COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

Modelling Chromospheric Line Profiles as Diagnostics of Velocity Fields in ω Centauri Red Giant Stars

M. Vieytes[1], P. Mauas[1], C. Cacciari[2], L. Origlia[2] and E. Pancino[2]

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Mass loss of $\sim$ 0.1-0.3 $M_\odot$ from Population II red giant stars (RGB) is a requirement of stellar evolution theory in order to account for several observational evidences in globular clusters. The aim of this study is to detect the presence of outward velocity fields, which are indicative of mass outflow, in six luminous red giant stars of the stellar cluster ω Cen. We compare synthetic line profiles computed using relevant model chromospheres to observed profiles of the Hα and Ca II K lines. The spectra were taken with UVES (R=45,000) and the stars were selected so that three of them belong to the metal-rich population and three to the metal-poor population, and sample as far down as 1 to 2.5 magnitudes fainter than the respective RGB tips. We do indeed reveal the presence of low-velocity outward motions in four of our six targets, without any apparent correlation with astrophysical parameters. This provides direct evidence that outward velocity fields and mass motions exist in RGB stars as much as 2.5 mag fainter than the tip. On the assumption that the mass outflow may eventually lead to mass loss from the star, we estimate mass-loss rates of some 10^{-9}-$10^{-10} M_\odot$ yr^{-1} that are compatible with the stellar evolution requirements. These rates seem to be correlated with luminosity rather than metallicity.

Accepted by A&A

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Long-term Chromospheric Activity in Southern M Dwarfs: Gl 229 A and Gl 752 A

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Several late-type stars present activity cycles similar to that of the Sun. However, these cycles have been mostly studied in F to K stars. Due to their small intrinsic brightness, M dwarfs are not usually the targets of long-term observational studies of stellar activity, and their long-term variability is generally not known. In this work, we study the long-term activity of two M dwarf stars: Gl 229 A (M1/2) and Gl 752 A (M2.5). We employ medium resolution echelle spectra obtained at the 2.15 m telescope at the Argentinian observatory CASLEO between the years 2000 and 2010 and photometric observations obtained from the ASAS database. We analyzed Ca II K line-core fluxes and the mean V magnitude with the Lomb-Scargle periodogram, and we obtain possible activity cycles of ∼4 yr and ∼7 yr for Gl 229 A and Gl 752 A respectively.

Accepted by AJ

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For preprints via ftp or WWW:**http://arxiv.org/abs/1011.1137**

Radiative Hydrodynamics Simulations of Red Supergiant Stars III. Spectro-photocentric Variability, Photometric Variability, and Consequences on Gaia Measurements

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Context: It has been shown that convection in red supergiant stars (RSG) gives rise to large granules causing surface inhomogeneities together with shock waves in the photosphere. The resulting motion of the photocenter (on time scales ranging from months to years) could possibly have adverse effects on the parallax determination with Gaia.
Aims:We explore the impact of the granulation on the photocentric and photometric variability. We quantify these effects in order to better characterize the error possibly altering the parallax.
Methods: We use 3D radiative-hydrodynamics (RHD) simulations of convection with CO5BOLD and the post-processing radiative transfer code OPTIM3D to compute intensity maps and spectra in the Gaia G band [325 – 1030 nm].
Results: We provide astrometric and photometric predictions from 3D simulations of RSGs that are used to evaluate the possible degradation of the astrometric parameters of evolved stars derived by

Gaia. We show in particular from RHD simulations that a supergiant like Betelgeuse exhibits a photocentric noise characterised by a standard deviation of the order of 0.1 AU. The number of bright giant and supergiant stars whose Gaia parallaxes will be altered by the photocentric noise ranges from a few tens to several thousandths, depending on the poorly known relation between the size of the convective cells and the atmospheric pressure scale height of supergiants, and to a lower extent, on the adopted prescription for galactic extinction. In the worst situation, the degradation of the astrometric fit due to the presence of this photocentric noise will be noticeable up to about 5 kpc for the brightest supergiants. Moreover, parallaxes of Betelgeuse-like supergiants are affected by a error of the order of a few percents. We also show that the photocentric noise, as predicted by the 3D simulation, does account for a substantial part of the supplementary 'cosmic noise' that affects Hipparcos measurements of Betelgeuse and Antares.

Accepted by A&A

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For preprints via ftp or WWW: **http://arxiv.org/abs/1012.5234**

The Solar and α Centauri A and B Models Improved by Opacity Enhancement - A Possible Explanation for the Oversize Cool Stars

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The Sun and α Cen A and B are the nearest stars to us. Despite the general agreement between their models and seismic and non-seismic constraints, there are serious problems pertaining to their interior. The good agreement between the sound speed and base radius of the convective zone of the Sun and the solar models is broken apart by a recent revision in solar chemical composition. For α Cen A and B, however, it is not possible to fit models with the same age and chemical composition to all seismic and non-seismic observational constraints.

At the age deduced from seismic constraints, the luminosity ratio ($L_{\rm A}/L_{\rm B}$) of the models is significantly lower than the ratio taken from the observed luminosities. Enhancement of opacity as a function of temperature is one way to restore the agreement between solar models and the Sun, but such an enhancement does not alter the situation for α Cen A and B. The reason is that models of both components are influenced in a similar manner and consequently the luminosity ratio doesn't change much. In the present study, problems pertaining to the interior of these three stars with a single expression for opacity enhancement are modelled. The opacity enhancement is expressed as a function of density, ionization degree of heavy elements (oxygen), and temperature. According to this expression, for improvement of the models the required opacity enhancement for α Cen A and B at $\log(T)=$ 6.5, for example, is about 7 and 22 per cent, respectively. The enhancement takes place in the region in which pressure ionization is effective, and is higher for low-mass stars than for high-mass stars. This result seems to be a possible explanation for the serious differences between models and observational results of cool stars.

Accepted by MNRAS

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For preprints via ftp or WWW: **arxiv.org/abs/1101.1205**

Solar Abstracts

Non-equilibrium Calcium Ionisation in the Solar Atmosphere

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The chromosphere of the Sun is a temporally and spatially very varying medium for which the assumption of ionisation equilibrium is questionable. Our aim is to determine the dominant processes and timescales for the ionisation equilibrium of calcium under solar chromospheric conditions. The study is based on numerical simulations with the RADYN code, which combines hydrodynamics with a detailed solution of the radiative transfer equation. The calculations include a detailed non-equilibrium treatment of hydrogen, calcium, and helium. Next to an hour long simulation sequence, additional simulations are produced, for which the stratification is slightly perturbed so that a ionisation relaxation timescale can be determined. The simulations are characterised by upwards propagating shock waves, which cause strong temperature fluctuations and variations of the (non-equilibrium) ionisation degree of calcium. The passage of a hot shock front leads to a strong net ionisation of Ca II, rapidly followed by net recombination. The relaxation timescale of the calcium ionisation state is found to be of the order of a few seconds at the top of the photosphere and 10 to 30 s in the upper chromosphere. At heights around 1 Mm, we find typical values around 60 s and in extreme cases up to ~ 150 s. Generally, the timescales are significantly reduced in the wakes of ubiquitous hot shock fronts. The timescales can be reliably determined from a simple analysis of the eigenvalues of the transition rate matrix. The timescales are dominated by the radiative recombination from Ca III into the metastable Ca II energy levels of the 4d ^{2}D term. These transitions depend strongly on the density of free electrons and therefore on the (non-equilibrium) ionisation degree of hydrogen, which is the main electron donor. The ionisation/recombination timescales derived here are too long for the assumption of an instantaneous ionisation equilibrium to be valid and, on the other hand, are not long enough to warrant an assumption of a constant ionisation fraction. Fortunately, the ionisation degree of Ca II remains small in the height range, where the cores of the H, K, and the infrared triplet lines are formed. We conclude that the difference due to a detailed treatment of Ca ionisation has only negligible impact on the modelling of spectral lines of Ca II and the plasma properties under the conditions in the quiet solar chromosphere.

Accepted by A&A

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Observations of Sausage Modes in Magnetic Pores

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We present here evidence for the observation of the magneto-hydrodynamic (MHD) sausage modes in magnetic pores in the solar photosphere. Further evidence for the omnipresent nature of acoustic global modes is also found. The empirical decomposition method of wave analysis is used to identify the oscillations detected through a 4170 Å 'blue continuum' filter observed with the Rapid Oscillations in the Solar Atmosphere (ROSA) instrument. Out of phase, periodic behavior in pore size and intensity is used as an indicator of the presence of magneto-acoustic sausage oscillations. Multiple signatures of the magneto-acoustic sausage mode are found in a number of pores. The periods range from as short as 30 s up to 450 s. A number of the magneto-acoustic sausage mode oscillations found have periods of 3 and 5 minutes, similar to the acoustic global modes of the solar interior. It is proposed that these

global oscillations could be the driver of the sausage type magneto-acoustic MHD wave modes in pores.

Accepted by ApJ Letters

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Low-Mass and Substellar Abstracts

Exoplanet Orbit Database and Exoplanet Data Exoplorer

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We present a database of well determined orbital parameters of exoplanets. This database comprises spectroscopic orbital elements measured for 421 planets orbiting 357 stars from radial velocity and transit measurements as reported in the literature. We have also compiled fundamental transit parameters, stellar parameters, and the method used for the planets discovery. This Exoplanet Orbit Database includes all planets with robust, well measured orbital parameters reported in peer-reviewed articles. The database is available in a searchable, filterable, and sortable form on the Web at http://exoplanets.org through the Exoplanets Data Explorer Table, and the data can be plotted and explored through the Exoplanet Data Explorer Plotter. We use the Data Explorer to generate publication-ready plots giving three examples of the signatures of exoplanet migration and dynamical evolution: We illustrate the character of the apparent correlation between mass and period in exoplanet orbits, the selection different biases between radial velocity and transit surveys, and that the multiplanet systems show a distinct semi-major axis distribution from apparently singleton systems.

Submitted to PASP

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For preprints via ftp or WWW: **http://xxx.lanl.gov/abs/1012.5676**

Cross-Listed Abstracts (Pre-Main Sequence Stars)

Editor's Note: **The abstracts below are being cross-listed with the** *Star Formation Newsletter.*

Deep XMM-Newton observation of the η Chamaleontis cluster

J. López-Santiago[1], J. F. Albacete-Colombo[2] and M. A. López-García[1]

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The members of the η Chamaleontis cluster are in an evolutionary stage in which disks are rapidly evolving. It also presents some peculiarities, such as the large fraction of binaries and accretion disks, probably related to the cluster formation process. Its proximity makes this stellar group an ideal target for studying the relation between X-ray emission and those stellar parameters. The main objective of this work is to determine general X-ray properties of the cluster members in terms of coronal temperature, column density, emission measure, X-ray luminosity and variability. We also aim to establish the relation between the X-ray luminosity of these stars and other stellar parameters, such as binarity and presence of accretion disks. A study of flare energies for each flare event and their relation with some stellar parameters is also performed. We used proprietary data from a deep XMM-Newton observation pointed at the core of the η Chamaleontis cluster. Specific software for the reduction of XMM-Newton data was used for the analysis of our observation. For the detection of sources, we used the wavelet-based code PWDetect. General coronal properties were derived from plasma model fitting. We also determined variability of the η Chamaleontis members in the EPIC field-of-view. A total of six flare-like events were clearly detected in five different stars. For them, we derived coronal properties during the flare events and pseudo-quiescent state separately. In our observations, stars that underwent a flare event have higher X-ray luminosities in the pseudo-quiescent state than cluster members with similar spectral type with no indications of flaring, independently whether they have an accretion disk or not. Observed flare energies are typical of both pre-main and main-sequence M stars. We detected no difference between flare energies of stars with and without an accretion disk.

Accepted by A&A

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For preprints via ftp or WWW: **http://argox.fis.ucm.es/SFG**

Upcoming Meeting

First International Symposium for Science with the SOAR Telescope

15 - 19 May, 2011

Maresias Beach, Brazil

FIRST ANNOUNCEMENT

The Southern Astrophysical Research (SOAR) Telescope is a 4.1 meter aperture telescope designed to produce the best quality images of any observatory in its class in the world. It was funded by a partnership between the U.S. National Optical Astronomy Observatory (NOAO), The Ministrio da Cincia e Tecnologia do Brasil, Michigan State University (MSU) and the University of North Carolina at Chapel Hill (UNC).

After five years of continuing science operations with the SOAR telescope, the First International Symposium of Science with SOAR will bring together specialists, graduate students, and post-docs from the different partners with expertise in a wide variety of scientific areas, who will highlight key results gathered from observations with SOAR and/or outline promising science programs for the future.

The Symposium is also an opportunity to discuss current instrument performance and future instrumentation to SOAR as well as to share common experience in the reduction and analysis of data with SOAR.

The Symposium will take place at the resort area of Maresias Beach, on the Atlantic coast of Sao Paulo, Brazil, on May 15-19, 2011. There will be a number of invited speakers, together with ample time for contributed (oral) papers, posters, and discussion.

Please see the symposium web site for more information and to register:

http://www.lna.br/FISSS2011/

Upcoming Meeting

The First LWS Solar Dynamics Observatory Science Workshop

The Spectra of Solar Activity

1 - 5 May 2011

Squaw Valley (Lake Tahoe), California

SECOND ANNOUNCEMENT

Living With a Star's Solar Dynamics Observatory invites you to its first science workshop to be held May 1 - 5, 2011 at the Resort at Squaw Creek, in Squaw Valley (Lake Tahoe), CA:

http://www.squawcreek.com/

The theme will address science questions that are fundamental to SDO's science investigations, Atmospheric Imaging Assembly (AIA), EUV Variability Experiment (EVE), and Helioseismic and Magnetic Imager (HMI).

All members of the science community are welcome and encouraged to attend. Additional information, including registration and housing, can be found at:

http://lws-sdo-workshops.org

Description of Meeting Theme:

Solar magnetism forces us to view the Sun, its atmosphere, and even the inner heliosphere as a single coupled system from the deep dynamo to the solar wind. The high resolution and global view of the Solar Dynamics Observatory, in conjunction with other ground- and space- based instruments and supported by advanced data-assimilation and modeling techniques, provides a new opportunity to study solar phenomena from near the resolution limit to the global scale, and how these are connected among themselves.

Within the broader context of the wide-ranging advances being made in solar and inner-heliospheric physics, this meeting aims to emphasize some long-standing problems to which SDO can uniquely contribute with its observational improvements in the multi-dimensional spectra of space, time, wavelength.

Meeting format:

The meeting will consist of both plenary sessions and working group/ discussion sessions. Along with some pre-defined session topics, there is an opportunity for sessions to be defined with input from the participants in order to address the newly emerging topics of interest from the larger LWS community. Please submit any suggestions for these sessions to Phillip Chamberlin (phillip.c.chamberlin@nasa.gov).

We are looking forward to seeing you in Squaw Valley.

Sincerely,

The LWS/SDO-1 Scientific Organizing Committee:

Phillip Chamberlin (Chair), Jesper Schou (Co-Chair), Aaron Birch, Frank Eparvier, Sarah Gibson, Lika Guhathakurta, Jim Klimchuk, K. D. Leka, Dana Longcope, Dean Pesnell, Karel Schrijver, Barbara Thompson, Harry Warren

Upcoming Meeting

Current Developments in Atomic, Molecular, Optical and Nano Physics

14 - 16 December 2011

Delhi University, Delhi, India

Dear colleagues:

We invite submissions for the sessions entitled:

Spectroscopy of Solar and Stellar Plasma
Atomic & Molecular Structure, Collision Processes, Data Production and Application, **and**
The Atomic Universe : Spectra as Probes of Cool Gas

in the 3rd International Conference on Current Developments in Atomic, Molecular, Optical and Nano Physics.

Further details on abstract submission, registration, accommodation and visas will be available soon at:

https://www.tbimice.com/cdamop2011/

Best regards,

Gerry Doyle

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.*****