COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

No. 133 — April 2007 Editor: Steve Skinner (coolnews@jila.colorado.edu)

TABLE OF CONTENTS

Stellar Abstracts

The 3D Morphology of VY Canis Majoris. I The Kinematics of the Ejecta

Roberta M. Humphreys[1], **L. Andrew Helton**[1] **and Terry J. Jomes**[1]

[1] Astronomy Department, University of Minnesota, Minneapolis, MN 55455

Images of the complex circumstellar nebula associated with the famous red supergiant VY CMa show evidence for multiple and asymmetric mass loss events over the past 1000 yrs. Doppler velocities of the arcs and knots in the ejecta showed that they are not only spatially distinct but also kinematically separate from the surrounding diffuse material. In this paper we describe second epoch HST/WFPC2 images to measure the transverse motions which when combined with the radial motions provide a complete picture of the kinematics of the ejecta including the total space motions and directions of the outflows. Our results show that the arcs and clumps of knots are moving at different velocities, in different directions, and at different angles relative to the plane of the sky and to the star, confirming their origin from eruptions at different times and from physically separate regions on the star. We conclude that the morphology and kinematics of the arcs and knots are consistent with a history of mass ejections not aligned with any presumed axis of symmetry. The arcs and clumps represent relatively massive outflows and ejections of gas very likely associated with large – scale convective activity and magnetic fields.

Accepted by AJ

For preprints contact: roberta@umn.edu

The 3D Morphology of VY Canis Majoris II: Polarimetry and the Line-of-Sight Distribution of the Ejecta

Terry J. Jones[1], Roberta M. Humphreys[1], L. Andrew Helton[1], Changfeng Gui[2] and Xiang Huang[2]

[1] Department of Astronomy, University of Minnesota, 116 Church Street S.E., Minneapolis, MN 55455

[2] Department of Mathematics, University of Connecticut, 196 Auditorium Road University of Connecticut, U-3009 Storrs, CT 06269-3009

We use imaging polarimetry taken with the HST/ACS/HRC to explore the three dimensional structure of the circumstellar dust distribution around the red supergiant VY Canis Majoris. The polarization vectors of the nebulosity surrounding VY CMa show a strong centro-symmetric pattern in all directions except directly East and range from 10% - 80% in fractional polarization. In regions that are optically thin, and therefore likely have only single scattering, we use the fractional polarization and photometric color to locate the physical position of the dust along the line-of-sight. Most of the individual arc-like features and clumps seen in the intensity image are also features in the fractioanl polarization map. These features must be distinct geometric objects. If they were just local density enhancements, the fractional polarization would not change so abruptly at the edge of the feature. The location of these features in the ejecta of VY CMa using polarimetry provides a determination of their 3D geometry independent of, but in close agreement with, the results from our study of their kinematics (Paper I).

Accepted by AJ

For preprints contact: tjj@astro.umn.edu

The Spectroscopic and Astrometric Orbits of HR 672

Francis C. Fekel[1], Michael Williamson[1] and D. Pourbaix[2]

[1] Center of Excellence in Information Systems, Tennessee State University, 3500 John A. Merritt Boulevard, Box 9501, Nashville, TN 37209 USA

[2] Institut d'Astromonie et d'Astrophysicque, Université Libre de Bruxelles, C.P. 226, Boulevard du Triomphe, 1050 Bruxelles, Belgium

From a very extensive set of radial velocities obtained at Fairborn Observatory we have computed a new spectroscopic orbit for HR 672. This binary has an orbital period of 93.290 days and an eccentricity of 0.5249. The greatly improved orbital elements have been incorporated into a new astrometric orbit, which has an inclination of 110 deg, from *Hipparcos* data. The primary is a slowly rotating early-G star that is situated nearly 1 mag above the main sequence and is likely synchronously rotating. It has an iron abundance that is greater than that of the Sun. Lines of the secondary were not detected at red wavelengths, consistent with an adopted M0 dwarf spectral type. The age of the system is estimated to be about 5 billion years. The binary is a good candidate for interferometric resolution at infrared wavelengths.

Accepted by AJ

For preprints contact: fekel@evans.tsuniv.edu

Detailed Diagnostics of an X-ray Flare in the Single Giant HR 9024

Paola Testa[1], Fabio Reale[2,3], David Garcia-Alvarez[4] and David P. Huenemoerder[1]

[1] Massachusetts Institute of Technology, Kavli Institute for Astrophysics and Space Research, 70 Vassar street, Cambridge, MA 02139, USA; testa@space.mit.edu

[2] Dipartimento di Scienze Fisiche & Astronomiche, Sezione di Astronomia, Università di Palermo Piazza del Parlamento 1, 90134 Palermo, Italy

[3] INAF - Osservatorio Astronomico di Palermo, Piazza del Parlamento 1, 90134 Palermo, Italy

[4] Imperial College London, Blackett Laboratory, Prince Consort Rd, London, SW7 2AZ, UK

We analyze a 96 ks *Chandra* HETGS observation of the single G-type giant HR 9024. The high flux allows us to examine spectral line and continuum diagnostics at high temporal resolution, to derive plasma parameters. A time-dependent 1D hydrodynamic model of a loop with half-length $L = 5 \times 10^{11}$ cm ($\sim R_\star/2$), cross-section radius $r = 4.3 \times 10^{10}$ cm, with a heat pulse of 15 ks and 2×10^{11} erg cm^{-2} s^{-1} deposited at the loop footpoints, satisfactorily reproduces the

observed evolution of temperature and emission measure, derived from the analysis of the strong continuum emission. For the first time we can compare predictions from the hydrodynamic model with single spectral features, other than with global spectral properties. We find that the model closely matches the observed line emission, especially for the hot ($\sim 10^8$ K) plasma emission of the Fe XXV complex at ~ 1.85Å.
The model loop has $L/R_\star \sim 1/2$ and aspect ratio $r/L \sim 0.1$ as typically derived for flares observed in active stellar coronae, suggesting that the underlying physics is the same for these very dynamic and extreme phenomena in stellar coronae independently on stellar parameters and evolutionary stage.

Accepted by ApJ

For preprints contact: testa@space.mit.edu

For preprints via ftp or WWW: http://space.mit.edu/home/testa/preprint.htm

Measurement of the Surface Gravity of η Bootis

G. T. van Belle[1], D. R. Ciardi[1] and A. F. Boden[1]

[1] Michelson Science Center, California Institute of Technology, Pasadena, CA 91125 USA

Direct angular size measurements of the G0IV subgiant η Boo from the Palomar Testbed Interferometer are presented, with limb-darkened angular size of $\theta_{LD} = 2.1894^{+0.0055}_{-0.0140}$ mas, which indicate a linear radius of $R = 2.672 \pm 0.028 R_\odot$. A bolometric flux estimate of $F_{BOL} = 22.1 \pm 0.28 \times 10^{-7}$ erg cm^{-2}s^{-1} is computed, which indicates an effective temperature of $T_{EFF} = 6100 \pm 28$ K and luminosity of $L = 8.89 \pm 0.16 L_\odot$ for this object. Similar data are established for a check star, HD 121860. The η Boo results are compared to, and confirm, similar parameters established by the *MOST* asteroseismology satellite. In conjunction with the mass estimate from the *MOST* investigation, a surface gravity of $\log g = 3.817 \pm 0.016$ [cm s^{-2}] is established for η Boo.

Accepted by ApJ

For preprints contact: gerard@ipac.caltech.edu

For preprints via ftp or WWW: http://spider.ipac.caltech.edu/staff/gerard/

Butterfly Diagram and Activity Cycles in HR 1099

Svetlana V. Berdyugina[1,2], Gregory W. Henry[3]

[1] Institute of Astronomy, ETH Zurich, 8092 Zurich, Switzerland
[2] Tuorla Observatory, University of Turku, FIN-21500, Piikkiö, Finland
[3] Center of Excellence in Information Systems, Tennessee State University, Nashville, TN 37203

We analyze photometric data of the active RS CVn–type star HR 1099 for the years 1975–2006 with an inversion technique and reveal the nature of two activity cycles of 15–16 yr and 5.3±0.1 yr duration. The 16 yr cycle is related to variations of the total spot area and is coupled with the differential rotation, while the 5.3 yr cycle is caused by the symmetric redistribution of the spotted area between the opposite stellar hemispheres (flip-flop cycle). We recover long-lived active regions comprising two active longitudes that migrate in the orbital reference frame with a variable rate because of the differential rotation along with changes in the mean spot latitudes. The migration pattern is periodic with the 16 yr cycle. Combining the longitudinal migration of the active regions with a previously measured differential rotation law, we recover the first stellar butterfly diagram without an assumption about spot shapes. We find that mean latitudes of active regions at opposite longitudes change antisymmetrically in the course of the 16 yr cycle: while one active region migrates to the pole, the other approaches the equator. This suggests a precession of the global magnetic field with respect to the stellar rotational axis.

Accepted by ApJL

For preprints contact: sveta@astro.phys.ethz.ch

For preprints via ftp or WWW: http://www.journals.uchicago.edu /ApJ/journal/issues/ApJL/v659n2/21069/21069.html

Simultaneous XMM-Newton and VLT/UVES Observations of the Flare Star CN Leonis

B. Fuhrmeister[1], C. Liefke[1] and J. H. M. M. Schmitt[1]

[1] Hamburger Sternwarte, University of Hamburg, Gojenbergsweg 112, D-21029 Hamburg, Germany

Aims: We present simultaneous observations with VLT/UVES and *XMM-Newton* of the active M5.5 dwarf CN Leo (Gl 406). The data were gathered during three half nights in May 2004 and December 2005, and they cover quiescent states, as well as flaring activity. Our main aim is to derive coronal properties from X-ray data and to compare these to results from the optical Fe XIII line.
Methods: We studied simultaneously-measured coronal and chromospheric parameters of CN Leo as determined from the *XMM-Newton* X-ray data, the forbidden optical coronal Fe XIII line at 3388 Å, and various optical chromospheric emission lines.
Results: We find that different activity levels of CN Leo can be traced as well in X-rays as with the Fe XIII line. Moreover, the Fe XIII line flux is in good agreement with a prediction using the differential emission measure as determined from the X-ray spectrum and Fe atomic data. We also present coronal X-ray properties for the quiescent and flaring states of CN Leo. During a flare two He MII transition region lines are also detected in the optical data.

Accepted by A&A

For preprints contact: bfuhrmeister@hs.uni-hamburg.de

For preprints via ftp or WWW: http://www.hs.uni-hamburg.de/DE/Ins/Per/Fuhrmeister/index.html

Rapid Magnetic Flux Variability on the Flare Star CN Leonis

A. Reiners[1,2], J.H.M.M. Schmitt[1] and C. Liefke[1]

[1] Hamburger Sternwarte, Gojenbergsweg 112, D-21029 Hamburg, Germany
[2] Universität Göttingen, Institut für Astrophysik, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany

We present UVES/VLT observations of the nearby flare star CN Leo covering the Wing-Ford FeH band near 1 μm with high spectral resolution. Some of the FeH absorption lines in this band are magnetically sensitive and allow a measurement of the mean magnetic flux on CN Leo. Our observations, covering three nights separated by 48 hours each, allow a clear detection of a mean magnetic field of $Bf \approx 2.2\,$kG. The differential flux measurements show a night-to-night variability with extremely high significance. Finally, our data strongly suggest magnetic flux variability on time scales as low as 6 hours in line with chromospheric variability.

Accepted by A&A

For preprints via ftp or WWW: http://www.aanda.org/articles/aa/pdf/forth/aa7095-07.pdf

Solar Abstracts

Self-consistent Coronal Heating and Solar Wind Acceleration from Anisotropic Magnetohydrodynamic Turbulence

Steven R. Cranmer[1], Adriaan A. van Ballegooijen[1], and Richard J. Edgar[1]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

We present a series of models for the plasma properties along open magnetic flux tubes rooted in solar coronal holes, streamers, and active regions. These models represent the first self-consistent solutions that combine: (1) chromospheric heating driven by an empirically guided acoustic wave spectrum, (2) coronal heating from Alfvén waves that have been partially reflected, then damped by anisotropic turbulent cascade, and (3) solar wind acceleration from gradients of gas pressure, acoustic wave pressure, and Alfvén wave pressure. The only input parameters are the photospheric lower boundary conditions for the waves and the radial dependence of the background magnetic field along the flux tube. We have not included multifluid or collisionless effects (e.g., preferential ion heating) which are not yet fully understood. For a single choice for the photospheric wave properties, our models produce a realistic range of slow and fast solar wind conditions by varying only the coronal magnetic field. Specifically, a two-dimensional model of coronal holes and streamers at solar minimum reproduces the latitudinal bifurcation of slow and fast streams seen by *Ulysses.* The radial gradient of the Alfvén speed affects where the waves are reflected and damped, and thus whether energy is deposited below or above the Parker critical point. As predicted by earlier studies, a larger coronal "expansion factor" gives rise to a slower and denser wind, higher temperature at the coronal base, less intense Alfvén waves at 1 AU, and correlative trends for commonly measured ratios of ion charge states and FIP-sensitive abundances that are in general agreement with observations. These models offer supporting evidence for the idea that coronal heating and solar wind acceleration (in open magnetic flux tubes) can occur as a result of wave dissipation and turbulent cascade.

Accepted by ApJ Supplement (August 2007)

For preprints contact: scranmer@cfa.harvard.edu

For preprints via ftp or WWW: http://arXiv.org/abs/astro-ph/0703333

Ph.D. Thesis Abstracts

Characterisation of Young Nearby Stars – The Ursa Major group

Matthias Ammler

Thesis work conducted at: Astrosphysical Institute and University Observatory, University of Jena, Germany

Current address: Centro de Astronomia e Astrofísica da Universidade de Lisboa, Observatório Astronómico de Lisboa, Tapada da Ajuda, 1349-018 Lisboa, Portugal

E-mail: ammler@oal.ul.pt

Ph.D dissertation directed by: Ralph Neuhäuser

Ph.D degree awarded: July 2006

This work presents a homogeneous set of stellar parameters and spectroscopic properties of a sample of kinematic Ursa Major (UMa) group members with spectral types late-F to early-K.

The UMa group is comprised of the stars in the UMa cluster in the Big Dipper constellation and of many co-moving stars spread over the whole sky. The definition of kinematic membership criteria has ever been difficult so that spectroscopic criteria should be added. Previous work indicates that the UMa group members are young with an age of roughly 300 Myrs. The youth leaves traces in the stellar spectrum. In addition to these youth indicators, iron abundance is an appropriate membership criterion in case it is different from that of other groups of stars. Spectroscopic properties of the UMa group already have been specified previously but resulting membership criteria are rather inconclusive.

The aim of this thesis is to readdress the spectroscopic properties of UMa group members with spectral types late-F to early-K, now based on a homogeneous assessment of the stellar parameters. A sample of kinematic members was drawn from the literature. Spectra of 20 stars were obtained with high resolving power ($\frac{\lambda}{\Delta\lambda} \approx 60000$) and high signal-to-noise ratio (≈ 200). The analysis of the stellar atmospheres of 10 UMa group members provides stellar parameters such as effective temperatures and surface gravities which are exposed to several tests. In particular they imply spectroscopic distances which are consistent with *Hipparcos* distances.

This work accounts for results of similar previous analyses and studies the Ursa Major group as a whole in several respects. The position in the so-called Kiel diagram is assessed as well as spectroscopic features such as rotational broadening and the filling-in of the Hα line. The most interesting results however concern the iron abundances and the equivalent widths of the Li I λ6707.8 Å absorption line. The new iron abundances increase the previously determined UMa group iron abundance slightly to [Fe/H]$= -0.03 \pm 0.04$. They can be distinguished from the Hyades moving group but are similar to the Pleiades. Taking into account the magnesium abundances, the UMa group coincides well with the thin disk population. The distribution of the lithium equivalent widths can be distinguished from the open clusters Pleiades, Hyades, and M 35, supporting the age estimate of roughly 300 Myrs. Furthermore it argues against a large intrinsic age spread in the UMa group though this result is based on a few data points only.

A promising prospect is to adopt these properties as membership criteria. The decision on the membership of many unsure UMa group candidates might be simplified substantially when combining lithium absorption and iron abundance with kinematic membership criteria.

Thesis-related Publications:
please refer to http://astro.oal.ul.pt/∼ammler/

Coronal Evolution of Solar-Like Stars: X-Ray Spectroscopy of Stars in Star-Forming Regions and the Solar Neighborhood

Alessandra Telleschi

Thesis work conducted at: Paul Scherrer Institut, Switzerland

Current address: Paul Scherrer Institut, Würenlingen and Villigen, CH-5232 Villigen PSI, Switzerland

E-mail: atellesc@astro.phys.ethz.ch

Ph.D dissertation directed by: Manuel Güdel

Ph.D degree awarded: February 2007

The full thesis is available here: http://www.astro.phys.ethz.ch/papers/atellesc/atellesc_p_nf.html

Solar-like stars are strong X-ray emitters in both their pre-main sequence (PMS) and main-sequence (MS) phases. In analogy to the Sun, X-rays are thought to originate in a corona. However, in the case of pre-main sequence stars, accretion processes might influence the X-ray properties of the stars.

In this thesis, results from X-ray spectroscopy of main-sequence solar analogs, pre-main sequence solar-like stars and a Herbig Ae/Be star are presented and discussed. All X-ray spectra have been obtained by the Reflection Grating Spectrometers (RGS) and the European Photon Imaging Cameras (EPIC) on board the *XMM-Newton* satellite.

In the first part of the thesis, high-resolution (RGS) X-ray spectra of a sample of six main-sequence G-type stars with ages between ≈ 0.1 Gyr and ≈ 1.6 Gyr have been analyzed. Using individual spectral lines, the Emission Measure Distributions (EMD) and the coronal abundances have been derived. As a solar analog evolves, its rotation rate decreases and its internal magnetic dynamo weakens, resulting in a decrease of magnetic activity and a decrease of the star's X-ray luminosity. The mean coronal temperatures derived from the EMDs decrease from ≈ 10 MK for the youngest stars to ≈ 4 MK for the oldest star in our stellar sample. These results have been interpreted with a model in which the coronal emission is produced by a superposition of stochastically occurring flares; more active stars are found to require a larger range of flare energies than less active stars. Abundances change from an inverse First Ionization Potential (FIP) effect, where abundances with high FIP are enhanced with respect to abundances with low FIP, to a solar-like FIP effect at ages ≥ 0.3 Gyr.

The analysis has then been extended to pre-main sequence stars in the Taurus-Auriga complex. The results presented here are part of a large survey, the "XMM-Newton Extended Survey of the Taurus Molecular Cloud" (XEST). High- and medium-resolution spectroscopy has been used to study the differences in the X-ray output of low-mass accreting stars (classical T Tauri Stars, CTTS) and non-accreting stars (weak-line T Tauri stars, WTTS). For nine PMS stars, high-resolution RGS spectra were obtained. For two accreting stars, BP Tau and AB Aur, the electron densities were derived from the O VII triplets. Using the O VII/O VIII flux ratio to quantify the cool plasma, a soft excess has been discovered; this feature seems to be a general feature in the spectra of CTTS, but is not present in WTTS and zero-age main-sequence stars. In BP Tau, the O VII triplet suggests high electron densities for this cool plasma ($n_e = 3.4 \times 10^{11}$ cm^{-3}), a signature that at least part of the X-ray emission might originate in accretion shocks. However, low electron densities ($n_e < 10^{10}$ cm^{-3}) are inferred for the accreting Herbig star AB Aur. No significant, systematic differences are present between the abundances of accreting and non-accreting stars. Rather, the Ne/Fe coronal abundance ratio is a function of spectral type. It systematically increases from G to early M stars.

In a second approach, results from the medium-resolution EPIC spectra have been used to study systematics in the X-ray properties of CTTS and WTTS. Both CTTS and WTTS are found to be saturated in X-rays, i.e., the X-ray luminosity (L_X) is proportional to the stellar bolometric luminosity (L_*), but the saturation level is different: for

CTTS, $L_{\rm X} = 10^{-3.73\pm0.05} L_*$ while for WTTS, $L_{\rm X} = 10^{-3.39\pm0.06} L_*$. Furthermore, WTTS are more X-ray luminous than CTTS by a factor of ≈ 2. A correlation between the average coronal temperature, $T_{\rm av}$, and $L_{\rm X}$ is present in WTTS but not in CTTS; overall, CTTS coronae are hotter than those of WTTS for low $L_{\rm X}$. The X-ray emission of WTTS is found to be consistent with the coronal emission of main-sequence stars, whereas CTTS show a soft excess in high-resolution spectra, a lower X-ray activity, and generally hotter coronae in medium-resolution spectra. A model is proposed in which accreting material penetrates magnetic structures and cools them to temperatures that are no longer accessible by X-ray CCD detectors. This would reduce the $L_{\rm X}$ determined from CCD spectra while would produce a soft excess that dominates the long-wavelength line spectra in grating spectrometers.

The high-resolution spectrum of the Herbig Ae/Be star AB Aur has been studied separately. The X-ray generation in Herbig stars is so far unexplained. AB Aur displays a soft spectrum characteristic of plasma at 1–6 MK. The X-ray light curve displays variability with a period of ≈ 42 hours. AB Aur's X-rays could be generated in a corona or in a magnetically confined wind. The latter alternative is supported by periodicities of optical lines formed in the wind, whose periods are consistent with the X-ray period.

Initial results from five *XMM-Newton* observations of the Chamaeleon I star-forming region are presented. The X-ray properties of CTTS and WTTS are analogous to those reported from the Taurus Molecular Cloud, except that both CTTS and WTTS indicate a similar X-ray saturation level ($L_{\rm X} \approx 10^{-3.3} L_*$). Comparing the hydrogen column densities ($N_{\rm H}$) found from the spectral fits with the corresponding infrared extinctions ($A_{\rm J}$), $N_{\rm H}/A_{\rm J}$ ratios significantly below the galactic values are found. This suggests a larger grain size of the dust in the vicinity of the Chamaeleon I stars.

Thesis-related Publications: ApJ, 622, 653 (2005); three A&A publications (2007), in press
(see http://www.astro.phys.ethz.ch/papers/atellesc/atellesc_p_nf.html for preprints)

Upcoming Meeting

Topical Session: Diagnostics of Cold Brown Dwarfs and Hot Exoplanets

30 May 2007

210th AAS Meeting

Honolulu, HI

Dear Colleagues:

This is a reminder for the Topical Session *Diagnostics of Cold Brown Dwarfs & Hot Exoplanets* to be held at the AAS summer meeting in Honolulu, Hawaii on Wednesday May 30th 2007.

This topical session will be very timely, with new results expected from the latest wide-field infrared sky surveys, exoplanet transit campaigns, high contrast imaging searches, and the constant enhancement of theoretical models to describe the atmospheres of ultracool dwarfs and extrasolar planets. The tentative format of the 6.5 hour full-day session is ten invited talks of 25 minutes each and ten contributed talks of 12 minutes each, together with two 10 minute discussion sessions and posters.

Topics for this session are: Ultracool T and Y Dwarfs (including gravity and metallicity effects), Cloud Formation in Brown Dwarfs and Planets, Detection of Young Giant Planets or "Cold Jupiters", and Irradiated Planets or "Hot Jupiters".

Invited speakers are T. Barman, A. Burgasser, A. Burrows, D. Charbonneau, M. Cushing, J. Fortney, D. Homeier, S. Leggett, M. Liu, M. Marley.

See http://www.aas.org/meetings/aas210 for further information.

We look forward to seeing you in Honolulu!

Sandy Leggett Gemini Observatory (skl@gemini.edu)
Mike Liu University of Hawaii

Upcoming Meeting

2007 Gordon Research Conference on Origins of Solar Systems

8 - 13 July 2007

Mt. Holyoke College

South Hadley, MA

Registration is now open for the 2007 Gordon Research Conference on Origins of Solar Systems, to be held at Mt. Holyoke College in South Hadley, MA on 8-13 July 2007. This unique interdisciplinary meeting includes astronomers and astrophysicists interested in star and planet formation, planetary scientists and meteoriticists interested in the early history of the Solar System, and plasma and life scientists. This meeting is much broader than most conferences and many fruitful research collaborations have been initiated at Gordon conferences, encouraged by the relaxed pace of the meeting.

Information on the meeting, registration, etc. is available at:

http://www.grc.org/programs.aspx?year=2007&program=origins .

Speakers and discussion leaders include Yuri Aikawa, Sean Andrews, David Bennett, Ted Bergin, Martin Bizzarro, Alan Boss, Fred Ciesla, Harold Connolly, Marianna Cosarinsky, Andrew Davis, Suzan Edwards, Elise Furlan, Charles Gammie, Matthieu Gounelle, Lynne Hillenbrand, Rhian Jones, Scott Kenyon, Zoe Leinhardt, Doug Lin, James Lyons, Michael Meyer, Amaya Moro-Martin, Frank Podosek, Ken Rice, Scott Sandford, Sara Seager, Meenakshi Wadhwa, Dan Watson, Ed Young, and Michael Zolensky.

The Chair and Vice-Chair of the 2007 Origins of Solar Systems conference are Lee Hartmann (Michigan) and Sara Russell (Natural History Museum, London). Please contact us (lhartm@umich.edu, sara.russell@nhm.ac.uk) with any questions or suggestions.

Upcoming Meeting

Structure Formation in the Universe: Galaxies, Stars, Planets

27 May - 1 June 2007

Chamonix, France

This is the **Last Annoucement** of the conference *Structure Formation in the Universe* to be held in Chamonix, France from 27 May through 1 June 2007. The aim of the conference is to bring together researchers working in the fields of planet, star and galaxy formation in order to share their expertise and to address common physical and numerical issues in the understanding of structure formation in astrophysics.

The **registration**, with the possibility to submit a **poster presentation**, is **now open**, and hotel reservations will be closed on 30 April.

Late Registration (380 euros) and **Financial support request**: **April 30, 2007**.

See information on the conference website: **http://chamonix2007.ens-lyon.fr/**

Organizer and contact (financial support) : **G. Chabrier (ENS-Lyon; chabrier@ens-lyon.fr)**

Job Opening

Postdoctoral Research Position

Atmospheres of Red Supergiant Stars

GRAAL - Université Montpellier II - CNRS (France)

A one-year (renewable one year, funds are available) post-doctoral position is available in the astrophysics group of Montpellier University. Our group is mainly involved in stellar physics and connected subjects, including stellar atmospheres, stellar interiors and evolution, primordial stars (see http://www.graal.univ-montp2.fr). The successful applicant will work in the Stellar Atmospheres group, and is expected to actively participate to our on-going research on the dynamics of atmospheres and winds of red supergiant stars.

The research project aims at a better understanding of the atmospheric dynamics of red supergiant stars (RSG). Based on radiative hydrodynamics simulations performed with the CO5BOLD code (B. Freytag et al.; http://www.astro.uu.se/~bf/co5bold_main.html) we compute synthetic spectra (under the assumption of pure LTE) in order to constrain dynamic properties of RSG. Non-LTE radiative transfer is however required in order to properly analyse RSG spectra, the final objective of this approach including reliable determination of abundances for these stars. A groundbreaking attack of this problem will consist in NLTE modelling of molecular lines in 1D models.

The successful candidate should thus have experience in the area of radiative transfer, spectrum synthesis, preferably in NLTE, and stellar atmosphere modelling. The net salary is about 1500 euros per month, with medical insurance and retirement plan. Adequate research resources, including travel funding, will be provided.

This project is part of the program *Massive Stars in the Local Universe* funded by the French National Science Agency (ANR), implying researchers at GRAAL and at the Laboratoire d'Astrophysique de Marseille (http://www.oamp.fr/lam/). The general goal of this program is to achieve a better understanding and treatment of mass loss in stellar atmosphere models for stars in the upper Hertzsprung-Russell diagram (for more details, see http://www.graal.univ-mtp2.fr/perso/josselin/MaSiLU.html).

Applications will be considered until the position is filled. The contract should start no later than October 2007.

The material (including resume, bibliography, statement of research and three letters of reference) should be sent to:

Dr Eric Josselin
GRAAL , Université Montpellier II
cc 072
F-34095 Montpellier Cedex 05
Fax: +33 4 67 14 45 35
e-mail: josselin@graal.univ-montp2.fr

Job Opening

Ph.D. Student Positions
Institute of Astronomy
University of Vienna (Austria)

Doctoral positions are available in the International Graduate School on *The Cosmic Matter Circuit* at the Institute of Astronomy, University of Vienna.

The international graduate school (Initiativkolleg: IK) on *The Cosmic Matter Circuit* awards up to nine doctoral positions to highly qualified and motivated students starting October 1st, 2007. The PhD program focuses on one of the big challenges of modern Astrophysics, the various proc-esses of matter cycles. Research topics range from the small-scale matter cycle (stellar mass loss, chemical yields, interstellar medium) via the galactic-scale matter cycle (propagation of Cosmic Rays, galactic disk-halo connection, galactic winds and gas infall) to the global extragalactic scales (e.g. gas removal from galaxies by galaxy-galaxy interactions and ram-pressure stripping, evolution of galaxy groups and clusters, and galaxy formation).

The positions are funded for 3 years. The successful applicants are employed half time (20 hours/ week) at the University of Vienna, including up to 10 hours/week in teaching and research tasks to be agreed individually. The total annual stipend amounts to 14,321 Euros, including health insurance, university tuition fees are waived. Very good skill of the English language is mandatory. The students are expected to hold a degree equivalent to the Austrian Diploma or Masters Degree in Astronomy/Astrophysics or a related area.

With more than 60000 students from 130 different countries the University of Vienna is one of the largest in Europe and offers a stimulating environment and atmosphere for studies and research. The Institute of Astronomy houses more than 400 students in Bachelor, Master, and PhD level studies and provides excellent training and research facilities with courses and research topics over a wide astronomical range from planetary sciences, stellar astrophysics and satellite astronomy to those of the IK. Owing to its long history, Vienna is one of the leading cultural metropoles of the world and is situated in the heart of the growing European Union. The city is located beautifully in the Danube valley, flanked by the Vienna forest, and is about 2 hours from one of the most attractive hiking and skiing resorts in Europe.

Applicants are invited to submit documents by e-mail or first class mail to the Spokesperson of the College that have to arrive before May 31st, 2007 and to include: (i) cover letter stating the reasons for applying; (ii) curriculum vitae; (iii) documentation of previous studies and certified copies of all university degrees received; (iv) expose of research interests and/or proposed dissertation projects (max. 3 pages). In addition, two letters of recommendation of persons familiar with the applicant's work and studies should be sent separately by the deadline to the Spokesperson. The University of Vienna is an equal opportunity employer and particularly encourages applications from women and disabled persons. Applications within the deadline will be fully considered, but reviewing will continue until the positions are filled.

Further information: http://forschung.univie.ac.at/en/portal/initiativkollegs/i033/ http://www.univie.ac.at/IK-CosmicMatterCirc
Supervisors and Lecturers responsible for the training program: Dieter Breitschwerdt, Gerhard Hensler, Thomas Lebzelter, Christian Theis and Werner Zeilinger.

Contact: Spokesperson of the Initiativkolleg: Prof. Dr. Gerhard Hensler Institute of Astronomy, University of Vienna, Tuerkenschanzstr. 17, A - 1180 Vienna, Austria e-mail: ik@astro.univie.ac.at, phone: +43 - 1 - 4277 51896, fax: +43 - 1 - 4277 9518

Job Opening

Ph.D. Student Positions
Exoplanetary Systems Research
University of Utrecht (Netherlands)

We have received funding for a high-precision imaging polarimeter to study the formation, evolution and structure of extra-solar planetary systems by detecting the polarization of starlight scattered by circumstellar material. The available position will primarily be in the areas of data analysis, interpretation, and modelling. The student will also have the opportunity to contribute to the design, construction, and calibration of the instrument.

Further information about the position can be obtained from

http:// www.uu.nl/uupublish/homeuu/homeenglish/working/vacancies/25678main.html or from Dr Sandra Jeffers (S.V.Jeffers(@)astro.uu.nl) and Prof.dr Christoph Keller (C.U.Keller(@)astro.uu.nl).

The deadline for the position is 1 May 2007.

Abstract Guidelines

Abstracts for *COOLNEWS* are solicited for papers that have been recently accepted by or submitted to refereed journals, and for recent Ph.D. theses. Abstracts for conference proceedings articles are *not* posted in *COOLNEWS*. The subject matter should pertain directly to cool stars (spectral types F,G,K,M or L), substellar objects, or the sun. Both theoretical and observational abstracts are appropriate.

Abstracts dealing with cool pre-main-sequence (PMS) stars will generally not be included in *COOLNEWS*, since they are already covered by the *Star Formation Newsletter*. Exceptions to this rule will be considered if the subject matter is truly cross-disciplinary. If you wish to submit a cross-disciplinary abstract on PMS stars, then first submit it to the *Star Formation Newsletter*. After doing so, submit the abstract to *COOLNEWS* accompanied by a short e-mail stating that it has already been submitted to the *Star Formation Newsletter*, and summarizing why it will be of interest to the cool star/solar community at large.

A monthly call for abstracts will be issued and abstracts received by the last day of the month will usually appear in the following month's newsletter. Announcements of general interest to the cool star and solar communities may also be submitted for posting in the newsletter. These might include (but are not restricted to) the following: (i) *Job Openings* directed toward cool star or solar researchers, (ii) announcements of *Upcoming Meetings*, (iii) announcements of *Upcoming Observing Campaigns* for which participation is solicited from the community at large, (iv) reviews of *New Books*, and (v) *General Announcements* that provide or request research-related information. Please send all correspondence to the editor at coolnews@jila.colorado.edu. Abstract templates and back issues can be obtained from the COOLNEWS Web-page at

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

*** Please send abstracts in the body of the message and *not* as attachments.***