# COOLNEWS

**A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN**

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## *Stellar Abstracts*

### Anisotropic Diffusion and Shear Instabilities

**Suzanne Talon[1] and Jean-Paul Zahn[1]**

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We examine the role of anisotropic turbulence on the shear instabilities in a stratified flow. Such turbulence is expected to occur in the radiative interiors of stars, due to their differential rotation and their strong stratification, and the turbulent transport associated with it will be much stronger in the horizontal than in the vertical direction. It will thus weaken the restoring force which is caused by the gradient of mean molecular weight ($\mu$). We find that the critical shear which is able to overcome the $\mu$-gradient is substantially reduced by this anisotropic turbulence, and we derive an estimate for the resulting turbulent diffusivity in the vertical direction.

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### Sleuthing the Dynamo: HST Faint Object Spectrograph Observations of Solar-Type Dwarfs in Young Galactic Clusters

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We have used the Faint Object Spectrograph of the *Hubble Space Telescope* to record the ultraviolet emissions of solar-type $[(B-V)_0 \sim 0\overset{m}{.}6]$ dwarf stars in young galactic clusters: five in the Hyades ($t \sim 600$ Myr); three in the Pleiades ($t \sim 70$ Myr); and two in $\alpha$ Persei ($t \sim 50$ Myr). Despite high levels of scattered light in the G130H

(1140–1606 Å) spectra, the key C IV $\lambda$1549 blend was detected in all of the targets. The $10^5$ K emission displays a dramatic decline from the youngest to the oldest stars of the sample, well-correlated with rotational velocity; evidence of flaring in the most active of the G dwarfs; a wide spread in intensity among the Pleiads; but a small dispersion among the Hyads. The Mg II $\lambda$2800 emission is strongly enhanced in the younger stars, and the 2000 Å continuum is significantly elevated in the Hyads compared with the Sun. The hyperactive stars of the sample show an apparent saturation of their C IV emission at high rotational velocities, analogous to that seen in X-rays. The rotation-activity relations possibly exhibit mild curvature, in addition to the saturation, which nevertheless maps onto a simple power law in $f_{\rm X}/f_{\rm bol}$ versus $f_{\rm CIV}/f_{\rm bol}$. The Sun apparently tracks a similar power law over the course of its magnetic activity cycle.

We discuss these results in terms of simple magnetic loop models. We show that the nonlinear power-law variation of $f_{\rm CIV}/f_{\rm bol}$ with rotational velocity (slope $\sim 1.5$, contrary to the suspected *linear* dependence of the magnetic filling factor) very likely arises from a systematic increase in the base pressures of the dominant coronal loops compared with their counterparts on the Sun. The nonlinear X-ray/C IV power law (slope $\sim 1.7$) separately indicates a significant increase in the mean apex temperature of the dominant coronal loops. We argue that the distribution of loop structures might change character from inactive stars like the Sun (dominated by X-ray Bright Points and Active Region loops) to the hyperactive cluster stars (dominated by inter-region Large Scale Structures or Post-Flare loops).

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## Temperature and Luminosity Effects in Photoelectric Spectrum Scanner Measurements of F0–K5 Stars

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We study the possibility of classifying stars with the use of the photoelectric spectrum scanner designed at Astronomisches Institut at Bochum using a spectral resolution of about 10 Å. We analyse temperature and luminosity effects in two spectral indices which were expected to be promising as spectral classification criteria from previous studies.

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## Theoretical Models of the Angular Momentum Evolution of Solar-Type Stars

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We examine the effects of different assumptions about the initial conditions, angular momentum loss law, and angular momentum transport on the angular momentum evolution of 0.5-1.2 solar mass stars. We first perform a parameter variation study to test the sensitivity of the surface rotation rate as a function of mass and age to changes in the initial conditions and input physics. We then check to see if the distribution of initial conditions for a given physical scenario is consistent for open clusters of different ages.

The behavior of the rapid rotators is highly sensitive to the saturation threshold for angular momentum loss ($\omega_{crit}$), above which angular momentum loss scales linearly with the rotation rate. Very high values for $\omega_{crit}$ suppress rapid rotation prior to the main sequence and very low values permit rapid rotation to survive for too long. For solid body (SB) and differential rotation (DR) models, higher mass models rotate more rapidly than the lower mass models for the same initial conditions and $\omega_{crit}$. DR models differ from SB models both from the direct effect of core/envelope decoupling as well as a change in the calibration of the angular momentum loss law needed to reproduce the solar rotation at the age of the Sun; the effects of both are discussed. Slow rotation in young clusters can be acheived with

modest disk lifetimes (3-10 Myr) for the DR models and longer disk lifetimes (10 or more Myr) for the SB models. In addition, the slowly rotating DR models spin down during the early main sequence more than the slowly rotating SB models do.

When compared with the cluster data, the observed mass dependence of the rapid rotator phenomenon can only be reproduced with a mass dependent $\omega_{crit}$ for both the SB and DR models. A scaling of $\omega_{crit}$ inversely proportional to the convective overturn time scale can reproduce the observed mass dependent spindown. The observed spindown of the slow rotators in the young open clusters is in better agreement with the DR than the SB models. We also discuss observational tests to distinguish different classes of models using low mass stars and rotation periods in open clusters.

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## Al, Mg and Eu Abundances in Globular Cluster Giants. Tests of Deep Mixing. I.

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Results of a systematic survey of Al, Mg, and Eu abundances of stars near the tip of the giant branch in globular clusters and in the halo field are reported. Mg abundances were obtained independently from spectral synthesis of the 5136 Å MgH features and from EW analysis of five Mg I features. A comparison of the two sets of Mg abundances shows good agreement. Within the errors, the field stars exhibit no star-to-star differences in O, Mg, or Al at any [Fe/H] metallicity. Among the moderately (–1.0 > [Fe/H] > –1.9) and very metal-poor ( –1.9 > [Fe/H] > –3.0) halo field giants, [Na/Fe] is found to have star-to-star differences. The giants in the globular cluster M71 ([Fe/H] = –0.8) are also found to have star-to-star differences in Na but not in Mg, Al. It is concluded that either Al and Na are created in different nucleosynthetic processes, or the NeNa cycle of deep mixing can occur without the NO or MgAl cycles. Star-to-star differences in Al abundances for bright giants in M92 ([Fe/H] = –2.2), M13 ([Fe/H] = –1.5) and M5 ([Fe/H]= –1.2) have been detected. The Al–Na correlation and the Al–O anti-correlation observed in these clusters are consistent with the predictions of the deep mixing theory (Langer & Hoffman 1995). M13, which has the largest spread in Al, Na and O abundances, has star-to-star differences in the Mg abundance that are anti-correlated with Al. The [Al/Mg] ratio is consistent with the hypothesis that Mg is being processed into Al. However, if only $^{25}$Mg and $^{26}$Mg are expected to be converted to $^{27}$Al, the implied ratios of these isotopes to $^{24}$Mg would be considerably larger than the measured Mg isotopic ratios in the few halo field giants which have been studied. The abundances, [Eu/Fe], of the r-process element Eu are found to be positive over the entire metallicity range. No correlations ($\chi^2_\nu$ = 0.64) between Eu and the deep mixing elements Al, Mg, O, and Na are found, ruling out a neutron-rich environment as the origin of the star-to-star abundance differences of these elements. The evidence presented here, when combined with results presented in the literature, imply that the star-to-star abundance differences observed among stars in the clusters M13, M5 and M92 are due to deep mixing of NeNa, MgAl and CNO processed material from within the stars themselves.

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## Loop Modeling of Coronal X-ray Spectra. III. Fitting Loop Spectra with One- and Two-component Thermal Models

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In this work we study coronal loops vs. one- and two-component thermal models, the first being the physically accurate description of the X-ray emitting, magnetically-confined solar corona, the others the standard analysis tool of X-ray spectra from stellar coronae. The scope of this work is to compare directly these two paradigms of coronal physics, also to find a possible relation between the loop characteristics and the findings of the thermal components fitting. We simulate observations of coronal spectra using a static loop model, including the effects of stellar gravity and of possible non-uniform loop cross-section. We evaluate the one- and two-temperature fitting results through extensive simulations, varying the loop parameters, the photon counting statistics, and considering two instruments: the ROSAT/PSPC and the ASCA/SIS. We find that one-temperature models do not fit adequately loop spectra with $10^3$ total counts or more, for any of the cases explored. Two-temperature models provide a good fit to single loop spectra in many of the cases explored, with the implication that the two temperatures found when fitting real observations may not necessarily indicate the presence of two classes of dominating loops in the observed corona, but rather may be explained with only one class of loops, as long as the ratio of the emission measures of the hot vs. cool component is larger than unity. The goodness of the fit worsens with increasing photon statistics and/or resolving power, especially for loops with relatively intense plasma pressure ($p_0 > 10$ dyn cm$^{-2}$) and as high as the pressure scale height. In such cases the two-temperature fitting and the loop modeling are therefore not equivalent, implying that, for such kind of observations, detailed loop fitting should be attempted. We comment on our findings and draw possible guidelines to interpret observations.

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## COYOTES IV: The Rotational Periods of Low-mass Post-T Tauri Stars in Taurus.

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We monitored the light variations of 58 weak-line T Tauri stars in Taurus, recently discovered in the X-ray wavelength range during the ROSAT All-Sky Survey. We derive photometric periods for 18 stars, all but one being ascribed to rotational modulation by stellar spots. The exception is a 37.6d period assigned to the orbital motion of a new pre-main sequence spectroscopic binary. Two thirds of the stars in our sample have an age larger than 10 Myr and up to 40 Myr, thus filling the observational gap that previously existed between T Tauri stars on convective tracks and ZAMS dwarfs for the determination of the rotational evolution of young low-mass stars. The rotational periods are found to range from 0.5 to 7.5 days, most periods being shorter than 5 days. This result provides direct evidence for the spin up of solar type stars as they contract on pre-main sequence radiative tracks, as predicted by recent models of angular momentum evolution. The paucity of long periods (P$\geq$5d, i.e., $V_{eq} \leq 10$ km s$^{-1}$ ) in the sample of post-T Tauri stars leaves, however, the origin of the numerous slow rotators observed in young clusters an open issue.

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*Editor's Note*: The above cross-disciplinary abstract has also been submitted to the *Star Formation Newsletter*.

## Nucleosynthesis of Light Elements Inside Thermally Pulsing AGB Stars. I: The Case of Intermediate-Mass Stars

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The structural and nucleosynthetic evolution of 3, 4, 5, 6 and 7 solar mass stars with two metallicities (Z=0.005 and 0.02) has been computed in detail, from the early pre-main sequence phase up to the thermally pulsing (TP) AGB phase or the onset of off-center carbon burning. Typically 10 to 20 thermal pulses have been followed for each TP-AGB object. This homogeneous and quite large set of models allows us to present an overview of the thermal pulse properties as well as of the nucleosynthesis accompanying the TP-AGB phase of intermediate-mass stars.

More specifically, after a brief description of the previous evolutionary stages, predictions are given for the isotopic ratios involving C, N, O, Ne, Mg, Al and Si. Also the surface abundances of $^{7}$Li, $^{19}$F and $^{23}$Na are reported. As the asymptotic phase of the thermal pulses has been reached for each star, we also indicate how these abundances will probably evolve until the stars completely loose their envelope, by including the evolution of the nucleosynthesis itself.

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## Really Cool Stars at the Galactic Center

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New and existing $K-$band spectra for 19 Galactic center late–type stars have been analyzed along with representative spectra of disk and bulge M giants and supergiants. Absorption strengths for strong atomic and molecular features have been measured. The Galactic center stars generally exhibit stronger absorption features centered near Na I ($2.206\mu$) and Ca I ($2.264\mu$) than representative disk M stars at the same CO absorption strength.

Based on the absolute $K-$band magnitudes and CO and $H_2O$ absorption strengths for the Galactic center stars and known M supergiants and asymptotic giant branch (AGB) stars, we conclude that only IRS 7 must be a supergiant. Two other bright stars in our Galactic center sample are likely supergiants as well. The remaining bright, cool stars in the Galactic center that we have observed are most consistent with being intermediate mass/age AGB stars. We identify five of the Galactic center stars as long period variables based on their $K-$band spectral properties and associated photometric variability. Estimates of initial masses and ages for the GC stars suggest multiple epochs of star formation have occurred in the Galactic center over the last 7–100 Myr.

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## Magnesium and Carbon Isotopes in Globular Cluster Giants. Tests of Deep Mixing. II.

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The first Mg isotope ratios measured in globular cluster giants have been reported. Mg and C isotope ratios are determined for a sub-set of the giants studied in Shetrone (1996). Seven M13 red giants and 10 halo field giants were observed at high resolution (R=61,000) with S/N ranging between 60 to 166 per pixel near 5140 Å. One giant, M13 II-90, was found to have asymmetric line profiles, indicating that it may be a spectroscopic binary.

The slightly metal-poor field giants are found to have $^{12}C/^{13}C$ ratios ranging from 10–14, whereas the more metal

poor cluster giants have ratios ranging from 3–6. Among the M13 giants, the distribution of $^{12}C/^{13}C$ is consistent ($\chi^2_\nu = 1.47$) with no trend with [Na/Fe], from which it is concluded that nearly all the outer envelope has been processed through regions which have undergone $^{12}C \rightarrow ^{13}C$ processing without significant portions of the atmosphere being processed through regions that have undergone the NeNa cycle.

Isotopic analysis of the 5135 Å MgH bands reveal four M13 stars with super-solar ratios of $^{25}Mg + ^{26}Mg$ compared with $^{24}Mg$ and one M13 star with solar isotopic ratios. Only one cluster star, L598, has sub-solar isotope ratios consistent with the isotopic ratios found in our and previous investigators' studies of halo field stars. The isotopic abundances [$^{24}Mg$/Fe] are found to be anti-correlated with the Al abundances and correlated with the total Mg ($^{24}Mg$+$^{25}Mg$+$^{26}Mg$) abundances. No correlation ($\chi^2_\nu = 1.08$) is found between [($^{25}Mg$+$^{26}Mg$)/Fe] and any of the elements potentially alterable by deep mixing (Na, O, Al and $^{24}Mg$). However, [($^{25}Mg$+$^{26}Mg$)/Fe] has been found to scale with the iron abundance over the entire metallicity range. It is established that the star-to-star [Mg/Fe] abundance differences in M13 are caused by differences in $^{24}Mg$. If deep mixing is responsible for the Al enhancements found in M13 giants, deep mixing cycles the atmospheres of some giants into regions where Al is produced from proton capture on $^{24}Mg$ at $T_9 \sim 0.07$. Using the observations found in the literature and presented in this work, we establish a mixing sequence to constrain future models of deep mixing.

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## The X-ray Spectrum of a Metal-Poor Corona

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We present an ASCA SIS spectrum of the Pop II binary star HD 89499. This is the most metal poor star ([Fe/H] = −2.1) known to have a corona. The ASCA data confirm initial results from ROSAT which suggested a very hot, single-component plasma temperature, with the temperature derived from the ASCA data being slightly higher ($2.6 \times 10^7$ K) than the one determined by ROSAT. The ASCA spectrum clearly shows the absence of emission lines and can be best modelled as thermal bremsstrahlung, although strong absorption at photon energies less than 0.5 keV is indicated. We suggest that such an extremely high coronal temperature results from the lack of an efficient cooling mechanism due to the absence of metallic (mostly Fe) emission lines.

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## OH 1.563$\mu$m Absorption From Starspots on Active Stars

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We present results from a study of starspots on active stars using a pair of vibrational-rotational absorption lines of the OH molecule near 1.563$\mu$m. We detect excess absorption due to dark, cool starspots on the RS CVn binaries II Pegasi, V1762 Cygni, and $\lambda$ Andromedae. This is the first detection of OH absorption from spots on stars other than the Sun. We hve measured absorption equivalent widths of these OH lines (which are blended at the resolution of our observations) in inactive giant and dwarf stars of spectral types G, K, and M. We find that the total equivalent width of the line pair increases approximately linearly as $T_{\rm eff}$ decreases from 5000 K to 3000 K. We measure starspot filling factors by fitting the spectra of active stars with linear combinations of comparison star spectra representing the spot and non-spot regions of the star. Fitting only one spectral feature, we cannot derive independent constraints on starspot area and temperature. Assuming spot temperatures based on previous analyses, we find (for one epoch) spot filling factors between 35% and 48% for II Peg, 22% and 26% for $\lambda$ And, and 27% and 32% for V1762 Cyg.

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## The Photosphere of the Sun: Statistical Correlations Between Magnetic Field, Intensity, and Velocity

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We have analysed a time series of high resolution spectra of Fe I lines 6301.5 Å and 6302.5 Å, near an active region, obtained at the Sacramento Peak Tower Telescope. The derived spectroheliograms and spectromagnetograms have been used to investigate the statistical relation between magnetic fields and the associated intensities and velocities. We found that two kinds of magnetic structures coexist: tiny bright flux tubes, located in the intergranular lanes, which explain the increase of the brightness of weak magnetic fields, (from 0 to 400 Gauss) and magnetic features of larger sizes which should be darker than the average photosphere. Downflows up to 200 m s$^{-1}$ are measured for magnetic signal values between 80 and 400 Gauss; they are certainly due to the presence of several tiny bright flux tubes in the resolution element. We also confirm that the contrast of granulation is reduced in magnetic field areas.

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## An Adaptive Grid Code for High Resolution 1-D Hydrodynamics of the Solar and Stellar Transition Region and Corona.

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We present a new version of the Palermo-Harvard hydrodynamic model of plasma confined in coronal loops, based on a regridding algorithm which ensures limited variations of thermodynamical variables across grid points. The code provides an accurate description of the dynamics of the chromosphere-corona transition region, in spite of the very steep temperature and density gradients, even during flare-like transients.

The new model can be used to synthesize, together with X-ray emission, the optically thin emission originating from the transition region, mainly in the EUV band. Here we show sample results.

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## Fe XVIII Emission Lines in Solar X-ray Spectra

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We have calculated intensity ratios for emission lines of Fe XVIII in the 13 – 94 Å wavelength range at electron temperatures characteristic of the solar corona, $T_e = 2 - 10 \times 10^6$ K. Our model ion includes data for transitions among the $2s^22p^5$, $2s2p^6$, $2s^22p^43l$ and $2s2p^53l$ ($l = s$, $p$ and $d$) states. Test calculations which omit the $2s2p^53l$ levels show that cascades from these are important. We compare our results with observed ratios determined from four solar X-ray instruments, a rocket-borne spectrograph, and spectrometers on the P78–1, OV1–17 and *Solar Maximum Mission* (SMM) satellites. In addition, we have generated synthetic spectra which we compare directly with flare observations from SMM. Agreement between theory and observation is generally quite good, with differences that are mostly less than 30%, providing limited support for the accuracy of the atomic physics data used in our calculations. However, large discrepancies are found for ratios involving the $2s^22p^5\ ^2\mathrm{P}_{3/2} - 2s2p^6\ ^2\mathrm{S}$ line at 93.84 Å, which currently remain unexplained. Our analysis indicates that the Fe XVIII feature at 15.83 Å is the $2s^22p^5\ ^2\mathrm{P}_{3/2} - 2s^22p^4(^3\mathrm{P})3s\ ^4\mathrm{P}_{3/2}$ transition, rather than $2s^22p^5\ ^2\mathrm{P}_{3/2} - 2s^22p^4(^3\mathrm{P})3s\ ^2\mathrm{P}_{3/2}$, as suggested by some authors.

Submitted to Solar Physics

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## On the Generation of Equipartition-strength Magnetic Fields by Turbulent Hydromagnetic Dynamos

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The generation of a mean magnetic field by the action of small-scale turbulent fluid motions, the $\alpha$-effect, is a fundamental ingredient of mean-field dynamo theory. However, recent mathematical models and numerical experiments are providing increasingly strong support to the notion that at high magnetic Reynolds numbers, the $\alpha$-effect is strongly impeded long before the mean magnetic field has reached energy equipartition with the driving fluid motions. Taken at face value, this raises serious doubt as to whether the solar magnetic field is produced by a turbulent hydromagnetic dynamo after all, since it is an observed fact that the Sun does possess a structured, large-scale mean magnetic field of strength comparable to equipartition. In this *Letter* we demonstrate that the class of mean-field turbulent hydromagnetic models known as *interface dynamos* can produce equipartition-strength mean magnetic fields even in the presence of strong $\alpha$-quenching.

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## *Ph.D. Thesis Abstract*

# Observational Tests of Deep Mixing in Population II Red Giants


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Ph.D degree awarded: June 1996



Globular clusters have been used as tests of stellar evolution for decades because their stars are believed to be co-eval and initially chemically homogeneous. However, during the past two decades, serious doubt has arisen concerning the chemical homogeneity of globular clusters. One interpretation of the origin of the chemical inhomogeneity is a deep mixing scenario. Deep mixing is thought to occur when some mechanism, such as meridional circulation, allows the surface material to be processed through regions of a star which have, in the past, undergone partial or complete CNO cycling. The most recent deep mixing theories have made strong predictions about the behavior of Mg and Al in stars which have undergone such mixing.

Results of a systematic survey of Al, $^{24,25,26}$Mg and Eu abundances of giants near the tip of the giant branch in globular clusters and in the halo field are reported. From analysis of the Al and Na abundances in moderately and very metal-poor halo field giants, as well as in the globular cluster M71, it is concluded that either Al and Na are created in different nucleosynthetic processes, or the NeNa cycle of deep mixing can occur without the NO or MgAl cycles. Star-to-star differences in Al abundances have been detected among bright giants in M92, M13 and M5. An Al–Na correlation and an Al–O anti-correlation are found which are consistent with the predictions of the deep mixing theory. M13, which has the largest spread in Al, Na and O abundances, has star-to-star differences in the Mg abundance that are anti-correlated with Al. The first Mg isotope ratios measured in globular cluster giants are reported. The isotopic abundances [$^{24}$Mg/Fe] are found to be anti-correlated with the Al abundances and correlated with the total Mg ($^{24}$Mg+$^{25}$Mg+$^{26}$Mg) abundances. No correlation is found between [($^{25}$Mg+$^{26}$Mg)/Fe] and any of the elements potentially alterable by deep mixing (Na, O, Al and $^{24}$Mg). It is established that the star-to-star [Mg/Fe] abundance differences in M13 are caused by differences in $^{24}$Mg. Using the observations found in the literature and presented in this work, we establish a mixing sequence to constrain future models of deep mixing.

## First Announcement

# A UMIST/CCP7 Workshop on DUST AND MOLECULES IN EVOLVED STARS

24-27 March 1997
UMIST, Manchester - UK
Organisers: I. Cherchneff & T.J. Millar

**Aim of the workshop:**

Late stages of evolution of low- and high-mass stars are characterized by very different circumstellar environments, but observations of these objects at optical, infrared and millimetre wavelengths often reveal the presence of the same type of solid compounds and molecular species. The aim of this workshop is to gather scientists working on late stages of stellar evolution to discuss the nature and the role of dust and molecules in evolved objects and to address and answer fundamental questions such as how the same type of solid compounds and molecular species can form in very different astrophysical environments.

A large fraction of the Infrared Space Observatory ISO mission is dedicated to the study of evolved objects and the workshop will be an opportunity to present new and exciting ISO results on circumstellar matter related to late stages of stellar evolution.

**Invited reviews:**

R. Bachiller (OAN, Spain) Chemical Evolution from the AGB to the Planetary Nebula Phase

M. Barlow (UCL, UK) ISO LWS Observations of Molecules and Dust in Evolved Stars and Nebulae

I. Cherchneff (UMIST, UK) Forming Dust in Hydrogen-Deficient Stellar Winds

D.D. Clayton (Clemson, USA) Isotopically Anomalous Dust from Supernovae

A. Dalgarno (CfA, USA) Molecules and Dust in Supernovae

A. Evans (Keele, UK) Dust and Molecules in Novae Environments

D. Field (Bristol, UK) To be confirmed

M. Jura (UCLA, USA) Dust in Discs and Outflows around Mass-Losing Stars

H. Olofosson (Stockholm, Sweden) Molecular Line Observations of Envelopes around AGB stars

P. Sarre (Nottingham, UK) Optical and IR Spectroscopy of Molecules in Circumstellar Environments

E. Sedlmayr (Berlin, Germany) Dust Formation in LPVs

M. Steffen (Potsdam, Germany) To be confirmed

X. Tielens (NASA/Ames, USA) Circumstellar Dust

K. van der Hucht (SRON, Physical Properties of Wolf-Rayet Winds as The Netherlands) Observed from Gamma to Radio Wavelengths

P.M. Williams (ROE, UK) Formation of Dust in Hostile Environments - What We Learn from Wolf-Rayet Stars

**If you are interested in participating, please contact:**

Dr. Isabelle Cherchneff, Department of Physics UMIST, P.O. Box 88 Manchester M60 1QD - United Kingdom

imc@ast.ma.umist.ac.uk

by September 30, 1996.

## *Announcements*

### HST/GHRS Results on Cool Stars

I will be presenting a review of HST/GHRS results on Cool Stars at the GHRS Symposium Sept. 11-12, 1996 and would very much appreciate copies of reprints and preprints of any papers on Cool Star topics based on GHRS observations. The time period covered is the full lifetime of HST, so I will appreciate both old and new publications. Either electronic postscript versions or hardcopies to the address below would be fine.

If you've got some research you'd like to make sure is included, this is your chance to ensure it makes it into the review - and the earlier I receive it, the better the odds!

Thanks very much,

Ken Carpenter
Code 681 NASA-GSFC Greenbelt, MD 20771
hrscarpenter@tma1.gsfc.nasa.gov
Tel. (301)-286-3453

## *Job Opening*

### Post-doctoral Research Assistantship

*Angular Momentum Evolution in Late-type Stars*

**Armagh Observatory, N. Ireland**

A vacancy exists for a suitably qualified candidate to work in the above area from 1 October 1996. The appointment, funded by the UK Particle Physics and Astronomy Research Council, will be for 20 months in the first instance and will attract a salary in the region of £15,154 (under review), corresponding to Point 5 on the RA1A scale. Details of the research programme may be had by contacting the address given below.

Applications, which may be submitted by eMail to: sgw@star.arm.ac.uk, and should reach the Observatory before 12:00 on 15 September 1996. Applicants should ensure that two referees reports in support of their application, which may also be sent by eMail, arrive by the same date.

*For further information contact*: Brendan Byrne (pbb@star.arm.ac.uk)

## *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` .