however, the Si IV index is nearly constant ($\mathcal{R}_{\rm Si\,IV}{\sim}10^{-8}$), independent of $\mathcal{R}_{\rm X}$ (which ranges from $\sim10^{-8}$ to $<10^{-10}$). The mechanism that diminishes X-ray activity in the red giants is highly sensitive to an as yet unidentified stellar property. Photoelectric

absorption by cool gas might play a more important role than previously suspected, particularly if hot magnetic loops are partly or completely buried in the chromosphere.

Accepted by ApJ

For preprints contact: ayres@vulcan.colorado.edu

For preprints via anonymous ftp: casa.colorado.edu /pub/ayres CORONAL_GRAVEYARD_REVISED.PS

Keck HIRES Spectra of the Field Brown Dwarf DBD J1228-1547

E.L. Martín[1,2], G. Basri[1], X. Delfosse[3] and T. Forveille[3]

[1] Dept. of Astronomy, 601 Campbell Hall, Univ. of California, Berkeley, CA 94720 USA

[2] Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain

[3] Laboratoire d'Astrophysique, Observatoire de Grenoble, 414 rue de la piscine, B.P.53X, 38041 Grenoble cedex, France

We report 10m-Keck echelle high-resolution spectroscopic observations of two very cool field dwarfs recently discovered by the near-infrared photometric survey DENIS. One of them, DBD J1228-1547, shows a conspicuous LiI resonance line that confirms it as an incontrovertible brown dwarf. From its high Li abundance and low T_{eff}, its mass is inferred to be below about 60 jupiters and its age is probably younger than $\sim 10^9$ years. The other DENIS object does not show a detectable LiI line in our data, probably due to convective depletion. We estimate its mass to be in the range 60 to 75 jupiters. Both objects show the strongest and broadest resonance line profiles from low ionization species ever seen. The extreme breadth of the KI lines are good further indicators of the expected high gravity in very low-mass dwarfs. We suggest a new spectral class, "L", for objects cooler than M-type (as these are). The radial velocities of both objects are modest, suggesting that they are kinematically young. They have rotational v sin$i$ in the range 20–30 km s^{-1}. The confirmation of at least one brown dwarf in only $\sim$1% of the final DENIS survey is a strong indication of the presence of a numerous population of free-floating substellar objects in the solar neighborhood.

Submitted to A&A Letters

For preprints contact: ege@popsicle.berkeley.edu

The HIPPARCOS Hertzsprung-Russell Diagram of S Stars: Probing Nucleosynthesis and Dredge-up

S. Van Eck[1], A. Jorissen[1], S. Udry[2], M. Mayor[2] and B. Pernier[2]

[1] Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles, C.P. 226, Boulevard du Triomphe, B-1050 Bruxelles, Belgium

[2] Observatoire de Genève, 51 Chemin des Maillettes, CH-1290 Sauverny, Switzerland

HIPPARCOS trigonometrical parallaxes make it possible to compare the location of Tc-rich and Tc-poor S stars in the Hertzsprung-Russell (HR) diagram: Tc-rich S stars are found to be cooler and intrinsically brighter than Tc-poor S stars. The comparison with the Geneva evolutionary tracks reveals that the line marking the onset of thermal pulses on the asymptotic giant branch (AGB) matches well the observed limit between Tc-poor and Tc-rich S stars. Tc-rich S stars are, as expected, identified with thermally-pulsing AGB stars of low and intermediate masses, whereas Tc-poor S stars comprise mostly low-mass stars (with the exception of 57 Peg) located either on the red giant branch or on the early AGB. Like barium stars, Tc-poor S stars are known to belong exclusively to binary systems, and their location in the HR diagram is consistent with the average mass of 1.6 ± 0.2 $M_\odot$ derived from their orbital mass-function distribution. A comparison with the S stars identified in the Magellanic Clouds and in the Fornax dwarf elliptical galaxy reveals that they have luminosities similar to the galactic Tc-rich S stars. However, most of the surveys of S stars in the external systems did not reach the lower luminosities at which galactic Tc-poor S stars are found. The deep Westerlund survey of carbon stars in the SMC uncovered a family of faint carbon stars that may be the analogues of the low-luminosity, galactic Tc-poor S stars.

Accepted by A&A

For preprints contact: svaneck@astro.ulb.ac.be

For preprints via WWW: http://astro.ulb.ac.be/iaa.htm

Field Brown Dwarfs Found by DENIS

X. Delfosse[1], C.G. Tinney[2], T. Forveille[1], N. Epchtein[3], E. Bertin[4,5,6], J. Borsenberger[4], E. Copet[3], B. de Batz[3], P. Fouqué[3,6], S. Kimeswenger[7], T. Le Bertre[3], F. Lacombe[3], D. Rouan[3], D. Tiphène[3]

[1] Observatoire de Grenoble, 414 rue de la Piscine, Domaine Universitaire de St. Martin d'Hères, F-38041 Grenoble, France

[2] Anglo-Australian Observatory, PO Box 296, Epping. N.S.W. 2121. Australia

[3] Observatoire de Paris, 5, Place Jules Janssen, 92195 Meudon Cedex, France

[4] Institut d'Astrophysique de Paris, 98bis, Bd Arago, 75014 Paris France

[5] Sterrewacht Leiden, University of Leiden, Niels Bohrweg 2, 2333 CA Leiden, The Netherlands

[6] European Southern Observatory, Casilla 19001, Santiago 19, Chile

[7] Institut für Astronomie der Universität Innsbruck, Technikerstr. 25, A-6020 Innsbruck, Austria

We present three candidate *field* Brown Dwarfs, identified by the DENIS survey. This on-going three colour survey of the southern sky has, as of July 1997, covered over 30% of the southern hemisphere in the I, J and K_{short} passbands. The enormous sampled volume makes DENIS ideal for detecting Brown Dwarfs. The present results are based on preliminary processing of about 230 square degrees of DENIS data – a small fraction of the existing sky coverage. This reveals a sizeable population of very cold dwarfs, three of which are at least as red as, and significantly brighter than, GD 165B. Infrared spectra confirm their dwarf status, and provide effective temperature information. One object (DBD J1058-1548) is comparable in temperature to GD 165B. A second (DBD J1228-1547) is slightly cooler, while a third (DBD J0205-1159) is significantly so – though not as cold as Gl 229B. The infrared spectrum of DBD J0205-1159 shows evidence for a methane absorption band, which implies an effective temperature much below the stellar limit. Lastly, recent detections of lithium in DBD J1228-1547 have proven it to have a substellar mass. This makes it the first *bona-fide, isolated, field* brown dwarf.

Submitted to A&A

For preprints contact: Xavier.Delfosse@obs.ujf-grenoble.fr

For preprints via ftp or WWW: ftp laog.obs.ujf-grenoble.fr (cd pub/publications/letter_denis/)

Radio Emission from ROSAT Discovered Young Stars in and Around Taurus-Auriga

Lee Carkner[1], Eric Mamajek[1], Eric Feigelson[1], Ralph Neuhäuser[2], Rainer Wichmann[3] and Joachim Krautter[3]

[1] Department of Astronomy & Astrophysics, Pennsylvania State University, University Park PA 16802

[2] Max-Planck-Institut für extraterrestrische Physik, D-85740 Garching, Germany

[3] Landessternwarte Königstuhl, D-69117 Heidelberg, Germany

An 8.4 GHz VLA survey of 91 recently discovered lithium-rich late-type stars from the *ROSAT* All-Sky Survey and pointed observations is presented. These objects lie in the vicinity of the Taurus-Auriga star-forming region (d $\simeq$ 140 pc), however some are dispersed nearly 30° from known active star-forming cloud cores. This sample represents a spatially-complete, flux-limited population of X-ray bright young stars both within and away from the primary Tau-Aur stellar nurseries. Of the 91 sources, 29 are detected in this radio survey with a sensitivity limit of ∼0.15 mJy. If they are at the distance of the star forming clouds, we find 32% of widely distributed young stars with $L_X \geq 5\times10^{28}$ ergs s^{-1} have radio luminosity densities in excess of 3.5×10^{15} erg $s^{-1}Hz^{-1}$. This detection rate, the ranges of radio and X-ray luminosities and L_R/L_X ratios are consistent with known young weak-lined T Tauri stars (ages $\sim 10^6$ yr) which reside *within* the Taurus molecular clouds, but is considerably higher than a zero-age main sequence population such as the Pleiades (age $\simeq 7\times10^7$ yr). The radio properties thus support the pre-main sequence classification of the stars. They fit well among other active young stars on the empirical L_R vs. L_X diagram, implying that solar type gyro-synchrotron activity is the radio emission mechanism.

Accepted by ApJ

For preprints contact: acarkner@astro.psu.edu

For preprints via ftp or WWW: http://www.astro.psu.edu/users/carkner/ttauri/intro.html

An Upper Bound to the Solar Oblateness

J.P. Rozelot[1] **and J. Rösch**[2]

[1] Observatoire de la Côte d'Azur, CERGA, av. Copernic, 06 130 Grasse, France
[2] Observatoire Midi-Pyrénées, 65 200 Bagnères de Bigorre, France

For more than a decade, it has been suggested that the shape of the Sun may vary in time. This not only concerns variations of the equatorial diameter, but also the oblateness. Thus the complete geometry of the Sun is maybe not so perfect. The aim of this paper is to briefly review up to now the figure of the Sun, and to emphazise some astrophysical consequences.

To sum up over the last 15 years, the amplitude of the observed variations of the solar radius made at the Calern Observatory (France) does not exceed 0.7" and has been probably less (0.3") during the last five years. Recently, new measurements of the solar oblateness made at the Pic du Midi Observatory (France) seem to confirm a possible oscillation with the solar cycle as previously conjectured by a Princeton's group. Furthermore, an upper bound to the solar oblateness can be derived from the observations and compared with the theoretical computations of the angular momentum of the Sun.

Let us mention that between July 1993 and July 1994 the reported mean value difference between the equatorial radius and the polar one is 11.5 ± 3.4 arc ms, (or $\epsilon = (1.20 \pm 0.34)\ .\ 10^{-5}$) consistent with previous observations. Effects of the atmosphere are briefly discussed. From the observed values of the quadrupole moment of the Sun here reviewed from 1902 to present, it can be concluded that the shape of the helioïd is not really neither spherical nor oblate. A bump seems to occur in the royal zones and a depletion is observed at a latitude of about (70°). Helioseismic measurements should eventually place useful limits on the strength and uniformity of the internal magnetic fields which may be responsible to the solar surface changes on different oscillation modes.

A knowledge of the physical character of such an oscillation of the geometry of the Sun is still pending (rapidly rotating core?), as well as the question of this out-of-round of our nearby star. However, correlation of the data with the solar irradiance variations may produce a forecasting model of the Sun, helpful to study, among other problems, the response on the Earth climatic system.

Accepted by Solar Physics (vol. 172)

For preprints contact: rozelot@obs-azur.fr

Upcoming Meetings

THE SECOND ANNUAL LOWELL OBSERVATORY FALL WORKSHOP
"Solar Analogs: Characteristics and Optimum Candidates"

Lowell Observatory, Flagstaff, Arizona, USA
October 5-7, 1997
Jeffrey C. Hall, G. Wesley Lockwood (Lowell),
and Richard R. Radick (NOAO/Sac Peak), SOC

http://www.lowell.edu/users/jch/workshop/analogs.html

THIRD ANNOUNCEMENT and CALL FOR PAPERS

This is the third and final general announcement for the the Second Annual Lowell Observatory Fall Workshop, which will focus on solar-analogous stars and the selection of optimum solar analog candidates. The goal of this workshop is to identify the very best solar-analogous stars, on the basis of as broad a set of solar and stellar characteristics as possible.

On Monday, October 6, our speakers will present a complete review of issues relevant to the selection of solar-analogous stars. The final list of speakers is Drs. Karen Harvey, Gary Rottman, David Soderblom, Ed Guinan, Richard Radick, Sallie Baliunas, Mark Giampapa, Giusa Cayrel, and Irina Glushneva.

The second day of the workshop will be entirely devoted to discussion and working group sessions. The day will begin with a panel discussion; our panelists will review what they have heard on the previous day and offer their opinions regarding essential considerations for selecting solar-analogous stars. The current panel includes Drs. Thomas Ayres, Robert Garrison, Dimitri Mihalas, Sabatino Sofia, and Richard Wade. During the small working group sessions and the plenary session that will follow, all attendees will have time to air their views and evaluate specific stars as solar analog candidates. Panelists will moderate the working groups; Dr. O. R. White will moderate the concluding plenary session.

We invite poster contributions. Your poster will be on display throughout the meeting. We encourage the presentation of specific data that may be of aid during the Tuesday working sessions.

Special events include: (1) excursions to northern Arizona points of interest during the day on Sunday, October 5, (2) an opening reception Sunday evening, and (3) the workshop dinner under the stars (though probably with an intervening tent) at Lowell's dark-sky site outside of Flagstaff.

The registration fee of $70 will cover all your meeting materials, attendance at the opening reception, refreshments and coffee on both days, catered lunches on both days, and the Monday night dinner. Proceedings will be published electronically, and you will be able to obtain them at no cost.

We invite all interested scientists to visit our meeting Web site at

http://www.lowell.edu/users/jch/workshop/analogs.html.

You will find complete meeting details, as well as an on-line registration form. Registration is limited due to the size of our meeting facilities, so please register early. THE REGISTRATION DEADLINE IS FRIDAY, SEPTEMBER 5, 1997. We have booked blocks of rooms for approximately $49/night at two Flagstaff hotels; these rooms are first-come first-served as well.

If you have questions or wish further information, please contact Jeffrey Hall or Wes Lockwood (jch@lowell.edu, gwl@lowell.edu); there is also an email response link at the Web site.

Job Announcement

Postdoctoral Research Assistant in Astrophysics

Dept. of Physics - UMIST
Manchester, UK
UMIST

The Astrophysics Group within the Department of Physics at UMIST has an opening for a Post-Doctoral Research Assistant in the field of Molecular Astrophysics, starting in January 1998, for a period of at least two years.

The Group, which includes I Cherchneff, G A Fuller, T J Millar and A Zijlstra, has research interests in all branches of molecular astrophysics including the physics and chemistry of interstellar clouds and circumstellar regions, dust formation in the late stages of stellar evolution, the properties of interstellar dust and the dynamics of outflows and jets from young stars.

The successful applicant will work with Professor T J Millar and Dr I M Cherchneff in the field of molecular astrophysics related to the circumstellar environments of evolved stars. Applications are encouraged from those with a strong interest in theory but applicants with an observational background will also be considered.

The appointment will be at the lower end of the PDRA 1A research scale. Applicants should send a letter outlining their research interests, a CV, and the names and addresses of two referees, to Professor T J Millar, Department of Physics, UMIST, PO Box 88, Manchester M60 1QD, UK (Tel. 0161-200-3677, e-mail: tjm@ast.phy.umist.ac.uk) before 15 October 1997. Further information on the Astrophysics Group can be found on our Web page at http://saturn.phy.umist.ac.uk:8000/

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. 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 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. 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 .`