COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

No. 38 — February 1999 Editor: Steve Skinner (coolnews@jila.colorado.edu)

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Stellar Abstracts

Do S Stars Show Strong Silicate Dust Emission

T. Lloyd Evans [1], and I.R. Little–Marenin[2]

[1] South African Astronomical Observatory, PO Box 9, Observatory 7935, South Africa
[2] CASA, CB 389, University of Colorado, Boulder, CO 80309, USA

S stars are generally regarded as intermediate between M and carbon stars in their properties, including the composition of their circumstellar material, as befits stars having an intermediate level of C/O enhancement. The existence of several stars with optical S classification but very strong silicate dust emission at 10 μm presents an anomaly. One suggestion was that these stars are intermediate between M stars and the ^{13}C-rich carbon stars with silicate dust emission from circumstellar material. However, new optical spectra show that these stars are either M stars or marginal MS stars, so that silicate dust emission declines along the $M \rightarrow MS \rightarrow S$ sequence and is not present in C stars with the exception of a few J-type silicate-carbon stars.

Accepted by MNRAS

For preprints contact: tle@da.saao.ac.za

Eclipsing Behaviour of the Radio Emission in the Algol System V505 Sagitarii

A. G. Gunn[1], P. A. Brady[1], V. Migenes[2], R. E. Spencer[1] and J. G. Doyle[3]

[1] University of Manchester, Nuffield Radio Astronomy Laboratories, Jodrell Bank, Lower Withington, Cheshire, SK11 9DG, UK
[2] ATNF, P. O. Box 76, Epping, NSW 2121, Australia
[3] Armagh Observatory, College Hill, Armagh, BT61 9DG, N. Ireland

We present radio interferometric observations of the EA2 Algol-type binary system V505 Sagitarii made with the ATNF Compact Array at 6 cm and 3.6 cm over one orbital cycle (1.18 days). We obtained a strong detection of the source (1.5 mJy at 6 cm and 1.4 mJy at 3.6 cm) and derive a brightness temperature for the emitting region of $T_b \sim$

2.7 10^9 K, a magnetic field strength of 17 G $< B <$ 170 G and an electron density of $N_e \sim 3.7\ 10^8$ cm^{-3}. The radio flux density levels show a clear modulation with evidence of eclipses of the emission region at both conjunctions of the binary. The form of the light curve implies that the radio source involves at least some enhanced emission in the intra-binary region. This has important consequences for the details of coronal formation and field interaction in active close binary stars. We discuss some scenarios for the formation of intra-binary active regions in Algol-type binary systems.

Accepted by MNRAS

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X-ray Observations of the Young Open Cluster Blanco 1

G. Micela[1], S. Sciortino[1], F. Favata[2], R. Pallavicini[1], and J. Pye[3]

[1] Osservatorio Astronomico di Palermo, Palazzo dei Normanni, 90134 Palermo, Italy

[2] Astrophysics Division – Space Science Department of ESA, ESTEC, Postbus 299, NL-2200 AG Noordwijk, The Netherlands

[3] Department of Physics and Astronomy, Leicester University, UK

We present results from two deep ROSAT HRI exposures on the Blanco 1 open cluster. Blanco 1 is one of the few open clusters at large distance from the Galactic Plane. This circumstance has suggested that it may have formed through a mechanism different from that responsible for the other nearby clusters. The age of Blanco 1 is rather uncertain since, depending on the adopted age indicator, it ranges between 30 and 90 Myr. Many cluster members show chromospheric emission typical of young stars. The X-ray observations presented here reveal a high number of X-ray sources, consistent with the young age of the cluster. The typical X-ray luminosity of the cluster members is consistent with that of the Pleiades and significantly lower than the α Per members. These results suggest than the age of Blanco 1 is more similar to the age of the Pleiades than to that of α Per.

The time sampling of the X-ray observations allows us to study the variability of the sources on time scales from hours to 6 months – 1 year.

Accepted by A&A

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Rotational Modulation of X-ray flares on Late-type Stars: T Tauri Stars and Algol

B. Stelzer[1], R. Neuhaeuser[1], S. Casanova[2], T. Montmerle[2]

[1] MPI für extraterrestrische Physik, Giessenbachstraße 1, D-85740 Garching, Germany

[2] Service d'Astrophysique, CEA Saclay, F-91191 Gif-sur-Ivette, France

We present evidence for rotational modulation of X-ray flares by an analysis of four outbursts on late-type stars. Two of the flares we discuss are found in *ROSAT* observations of T Tauri Stars and were obtained between September and October 1991. A flare on the T Tauri Star V773 Tau was observed by *ASCA* in September 1995. To this sample we add a *Ginga* observation of a flare on Algol observed in January 1989.

The structure of the X-ray lightcurves observed in this selection of flare events is untypical in that the maximum emission extends over several hours producing a round hump in the lightcurve instead of a sharp peak. We explain this deviation from the standard shape of a flare lightcurve as the result of a flare erupting on the back side of the star and gradually moving into the line of sight due to the star's rotation. Making use of the known rotational periods of the stars our model allows to determine the decay timescale of the flares and the size of the X-ray emitting volume according to the standard magnetic loop model. Spectral information, which is available in sufficient quality for the Algol observation only, supports our proposition that changes of the visible volume are responsible for the observed time development of these flares.

Accepted by A&A

For preprints contact: stelzer@xray.mpe.mpg.de

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Modelling the Sun as an Active Star I. A Diagnosis of Photometric Starspot Models

K. Oláh[1], L. van Driel-Gesztelyi[1],[2], Zs. Kővári[1] and J. Bartus[1]

[1] Konkoly Observatory of the Hungarian Academy of Sciences, H-1525 Budapest, Hungary
[2] Observatoire de Paris, DASOP, F-92195 Meudon Cedex, France

We provide a diagnosis of photometric starspot models through modelling active areas on the Sun using softwares originally written for starspot modelling. The data we used were one-dimensional measurements of the Sun in radio (10.7cm, DRAO, Canada) and in soft X-rays (GOES satellites). In these wavelengths the response to magnetic activity results in similar amplitude variability on the Sun to those we attribute to starspots in visual wavelengths. The modelling results were compared with contemporaneous direct images (obtained at Nobeyama, Japan and with the Yohkoh and SOHO spacecraft).

We found that: *a)* knowing well the basic physical parameters of a star, the resulting total spotted area is a fairly good approximation of the reality, thus making sense of photometric starspot modelling; *b)* long-term variability coupled with the rotational modulation may result in artificially high latitude spots; *c)* in two- or multi-spot models a resulting small spot can account for short living spots; *d)* systematic change in spot size could be partially due to flux ratio changes. The contrast between the studied bright active region and the undisturbed area on the Sun decreased in time following roughly a power law. At the same time, the emission measure of the active region's core similarly decreased.

Accepted by A&A

For preprints contact: olah@buda.konkoly.hu

Coronal and Transition Region Structure in the RS CVn Binaries V711 Tau, AR Lac and II Peg. II. Energy Balance Models

N. W. Griffiths[1]

[1] Experimental Astrophysics Group, Space Sciences Laboratory, University of California, Berkeley, CA 94720-7450 [formerly Department of Physics (Theoretical Physics), University of Oxford, UK]

Models for the upper transition regions and coronae of the RS CVn binaries V711 Tau, AR Lac and II Peg are presented. Empirical emission measure distributions discussed in Griffiths & Jordan (1998) are compared with those from theoretical models that assume an energy balance between optically thin radiative losses and conductive heating. The inadequacies of spherically symmetric, gravitationally bound models are highlighted, and this study focuses instead on energy balance solutions in magnetic loop geometries. The loop models reproduce the observed emission measure distributions and electron densities using two families of structures. The hotter loops have peak temperatures of $\log T_e \sim 7.35$ and a height of $\sim 0.05R_\star$, whereas the cooler loops have peak temperatures of $\log T_e \sim 6.9$ and a height of $\sim 0.15R_\star$. The area coverage of the loops is consistent with photospheric spot patterns determined from photometry and Doppler Imaging techniques, and the magnetic field strengths required to heat these loops agree with measured values. The ratio of conductive and radiative fluxes in the loop models are close to the value for a stable minimum energy loss solution. Possible variations in the stellar Fe abundance, and its implications for the loop models, are also discussed.

Accepted by ApJ

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Brightness Distribution Across the Disk of a Red Giant from Gravitational Microlensing Observations

M.B.Bogdanov[1] and A.M.Cherepashchuk[2]

[1] Saratov State University, Bolschaya Kazachiya st. 112-a, Saratov, 410026 Russia
[2] Sternberg Astronomical Institute, Universitetskii pr. 13, Moscow, 119899 Russia

The gravitational microlensing event MACHO Alert 95-30 has been observed for an M4III giant of the Galactic

bulge by MACHO and GMAN collaborations. Alcock at al.(Astrophys.J. 1997. V.491. P.436) have measured the angular diameter of this star in units of the lens's Einstein cone radius assuming a nonlinear law of the center-to-limb darkening for the plane-parallel photosphere model. It is known, however, that the red giants must possess of extended photospheres. Therefore usual linear or nonlinear laws of the darkening are incorrect for these objects.

We present the result of an analysis of these observations by the method of brightness distribution reconstruction. Assuming the case of circular symmetry, the radial brightness distribution across the stellar disk can be connected with the microlensing light curve by means of a Fredholm integral equation of the 1st kind. The search of solution of the ill-posed inverse problem for this equation has been carried out in the class of nonnegative functions that do not increase with increasing distance from the center of stellar disk.

The result of the reconstruction does not contradict the model fitting data. It appears that the extension of the stellar photosphere is small enough. This conclusion agrees qualitatively with the results of photosphere model calculations for red giants.

Accepted by Astronomy Reports

For preprints contact: bogdanov.ge.sgu@oda.ssu.runnet.ru

X-ray Observations of the Young Open Cluster Blanco 1

G. Micela[1], S. Sciortino[1], F. Favata[2], R. Pallavicini[1], and J. Pye[3]

[1] Osservatorio Astronomico di Palermo, Palazzo dei Normanni, 90134 Palermo, Italy
[2] Astrophysics Division – Space Science Department of ESA, ESTEC, Postbus 299, NL-2200 AG Noordwijk, The Netherlands
[3] Department of Physics and Astronomy, Leicester University, UK

We present results from two deep ROSAT HRI exposures on the Blanco 1 open cluster. Blanco 1 is one of the few open clusters at large distance from the Galactic Plane. This circumstance has suggested that it may have formed through a mechanism different from that responsible for the other nearby clusters. The age of Blanco 1 is rather uncertain since, depending on the adopted age indicator, it ranges between 30 and 90 Myr. Many cluster members show chromospheric emission typical of young stars. The X-ray observations presented here reveal a high number of X-ray sources, consistent with the young age of the cluster. The typical X-ray luminosity of the cluster members is consistent with that of the Pleiades and significantly lower than the α Per members. These results suggest than the age of Blanco 1 is more similar to the age of the Pleiades than to that of α Per.

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Library of Medium-resolution Fiber Optic Echelle Spectra of F, G, K, and M Field Dwarfs to Giant Stars

D. Montes[1,2], L.W. Ramsey[2] A.D. Welty[3]

[1]Departamento de Astrofísica, Facultad de Físicas, Universidad Complutense de Madrid, E-28040 Madrid, Spain
[2]Pennsylvania State University, Dept. of Astronomy & Astrophisics, 525 Davey Lab, University Park, PA 16802, USA
[3]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA

We present a library of Penn State Fiber Optic Echelle (FOE) observations of a sample of field stars with spectral types F to M and luminosity classes V to I. The spectral coverage is from 3800 Å to 10000 Å with nominal a resolving power 12000. These spectra include many of the spectral lines most widely used as optical and near-infrared indicators of chromospheric activity such as the Balmer lines (Hα to Hϵ), Ca II H & K, Mg I b triplet, Na I D_1, D_2, He I D_3, and Ca II IRT lines. There are also a large number of photospheric lines, which can also be affected by chromospheric activity, and temperature sensitive photospheric features such as TiO bands. The spectra have been compiled with the goal of providing a set of standards observed at medium resolution. We have extensively used such data for the

study of active chromosphere stars by applying a spectral subtraction technique. However, the data set presented here can also be utilized in a wide variety of ways ranging from radial velocity templates to study of variable stars and stellar population synthesis. This library can also be used for spectral classification purposes and determination of atmospheric parameters ($T_{\rm eff}$, $\log g$, [Fe/H]). A digital version of all the fully reduced spectra is available via ftp and the World Wide Web (WWW) in FITS format.

Accepted by ApJ Supp.

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Solar Abstracts

Spectroscopic Constraints on Models of Ion-Cyclotron Resonance Heating in the Polar Solar Corona and High Speed Solar Wind

Steven R. Cranmer[1], George B. Field[1] and John L. Kohl[1]

[1] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA

Using empirical ion velocity distributions derived from UVCS and SUMER ultraviolet spectroscopy, we construct theoretical models of the nonequilibrium plasma state of the polar solar corona. The primary energy deposition mechanism we investigate is the dissipation of high frequency (10–10000 Hz) ion-cyclotron resonant Alfvén waves which can heat and accelerate ions differently depending on their charge and mass. We solve the internal energy conservation equations for the ion temperature components parallel and perpendicular to the superradially expanding magnetic field lines and use empirical constraints for the remaining parameters. We find that it is possible to explain many of the kinetic properties of the plasma (such as high perpendicular ion temperatures and strong temperature anisotropies) with relatively small amplitudes for the resonant waves. There is suggestive evidence for steepening of the Alfvén wave spectrum between the coronal base and the largest heights observed spectroscopically, and it is important to take Coulomb collisions into account to understand observations at the lowest heights. Because the ion-cyclotron wave dissipation is rapid, the extended heating seems to demand a constantly replenished population of waves over several solar radii. This indicates that the waves are generated gradually throughout the wind rather than propagated up from the base of the corona.

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For preprints contact: scranmer@cfa.harvard.edu

For preprints via WWW: http://cfa-www.harvard.edu/~scranmer/cranmer_preprint.html

The Pressure Limitations on Flux Pile-Up Reconnection

Yuri E. Litvinenko[1]

[1] Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, NH 03824-3525, USA

The problem of the plasma pressure limitations on the rapidity of flux pile-up magnetic reconnection is re-examined, following the claim made by Jardine and Allen (1998) that the limitations can be removed by relaxing the assumption of zero-vorticity two-dimensional plasma flows. It is shown that for a two-dimensional stagnation point flow with nonzero vorticity the magnetic merging rate cannot exceed the Sweet–Parker scaling in a low-beta plasma. The pressure limitation appears to be much less restrictive for weak three-dimensional flux pile-up, provided the perturbation length scale in the third dimension is much less than the global length scale. The actual reconnection rate in the latter case, however, is much lower than this upper estimate unless the current sheet width is also much less than the global scale.

Accepted by Solar Physics

For preprints contact: yuri.litvinenko@unh.edu

Search for X-ray Emission from Bona-fide and Candidate Brown Dwarfs

R. Neuhäuser[1], C. Briceño[2], F. Comerón[3], T. Hearty[1], E.L. Martín[4], J.H.M.M. Schmitt[5], B. Stelzer[1], R. Supper[1], W. Voges[1], and H. Zinnecker[6]

[1] MPI für extraterrestrische Physik, Giessenbachstraße 1, D-85740 Garching, Germany
[2] Yale University, Department of Physics, New Haven, CT 06520-8121, USA
[3] European Southern Observatory, D-85748 Garching, Germany
[4] Astronomy Department, University of California at Berkeley, Berkeley, CA 94720, USA
[5] Universität Hamburg, Sternwarte, Gojensbergweg 112, D-21029 Hamburg, Germany
[6] Astrophysikalisches Institut, An der Sternwarte 16, D-14482 Potsdam, Germany

Following the recent classification of the X-ray detected object V410 x-ray 3 with a young brown dwarf candidate (Briceño et al. 1998) and the identification of an X-ray source in Chamaeleon as young bona-fide brown dwarf (Neuhäuser & Comerón 1998), we investigate all ROSAT All-Sky Survey and archived ROSAT PSPC and HRI pointed observations with bona-fide or candidate brown dwarfs in the field of view with exposure times ranging from 0.13 to 221 ks, including dedicated 64 ks and 42 ks deep ROSAT HRI pointed observations on the low-mass star BRI 0021−0214 and the brown dwarf Calar 3, respectively. Out of 26 bona-fide brown dwarfs, one is newly detected in X-rays, namely ρ Oph GY 202. Also, four out of 57 brown dwarf candidates studied here are detected in X-rays, namely the young Taurus brown dwarf candidates MHO-4, MHO-5, V410 Anon 13, and V410 x-ray 3. The M9.5-type star BRI 0021−0214 is not detected. In the appendix, we also present catalogued, but as yet unnoticed B- and R-band data for some of the objects studied here.

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For preprints contact: rne@mpe.mpg.de

For preprints via ftp: astro-ph/9812455

Announcement

2MASS Data Sampler Release

The Two Micron All Sky Survey (2MASS) announces the public availability of the 2MASS Sampler Data Release. The Sampler data products can be accessed from the IPAC/2MASS Web site at http://www.ipac.caltech.edu/2mass/ or directly from the NASA/Infrared Science Archive site at http://irsa.ipac.caltech.edu/.

The objective of the 2MASS Sampler is to introduce the astronomical community to the content and format of the 2MASS datasets, and to the web-based Access Tools, to provide an opportunity for the 2MASS project to receive community feedback in preparation for a large 1999 Spring data release, and to enable the community to carry out scientific investigations with the 2MASS dataset for the first time.

The 2MASS Sampler consists of a Point Source Catalog containing 227,197 objects, an Extended Source Catalog containing 2,133 resolved sources, and 5,658 compressed 512x1024 pixel (1"/pixel) images, covering about 63 square degrees of the northern sky.

The 2MASS webpage contains general information and documentation about this data release. Assistance with the Sampler is available via the 2MASS Help Desk at 2mass@ipac.caltech.edu.

A CD-ROM containing the Sampler data is also available.

The Two Micron All Sky Survey is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center, funded by the NASA and the NSF.

Announcement

Coordinated Observing Campaign (AD Leo)

AD Leo '99 Campaign

Manuel Güdel, Marc Audard (PSI, Switzerland), Edward F. Guinan (Villanova University, PA, USA), Rolf Mewe (SRON, The Netherlands), Jeremy Drake (CfA, USA)

We invite observers to join in a coordinated campaign on AD Leo by obtaining observations simultaneous with our approved EUVE Cycle 7 project.

The project was awarded 900 ks of EUVE exposure time; the observations are therefore anticipated to extend over about 1 month, with pieces of approximately 30 minutes on source alternating with intervals of about 1 hour off source (Earth blocks). These observations offer a potential for coordinated observations to investigate flare physics. Observing time with BeppoSAX, the VLA, and optical photometric telescopes has already been requested. We will analyze all EUVE (spectroscopic and photometric) data and share simultaneous SW/MW/LW spectra and DS light curves with collaborators who obtain coordinated observations that are *useful* for a combined interpretation (e.g., photometric monitoring; flare spectroscopy; etc). In that case, we will provide the EUVE data products to collaborators or invite observers to participate in our main monitoring project. We will decide on collaborations based on the kind of contributed observation, its length, and its suitability for specific scientific objectives. Interested observers may contact us at the address below.

AD Leo was selected for the following reasons: i) Its flare rate is rather high; in the optical range, the detectable flare rate can be as high as one per hour in the U band (AD Leo's quiescent magnitudes are B = 10.97 and V = 9.43). ii) Its late spectral type (dM3e, B-V = 1.54) provides high contrast in the U and B band for flare observations. iii) Typical EUV flare durations are longer than one EUVE satellite orbit (96 min) so that individual flares can be monitored. iv) The stellar rotation period is long enough so that rotational modulation of flare light curves should not be too severe. v) Given its close distance of about 5 pc, relatively modest-energy flares can be studied. Further details on AD Leo and the observations can be found on the WWW:

http://www.astro.phys.ethz.ch/staff/guedel/adleo.html

Contact Address: guedel@astro.phys.ethz.ch

Job Announcement

Postdoctoral Position
Institute of Theoretical Astrophysics
Oslo, Norway

One or more positions will be available during 1999 for the project "Modelling of Astrophysical Plasmas". The goal of the project is to arrive at a coherent description of the physics of the outer solar atmosphere, heliosphere and their effects on the geosphere. This will be accomplished by combining the complimentary expertise of existing research groups in atmosphere and plasma modelling with expertise in large scale scientific visualization. Preference will be given to individuals having experience in numerical simulations involving hydrodynamical modeling and/or parallel computing. Length of employment will be for two years. More information can be obtained at http://www.astro.uio.no/ matsc/map

Applicants should send a curriculum vitae, bibliography, a one or two-page statement of research interests, and letters of recommendation from three referees to Professor Mats Carlsson, Institute of Theoretical Astrophysics, P.O. Box 1029 Blindern, N-0315 Oslo, Norway by 1 March 1999.

Upcoming Meetings

FIRST ANNOUNCEMENT
Physics of the Solar Corona and Transition Region
24 - 27 August, 1999
Location: Monterey, California

Information and registration:

`http://www.lmsal.com/coronal_workshop.html`

The Sun's magnetic field is responsible for the spectacularly dynamic and intricate phenomenon that we call the corona. The past decade has seen an enormous increase in our understanding of this part of the solar outer atmosphere, both as a result of observations and because of rapid advances in numerical studies. The YOHKOH satellite has observed the Sun now for over six years, producing spectacular sequences of images that convey the complexity of the corona. The imaging and spectroscopic instruments on SOHO have added information on the cooler part of the corona. And since April of 1998 TRACE has given us very high resolution images of the 1-2 MK corona, at cadences where we can observe loop oscillations, evolution, mass ejecta, etc. in detail.

The meeting is dedicated to an exploration of the most recent results on the solar corona, as well as on the transition region and low solar wind. The workshop is divided into seven scientific sessions, detailed below. Invited speakers will introduce the topics, but the remainder of each session will be defined by the attendees: the organizers will select topics from the contributed papers that best fit the themes to fill the remainder of the sessions with talks, while there will be ample time for discussions and poster viewing.

The topics cover a broad range of interests within coronal physics, and we hope to see contributions from a broad community, including current space-based instruments as well as ground-based observatories. There will be no limits on the number of contributions per attendee.

The meeting will be held in the Monterey Beach Hotel, in Monterey, California. The scientific program will start at 9 am on Tuesday, 24 August 1999, and end around noon on Friday, 27 August 1999.

Upcoming Meetings

NEARBY STARS WORKSHOP

NASA Ames Research Center

Moffett Field, California

June 24-26, 1999

sponsored by NASA's Astrobiology Institute
and the National Science Foundation

In 1998, NASA began a new initiative within the Astrobiology Institute at Ames Reserch Center known as the NStars (Nearby Stars) Project. Because of the fundamental nature of nearby star research, the National Science Foundation has recently joined forces with NASA to support NStars.

This workshop will bring together astronomers studying the Sun's nearest neighbors, both observationally and theoretically. Particular emphasis will be placed on stars within 20 parsecs, the horizon of the NStars Project. All information about these stars — astrometry, photometry, spectroscopy, multiplicity, age/activity, infrared excess – is relevant. Astronomers interested in the future online version of the NStars Database, associated supporting Research, or the Outreach mission of NStars are invited to take part in this workshop. Discussions will include an assessment of what is needed in the NStars database, what is missing, how to fill the gaps, and funding resources. At this time, we are generating a list of astronomers interested in attending the workshop to whom future announcements will be sent.

If you are interested in the NStars Workshop, please respond to

Dana Backman (backman@cma.arc.nasa.gov) or
Todd Henry (thenry@recons.harvard.edu)

Rho Christensen at NASA/Ames can be contacted for logistical questions about the workshop at rchristensen@mail.arc.nasa.gov.

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

`http://casa.colorado.edu/~skinners/coolnews.html .`