COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

A *Spitzer* Study of Asymptotic Giant Branch Stars. III. Dust Production and Gas Return in Local Group Dwarf Irregular Galaxies

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We present the third and final part of a census of Asymptotic Giant Branch (AGB) stars in Local Group dwarf irregular galaxies. Papers I and II presented the results for WLM and IC 1613. Included here are Phoenix, LGS 3, DDO 210, Leo A, Pegasus dIrr, and Sextans A. *Spitzer* photometry at 3.6, 4.5, 5.8, and 8 μm are presented, along with a more thorough treatment of background galaxy contamination than was presented in papers I and II. We find that at least a small population of completely optically obscured AGB stars exists in each galaxy, regardless of the galaxy's metallicity, but that higher-metallicity galaxies tend to harbor more stars with slight IR excesses. The optical incompleteness increases for the redder AGB stars, in line with the expectation that some AGB stars are not detected in the optical due to large amounts of extinction associated with in situ dust production. Overall, there is an underrepresentation of 30% – 40% in the optical AGB within the $1\,\sigma$ errors for all of the galaxies in our sample. This undetected population is large enough to affect star formation histories derived from optical color-magnitude diagrams. As measured from the $[3.6]-[4.5]$ color excesses, we find average stellar mass-loss rates ranging from $3.1\times10^{-7} - 6.6\times10^{-6}$ $M_\odot$ yr^{-1}, and integrated galaxy mass-loss rates ranging from $4.4\times10^{-5} - 1.4\times10^{-3}$ $M_\odot$ yr^{-1}. The integrated mass-loss rate is sufficient to sustain the current star formation rate in only LGS 3 and DDO 210, requiring either significant non-dusty mass loss or gas accretion in Phoenix, Leo A, Pegasus dIrr, Sextans A, WLM, and IC 1613 if they are to maintain their status as gas-rich galaxies.

Accepted by ApJ

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For preprints via WWW: arXiv:0903.3871

The Young Active Star SAO 51891 (V383 Lac)

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Aims. The aim of this work is to investigate the surface inhomogeneities of a young, late-type star, SAO 51891, at different atmospheric levels, from the photosphere to the upper chromosphere, analyzing contemporaneous optical high-resolution spectra and broad-band photometry.
Methods. The full spectral range of FOCES@CAHA ($R \simeq 40\,000$) is used to perform the spectral classification and to determine the rotational and radial velocities. The lithium abundance is measured to obtain an age estimate. The $BVRIJHK_{\rm s}$ photometric bands are used to construct the spectral energy distribution (SED). The variations in the observed BV fluxes and effective temperature are used to infer the presence of photospheric spots and observe their behavior over time. The chromospheric activity is studied applying the spectral subtraction technique to Hα, CaII H & K, Hϵ, and CaII IRT lines.
Results. We find SAO 51891 to be a young K0–1V star with a lithium abundance close to the Pleiades upper envelope, confirming its youth (~ 100 Myr), which is also inferred from its kinematical membership to the Local Association. No infrared excess is detected from analysis of its SED, limiting the amount of remaining circumstellar dust. We detect a rotational modulation of the luminosity, effective temperature, CaII H & K, Hϵ, and CaII IRT total fluxes. A simple spot model with two main active regions, about 240 K cooler than the surrounding photosphere, fits very well the observed light and temperature curves. The small-amplitude radial velocity variations are also well reproduced by our spot model. The anti-correlation of light curves and chromospheric diagnostics indicates chromospheric plages spatially associated with the spots. The largest modulation amplitude is observed for the Hϵ flux suggesting that this line is very sensitive to the presence of chromospheric plages.
Conclusions. SAO 51891 is a young active star, lacking significant amounts of circumstellar dust or any evidence for low mass companions, which displays the typical phenomena produced by magnetic activity. The spots turn out to be larger and warmer than those in less active main-sequence stars. If some debris material is still present around the star, it will only be detectable by future far-infrared and sub-mm observations (e.g., Herschel or ALMA). The RV variation produced by the starspots has an amplitude comparable with those induced by Jupiter-mass planets orbiting close to the host star. SAO 51891 is another good example of an active star in which the detection of planets may be hampered by the high activity level.

Accepted by A&A

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Quantifying the Contamination by Old Main-sequence Stars in Young Moving Groups: The Case of the Local Association

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The associations and moving groups of young stars are excellent laboratories for investigating stellar formation in the solar neighborhood. Previous results have confirmed that a non-negligible fraction of old main-sequence stars is present in the lists of possible members of young stellar kinematic groups. A detailed study of the properties of these samples is needed to separate the young stars from old main-sequence stars with similar space motion, and identify the origin of these structures. We used stars possible members of the young ($\sim 10-650$ Myr) moving groups from the literature. To determine the age of the stars, we used several suitable age indicators for young main sequence stars, i.e., X-ray fluxes and other photometric data. We also used spectroscopic data, in particular the equivalent width of

the lithium line Li I λ6707.8 Å and H_α, to constrain the range of ages of the stars. By combining photometric and spectroscopic data, we were able to separate the young stars ($10 - 650$ Myr) from the old ($> 1Gyr$) field ones. We found, in particular, that the Local Association is contaminated by old field stars at the level of $\sim 30\%$. This value must be considered as the contamination for our particular sample, and not of the entire Local Association. For other young moving groups, it is more difficult to estimate the fraction of old stars among possible members. However, the level of X-ray emission can, at least, help to separate two age populations: stars with < 200 Myr and stars older than this. Our results are consistent with a scenario in which the moving groups contain both groups of young stars formed in a recent star-formation episode and old field stars with similar space motion. Only by combining X-ray and optical spectroscopic data is it possible to distinguish between these two age populations.

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For preprints via ftp or WWW: http://www.ucm.es/info/Astrof/users/dmg/papers/

Magnetic Activity on 12 Cam and 29 Dra from Long-term Photometry

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We present newly discovered magnetic cycles of two late-type and long-period SB1 systems: 12 Cam and 29 Dra. The long-term photometry study revealed the presence of magnetic multiperiodic cycles on both stars, namely 14.8 and 8.5 yr for 12 Cam and 20.3, 11.1 and 7.6 yr for 29 Dra. Furthermore, the modelling of the V-band light curves revealed the existence of two active longitudes on 12 Cam and probably on 29 Dra as well. Both stars show changes of rotational period. The 12 Cam is the slowest rotating star whose activity cycle has been determined. The activity cycles determined by us allow us to extend to the slower rotation regime and to improve the significance of the empirical relation between rotation period and magnetic cycle length.

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Altair - The 'Hottest' Magnetically Active Star in X-rays

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The A7 star Altair is one of the hottest magnetically active stars and its proximity to the Sun allows a detailed investigation of a corona in X-rays for a star with a shallow convection zone. We used a deep XMM-Newton observation of Altair and analyzed X-ray light curves, spectra and emission lines; we investigated the temporal behavior and properties of the X-ray emitting plasma and studied the global coronal structure. Altair's corona with an X-ray luminosity of $L_{\rm X} = 1.4 \times 10^{27}$ erg/s and an activity level of $\log L_{\rm X}/L_{\rm bol} = -7.4$ is located predominantly at low latitude regions and exhibits X-ray properties that are overall very similar to those of other weakly active stars. The X-ray emission is dominated by cool plasma ($1-4$ MK) at low density, and elemental abundances exhibit a solar-like FIP effect and Ne/O ratio. The X-ray brightness varies by 30 % over the observation, most likely due to rotational modulation and minor activity; in contrast, no strong flares or significant amounts of hot plasma were detected. The X-ray activity level of Altair is apparently close to the saturation level, which is reduced by roughly four orders of magnitude when compared to late-type stars. With its fast rotation, Altair provides an inefficient, but very stable dynamo that mainly operates in convective layers below its 'cooler' surface areas around the equator. This dynamo mechanism results in magnetic activity and leads to X-ray properties that are similar to those of the quiescent Sun, despite very different underlying stars.

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The Physical Properties of the Red Supergiant WOH G64: The Largest Star Known?

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WOH G64 is an unusual red supergiant (RSG) in the Large Magellanic Cloud (LMC), with a number of properties that set it apart from the rest of the LMC RSG population, including a thick circumstellar dust torus, an unusually late spectral type, maser activity, and nebular emission lines. Its reported physical properties are also extreme, including the largest radius for any star known and an effective temperature that is much cooler than other RSGs in the LMC, both of which are at variance with stellar evolutionary theory. We fit moderate-resolution optical spectrophotometry of WOH G64 with the MARCS stellar atmosphere models, determining an effective temperature of 3400 ± 25 K. We obtain a similar result from the star's broadband $V - K$ colors. With this effective temperature, and taking into account the flux contribution from the aysmmetric circumstellar dust envelope, we calculate $\log(L/L_\odot) = 5.45 \pm 0.05$ for WOH G64, quite similar to the luminosity reported by Ohnaka and collaborators based on their radiative transfer modeling of the star's dust torus. We determine a radius of $R/R_\odot = 1540$, bringing the size of WOH G64 and its position on the H-R diagram into agreement with the largest known Galactic RSGs, although it is still extreme for the LMC. In addition, we use the Ca II triplet absorption feature to determine a radial velocity of 294 ± 2 km s^{-1} for the star; this is the same radial velocity as the rotating gas in the LMC's disk, which confirms its membership in the LMC and precludes it from being an unusual Galactic halo giant. Finally, we describe the star's unusual nebula emission spectrum; the gas is nitrogen-rich and shock-heated, and displays a radial velocity that is significantly more positive than the star itself by 50 km s^{-1}.

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LO Pegasi: An Investigation of Multi-band Optical Polarization

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We present BVR polarimetric study of the cool active star LO Peg for the first time. LO Peg was found to be highly polarized among the cool active stars. Our observations yield average values of polarization in LO Peg: $P_B = 0.387\ pm 0.004\%$, $\theta_B = 88\,\mathrm{deg} \pm 1\,\mathrm{deg}$; $P_V = 0.351 \pm 0.004\%$, $\theta_V = 91\ deg \pm 1\,\mathrm{deg}$; and $P_R = 0.335 \pm 0.003\%$, $\theta_R = 91\,\mathrm{deg} \pm 1\,\mathrm{deg}$. Both the degree of polarization and the position angle are found to be variable. The semi-amplitude of the polarization variability in B, V and R bands are found to be 0.18 ± 0.02%, 0.13 ± 0.01% and 0.10 ± 0.02%, respectively. We suggest that the levels of polarization observed in LO Peg could be the result of scattering of an anisotropic stellar radiation field by an optically thin circumstellar envelope or scattering of the stellar radiation by prominence -like structures.

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For preprints via ftp or WWW: http://arxiv.org/pdf/0903.2558v1

HE 1327-2326, An Unevolved Star With [Fe/H] < -5.0
III. Does Its Atmosphere Reflect Its Natal Composition?

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Based on spectroscopic constraints derived from NLTE line formation, we explore the likely range of stellar parameters ($T_{\rm eff}$ and log g) for the hyper-metal-poor (HMP) star HE 1327$-$2326. Combining the constraints from Balmer line profiles and the Ca I/II ionization equilibrium, a subgiant stage of evolution is indicated. This result is further supported by spectrophotometric observations of the Balmer jump. If a higher $T_{\rm eff}$ value was used (as favoured by some photometric calibrations), the spectroscopic analysis would indicate a turnoff-point stage of evolution.

Using a stellar-structure code that treats the effects of atomic diffusion throughout the star in detail, we evolve a low-mass model star to reach the HR-diagram position of HE 1327$-$2326 after roughly 13 Gyr. While the surface abundances are modified significantly (by more than 1 dex for the case of uninhibited diffusion), such corrections can not resolve the discrepancy between the abundance inferred from the non-detection of the Li I resonance line at 6707 Å and the WMAP-based primordial lithium abundance. As there are numerous processes that can destroy lithium, any cosmological interpretation of a lower-than-expected lithium abundance at the lowest metallicities will have to await sample sizes of unevolved hyper-metal-poor stars that are one order of magnitude larger. The situation remains equally inconclusive concerning atomic-diffusion corrections. Here, attempts have to be made to better constrain internal mixing processes, both observationally and by means of sophisticated modelling. With constraints on additional mixing processes taken from a recent globular-cluster study, the likeliest scenario is that HE 1327$-$2326's surface abundances have undergone mild depletion (of order 0.2 dex).

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For preprints via WWW: http://arxiv.org/abs/0903.3885

Upcoming Meeting

Ninth SAS Workshop

29 June - 3 July 2009

Villafranca del Castillo, Spain

SECOND ANNOUNCEMENT

The XMM-Newton Science Operations Centre announces the 9th SAS Workshop, which will be held at the European Space Astronomy Centre of ESA (Villafranca del Castillo, Spain) between the 29th of June and the 3rd of July 2009.

SAS Workshops aim at providing XMM-Newton users with a basic introduction to the procedures and techniques to successfully reduce and analyse XMM-Newton data. The 5-day workshop is organised around 5 half-days of presentations and 5 half-days of practical training sessions. The sessions cover all aspects of data reduction and data analysis for all the X-ray cameras on-board XMM-Newton, as well as for its Optical Monitor.

Interested persons are encouraged to send an email through the XMM-Newton Helpdesk at:
http://xmm.esac.esa.int/external/xmm_user_support/helpdesk.shtml
no later than Friday, May 22nd, 2009.

Please specify in the subject line:

Subject: Interest in participating in the 9th XMM-Newton SAS Workshop

and provide the following information:

Name, Organization, Address, Country, Phone, E-mail, Main Research Field.

Need means of transportation between pre-booked accommodation at El Escorial and Venue at ESAC? : YES/NO
Bring your own laptop? : YES/NO
Would you like to have an introductory session to XSPEC? : YES/NO

No fee is required to attend the SAS Workshop. We regret to inform that no financial support is available for Workshop participants.

Readers may find more information at:
http://xmm.esac.esa.int/external/xmm_data_analysis/sas_workshops/sas_ws9_files/

Upcoming Meeting

ASTROCAM School
Young Stellar Objects: From Cool Stars to Exoplanets

29 - 3 July 2009

El Escorial, Madrid, Spain

ASTROCAM, the Astrophysical Network of the Comunidad de Madrid (*http://www.astrocam.es*) formed by researchers from CSIC, UCM, UAM, ESAC, UPM and UEM, with the participation of the local companies DEIMOS, GMV, SERCO, VEGA and INSA, is pleased to announce the organisation of an international School on *Young Stellar Objects: From Cool Stars to Exoplanets* to be held at the Real Centro Universitario Escorial-Maria Cristina, sited at San Lorenzo de El Escorial, Madrid, Spain, on 29 June - 3 July 2009.

The school intends to offer an introduction to the theme of young stellar and substellar objects and will include lectures on young stars and angular momentum evolution, young stars in associations and moving groups, brown dwarfs and isolated planetary mass objects, and exoplanets of young stars. The lectures will cover theoretical and observational topics including practical exercises on real data.

Pre-registration: The number of attendants will be limited to 30 Master and PhD students and recent post-docs. All the interested students should fill the pre-registration form (deadline 30 April 2009). Positions will be filled priorizing Master and PhD students and on the basis of "first arrived first served" approach. The final list of accepted students will be published at the beginning of May.

Financial support: There is no registration-fee. The accommodation expenses for all the students at the Real Centro Universitario Escorial-Maria Cristina will be covered by the organization of the school. No financial support is available for the travel expenses.

Scientific Organising Committee: - D. Montes (chair), J.A. Caballero, E. de Castro, M. Cornide, M.J. Fernández-Figueroa, J. López Santiago (UCM, Fis.), A.I. Gómez de Castro (UCM, Mat.), E.L. Martín (IAC), B. Montesinos (LAEX-CAB).

Local Organising Committee: J.A. Caballero (chair), J. López Santiago, R.M. Martínez Arníiz, D. Montes (UCM, Fis.), M. Castellanos (ASTROCAM Manager).

Detailed information of the School including preliminary program and pre-registration instructions can be found in this web page:
http://www.astrocam.es/school09/

Job Opening

Postdoctoral Position

Ultracool Dwarf Research

Armagh Observatory (N. Ireland)

A postdoctoral research position funded by the Leverhulme Trust is available from 2009 September 1, or as soon as possible thereafter for a period up to 3 years to work at the Armagh Observatory with Professor J.G. Doyle. Applicants must have, or be about to obtain, a PhD in an appropriate discipline and if possible, expertise in the relevant research area.

The job entails further research into Ultracool Dwarfs, via radio and optical observations, plus modelling. The unexpected detection of pulsed radio emission from these objects has opened new avenues of research into the electron cyclotron instability and aurora activity. Experience in the observations and modelling of radio and optical data relating to late-type stars and/or planetary physics would be desirable. This work is relevant to various aspects of coronal astrophysics and exoplanets.

Full details of the position is available from the Armagh Observatory web-site:
http://star.arm.ac.uk/jobs/
Successful candidates will be expected to make a significant contribution to the Observatory's research profile, and play a full role in all Observatory activities.

The initial closing date for receipt of applications is 2009 June 19. Late applications may be considered until the position is filled. Applicants should obtain an application pack from the Administrator or from the Observatory web-site, and send the completed application form together with a full curriculum vitae, statement of research interests and complete bibliography, by the initial closing date for applications or as soon as possible thereafter to: The Administrator, Armagh Observatory, College Hill, Armagh BT61 9DG, Northern Ireland (Tel: +44-(0)28-3752-2928; FAX: +44-(0)28-3752-7174; e-mail: lfy@arm.ac.uk).

Candidates should ensure that references from at least two referees are sent to the Administrator in time to reach the Observatory by the initial closing date or as soon as possible thereafter. Email Inquiries to: jgd(at)arm.ac.uk

The Armagh Observatory is an equal opportunities employer.

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.***