THE HOT STAR NEWSLETTER

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An electronic publication dedicated to A, B, O, Of, LBV and Wolf-Rayet stars and related phenomena in galaxies

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eenens@astro.ugto.mx ftp://ftp.sron.nl/pub/karelh/UPLOADS/WRBIB/

Contents of this newsletter

From the editor

Hot Massive Star Working Group Elections

This newsletter and the vote have been delayed because of a prolonged interrumption of our internet service. Please accept my apologies.

We are in the process of renewing more than half of the Organizing Committee of the Working Group on Hot Massive Stars. Our Working Group, officially recognized by the IAU, has served as a bridge with the IAU Executive Committee and other IAU WGs and Commissions, as well as between members of our research community for example in the coordination of activities and the exchange of information, mainly via our newsletter.

We hope that, with fresh input, our WG Organizing Committee will find new ways to serve our community and promote our interests. In the next few days, you will receive by e-mail a ballot containing the names of the candidates. You will be asked to choose up to six names among them. Those with most votes will replace the six members who are resigning from the Organizing Committee: Joe Cassinelli, Peter Conti, Kathy Garmany, Rolf Kudristky, André Maeder and Karel an der Hucht.

I take this opportunity to warmly thank them for their cooperation since the creation of our WG.

Philippe Eenens (new address from August: `eenens@astro.ulg.ac.be`)

Accepted Papers

Non-spherical evolution of the line-driven wind instability

E. L. Gomez[1] and R. J. R. Williams[2]

[1] Department of Physics and Astronomy, Cardiff University, PO BOX 913, CF24 3YB

[2] AWE, Aldermaston, Berkshire, RG7 4PR

In this paper, we study the structure and stability of line driven winds using numerical hydrodynamic simulations. We calculate the radiation force from an explicit non-local solution of the radiation transfer equation, rather than a Sobolev approximation, without restricting the flow to one-dimensional symmetry. We find that the solutions which result have complex and highly variable structures, including dense condensations which we compare to observed variable absorption features in the spectra of early type stars.

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Preprints from `e.gomez@astro.cf.ac.uk`

WR bubbles and HeII emission

Y. Nazé[1], G. Rauw[1], J. Manfroid[1], Y.-H. Chu[2], and J.-M. Vreux[1]

[1] Institut d'Astrophysique et de Géophysique; Université de Liège; Allée du 6 Août 17, Bat. B5c; B 4000 - Liège; Belgium

[2] Astronomy Department; University of Illinois at Urbana-Champaign; 1002 West Green Street; Urbana, IL 61801; USA

We present the very first high quality images of the HeII λ4686 emission in three high excitation nebulae of the Magellanic Clouds. A fourth high excitation nebula, situated around the WR star BAT99-2, was analysed in a previous letter. Using VLT FORS data, we investigate the morphology of the ring nebulae around the early-type WN stars BAT99-49 & AB7. We derive the total HeII fluxes for each object and compare them with the most recent theoretical WR models. Whilst the ionization of the nebula around BAT99-49 can be explained by a WN star of temperature 90-100 kK, we find that the HeII emission measure of the nebula associated with AB7 requires an He^+ ionizing flux larger than predicted for the hottest WN model available. Using Hα, [OIII] and HeI λ5876 images along with long-slit spectroscopy, we investigate the physical properties of these ring nebulae and find only moderate chemical enrichment.

We also surveyed seven other LMC WR stars but we failed to detect any HeII emission. This holds also true for BAT99-9 which had been proposed to excite an HeII nebula. Four of these surveyed stars are surrounded by a ring nebula, and we use the FORS data to derive their chemical composition: the nebula around BAT99-11 shows a N/O ratio and an oxygen abundance slightly lower than the LMC values, while the nebula around BAT99-134 presents moderate chemical enrichment similar to the one seen near BAT99-2, 49 and AB7. Comparing the WR stars of the LMC, BAT99-2 and 49 appear rather unique since similar stars do not reveal high excitation features.

The third high excitation nebula presented in this paper, N44C, does not harbor stars hotter than mid-O main sequence stars. It was suggested to be a fossil X-ray nebula ionized by the transient LMC X-5. Our observations of N44C reveal no substantial changes in the excitation compared to previous results reported in the literature. Therefore, we conclude that either the recombination timescale of the X-ray nebula has been underestimated or that the excitation of the nebula is produced by another, yet unknown, mechanism.

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Preprints from naze@astro.ulg.ac.be
or on the web at http://vela.astro.ulg.ac.be/Preprints/P81/index.html or astroph/0306084

An *XMM-Newton* observation of the very young open cluster NGC 6383

G. Rauw[1], M. De Becker[1], E. Gosset[1], J.M. Pittard[2] and I.R. Stevens[3]

[1] Institut d'Astrophysique, Université de Liège, Allée du 6 Août, Bât B5c, B-4000 Liège (Sart Tilman), Belgium

[2] Department of Physics & Astronomy, University of Leeds, Leeds LS2 9JT, UK

[3] School of Physics & Astronomy, University of Birmingham, Edgbaston Birmingham B15 2TT, UK

We report the detection of a number of X-ray sources associated with the very young open cluster NGC 6383. About two thirds of these objects are correlated with a rather faint optical source and all but one have at least one infrared counterpart within a correlation radius of 8 arcsec. Although NGC 6383 is not associated with a prominent star forming region, the overall properties of many of the X-ray sources suggest that they may be candidates for low-mass pre-main sequence stars. The number of X-ray sources increases towards the cluster center suggesting that there exists a close relation between the massive O-star binary system HD 159176 in the cluster core and the population of X-ray bright low-mass objects in NGC 6383.

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A WSRT 1400-MHz and 350-MHz continuum survey of the Cygnus OB2 association, in search of hot massive stars

D.Y.A. Setia Gunawan[1], A.G. de Bruyn[1,2], K.A. van der Hucht[3], and P.M. Williams[4]

[1] Kapteyn Astronomical Institute, P.O. Box No. 800, NL-9700AV Groningen, the Netherlands

[2] Netherlands Foundation for Research in Astrophysics, P.O. Box No. 2, NL-7990AA Dwingeloo, the Netherlands

[3] SRON National Institute for Space Research, Sorbonnelaan 2, NL-3584CA Utrecht, the Netherlands

[4] Institute for Astronomy, University of Edinburgh, Royal Observatory, Blackford Hill, Edinburgh EH9 3HJ, U.K.

We present a radio continuum survey at 1400 MHz and 350 MHz of a region of $2^\circ \times 2^\circ$ centered on the Cygnus OB2 association ($d = 1.7$ kpc), using the Westerbork Synthesis Radio Telescope (WSRT) with angular resolutions of, respectively, $13''$ and $55''$. The resulting $5\,\sigma$ flux-density limits of, respectively, ~ 2 mJy and ~ 10 - 15 mJy are a significant improvement over previous surveys. We detected 210

discrete sources with sizes $< 1.9\,\theta_{\rm beam}$ (beam size), 98 of which at both frequencies. We also detected 28 resolved sources (sizes $> 1.9\,\theta_{\rm beam}$), still having well defined peak intensities. The observed spectral index α_{350}^{1400} distribution and source count strongly suggest an excess of sources of Galactic origin in the direction of Cyg OB2.

We have searched for positional coincidences of the detected sources in our list with other radio, infrared, and optical objects from various surveys by using the *Likelihood Ratio* (*LR*) method. Furthermore, we looked for objects which show characteristics of either optically thick stellar winds ($\alpha \geq +0.6$), or non-thermal emission ($-1 \leq \alpha \leq +0.6$) and/or variable spectral flux density. The *LR*-method resulted in 108 identifications. Eighty unidentified sources, i.e. $\sim 2/3$, show characteristics of sources of Galactic origin, 10 of which may be stars. The remaining unidentified sources are probably of extragalactic origin.

We identified one source with the O7 star Cyg OB2-335 and consider it to be a candidate colliding-wind binary. We also identify 19 point sources with known infrared and optical objects: these have nearly flat or inverted spectral indices and some of them show flux-density variability. Follow-up multi-frequency monitoring of these sources will be important in establishing the reality of the flux variabilities and to assess the nature of these sources.

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Preprint on the web at `ftp://ftp.sron.nl/pub/karelh/UPLOADS/papers.dir/CygOB2.ps.gz`

Constraints from ISO Data on the Velocity Law and Clumpiness of WR 136

R. Ignace, M. F. Quigley, and J. P. Cassinelli

Department of Astronomy, University of Wisconsin

Observations with the Infrared Space Observatory (ISO) SWS spectrometer are used to constrain the velocity law and wind clumping of the well-studied Wolf-Rayet (WR) star WR 136 (HD 192163) (WN6). Because the free-free continuum opacity in WR winds increases steadily with wavelength in the IR, each point in the continuous spectrum may be regarded as forming in a pseudo-photosphere of larger radius for longer wavelength. Using this idea in combination with an analysis of the Doppler-broadened widths of several He II recombination lines, we can derive information about the velocity law and clumpiness of the stellar wind of WR 136. The observed line emission emerges from the region exterior to the radius of optical depth unity in the free-free opacity, corresponding to $v \gtrsim 0.3 v_\infty$ for our shortest wavelength line. The ISO observations provide the continuum shape, flux level, and seven fairly strong He II emission profiles. Adopting a β-law distribution for the outflow velocity law, we compute the continuous energy distribution and line profiles. We find that there is a broad range of β-values consistent with the continuum data if we also allow the wind temperature to be a free parameter. Interestingly, the continuum data are found to constrain the wind to have fairly low clumping values for the IR-forming region. Using the continuum results in conjunction with line profile modeling, the observational constraints are best satisfied with a clumping factor of $D_c = <\rho^2> / <\rho>^2$ of 1–3 and a β-value of 2–3, although higher β values are not strongly ruled out for a modest wind temperature. The wavelength range of our ISO data allows us to probe only the outer wind acceleration zone, but in combination with radio observations, our finding that the wind clumping is fairly small suggests that the clumping in the wind of WR 136 decreases with increasing radius.

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The physical properties of the compact star forming region N88A and its neighbourhood in the SMC
I. Excitation and abundances

G. Testor[1], J.L. Lemaire[2], D. Field[3]

[1] LUTH, UMR 8102 du CNRS, Observatoire de Paris, 92195 Meudon, France

[2] LERMA, UMR 8112 du CNRS, Observatoire de Paris, 92195 Meudon, France and Université de Cergy-Pontoise, 95031 Cergy Cedex

[3] Department of Physics and Astronomy, Århus University, 8000 Århus C, Denmark.

We present optical, near-infrared (NIR) images and spectra of the compact, dusty and complex HII region N88A in the SMC. The data were obtained mainly in the visible with the Boller & Chivens (B&C) spectrograph at the ESO 1.5m telescope and recently with the infrared spectrometer and array camera (ISAAC) at the VLT, around 2 μm. The NIR observations identified a region emitting in H_2, both in and around the two major components of N88. Using long-slit spectra obtained in the 3600-10100 Å wavelength range we have re-determined the key physical parameters of electron temperature and densities. The spectral type of the complex exciting source of N88A has been classified as an O6-O8 V, using He and H lines in the visible and NIR, with the HeI 1.7μm/2.11μm line ratio in the K band spectrum, suggesting that N88A is effectively ionized by a source of type $<$ O7 V. However, from reddening correction and the temperature determined by photoionization model calculations, the ionizing source should also contain a very early type O star. A comparison with a recent photometric study shows that the V magnitude of the exciting source of N88A has previously been overestimated. The chemical abundances of He, O, N, Ne, S, and Ar, from emission-line intensities, are also derived. Abundancies are consistent with the average abundances for SMC HII regions.

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Preprints from testor@mesiog.obspm.fr

XMM-Newton Observations of the Nitrogen-Rich Wolf-Rayet Star WR 1

R. Ignace[1], L.M. Oskinova[2], and J.C. Brown[3]

[1] Department of Astronomy, University of Wisconsin

[2] Astrophysik, Univerität Potsdam

[3] Department of Physics and Astronomy, University of Glasgow

We present XMM-Newton results for the X-ray spectrum from the N-rich Wolf-Rayet (WR) star WR 1. The EPIC instrument was used to obtain a medium-resolution spectrum. The following features characterize this spectrum: (a) significant emission "bumps" appear that are coincident with the wavelengths of typical strong lines, such as MgXI, SiXIII, and SXV; (b) little emission is detected above 4 keV, in contrast to recent reports of a hard component in the stars WR 6 and WR 110 which are of similar subtype; and (c) evidence for sulfur K-edge absorption at about 2.6 keV, which could only arise from absorption of X-rays by the ambient stellar wind. The lack of hard emission in our dataset is suggestive that WR 1 may truly be a single star, thus representing the first *detailed* X-ray spectrum that isolates the WR wind alone (in contrast to colliding wind zones). Although

the properties of the S-edge are not well-constrained by our data, it does appear to be real, and its detection indicates that at least some of the hot gas in WR 1 must reside interior to the radius of optical depth unity for the total absorptive opacity at the energy of the edge.

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A Dissipative Model of Interacting Winds for WR 140: A Comparison with Observations

S.A.Zhekov[1] and A.V.Myasnikov[2]

[1] Space Research Institute, Sofia, Bulgaria

[2] Institute for Problems in Mechnics, Moscow, Russia

A comparison between a stellar-wind interaction model with electron heat conduction and the ASCA X-ray observations of the (WR+O) binary system WR 140 has been made for the first time. This comparison shows that a good agreement with observations can be achieved by varying the physiscal stellar-wind parameters within the range allowed by the accuracy of their determination. The self-consistent two-temperature model with heat conduction is an outgrouth of the model of interacting winds in such systems, which is required to properly interpret future detailed X-ray observations on the Chandra amd XMM-Newton satellites.

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Preprints from szhekov@space.bas.bg

Theoretical X-ray Line Profiles from Colliding Wind Binaries

David B. Henley[1], Ian R. Stevens[1] and Julian M. Pittard[2]

[1] School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham B15 2TT, U.K.

[2] Department of Physics and Astronomy, University of Leeds, Woodhouse Lane, Leeds LS2 9JT, U.K.

We present theoretical X-ray line profiles from a range of model colliding wind systems. In particular, we investigate the effects of varying the stellar mass-loss rates, the wind speeds, and the viewing orientation. We find that a wide range of theoretical line profile shapes is possible, varying with orbital inclination and phase. At or near conjunction, the lines have approximately Gaussian profiles, with small widths (HWHM $\sim 0.1 v_\infty$) and definite blue- or redshifts (depending on whether the star with the weaker wind is in front or behind). When the system is viewed at quadrature, the lines are generally much broader (HWHM $\sim v_\infty$), flat-topped and unshifted. Local absorption can have a major effect on the observed profiles – in systems with mass-loss rates of a few times 10^{-6} $M_\odot$ yr^{-1} the lower energy lines ($E \lesssim 1$ keV) are particularly affected. This generally results in blueward-skewed profiles, especially when the system is viewed through the dense wind of the primary. The orbital variation of the line widths and shifts is reduced in a low inclination binary. The extreme case is a binary with $i = 0°$, for which we would expect no line profile variation.

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or by anonymous ftp to `ftp.sr.bham.ac.uk/pub/dbh/papers/lineprofilepaper.ps.gz`
or on the web at `astro-ph/0306451`

Quantitative Spectroscopy of O Stars at Low Metallicity. O Dwarfs in NGC 346.

J.-C. Bouret[1], T. Lanz[2,3], D. J. Hillier[4], S. R. Heap[2], I. Hubeny[2,5], D. J. Lennon[6], L. J. Smith[7], and C. J. Evans[6,7]

[1] Laboratoire d'Astrophysique de Marseille, Traverse du Siphon - BP 8, 13376 Marseille Cedex 12, France
[2] NASA Goddard Space Flight Center, Code 681, Greenbelt, MD 20771
[3] Department of Astronomy, University of Maryland, College Park, MD 20742
[4] Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260
[5] National Optical Astronomy Observatories, Tucson, AZ 85726
[6] Isaac Newton Group, Apartado 321, 38700 Santa Cruz de La Palma, Canary Islands, Spain
[7] Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK

We present the results of a detailed analysis of the properties of dwarf O-type stars in a metal-poor environment. High-resolution, high-quality, ultraviolet and optical spectra of six O-type stars in the H II region NGC 346 have been obtained from a spectroscopic survey of O stars in the SMC. Stellar parameters and chemical abundances have been determined using NLTE line-blanketed photospheric models calculated with Tlusty. Additionally, we have modeled the spectra with the NLTE line-blanketed wind code, CMFGEN, to derive wind parameters. Stellar parameters and chemical abundances, and in particular iron abundances, obtained with the two NLTE codes compare quite favorably. This consistency demonstrates that basic photospheric parameters of main-sequence O stars can be reliably determined using NLTE static model atmospheres. With the two NLTE codes, we need to introduce a microturbulent velocity in order to match the observed spectra. Our results hint at a decrease of the required microturbulent velocity from a value close to the sonic velocity in early O stars to a low value in late O stars. Similarly to several recent studies of Galactic, LMC and SMC stars, we derive effective temperatures lower than predicted from the widely-used relation between spectral type and $T_{\rm eff}$, resulting in lower stellar luminosities and lower ionizing fluxes. From evolutionary tracks in the HR diagram, we find an age of $3\,10^6$ years for NGC 346. A majority of the stars in our sample reveal CNO-cycle processed material at their surface during the main-sequence stage, indicating thus fast stellar rotation and/or very efficient mixing processes. We obtain an overall metallicity, $Z = 0.2 Z_{\odot}$, in good agreement with other recent analyses of SMC stars. We study the dependence of the mass loss rate with the stellar metallicity and find a satisfactory agreement with recent theoretical predictions for three most luminous stars of the sample. The wind-momentum luminosity relation for our sample stars derived for these stars agree with previous studies. However, the three other stars of our sample reveal very weak signatures of mass loss. We obtain mass loss rates that are significantly lower than $10^{-8}\,{\rm m_{\odot} yr^{-1}}$, which is below the predictions of radiative line-driven wind theory by an order of magnitude or more. Furthermore, evidence of clumping in the wind of main-sequence of O stars is provided by O Vλ1371. Like previous studies of O star winds, we are unable to reproduce this line with homogeneous wind models, but we have achieved very good fits with clumped models. Clumped wind models systematically yield lower mass loss rates than theoretical predictions.

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Mass loss from Stars

Joseph P. Cassinelli

Department of Astronomy, University of Wisconsin

This is a chapter from the reference book "The Century of Space Science" published by Kluwer press. In it I review selected highlights of the origin and development of our understanding of stellar winds and mass loss during the 20th century. As a unifying theme, special attention is given to the various dividing lines and boundaries on the Hertzsprung-Russell diagram that mark sharp changes in outflow properties associated with slight changes in stellar parameters. These boundaries were discovered mostly through space satellite surveys. Their locations on the HR diagram led to insight regarding the driving mechanisms, and the dependence of the winds on basic stellar properties such as effective temperature, surface gravity and stellar rotation.

in *The Century of Space Science* **Kluwer Academic Press**
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On the Structure and Kinematics of Nebulae around LBVs and LBV Candidates in the LMC

Kerstin Weis[1,2,3,*]

[1] Institut für Theoretische Astrophysik, Universität Heidelberg, Germany

[2] University of Minnesota, Astronomy Department, Minneapolis, USA

[3] Max-Planck-Institut für Radiastronomie, Bonn, Germany

[*] Feodor-Lynen fellow, Alexander-von-Humboldt foundation

We present detailed analysis of the morphology and kinematics of nebulae around LBVs and LBV candidates in the Large Magellanic Cloud. HST images and high-resolution Echelle Spectra were used to determine the size, shape, brightness, and expansion velocities of the LBV nebulae around R 127, R 143, and S 61. For S Dor, R 71, R 99, and R 84 we discuss the possible presence of nebular emission, and derive upper limits for the size and lower limits on the expansion velocities of possible nebulae. Including earlier results for the LBV candidates S 119 and Sk−69°279 we find that in general the nebulae around LBVs in the LMC are comparable in size to those found in the Milky Way. The expansion velocities of the LMC nebulae, however, are significantly lower—by about a factor of 3 to 4—than those of galactic nebulae of comparable size. Galactic and LMC nebulae show about the same diversity of morphologies, but only in the LMC do we find nebulae with outflow. Bipolarity—at least to some degree—is found in nebulae in the LMC as well as in the Milky Way, and manifests a much more general feature among LBV nebulae than previously known.

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or on the web at `http://www.astro.rub.de/kweis/publications.html`
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XMM-Newton X-ray observations of the Carina Nebula

J.F. Albacete Colombo[1], M. Méndez[2] and N.I. Morrell[1]

[1] Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata Paseo del Bosque S/N, 1900 La Plata, Argentina.

[2] SRON, National Institute for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, The Netherlands

We use new *XMM-Newton* observations to perform a detailed X-ray analysis of the Carina Nebula region in the 0.3–12 keV energy range. Our source detection yields 80 discrete X-ray sources, from which about 20% seem not to have optical counterpart. To get an idea of the energy spectrum of these sources, we construct an X-ray color-color diagram using the energy bands 0.3–2 keV, 2–4.5 keV, and 4.5–12 keV. We analyze the spectra of the most intense X-ray sources associated with early type stars, including the LBV η Car and WR25. We show that the X-ray emission from these sources is well fitted by multi-temperature model spectra. We detect surprisingly intense X-ray emission at energies above 4 keV for some of the observed early type stars, especially from CPD-59 2629 (Tr16-22) which presents particularly hard X-ray emission. We detect intense soft X-ray emission, below < 2 keV, in HDE 303311, which presents an X-ray excess of about 100 times higher than what has been observed in other O5V stars. We use these data to construct the L_x/L_{bol} relation for the 0.3–12 keV and 3.0–12 keV energy range, for all the observed O-type stars, plus η Carina and WR25. Most of the bright stars seem to agree with low metallicity spectral models. The L_x/L_{bol} ratio for O-type stars in the 0.3–12 keV, is well fitted by a constant $\approx 6.0^{7.5}_{4.8} \times 10^{-7}$, in fair agreement with the canonical expression $L_x/L_{bol} \sim 2 \times 10^{-7}$ formerly estimated for the 0.3–2.4 keV energy band. In contrast, the L_x/L_{bol} relation for the 3.0–12 keV presents a strong deviation from the canonical relation, with a high dispersion of about four orders of magnitude. We also detect intrinsic X-ray time variability in seven sources, over the time scale of about 50 hours covered by the observations. That includes an X-ray flare of about 2 hours duration detected in DETWC Tr16 J104429.2-594143, a source probably not physically associated with the Carina Nebula. We discuss the different underlying physical mechanisms that can be responsible for the X-ray emission from early-type stars.

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or on the web at `http://lilen.fcaglp.unlp.edu.ar/~albacete/`

On emission-line spectra obtained from evolutionary synthesis models I. Dispersion in the ionising flux and Lowest Luminosity Limits

M. Cerviño[1], V. Luridiana[1], E. Pérez[1], J.M. Vílchez[1] and D. Valls-Gabaud[2]

[1] Instituto de Astrofísica de Andalucía (CSIC), Camino bajo de Huétor 24, Apdo. 3004, 18080 Granada, Spain

[2] UMR CNRS 5572, Laboratoire d'Astrophysique, Observatoire Midi-Pyrénées, 14 Avenue Edouard Belin, 31400 Toulouse, France

Stellar clusters with the same general physical properties (e.g., total mass, age, and star-formation mode) may have very different stellar mass spectra due to the incomplete sampling of the underlying mass function; such differences are especially relevant in the high-mass tail of the mass function due to the smaller absolute number of massive stars. Since the ionising spectra of star-forming regions are mainly produced by massive stars and their by-products, the dispersion in the number of massive stars across individual clusters also produces a dispersion in the properties of the corresponding ionising spectra. This implies that regions with the same physical properties may produce very different

emission line spectra, and occupy different positions in emission-line diagnostic diagrams. In this paper, we lay the bases for the future analysis of this effect by evaluating the dispersion in the ionising fluxes of synthetic spectra computed with evolutionary models. As an important consequence of the explicit consideration of sampling effects, we found that the intensities of synthetic fluxes at different ionisation edges are strongly correlated, a fact suggesting that no additional dispersion will result from the inclusion of sampling effects in the analysis of diagnostic diagrams; this is true for HII regions on all scales, those ionised by single massive stars through those ionised by super stellar clusters. This finding is especially relevant, in consideration of the fact that real HII regions are found in a band sensibly narrower than predicted by standard methods. Additionally, we find convincing suggestions that the He II line intensities are strongly affected by sampling, especially during the WR phase, and so cannot be used to constrain the evolutionary status of stellar clusters. We also establish the range of applicability of synthesis models set by the Lowest Luminosity Limit for the ionising flux, that is the lowest limit in cluster mass for which synthesis models can be applied to predict ionising spectra. This limit marks the boundary between the situations in which the ionising flux is better modeled with a single star as opposed to a star cluster; this boundary depends on the metallicity and age of the stellar population, ranging from 10^3 to more than 10^6 $M_\odot$ in the case of a single burst event. As a consequence, synthesis models should not be used to try to account for the properties of clusters with smaller masses.

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or on the web at `astro-ph/0304062`
Model results available from the URL `http://laeff.inta.es/users/mcs/SED/`

The Unusual 2001 Periastron Passage in the 'Clockwork' Colliding-Wind Binary WR 140

S.V. Marchenko[1], A.F.J. Moffat[2], D. Ballereau[3], J. Chauville[3], J. Zorec[4], G.M. Hill[5], K. Annuk[6], L.J. Corral[7], H. Demers[2], P.R.J. Eenens[8], K.P. Panov[9], W. Seggewiss[1]0, J.R. Thomson[1]1, A. Villar-Sbaffi[2]

[1] Department of Physics and Astronomy, Western Kentucky University, Bowling Green, KY 42101-3576, USA

[2] Département de Physique, Université de Montréal, C.P. 6128, Succ. "Centre-Ville", Montréal, Qc, H3C 3J7, Canada, and Observatoire du mont Mégantic

[3] GEPI, UMR 8111 du CNRS, Observatoire de Paris-Meudon, 92195 Meudon, France

[4] Institut d'Astrophysique de Paris, CNRS, 98bis boulevard Arago, 75014 Paris, France

[5] W.M. Keck Observatory, 65-1120 Mamalahoa Hwy, Kamuela, HI 96743, USA

[6] Tartu Observatory, EE 2444, Toeravere, Estonia

[7] Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain

[8] Department of Astronomy, University of Guanajuato, 36000 Guanajuato, GTO, Mexico

[9] Institute of Astronomy, Bulgarian Academy of Sciences, Sofia, Bulgaria

[1]0 Sternwarte der Universität Bonn, Auf dem Hügel 71, 53121, Bonn, Germany

[1]1 David Dunlap Observatory ,PO Box 360, Station A,Richmond Hill, Ontario,L4C 4Y6

We follow using both optical spectroscopy and photometry, the 'textbook' colliding-wind WR+O binary WR140 through and between the periastron passages of 1993 and 2001. An extensive collection of high-quality spectra allows us to derive precise orbital elements for both components simultaneously. We confirm the extremely high eccentricity of the system, $e = 0.881 \pm 0.005$, find an excellent match of the newly derived period to the previous estimates, $P = 2899.0 \pm 1.3$ d, improve the accuracy of the time of periastron passage, $T_0 = HJD2446147.4 \pm 3.7$. Around periastron, at orbital phases $\phi \sim 0.995 - 1.015$, additional emission components appear on the tops of the broad Wolf-Rayet emission lines of relatively low ionization potential. The phase-dependent behavior of these excess line-emissions points to their origin in the wind-wind collision zone, which allows us to place some limits on the orbital inclination of the system, $i = 50^\circ \pm 15^\circ$, and half-opening angle of the bow shock cone, $\theta = 40^\circ \pm 15^\circ$. The relatively sudden appearance and disappearance of the extra emission components probably signify a rapid switch from an adiabatically- to a radiatively-dominated regime and back again. Multi-year UBV photometry provides one more surprise: in 2001 at $\phi = 0.02 - 0.06$, the system went through a series of rapid, eclipse-like events. Assuming these events to be related to an episode of enhanced dust formation at periastron, we estimate the characteristic size of the dust grains to be $a \sim 0.07\mu m$.

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Preprints from sergey.marchenko@wku.edu
or on the web at http://gemini.tccw.wku.edu:8080/∼sergey/ms.pdf

Submitted Papers

Radio and submillimetre observations of wind structure in ζ Pup

R. Blomme[1], G.C. Van de Steene[1], R.K. Prinja[2], M.C. Runacres[1], J.S. Clark[2]

[1] Royal Observatory of Belgium, Ringlaan 3, B-1180 Brussel, Belgium

[2] Department of Physics & Astronomy, University College London, Gower Street, London WC1E 6BT, UK

We present radio and submillimetre observations of the O4I(n)f star ζ Pup, and discuss structure in the outer region of its wind ($\sim 10-100\ R_*$). The properties of bremsstrahlung, the dominant emission process at these wavelengths, make it sensitive to structure and allow us to study how the amount of structure changes in the wind by comparing the fluxes at different wavelengths. Possible forms of structure at these distances include Corotating Interaction Regions (CIRs), stochastic clumping, a disk or a polar enhancement. As the CIRs are azimuthally asymmetric, they should result in variability at submillimetre or radio wavelengths.

To look for this variability, we acquired 3.6 and 6 cm observations with the Australia Telescope Compact Array (ATCA), covering about two rotational periods of the star. We supplemented these with archive observations from the NRAO Very Large Array (VLA), which cover a much longer time scale. We did not find variability at more than the ±20 % level. The long integration time does allow an accurate determination of the fluxes at 3.6 and 6 cm. Converting these fluxes into a mass loss rate, we find $\dot{M} = 3.5 \times 10^{-6}\ M_\odot$/yr. This value confirms the significant discrepancy with the mass loss rate derived from the Hα profile, making ζ Pup an exception to the usually good agreement between the Hα and radio mass loss rates.

To study the run of structure as a function of distance, we supplemented the ATCA data by observing ζ Pup at 850 μm with the James Clerk Maxwell Telescope (JCMT) and at 20 cm with the VLA. A smooth wind model shows that the millimetre fluxes are too high compared to the radio fluxes. While recombination of helium in the outer wind cannot be discounted as an explanation, the wealth of evidence for structure strongly suggests this as the explanation for the discrepancy. Model calculations show that the structure needs to be present in the inner $\sim 70\ R_*$ of the wind, but that it decays significantly, or maybe even disappears, beyond that radius.

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Preprints from Ronny.Blomme@oma.be
or on the web at http://arXiv.org/abs/astro-ph/0306310

A WN4 companion to BD $+62°2296$ in Cas OB5

I. Negueruela[1,2]

[1] Dpto. de Física, Ing. de Sistemas y Teoría de la Señal, Universidad de Alicante, Apdo. 99, E03080 Alicante, Spain
[2] Observatoire de Strasbourg, 11 rue de l'Université, F67000 Strasbourg, France

I report observations of the triple system BD $+62°2296$ showing that all its components are early-type stars, most likely physically related. The faintest component BD $+62°2296$B is a hitherto uncatalogued Wolf-Rayet star. The brightest component, star A, is shown to be a seemingly normal B2.5Ia supergiant. Long-slit spectroscopy of BD $+62°2296$B shows it to be a narrow-lined WN4 star. Given the spatial separation, the two objects are unlikely to form a physical binary. Spectra of the third visual component, BD $+62°2296$C, allow its classification as a B0III star. Such concentration of massive stars strongly suggests that BD $+62°2296$ is in reality a very compact young open cluster in the area of the OB association Cas OB5.

Submitted to Astronomy & Astrophysics
Preprints from ignacio@dfists.ua.es

Jobs

Postdoctoral Position in Numerical Hydrodynamics of Wind-Blown Nebulae around Massive Stars/Supernova Remnants

Pending budget approval, we invite applications for a postdoctoral research position, based at the ASCI Flash Center in the department of Astronomy and Astrophysics, Univ of Chicago. The applicant will work with Dr. Vikram Dwarkadas and collaborators on numerical studies related to the formation and evolution of wind-blown nebulae around massive stars, and/or the evolution of supernovae within these nebulae. Expertise in computational astrophysical fluid dynamics is desirable. Experience in one or more of the following areas would be preferred: theory of wind-blown bubbles, winds from massive stars, or supernova-circumstellar interaction. A PhD in astrophysics is required.

The ASCI Flash Center's (http://flash.uchicago.edu) purpose is to develop and apply a general-purpose multi-physics adaptive mesh refinement code, FLASH, which would be available to the successful applicant.

The position is initially for a year, with the possibility of renewal for up to two more years, depending on performance and the availability of funding.

To apply, please submit to the address listed above a curriculum vitae, a list of publications, a summary of research experience, a brief description of research interests, and the names and contact information (including email) for three references. Applications may be submitted electronically, only in postscript or PDF format, but please send hardcopy also. For further information please feel free to contact vikram@flash.uchicago.edu. Applications received prior to Sep 05 2003 will receive first consideration. Women and minorities are strongly encouraged to apply. AAE/EOE.

Address: Vikram Dwarkadas, ASCI Flash Center/Astronomy and Astrophysics, University of Chicago, 5640 S. Ellis Ave, RI 451, Chicago, IL 60637, USA; Phone: 773-834-3724; Fax: 773-834-3230; email: vikram@flash.uchicago.edu
web: http://flash.uchicago.edu/∼vikram/

Meetings

Stellar Photometry: Past, Present and Future

In the year 2003 Astronomical Observatory of Vilnius University is celebrating the 250th anniversary of its founding. In commemoration of this event we are planning an international meeting "Stellar Photometry: Past, Present and Future" to be held in **September 17-20, 2003 in Vilnius, Lithuania**. The meeting will cover various aspects of stellar photometry, among them:
– photometric techniques;
– applications of stellar photometry to the study of: – physics of stars; – interstellar extinction; – stellar populations.
A special session devoted to the history of astronomy in Lithuania will be organised. The meeting will include invited and contributed talks. Contributed papers will be published in Proceedings of the meeting.

Contact addresses:

Jokubas Sudzius (LOC, chair) Vilnius University Observatory Ciurlionio 29, Vilnius LT-2009, Lithuania. E-mail: jokubas.sudzius@ff.vu.lt
More information about the Meeting and useful local WEB links may be found at:
http://www.astro.ff.vu.lt/vao250/

Pre-registration form to be sent by e-mail to VAO250@ff.vu.lt not later than 1 July, 2003.

Family name (Surname):
First name:
Institution (to be written on the badge):
Postal Address:
City:
Country:
Email:
Phone Number:
Fax Number:
Accompanying person(s):
Children (age):
Will you take part in the closing dinner?: YES/NO (19 September, Friday, estimated cost 30-50 Euros)
Do you need assistance in hotel booking: YES/NO
If "YES" then which hotel and what kind of room do you choose:
Hotel category: (you may specify)
Room: SINGLE/DOUBLE

Date of arrival:
Date of departure:
Tentative title of presentation:
Type of presentation: ORAL/POSTER

More details about hotels in Vilnius you may find at `http://www.lithuanianhotels.lt/`

The Formation and Evolution of Massive Young Star Clusters

A workshop to be held in Cancun, Mexico from 17-21 November 2003
www.star.ucl.ac.uk/clusters
Email: clusters@star.ucl.ac.uk

We would like to invite you to a workshop on "The Formation and Evolution of Massive Young Clusters" from November 17-21, 2003, to be held at the Westin Hotel, Cancun, Mexico. A brief description of the aims of the meeting are given below. More details and a pre-registration form can be found at www.star.ucl.ac.uk/clusters. This workshop will be a follow-up to the IAU symposium held in Pucon on "Extragalactic Star Clusters" and the ESO workshop on "Extragalactic Globular Cluster Systems". It will focus on massive ($> 10^4$ solar masses) young (< 1 Gyr) clusters in galactic and extra-galactic environments.

Rationale

Over the last decade, the importance of young massive star clusters as signposts to major star formation events has been recognised. They have been discovered near the Galactic Centre, in nearby starburst galaxies, merging galaxies, ultra-luminous infra-red galaxies, and undoubtedly played an important role in early bursts of star formation. Starburst-driven superwinds have been revealed as important sources of regulating star formation and ejecting enriched material into the intergalactic medium. Our understanding of the formation, evolution and eventual fate of massive young star clusters is developing rapidly but there are still many unanswered questions. Observations with, for example, HST, ISO and large ground-based telescopes have allowed us to investigate their formation in giant molecular clouds, to analyse their stellar content, and assess their chances of survival. There has also been much progress in theoretical modelling using computer simulations of cluster formation and N-body codes to trace their dynamical evolution.

Topics and Deadlines

Properties of Massive Young Clusters; Giant Molecular Clouds; Formation of Clusters; The Structure of Very Young Clusters; Dynamics and Survival; Consequences. We intend that the meeting will be very much a workshop with a strong emphasis on current topics and controversies. There will be sufficient time for lively discussions and the number of participants will be limited to around 80. The proceedings will be published as part of the PASP conference series. The deadline for final registration is August 15th. We will send out a second announcement with details of invited speakers early July.

Scientific Organising Committee

Henny Lamers (Utrecht, co-chair), Linda Smith (UCL, London, co-chair), Andi Burkert (MPIA, Heidelberg), Cathie Clarke (IOA, Cambridge), Bruce Elmegreen (IBM), Jay Gallagher (Wisconsin), Lynne Hillenbrand (Caltech), Luis Ho (Carnegie), Rob Kennicutt (Arizona), Ariane Lancon (Strasbourg), Philip Myers (CFA, Harvard), Antonella Nota (STScI), Simon Portegies Zwart (Amsterdam), Nick Scoville (Caltech), Brad Whitmore (STScI).