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formely known as the hot star newsletter

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Abstracts of 22 accepted papers

Are C-rich ultra iron poor stars also He-rich?

**Georges Meynet[1], Raphael Hirschi[2,3], Sylvia Ekstrom[1],
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The three most iron poor stars presently known ([Fe/H] equal to -5.96, -5.4 and -4.75) are carbon-rich, they are called C-Rich Ultra-Metal Poor Stars (CRUMPS).
The origin of their peculiar surface abundances is not understood.

We propose a synthetic view of the different models so far proposed to explain the peculiar abundances observed at the surface of the CRUMP stars. We deduce some expected trends based on nucleosynthetic arguments and look for signatures allowing to discriminate among models.

We discuss the conditions for having CRUMP stars which are He-rich, i.e. with a mass fraction of helium greater than 0.30 and up to 0.60. We discuss the chemical composition of stars made of interstellar medium mixed with wind material of very metal poor massive stars, with wind plus supernova ejecta and with material extracted from the envelope of early AGB stars. Rotating and non-rotating models are considered. The high nitrogen abundances observed in CRUMP stars imply that the material which is responsible for their peculiar abundance pattern must be heavily enriched in primary nitrogen. We show that rotating stars (both massive and intermediate mass stars) can produce the required amount of primary nitrogen, and can also account for the observed enhancements in C, O, Na, Mg and Al. CRUMP stars formed from wind material of massive stars mixed with small amounts of pristine interstellar medium are He-rich (helium mass fraction between 0.30 and 0.60), Li-depleted and present low ^{12}C/^{13}C ratios (inferior to 10 in number). Such He-rich stars, if discovered, would confirm that the most metal poor CRUMPs formed from essentially pure wind/envelope material. They would provide the most direct way to probe the nucleosynthetic outputs of the first generations of stars.

We show that rotation is a key ingredient to explain the abundance patterns of CRUMPS stars and probably also of at least some Carbon-Enhanced Metal Poor (CEMP) stars, in particuliar the CEMP-no stars. Similar non-rotating models, without any extra-mixing, do not succeed to explain the enhancements in the three CNO elements.

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Weblink: http://arxiv.org/abs/1004.5024

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The GSF Instability and Turbulence do not Account for the Relatively Low Rotation Rate of Pulsars

Raphael Hirschi (1,2), André Maeder (3)

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The aim of this paper is to examine the effects of the horizontal turbulence in differentially rotating stars on the GSF instability and apply our results to pre-supernova models. For this purpose we derive the expression for the GSF instability with account of the thermal transport and smoothing of the mu-gradient by the horizontal turbulence. We apply the new expressions in numerical models of a 20 solar mass star. We show that if N^2_{Omega} < 0 the Rayleigh-Taylor instability cannot be killed by the stabilizing thermal and mu-gradients, so that the GSF instability is always there and we derive the corresponding diffusion coefficient. The GSF instability grows towards the very latest stages of stellar evolution. Close to the deep convective zones in pre-supernova stages, the transport coefficient of elements and angular momentum by the GSF instability can very locally be larger than the shear instability and even as large as the thermal diffusivity. However the zones over which the GSF instability is acting are extremely narrow and there is not enough time left before the supernova explosion for a significant mixing to occur. Thus, even when the inhibiting effects of the mu-gradient are reduced by the horizontal turbulence, the GSF instability remains insignificant for the evolution. We conclude that the GSF instability in pre-supernova stages cannot be held responsible for the relatively low rotation rate of pulsars compared to the predictions of rotating star models.

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Weblink: http://arxiv.org/abs/1004.5470

Comments: 6 pages, 4 figures

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CMF models of hot star winds
I. Test of the Sobolev approximation in the case of pure line transitions

Jiri Krticka, Jiri Kubat

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We provide hot star wind models with radiative force calculated using the solution of comoving frame (CMF) radiative transfer equation. The wind models are calculated for first stars, O stars, and central stars of planetary nebulae. We show that without line overlaps and with solely thermal line

broadening the pure Sobolev approximation gives reliable estimate of the radiative force even close to the wind sonic point. Consequently, models with the Sobolev line force provide good approximation for solutions obtained with non-Sobolev transfer. Taking line overlaps into account, the radiative force becomes slightly lower, which leads to the decrease of the wind mass-loss rate by roughly 40%. Below the sonic point the CMF line force is significantly lower than the Sobolev one. In the case of pure thermal broadening this does not influence the mass-loss rate, as the wind mass-loss rate is set in the supersonic part of the wind. However, when additional line broadening is present (e.g., the turbulent one) the region of low CMF line force may extend outwards to the regions where the mass-loss rate is set. This results in decrease of the wind mass-loss rate. This effect can at least partly explain low wind mass-loss rates derived from some observational analyses of luminous O stars.

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Large-Scale Periodic Variability of the Wind of the Wolf-Rayet Star WR1 (HD 4004)

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We present the results of an intensive photometric and spectroscopic monitoring campaign of the WN4 Wolf-Rayet (WR) star WR1=HD4004. Our broadband V photometry covering a timespan of 91 days shows variability with a period of P=16.9$^{+0.6}_{-0.3}$ days. The same period is also found in our spectral data. The light-curve is non-sinusoidal with hints of a gradual change in its shape as a function of time. The photometric variations nevertheless remain coherent over several cycles and we estimate that the coherence timescale of the light-curve is of the order of 60 days. The spectroscopy shows large-scale line-profile variability which can be interpreted as excess emission peaks moving from one side of the profile to the other on a timescale of several days. Although we cannot unequivocally exclude the unlikely possibility that WR1 is a binary, we propose that the nature of the variability we have found strongly suggests that it is due to the presence in the wind of the WR star of large-scale structures, most likely Co-rotating Interaction Regions (CIRs), which are predicted to arise in inherently unstable radiatively driven winds when they are perturbed at their base. We also suggest that variability observed in WR6, WR134 and WR137 is of the same nature. Finally, assuming that the period of CIRs is related to the rotational period, we estimate the rotation rate of the four stars for which sufficient monitoring has been carried out; i.e. v$_{rot}$=6.5, 40, 70 and 275 km/s for WR1, WR6, WR134 and WR137, respectively.

Reference: Astrophysical Journal, in press.
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1004.4893

Comments: 19 pages, 13 figures, 1 table

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Multiple shells around G79.29+0.46 revealed by near-IR to millimeter data

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Aiming to perform a study of the warm dust and gas in the luminous blue variable star G79.29+0.46 and its associated nebula, we present infrared Spitzer imaging and spectroscopy, and new CO J = 2--1 and 4--3 maps obtained with the IRAM 30 m radio telescope and the Submillimeter Telescope, respectively. We have analyzed the nebula detecting multiple shells of dust and gas connected to the star. Using Infrared Spectrograph Spitzer spectra, we have compared the properties of the central object, the nebula, and their surroundings. These spectra show a rich variety of solid-state features (amorphous silicates, polycyclic aromatic hydrocarbons, and CO$_2$ ices) and narrow emission lines, superimposed on a thermal continuum. We have also analyzed the physical conditions of the nebula, which point to the existence of a photo-dissociation region.

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Weblink: astro-ph/1003.4455

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The potential of Red Supergiants as extra-galactic abundance probes at low spectral resolution

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Red Supergiants (RSGs) are among the brightest stars in the local universe, making them ideal candidates with which to probe the properties of their host galaxies. However, current quantitative spectroscopic techniques require spectral resolutions of R>17,000, making observations of RSGs at distances greater than 1Mpc unfeasible. Here we explore the potential of quantitative spectroscopic techniques at much lower resolutions, R ~2-3000. We take archival J-band spectra of a sample of RSGs in the Solar

neighbourhood. In this spectral region the metallic lines of FeI, MgI, SiI and TiI are prominent, while the molecular absorption features of OH, H_2O, CN and CO are weak. We compare these data with synthetic spectra produced from the existing grid of model atmospheres from the MARCS project, with the aim of deriving chemical abundances. We find that all stars studied can be unambiguously fit by the models, and model parameters of log g, effective temperatures Teff, microturbulence and global metal content may be derived. We find that the abundances derived for the stars are all very close to Solar and have low dispersion, with an average of [logZ]=0.13+/-0.14. The values of Teff fit by the models are ~150K cooler than the stars' literature values for earlier spectral types when using the Levesque et al. temperature scale, though this temperature discrepancy has very little systematic effect on the derived abundances as the equivalent widths (EWs) of the metallic lines are roughly constant across the full temperature range of RSGs. Instead, elemental abundances are the dominating factor in the EWs of the diagnostic lines. Our results suggest that chemical abundance measurements of RSGs are possible at low- to medium-resolution, meaning that this technique is a viable infrared-based alternative to measuring abundance trends in external galaxies.

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Weblink: http://xxx.lanl.gov/abs/1005.1008

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Detection of a magnetic field on HD108: clues to extreme magnetic braking and the Of?p phenomenon

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We report the detection of a magnetic field on the Of?p star HD108. Spectropolarimetric observations conducted in 2007, 2008 and 2009 respectively with NARVAL@TBL and ESPaDOnS@CFHT reveal a clear Zeeman signature in the average Stokes V profile, stable on timescales of days to months and slowly increasing in amplitude on timescales of years. We speculate that this timescale is the same as that on which Ha emission is varying and is equal to the rotation period of the star. The corresponding longitudinal magnetic field, measured during each of the three seasons, increases slowly from 100 to 150G, implying that the polar strength of the putatively-dipolar large-scale magnetic field of HD108 is at least 0.5kG and most likely of the order of 1-2 kG. The stellar and wind properties are derived through a quantitative spectroscopic analysis with the code CMFGEN. The effective temperature is difficult to constrain because of the unusually strong HeI4471 and HeI5876 lines. Values in the range 33000-37000 K are preferred. A mass loss rate of about 1e-7 Msun/yr (with a clumping factor f=0.01) and a wind terminal velocity of 2000 km/s are derived. The wind confinement parameter eta_star is larger than 100, implying that the wind of HD108 is magnetically confined. Stochastic short-term variability is observed in the wind-sensitive lines but not in the photospheric lines, excluding the presence of pulsations. Material infall in the confined wind is the most likely origin for lines formed in the inner wind. Wind-clumping also probably causes part of the Ha variability. The projected rotational velocity of HD108 is lower than 50 km/s, consistent with the spectroscopic and photometric variation timescales of a few decades. Overall, HD108 is very similar to the magnetic O star HD191612 except for an even slower rotation.

Reference: MNRAS accepted
Status: Manuscript has been accepted

Weblink: http://xxx.lanl.gov/abs/1005.1854

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On the Size of the Non-Thermal Component in the Radio Emission from Cyg OB2 #5

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Cyg OB2 #5 is a contact binary system with variable radio continuum emission. This emission has a low-flux state where it is dominated by thermal emission from the ionized stellar wind and a high-flux state where an additional non-thermal component appears. The variations are now known to have a period of 6.7+-0.2 yr. The non-thermal component has been attributed to different agents: an expanding envelope ejected periodically from the binary, emission from a wind-collision region, or a star with non-thermal emission in an eccentric orbit around the binary. The determination of the angular size of the non-thermal component is crucial to discriminate between these alternatives. We present the analysis of VLA archive observations made at 8.46 GHz in 1994 (low state) and 1996 (high state), that allow us to subtract the effect of the persistent thermal emission and to estimate an angular size of <=0.02" for the non-thermal component. This compact size favors the explanation in terms of a star with non-thermal emission or of a wind-collision region.

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Neutral material around the B[e] supergiant star LHA 115-S 65. An outflowing disk or a detached Keplerian rotating disk?

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B[e] supergiants are surrounded by large amounts of hydrogen neutral material, traced by the emission in the optical [OI] lines. This neutral material is most plausibly located within their dense, cool circumstellar disks, which are formed from the (probably non-spherically symmetric) wind material released by the star. Neither the formation mechanism nor the resulting structure and internal kinematics of these disks (or disk-like outflows) are well known. However, rapid rotation, lifting the material from the equatorial surface region, seems to play a fundamental role. The B[e] supergiant LHA 115-S 65 (in short: S65) in the Small Magellanic Cloud is one of the two most rapidly rotating B[e] stars known. Its almost edge-on orientation allows a detailed kinematical study of its optically thin forbidden emission lines. With a focus on the rather strong [OI] lines, we intend to test the two plausible disk scenarios: the outflowing and the Keplerian rotating disk. Based on high- and low-resolution optical spectra, we investigate the density and temperature structure in those disk regions that are traced by the [OI] emission to constrain the disk sizes and mass fluxes needed to explain the observed [OI] line luminosities. In addition, we compute the emerging line profiles expected for either an outflowing disk or a Keplerian rotating disk, which can directly be compared to the observed profiles. Both disk scenarios deliver reasonably good fits to the line luminosities and profiles of the [OI] lines. Nevertheless, the Keplerian disk model seems to be the more realistic one, because it also agrees with the kinematics derived from the large number of additional lines in the spectrum. As additional support for the presence of a high-density, gaseous disk, the spectrum shows two very intense and clearly double-peaked [CaII] lines. We discuss a possible disk-formation mechanism, and similarities between S65 and the group of Luminous Blue Variables.

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Weblink: http://arxiv.org/abs/1005.4511

Comments: 13 pages, 12 figures

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Evolution of massive stars with pulsation-driven superwinds during the RSG phase

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Pulsations driven by partial ionization of hydrogen in the envelope are often considered important for driving winds from red supergiants (RSGs). In particular, it has been suggested by some authors that the pulsation growth rate in a RSG can be high enough to trigger an unusually strong wind (or a super-wind), when the luminosity to mass ratio becomes sufficiently large. Using both hydrostatic and hydrodynamic stellar evolution models with initial masses ranging from 15 to 40~Msun, we investigate 1) how the pulsation growth rate depends on the global parameters of supergiant stars, and 2) what would be the consequences of a pulsation-driven super-wind, if it occurred, for the late stages of massive star evolution. We suggest that such a super-wind history
would be marked by a runaway increase, followed by a sudden decrease, of the winds mass loss rate. The impact on the late evolution of massive stars would be substantial, with stars losing a huge fraction of their H-envelope even with a significantly lower initial mass than previously predicted. This might explain the observed lack of Type II-P supernova progenitors having initial
mass higher than about 17~Msun. We also discuss possible implications for a subset of Type IIn supernovae.

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Weblink: http://www.matteocantiello.com/index.php?option=com_content&view=article&id=12:pdsw&catid=22:papers

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High-resolution imaging of Galactic massive stars with AstraLux I. 138 fields with delta > −25 degrees

J Maíz Apellániz

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Context. Massive stars have high-multiplicity fractions, and many of them have still undetected components, thus hampering the study of their properties.
Aims. I study a sample of massive stars with high angular resolution to better characterize their multiplicity.
Methods. I observed 138 fields that include at least one massive star with AstraLux, a lucky imaging camera at the 2.2 m Calar Alto telescope. I also used observations of 3 of those fields with ACS/HRC on HST to obtain complementary information and to calibrate the AstraLux data. The results were compared with existing information from the Washington Double Star Catalog, Tycho-2, 2MASS, and other literature results.
Results. I discover 16 new optical companions of massive stars, the majority of which are likely to be physically bound to their primaries. I also improve the accuracy for the separation and magnitude difference of many previously known systems. In a few cases the orbital motion is detected when comparing the new data with existing ones and constraints on the orbits are provided. Conclusions. The analysis indicate that the majority of the AstraLux detections are bound pairs. For a range of separations of 0.1"-14" and magnitude differences lower than 8, I find that the multiplicity fraction for massive stars is close to 50%. When objects outside those ranges are included, the multiplicity fraction should be considerably higher.

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Probing the evolving massive star population in Orion with kinematic and radioactive tracers

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Orion is the nearest star-forming region to host a significant number of young and massive stars. The energy injected by these OB stars is thought to have created the Eridanus superbubble. Because of its proximity, Orion is a prime target for a detailed investigation of the interaction between massive stars and their environment.
We study the massive star population of Orion and its feedback in terms of energy and mass, in order to compare the current knowledge of massive stars with kinematic and radioactive tracers in the surrounding interstellar medium (ISM). We assembled a census of the most massive stars in Orion, then used stellar isochrones to estimate their masses and ages, and used these results to establish the stellar content of Orion's individual OB associations. From this, our new population synthesis code was utilized to derive the history of the emission of UV radiation and kinetic energy of the material ejected by the massive stars and also to follow the ejection of the long-lived radioactive isotopes ^{26}Al and ^{60}Fe. To estimate the precision of our method, we compare and contrast three distinct representations of the massive stars. We compared the expected outputs with observations of ^{26}Al gamma-ray signal and the extent of the Eridanus cavity.
We find an integrated kinetic energy emitted by the massive stars of 1.8$^{+1.5}_{-0.4}times10^{52}$ erg. This number is consistent with the energy thought to be required to create the Eridanus superbubble. We also find good agreement between our model and the observed ^{26}Al signal, estimating a mass of $5.8^{+2.7}_{-2.5}times10^{-4}$ M_{odot} of ^{26}Al in the Orion region.
Our population synthesis approach is demonstrated for the Orion region to reproduce three different kinds of observable outputs from massive stars in a consistent manner: Kinetic energy as manifested in ISM excavation, and ionization as manifested in free-free emission, and nucleosynthesis ejecta as manifested in radioactivity gammarays. The good match between our model and the observables does not argue for considerable modifications of mass loss. If clumping effects turn out to be strong, other processes would need to be identified to compensate for their impact on massive-star outputs. Our population synthesis analysis jointly treats kinematic output and the return of radioactive isotopes, which proves a powerful extension of the methodology that constrains feedback from massive stars.

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Detection of high-velocity material from the wind-wind collision zone of Eta Carinae across the 2009.0 periastron passage

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We report near-IR spectroscopic observations of the Eta Carinae massive binary system during 2008-2009 using VLT/CRIRES. We detect a strong, broad absorption wing in He I 10833 extending up to -1900 km/s across the 2009.0 spectroscopic event. Archival HST/STIS ultraviolet and optical data shows a similar high-velocity absorption (up to -2100 km/s) in the UV resonance lines of Si IV 1394, 1403 across the 2003.5 event. UV lines from low-ionization species, such as Si II 1527, 1533 and C II 1334, 1335, show absorption up to -1200 km/s, indicating that the absorption with v from -1200 to -2100 km/s originates in a region markedly faster and more ionized than the nominal wind of the primary star. Observations obtained at the OPD/LNA during the last 4 spectroscopic cycles (1989-2009) also display high-velocity absorption in He I 10833 during periastron. Based on the OPD/LNA dataset, we determine that material with v < -900 km/s is present in the phase range 0.976 < phi < 1.023 of the spectroscopic cycle, but absent in spectra taken at phi < 0.947 and phi > 1.049. Therefore, we constrain the duration of the high-velocity absorption to be 95 to 206 days (or 0.047 to 0.102 in phase). We suggest that the high-velocity absorption originates from shocked gas in the wind-wind collision zone, at distances of 15 to 45 AU in the line-of-sight to the primary star. Using 3-D hydrodynamical simulations of the wind-wind collision zone, we find that the dense high-velocity gas is in the line-of-sight to the primary star only if the binary system is oriented in the sky so that the companion is behind the primary star during periastron, corresponding to a longitude of periastron of omega ~ 240 to 270 degrees. We study a possible tilt of the orbital plane relative to the Homunculus equatorial plane and conclude that our data are broadly consistent with orbital inclinations in the range i=40 to 60 degrees.

Reference: A&A, in press
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A ~40 year variability cycle in the LBV/WR binary system HD 5980 ?

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Department of Astronomy, University of Pittsburg; Las Campanas Observatory, The Carnegie Observatories; Departamento de Fisica, Universidad de la Serena; Facultad de Ciencias Astronomicas y Geofisicas, Universidad Nacional de La Plata.

The massive Wolf-Rayet stellar system HD 5980 in the Small Magellanic Cloud entered a sudden and brief 1--3 mag eruptive state in the mid-1990s. The cause of the instability is not yet understood, but mechanisms similar to those in luminous blue variables are suspected. Using a previously unreported set of spectroscopic data obtained in 1955--1967 and recently acquired optical and HST/STIS spectra, we find that: 1) the brief eruptions of 1993 and 1994 occurred at the beginning of an extended (on the order of decades) high state of activity characterized by large emission-line intensities; 2) the level of activity is currently subsiding; and 3) another strong emission-line episode appears to have occurred between 1960--1965, suggesting the possibility that the long-term cyclical variability may be recurrent on an approximate 40 year timescale. These characteristics suggest the possible classification of HD 5980 as an S Doradus-type variable. The effects due to binary interactions in the system are discussed, and we tentatively suggest that the short duration and relatively hot spectral type (WN11/B1.5I) observed during maximum in the visual light curve may be attributed to these interactions.

Reference: AJ, 139, 2600 (2010)
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Weblink: http://macuilli.fis.unam.mx/~gloria/HD5980_SDor.pdf

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A Sea Change in Eta Carinae

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Most stellar-wind emission features in the spectrum of eta Car have recently decreased by factors of order 2 relative to the continuum.
This is unprecedented in the modern observational record.The simplest, but unproven, explanation is a rapid decrease in the wind density.

Reference: Astrophysical Journal Letters
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1004.3529

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The Morphology of IRC+10420's Circumstellar Ejecta

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Images of the circumstellar ejecta associated with the post-red supergiant IRC+10420 show a complex ejecta with visual evidence for episodic mass loss. In this paper we describe the transverse motions of numerous knots, arcs and condensations in the inner ejecta measured from second epoch HST/WFPC2 images. When combined with the radial motions for several of the features, the total space motion and direction of the outflows show that they were ejected at different times, in different directions, and presumably from separate regions on the surface of the star. These discrete structures in the ejecta are kinematically distinct from the general expansion of the nebula and their motions are dominated by their transverse velocities. They are apparently all moving within a few degrees of the plane of the sky. We are thus viewing IRC+10420 nearly pole-on and looking nearly directly down onto its equatorial plane. We also discuss the role of surface activity and magnetic fields on IRC+10420's recent mass loss history.

Reference: Astronomical Journal
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New findings on the prototypical Of?p stars

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In recent years several in-depth investigations of the three Galactic Of?p stars were undertaken. These multiwavelength studies revealed the peculiar properties of these objects (in the X-rays as well as in the optical): magnetic fields, periodic line profile variations, recurrent photometric changes. However, many questions remain unsolved. To clarify some of the properties of the Of?p stars, we have continued their monitoring. A new XMM observation and two new optical datasets were obtained. Additional information for the prototypical Of?p trio has been found. HD108 has now reached its quiescent, minimum-emission state, for the first time in 50--60yrs. The echelle spectra of HD148937 confirm the presence of the 7d variations in the Balmer lines and reveal similar periodic variations (though of lower amplitudes) in the HeI5876 and HeII4686 lines, underlining its similarities with the other two prototypical Of?p stars. The new XMM observation of HD191612 was taken at the same phase in the line modulation cycle but at a different orbital phase as previous data. It clearly shows that the X-ray emission of HD191612 is modulated by the 538d period and not the orbital period of 1542d - it is thus not of colliding-wind origin and the phenomenon responsible for the optical changes appears also at work in the high-energy domain. There are however problems: our MHD simulations of the wind magnetic confinement predict both a harder X-ray flux of a much larger strength than what is observed (the modeled DEM peaks at 30-40MK, whereas the observed one peaks at 2MK) and narrow lines (hot gas moving with velocities of 100--200km/s, whereras the observed FWHM is ~2000km/s).

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Detection of frequency spacings in the young O-type binary HD 46149 from CoRoT photometry

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Using the CoRoT space based photometry of the O-type binary HD46149, stellar atmospheric effects related to rotation can be separated from pulsations, because they leave distinct signatures in the light curve. This offers the possibility of characterising and exploiting any pulsations seismologically.

Combining high-quality space based photometry, multi-wavelength photometry, spectroscopy and constraints imposed by binarity and cluster membership, the detected pulsations in HD46149 are analyzed and compared with those for a grid of stellar evolutionary models in a proof-of-concept approach.

We present evidence of solar-like oscillations in a massive O-type star, and show that the observed frequency range and spacings are compatible with theoretical
predictions. Thus, we unlock and confirm the strong potential of this seismically unexplored region in the HR diagram.

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Non-thermal radio emission from O-type stars. IV. Cyg OB2 No. 8A

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We study the non-thermal radio emission of the binary Cyg OB2 No. 8A, to see if it is variable and if that variability is locked to the orbital phase. We investigate if the synchrotron emission generated in the colliding-wind region of this binary can explain the observations and we verify that our proposed model is compatible with the X-ray data.
We use both new and archive radio data from the Very Large Array (VLA) to construct a light curve as a function of orbital phase. We also present new X-ray data that allow us to improve the X-ray light curve. We develop a numerical model for the colliding-wind region and the synchrotron emission it generates. The model also includes free-free absorption and emission due to the stellar winds of both stars. In this way we construct artificial radio light curves and compare them with the observed one.
The observed radio fluxes show phase-locked variability. Our model can explain this variability because the synchrotron emitting region is not completely hidden by the free-free absorption. In order to obtain a better agreement for the phases of minimum and maximum flux we need to use stellar wind parameters for the binary components which are somewhat different from typical values for single stars. We verify that the change in stellar parameters does not influence the interpretation of the X-ray light curve. Our model has trouble explaining the observed radio spectral index. This could indicate the presence of clumping or porosity in the stellar wind, which - through its influence on both the Razin effect and the free-free absorption - can considerably influence the spectral index. Non-thermal radio emitters could therefore open a valuable pathway to investigate the difficult issue of clumping in stellar winds.

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Supernova Remnants and Star Formation in the Large Magellanic Cloud

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It has often been suggested that supernova remnants (SNRs) can trigger star formation. To investigate the relationship between SNRs and star formation, we have examined the known sample of 45 SNRs in the Large Magellanic Cloud to search for associated young stellar objects (YSOs) and molecular clouds. We find seven SNRs associated with both YSOs and molecular clouds, three SNRs associated with YSOs but not molecular clouds, and eight SNRs near molecular clouds but not associated with YSOs. Among the 10 SNRs associated with YSOs, the association between the YSOs and SNRs can be either rejected or cannot be convincingly established for eight cases. Only two SNRs have YSOs closely aligned along their rims; however, the time elapsed since the SNR began to interact with the YSOs' natal clouds is much shorter than the contraction timescales of the YSOs, and thus we do not see any evidence of SNR-triggered star formation in the LMC. The 15 SNRs that are near molecular clouds may trigger star formation in the future when the SNR shocks have slowed down to $<$45 km~s^{-1}. We discuss how SNRs can alter the physical properties and abundances of YSOs.

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Systematic detection of magnetic fields in massive, late-type supergiants

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We report the systematic detection of magnetic fields in massive (M > 5$,$M_odot$) late-type supergiants, using spectropolarimetric observations obtained with ESPaDOnS at the Canada-France-Hawaii Telescope. Our observations reveal detectable Stokes V Zeeman signatures in Least-Squares Deconvolved mean line profiles in one-third of the observed sample of more than 30 stars. The signatures are sometimes complex, revealing multiple reversals across the line. The corresponding longitudinal magnetic field is seldom detected, although our longitudinal field error bars are typically 0.3 G ($1sigma$). These characteristics suggest topologically complex magnetic fields, presumably generated by dynamo action. The Stokes V signatures of some targets show clear time variability, indicating either rotational modulation or intrinsic evolution of the magnetic field. We also observe a weak correlation between the unsigned longitudinal magnetic field and the CaII K core emission equivalent width of the active G2Iab supergiant $beta$~Dra and the G8Ib supergiant $epsilon$~Gem.

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A Library of Theoretical Ultraviolet Spectra of Massive, Hot Stars for Evolutionary Synthesis

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We computed a comprehensive set of theoretical ultraviolet spectra of hot, massive stars with the radiation-hydrodynamics code WM-Basic. This model atmosphere and spectral synthesis code is optimized for computing the strong P Cygni-type lines originating in the winds of hot stars, which are the strongest features in the ultraviolet spectral region. The computed set is suitable as a spectral library for inclusion in evolutionary synthesis models of star clusters and star-forming galaxies. The chosen stellar parameters cover the upper left Hertzsprung-Russell diagram at L ≳ 10^2.75 L⊙ and T_eff ≳ 20,000 K. The adopted elemental abundances are 0.05 Z⊙, 0.2 Z⊙, 0.4 Z⊙, Z⊙, and 2 Z⊙. The spectra cover the wavelength range from 900 to 3000 Å and have a resolution of 0.4 Å. We compared the theoretical spectra to data of individual hot stars in the Galaxy and the Magellanic Clouds obtained with the International Ultraviolet Explorer (IUE) and Far Ultraviolet Spectroscopic Explorer (FUSE) satellites and found very good agreement. We built a library with the set of spectra and implemented it into the evolutionary synthesis code Starburst99 where it complements and extends the existing empirical library

towards lower chemical abundances. Comparison of population synthesis models at solar and near-solar composition demonstrates consistency between synthetic spectra generated with either library. We discuss the potential of the new library for the interpretation of the rest-frame ultraviolet spectra of star-forming galaxies. Properties that can be addressed with the models include ages, initial mass function, and heavy-element abundance. The library can be obtained both individually or as part of the Starburst99 package.

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Comments:

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MEETINGS

IAU Symposium 272 Active OB stars: tructure, evolution, mass loss and critical limits

July 19 - 23, 2010

Venue: Paris, France

The IAU Symposium 272 will concentrate on physical processes related to active OB stars. These massive stars display strong variability on various time scales due to such phenomena as mass outflows, rapid rotation, pulsations, magnetism, binarity, radiative instabilities, and the influence of their circumstellar environment. This concerns in particular Be, Bp, beta Cep, Slowly Pulsating B Stars (SPB), B[e] and O stars, as well as massive binaries such as the Be X-ray binaries and those that harbor O-type subdwarf companions.

The Symposium will cover the topics of internal structure, evolution, and circumstellar environment of active OB stars. It will also consider the populations of active massive stars and their role either as extreme condition test beds or as calibrators.

Weblink: http://iaus272.obspm.fr/

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Frontiers in Computational Astrophysics:
Particles and Flames in Radiative and Magnetic Flows

October 11-15, 2010

Venue: ENS-Lyon

Computational astrophysics has rapidly evolved in recent years. Multi-scale, multi-physics simulations of entire stars, planets, galaxies come within reach today. While promising new and decisive insights, this progress also challenges the computational astrophysics community. The workshop wants to support this development by bringing together researchers from different fields within and outside astrophysics. The goal of the workshop is to discuss computational approaches and strategies to efficiently tackle the above challenges in the age of massive parallelism.

Topics Covered

Astrophysics

interstellar medium turbulence and star formation, multi-dimensional stellar structure models, atmospheres of stars and planets, accretion flows, type Ia supernovae and novae.

Physical Processes

turbulence, combustion and explosive physics, particle acceleration and propagation, interplay between hydrodynamical and kinetic models in high energy objects, dynamos and magnetism, radiative transfer.

Computational Methods

multi-scale algorithms, efficient solvers of large linear systems, stiff equations, adaptive meshes, interface tracking, subgrid-scale modeling, massive parallelism and GPUs, visualization and data-analysis.

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