# *COOLNEWS*

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

No. 184 — March - April 2013 Editor: Steve Skinner (coolnews@jila.colorado.edu)

TABLE OF CONTENTS



## *Coolnews on the Web*

The current and previous issues of *Coolnews* are available on the following web page in pdf, postscript, and Latex format: **http://casa.colorado.edu/∼skinners/coolnews.html**

## *Stellar Abstracts*

### Spatially Resolved, High-Spectral Resolution Observation of the K Giant Aldebaran in the CO First Overtone Lines with VLTI/AMBER

**Keiichi Ohnaka**[1]

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We present a high-spatial and high-spectral resolution observation of the well-studied K giant Aldebaran with AMBER at the Very Large Telescope Interferometer (VLTI). Our aim is to spatially resolve the outer atmosphere (so-called MOLsphere) in individual CO first overtone lines and derive its physical properties, which are important for understanding the mass-loss mechanism in normal (i.e., non-Mira) K–M giants. Aldebaran was observed between 2.28 and 2.31 $\mu$m with a projected baseline length of 10.4 m and a spectral resolution of 12000. The uniform-disk diameter observed in the CO first overtone lines is 20–35% larger than is measured in the continuum. We have also detected a signature of inhomogeneities in the CO-line-forming region on a spatial scale of ∼45 mas, which is more than twice as large as the angular diameter of the star itself. While the MARCS photospheric model reproduces the observed spectrum well, the angular size in the CO lines predicted by the MARCS model is significantly smaller than observed. This is because the MARCS model with the parameters of Aldebaran has a geometrical extension of only ∼2% (with respect to the stellar radius). The observed spectrum and interferometric data in the CO lines can be simultaneously reproduced by placing an additional CO layer above the MARCS photosphere. This CO layer is extended to $2.5 \pm 0.3$ $R_\star$ with CO column densities of $5 \times 10^{19}$–$2 \times 10^{20}$ cm$^{-2}$ and a temperature of $1500 \pm 200$ K. The high spectral resolution of AMBER has enabled us to spatially resolve the inhomogeneous, extended outer atmosphere (MOLsphere) in the individual CO lines for the first time in a K giant. Our modeling of the MOLsphere of Aldebaran suggests a rather small gradient in the temperature distribution above the photosphere up to 2–3 $R_\star$. (*continued →*)

Accepted by A&A

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*For preprints via WWW*: http://arxiv.org/abs/1303.4763

## Photometric Variability in *Kepler* Target Stars. III. Comparison with the Sun on Different Timescales

**Gibor Basri[1], Lucianne M. Walkowicz[2], Ansgar Reiners[3]**

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We utilize *Kepler* data to study the precision differential photometric variability of solar-type and cooler stars at different timescales, ranging from half an hour to 3 months. This is done in part by using the overall range of variability on long timescales of the light curves as an activity diagnostic. We also define a diagnostic that characterizes the median differential intensity change between data bins of a given timescale. We apply these same diagnostics to solar data from SOHO that has been rendered comparable to *Kepler*. In order to make a direct comparison between the Sun and *Kepler* stars of different brightnesses, we develop a simple three-parameter noise model for *Kepler* that is well matched to the lower envelope of variability for all stars and timescales in the *Kepler* dataset.

We come to the clear conclusion that the Sun exhibits similar photometric variability on all timescales when compared to similar solar-type stars in the *Kepler* field. We are also able to address again the question of what fraction of comparable stars in the *Kepler* field are more active than the Sun, and confirm that it is between a quarter and a third of them (depending on the timescale). The exact active fraction depends in part on what is meant by "more active than the Sun" and in part on the magnitude limit of the sample of stars considered. We argue that a reliable result can only be found for timescales of half a day or longer, and requires stars brighter than $M_{Kep}$ of 14, since otherwise there is too large a contribution of non-stellar noise. We also confirm that as one moves to cooler stars, the active fraction of stars becomes steadily larger (greater than 90% for the M dwarfs). We discuss the properties of different effective temperature groups of main sequence stars, from 6500-3500K. The Sun is a good photometric model at all timescales for those cooler stars that have long-term (monthly) variability within the span of solar variability.

Accepted by ApJ

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## Transient High Frequency Optical Oscillations on Two Weak Ares of the Red Dwarf V390 Auri

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In this paper the presence of high-frequency oscillations on two weak ares of the G8 dwarf V390 Auri is investigated. The combined use of fractal analysis and DFT-analysis enable us to estimate proper random noise and to detect possible weak transient optical oscillations. In accordance with the results of the previous studies the results of the present study indicate that (1) transient high frequency oscillations occur during the are event; (2) the observed frequencies, not rigorously bounded, range between 0.011 Hz (period 1.5 min) and 0.083 Hz (period 12 s). This result is in accordance with the results of the observation of transient optical oscillation on strong and medium flares.

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## On the Origin of W UMa Type Contact Binaries - A New Method for Computation of Initial Masses

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W UMa type binaries have two defining characteristics. These are (i) the effective temperatures of both components are very similar, and (ii) the secondary (currently less massive) component is overluminous for its current mass. We consider the latter to be an indication of its mass before the mass-transfer event. For these stars, we define a mass difference ($\delta M$) between the mass determined from its luminosity and the present mass determined from fitting the binary orbit. We compare the observed values of the mass difference to stellar models with mass-loss. The range of initial secondary masses that we find for observed W UMa type binaries is 1.3-2.6 $M_\odot$. We discover that the A- and the W-subtype contact binaries have different ranges of initial secondary masses. Binary systems with an initial mass higher than $1.8 \pm 0.1$ $M_\odot$ become A-subtype while systems with initial masses lower than this become W-subtype. Only 6 per cent of systems violate this behavior. We also obtain the initial masses of the primaries using the following constraint for the reciprocal of the initial mass ratio: $0 < 1/q_i < 1$. The range of initial masses we find for the primaries is 0.2-1.5 $M_\odot$, except for two systems. Finally in comparing our models to observed systems, we find evidence that the mass transfer process is not conservative. We find that only 34 per cent of the mass from the secondary is transferred to the primary. The remainder is lost from the system.

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*For preprints via ftp or WWW*: http://arxiv.org/abs/1301.6035

## MARVELS-1: A Face-On Double-Lined Binary Star Masquerading as a Resonant Planetary System and Consideration of Rare False Positives in Radial Velocity Planet Searches

**Jason T. Wright**[1,2], **Arpita Roy**[1,2], **Suvrath Mahadevan**[1,2], **Sharon X. Wang**[1,2], **Eric B. Ford**[3], **Matt Payne**[3,5], **Brian L. Lee**[3,6], **Ji Wang**[4], **Justin R. Crepp**[7], **B. Scott Gaudi**[8], **Jason Eastman**[8], **Joshua Pepper**[9], **Jian Ge**[3], **Scott W. Fleming**[1,2], **Luan Ghezzi**[10,11], **Jonay I. González-Hernández**[12,13], **Phillip Cargile**[9], **Keivan G. Stassun**[9,14], **John Wisniewski**[15], **Leticia Dutra-Ferreira**[16,11], **Gustavo F. Porto de Mello**[16,11], **Márcio A. G. Maia**[10,11], **Luiz Nicolaci da Costa**[10,11], **Ricardo L. C. Ogando**[10,11], **Basilio X. Santiago**[17,11], **Donald P. Schneider**[1,2], **Fred R. Hearty**[18]

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We have analyzed new and previously published radial velocity observations of MARVELS-1, known to have an ostensibly substellar companion in a $\sim$ 6-day orbit. We find significant ($\sim 100$ m s$^{-1}$) residuals to the best-fit model for the companion, and these residuals are naïvely consistent with an interior giant planet with a $P = 1.965$d in a nearly perfect 3:1 period commensuribility ($|P_b/P_c - 3| < 10^{-4}$). We have performed several tests for the reality of

such a companion, including a dynamical analysis, a search for photometric variability, and a hunt for contaminating stellar spectra. We find many reasons to be critical of a planetary interpretation, including the fact that most of the three-body dynamical solutions are unstable. We find no evidence for transits, and no evidence of stellar photometric variability. We have discovered two apparent companions to MARVELS-1 with adaptive optics imaging at Keck; both are M dwarfs, one is likely bound, and the other is likely a foreground object. We explore false-alarm scenarios inspired by various curiosities in the data. Ultimately, a line profile and bisector analysis lead us to conclude that the $\sim 100$ m $s^{-1}$ residuals are an artifact of spectral contamination from a stellar companion contributing $\sim 15$–$30\%$ of the optical light in the system. We conclude that origin of this contamination is the previously detected radial velocity companion to MARVELS-1, which is not, as previously reported, a brown dwarf, but in fact a G dwarf in a face-on orbit.

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*For preprints via WWW*: http://arxiv.org/abs/1305.0280

# *Solar Abstracts*

## Consistent Long-term Variation in the Hemispheric Asymmetry of Solar Rotation

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Solar active longitudes and their rotation have been studied for a long time using various forms of solar activity. However, the results on the long-term evolution of rotation rates and the hemispheric asymmetry obtained by earlier authors differ significantly from each other. We aim to find a consistent result on the long-term migration of active longitudes of sunspots in 1877-2008 separately for the two hemispheres. We use a dynamic, differentially rotating reference system to determine the optimum values of the differential rotation parameters of active longitudes for each year in 1877-2008. Using these parameters we determine the momentary rotation rates at the reference latitude of 17° and calculate the non-axisymmetries of active longitudes. We repeat the procedure using five different fit intervals and two weighting methods and compare the results. The evolution of solar surface rotation in each hemisphere suggests a quasi-periodicity of about 80-90 years. The long-term variations of solar rotation in the northern and southern hemisphere have a close anti-correlation, leading to a significant 80-90-year quasi-periodicity in the north-south asymmetry of solar rotation. The north-south asymmetry of solar rotation is found to have an inverse relationship with the area of large sunspots. The latitudinal contrast of differential rotation is also found to be anti-correlated with sunspot area. Different fit and weight methods yield similar results. Our results give strong evidence for the anti-correlation of the rotation of the two solar hemispheres. The found long-term oscillation of solar rotation suggests that a systematic interchange of angular momentum takes place between the two hemispheres at the period of about 80-90 years.

Accepted by A&A

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## On the Possibility of Habitable Moons in the System of HD 23079: Results from Orbital Stability Studies

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The aim of our study is to investigate the possibility of habitable moons orbiting the giant planet HD 23079b, a Jupiter-mass planet, which follows a low-eccentricity orbit in the outer region of HD 23079's habitable zone. We show that HD 23079b is able to host habitable moons in prograde and retrograde orbits, as expected, noting that the outer stability limit for retrograde orbits is increased by nearly 90% compared to that of prograde orbits, a result consistent with previous generalized studies. For the targeted parameter space it was found that the outer stability limit for habitable moons varies between 0.05236 and 0.06955 AU (prograde orbits) and between 0.1023 and 0.1190 AU (retrograde orbits) depending on the orbital parameters of the Jupiter-type planet if a minimum mass is assumed. These intervals correspond to 0.306 and 0.345 (prograde orbits) and 0.583 and 0.611 (retrograde orbits) of the planet's Hill radius. Larger stability limits are obtained if an increased value for the planetary mass $m_p$ is considered; they are consistent with the theoretically deduced relationship of $m_p^{1/3}$. Finally, we compare our results to the statistical formulae of Domingos et al. (2006) [MNRAS 373, 1227], indicating both concurrence and limitations.

Accepted by Publ. Astron. Soc. Australia

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*For preprints via ftp or WWW*: http://arxiv.org/abs/1304.1157

# *Atomic Data Abstracts*

## Improving the Ni I Atomic Model for Solar and Stellar Atmospheric Models

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Neutral nickel (Ni I) is abundant in the solar atmosphere and is one of the important elements that contribute to the emission and absorption of radiation in the spectral range between 1900 and 3900 Å. Previously, the Solar Radiation Physical Modeling (SRPM) models of the solar atmosphere only considered a few levels of this species. Here, we improve the Ni I atomic model by taking into account 61 levels and 490 spectral lines. We compute the populations of these levels in full NLTE using the SRPM code and compare the resulting emerging spectrum with observations. The present atomic model significantly improves the calculation of the solar spectral irradiance at near-UV wavelengths, which is important for Earth atmospheric studies, and particularly for ozone chemistry.

Accepted by ApJ

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*Upcoming Meeting*

# XXV Canary Islands Winter School of Astrophysics

## Cosmic Magnetic Fields

### 11 - 22 November 2013

### Tenerife, Canary Islands

FIRST ANNOUNCEMENT

Dear Colleagues:

The *XXV Canary Islands Winter School of Astrophysics* will be devoted to Cosmic Magnetic Fields. The Canary Islands Winter School of Astrophysics has been organized by the Instituto de Astrofisica de Canarias (http://www.iac.es/index.php?lan every year since 1989. The next one will be held in the word heritage city of La Laguna, Tenerife, from November 11 to November 22, 2013.

**The school will overview all astrophysical environments where the magnetic field plays a significant role. It will provide a unifying view of the subject, from cosmology to the Sun, and from molecular clouds to AGNs. Details on lecturers and lecture topics are given in the school webpage.**

In order to maximize interactions, lectures and students will stay in the same hotel, which is also the school venue (http://www.hotelnivaria.com/). Special poster sessions will be organized for the students that want to present their recent work.

The school is addressed to post-graduate students in Astrophysics completing their PhD, and also to young post-docs. It is limited to 50 participants, and requires a registration fee of 1500 UE. The fee covers attending the school plus lodging in double-room, half board (breakfast and lunch) occupancy, during the duration of the school. In addition, it covers the social events and excursions to the two major observatories of the Canary Islands ('El Teide', in Tenerife http://www.iac.es/eno.php?op1=3&lang=en , and 'El Roque de los Muchachos' on the island of La Palma http://www.iac.es/eno.php?op1=2&lang=en).

There will be limited funds for grants.

Please, visit the school web page for information and pre-registration:

http://www.iac.es/winterschool/2013/

Deadline: 15 June 2013

J. Sanchez Almeida, M. Martinez Gonzalez, F. Garzon, and F. Sanchez

*Upcoming Meeting*

# IAU Symposium 302

## Magnetic Fields Throughout Stellar Evolution

### 26 - 30 August 2013

### Biarritz, France

SECOND ANNOUNCEMENT

http://iaus302.sciencesconf.org

This is the second announcement for the Symposium 302 of the International Astronomical Union, entitled "Magnetic fields throughout stellar evolution". The conference will be held in Biarritz (France), 26-30 August 2013.

**Presentation**:

Magnetic fields are key actors in the evolution of all stellar objects, through their ability to influence the angular momentum evolution, internal mixing or mass-loss of stars, as well as their activity phenomena or star-planet interactions. The present Symposium is aimed at offering a synthetic view of recent progresses in the young and growing domain of stellar magnetism. This research area is now benefiting from the rapid, combined development of observations and numerical simulations, enabling stellar physicists to take magnetic fields into account in most models of stellar structure and evolution.

**Topics**:

* Stellar structure and evolution * Magnetized accretion and outflows in young stellar objects * Magnetic braking of PMS stars * Solar and stellar activity in photospheres, chromospheres and coronae, and stellar cycles * Magnetism in very low-mass stars and brown dwarfs * Star-planet interaction * Stellar dynamos across the HR diagram * Magnetic field origin and stability in massive stars * Magnetically-confined winds of massive stars * Cool active subgiants and giants * Dynamo and mass-loss in giant and supergiant stars * Final phases of stellar evolution : magnetism in compact objects

**Scientific Organizing Committee**:

* Gibor Basri (Univ. California, USA) * Matthew Browning (Univ. Toronto,Canada) * Corinne Charbonnel (Geneva Observatory, Switzerland) * Jose-Dias do Nascimento (Univ. Natal, Brazil) * Siraj Hasan (IIA, India) * Moira Jardine (Univ. Saint Andrews, Scotland, co-chair) * Oleg Kochukhov (Univ. Uppsala, Sweden) * Renada Konstantinova-Antova (Bulgarian Academy of Sciences, Bulgaria) * Hiroaki Isobe (Univ. Kyoto, Japan) * Stephen Marsden (James Cook University, Australia) * Pascal Petit (Univ. Toulouse, France, chair) * Sami Solanki (MPS, Germany) * Henk Spruit (MPA, Germany, co-chair) * Klaus Strassmeier (AIP, Germany) * Asif ud-Doula (Penn State, USA) * Gregg Wade (RMC, Canada)

**Confirmed speakers**:

Jonathan Braithwaite - Sacha Brun - Rim Fares - Jason Grunhut - Gaitee Hussain - Oleg Kochukhov - Heidi Korhonen - Ryuichi Kurosawa - Norbert Langer - Franois Lignires - Stuart Littlefair - Stan Owocki - Ralph Pudritz - Nanda Rea - Ansgar Reiners - Andreas Reisenegger - Karel Schrijver - Saku Tsuneta - Aline Vidotto - Wouter Vlemmings - Lucianne Walkowicz

**Venue**:

The conference will be held at Casino Municipal, Biarritz (France). Situated on the French Atlantic coast, at the western end of the Pyrenees mountain range, Biarritz is a friendly and attractive town benefiting from the mild weather of southern France. It can be easily reached by plane or train and offers more than 2,300 hotel rooms. With 6 km of beaches, Biarritz is the historical capital of surfing in Europe. You can also find there the secondoldest golf course in Europe, 5 thalassotherapy centres and a casino.

The town is just a stones throw away from Spain and is less than 150 km away from Bilbao and its famous Guggenheim

museum. Biarritz is also located at less than 200 km from Bordeaux and its world-famous wineries. It is a perfect starting point to explore the Basque country, with its authentic countryside and charming villages. A half-day excursion will bring the participants to selected spots around the town, and the symposium diner will be the opportunity to enjoy French gastronomy.

**Accommodation**:

Biarritz is very attractive during the month of August, and hotels get fully booked very early. We thereforevery strongly recommend to book your hotel as soon as possible!A list of hotels is available here:
http://iaus302.sciencesconf.org/resource/page/id/9

**Social Events**:

The conference dinner will take place on Thursday night (29 Aug 2013), at Salle des Ambassadeurs (Casino Municipal). The banquet cost is 40 euros per person.

Three optional wednesday tours are proposed, to be chosen between a visit of Domaine Brana (winery), a discovery of the Basque coast by boat, and a visit of Chateau-Observatory Abbadia. Additional fees of 20 euros per person apply for the tours.

**Registration**:

Registration fee is 350 per participant. The fee allows access to the conference venue, the welcome cocktail on Sunday night, the coffee breaks, four lunches, and a hard copy of proceedings. Addditionnal fee is requested for conference dinner (40 euros) and Wednesday tours (20 euros).

The online payment interface is available here:

http://iaus302.irap.omp.eu

Cancellations: Requests for cancellation with a 50% fee refund will only be accepted through 01 Jul 2013.

– Abstract submission:

Abstract can be submitted at the following address:http://iaus302.sciencesconf.org/submission/submit

– Visa information:

General information for preparing your entry in France and applying to a French Visa is available here:

http://www.diplomatie.gouv.fr/en/france/coming-to-france/getting-a-visa/

Invitation letters will be provided to registered participants whenever needed. Should you require a letter, we invite you to contact the organizers by email (iaus302@sciencesconf.org).

**Proceedings**:

The proceedings of the Symposium will be published by Cambridge University Press. A hardcopy of the proceedings will be sent to each registered participant. Further information will follow about page limits and LaTeX templates. The deadline for submission of the proceedings is 30 Sep 2013.

**Important dates**:

* Abstract deadline for contributed talks: 13 May 2013 * Abstract deadline for posters: 21 Jun 2013 * Deadline for registration: 15 Jul 2013 * Deadline for proceedings submission: 30 Sep 2013

**Contact**:

Any inquiry about the conference should be addressed toiaus302@sciencesconf.org

We hope to see as many of you as possible in Biarritz this summer!

Best regards, the SOC and LOC

*Upcoming Meeting*

# Physics at the Magnetospheric Boundary:

## Neutron Stars, White Dwarfs and Young Stellar Objects

### 25 - 28 June 2013

### University of Geneva, Switzerland

THIRD CIRCULAR

The *Physics at the Magnetospheric Boundary* conference is aimed at bringing together specialists working theoretically, numerically and observationally on processes occurring at the limit of the magnetically dominated region around accreting objects such as Neutron Stars, White Dwarfs, and Young Stellar Objects.

The program of talks is now available online:

http://www.isdc.unige.ch/magbound/index.php/preliminary-program

Poster submission and registration are **still open until May 27**.

For more details, see:

http://www.isdc.unige.ch/magbound/

For any information, please contact:
magbound.webmaster@gmail.com

# *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 bimonthly call for abstracts will be issued. 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.***