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Contents of this newsletter

Refereed Papers

Supersonic turbulence in shock-bound interaction zones I: symmetric settings

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Colliding hypersonic flows play a decisive role in many astrophysical objects. They contribute, for example, to molecular cloud structure, the X-ray emission of O-stars, differentiation of galactic sheets, the appearance of wind-driven structures, or, possibly, the prompt emission of γ-ray bursts. Our intention is the thorough investigation of the turbulent interaction zone of such flows, the cold dense layer (CDL). In this paper, we focus on the idealized model of a 2D plane parallel isothermal slab and on symmetric settings, where both flows have equal parameters. We performed a set of high-resolution simulations with upwind Mach numbers, $5 < M_{\rm u} < 90$.

We find that the CDL is irregularly shaped and has a patchy and filamentary interior. The size of these structures increases with $\ell_{\rm cdl}$, the extension of the CDL. On average, but not at each moment, the solution is about self-similar and depends only on $M_{\rm u}$. We give the corresponding analytical

expressions, with numerical constants derived from the simulation results. In particular, we find the root mean square Mach number to scale as $M_{\rm rms} \approx 0.2 M_{\rm u}$. Independent of $M_{\rm u}$ is the mean density, $\rho_{\rm m} \approx 30\rho_{\rm u}$. The fraction $f_{\rm eff}$ of the upwind kinetic energy that survives shock passage scales as $f_{\rm eff} = 1 - M_{\rm rms}^{-0.6}$. This dependence persists if the upwind flow parameters differ from one side to the other of the CDL, indicating that the turbulence within the CDL and its driving are mutually coupled. In the same direction points the finding that the auto-correlation length of the confining shocks and the characteristic length scale of the turbulence within the CDL are proportional.

In summary, larger upstream Mach numbers lead to a faster expanding CDL with more strongly inclined confining interfaces relative to the upstream flows, more efficient driving, and finer interior structure relative to the extension of the CDL.

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On the web at: `http://fr.arxiv.org/abs/astro-ph/0606753`

Preprints from: `folini@astro.phys.ethz.ch`

Abundance analysis of prime B-type targets for asteroseismology I. Nitrogen excess in slowly-rotating beta Cephei stars

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Seismic modelling of the beta Cephei stars promises major advances in our understanding of the physics of early B-type stars on (or close to) the main sequence. However, a precise knowledge of their physical parameters and metallicity is a prerequisite for correct mode identification and inferences regarding their internal structure. Here we present the results of a detailed NLTE abundance study of nine prime targets for theoretical modelling: gamma Peg, delta Cet, nu Eri, beta CMa, xi1 CMa, V836 Cen, V2052 Oph, beta Cep and DD (12) Lac. The following chemical elements are considered: He, C, N, O, Mg, Al, Si, S and Fe. Our abundance analysis is based on a large number of time-resolved, high-resolution optical spectra covering in most cases the entire oscillation cycle of the stars. Nitrogen is found to be enhanced by up to 0.6 dex in four stars, three of which have severe constraints on their equatorial rotational velocity, Ω R, from seismic or line-profile variation studies: beta Cep (Ω R $\sim$ 26 km/s), V2052 Oph (Ω R $\sim$ 56 km/s), delta Cet (Ω R ¡ 28 km/s) and xi1 CMa (Ω R sin i ¡ 10 km/s). The existence of core-processed material at the surface of such largely unevolved, slowly-rotating objects is not predicted by current evolutionary models including rotation. We draw attention to the fact that three stars in this subsample have a detected magnetic field and briefly discuss recent theoretical work pointing to the occurrence of diffusion effects in beta Cephei stars possibly capable of altering the nitrogen surface abundance. On the other hand, the abundances of all the other chemical elements considered are, within the errors, indistinguishable from the values found for OB dwarfs in the solar neighbourhood. Despite the mild nitrogen excess observed in some objects, we thus find no evidence for a significantly higher photospheric metal content in the studied beta Cephei stars compared to non-pulsating B-type stars of similar characteristics.

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On the web at: `http://www.ster.kuleuven.ac.be/~thierry/drafts.html`

Preprints from: `thierry@ster.kuleuven.be`

The Galactic WN stars: line-blanketed analyses versus evolutionary models

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Context. Very massive stars pass through the Wolf-Rayet (WR) stage before they finally explode. Details of their evolution have not yet been safely established, and their physics are not well understood. Their spectral analysis requires adequate model atmospheres, which have been developed step by step during the past decades and account in their recent version for line blanketing by the millions of lines from iron and iron-group elements. However, only very few WN stars have been re-analyzed by means of line-blanketed models yet.

Aims.The quantitative spectral analysis of a large sample of Galactic WN stars with the most advanced generation of model atmospheres should provide an empirical basis for various studies about the origin, evolution, and physics of the Wolf-Rayet stars and their powerful winds.

Methods. We analyze a large sample of Galactic WN stars by means of the Potsdam Wolf-Rayet (PoWR) model atmospheres, which account for iron line blanketing and clumping. The results are compared with a synthetic population, generated from the Geneva tracks for massive star evolution.

Results. We obtain a homogeneous set of stellar and atmospheric parameters for the Galactic WN stars, partly revising earlier results.

Conclusions. Comparing the results of our spectral analyses of the Galactic WN stars with the predictions of the Geneva evolutionary calculations, we conclude that there is rough qualitative agreement. However, the quantitative discrepancies are still severe, and there is no preference for the tracks that account for the effects of rotation. It seems that the evolution of massive stars is still not satisfactorily understood.

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Preprints from: `wrh@astro.physik.uni-potsdam.de`

The Structure of the Homunculus: I. Shape and Latitude Dependence from H_2 and [Fe II] Velocity Maps of Eta Carinae

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High resolution long-slit spectra obtained with the Phoenix spectrograph on Gemini South provide our most accurate probe of the three dimensional structure of the Homunculus Nebula around η Carinae. The new near-infrared spectra dramatically confirm the double-shell structure inferred previously from thermal dust emission, resolving the nebula into a very thin outer shell seen in H_2 λ21218, and a warmer, thicker inner layer seen in [Fe II] λ16435. The remarkably thin and uniform H_2 skin has ΔR/R of only a few per cent at the poles, hinting that the most important mass loss during the 19th century eruption may have had a very short duration of $\lesssim$5 yr. H_2 emission traces the majority of the more than 10 $M_\odot$ of material in the nebula, and has an average density of order $n_H \gtrsim 10^{6.5}$ cm^{-3}. This emission, in turn, yields our first definitive picture of the exact shape of the nebula, plus a distance of 2350$\pm$50 pc and an inclination angle of $\sim 41^\circ$ (the polar axis is tilted 49° from the plane of the sky). The distribution of the H_2 emission provides the first measure of the latitude dependence of the speed, mass loss, and kinetic energy associated with η Car's 19th century explosion. Almost 75% of the total mass and more than 90% of the kinetic energy in the ejecta were released at high latitudes between 45° and the polar axis. This rules out a model for the bipolar shape wherein an otherwise spherical explosion was pinched at the waist by a circumstellar torus. Also, the ejecta could not have been deflected toward polar trajectories by a companion star, since the kinetic energy of the polar ejecta is greater than the binding energy of the putative binary system. Instead, most of the mass appears to have been directed poleward by the explosion itself — or the star failed to launch material from low latitudes, which would have important consequences for the angular momentum evolution of the star. In any case, comparing H_2 and [Fe II] emission resolves some puzzles about structure noted in previous studies. H_2 emission also provides our first reliable picture of the critical innermost waist of the Homunculus, yielding clues to the observed morphology of the core and the more extended equatorial debris.

Reference: 2006, ApJ, 644, 1151

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Preprints from: nathans@colorado.edu

Cleaning up Eta Carinae: Detection of Ammonia in the Homunculus

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We report the first detection of ammonia in the Homunculus nebula around η Carinae, which is also the first detection of emission from a polyatomic molecule in this or any other luminous blue variable (LBV) nebula. Observations of the NH_3 (J,K)=(3,3) inversion transition made with the Australia Telescope Compact Array reveal emission at locations where infrared H_2 emission had been detected previously, near the strongest dust emission in the core of the Homunculus. We also detect ammonia emission from the so-called "strontium filament" in the equatorial disk. The presence of NH_3 around η Car hints that molecular shells around some Wolf-Rayet stars could have originated in prior LBV eruptions, rather than in cool red supergiant winds or the ambient interstellar medium. Combined with the lack of any CO detection, NH_3 seems to suggest that the Homunculus is nitrogen rich like the ionized ejecta around η Car. It also indicates that the Homunculus is a unique laboratory in which to study unusual molecule and dust chemistry, as well as their rapid formation in a nitrogen-rich

environment around a hot star. We encourage future observations of other transitions like NH_3 (1,1) and (2,2), related molecules like N_2H^+, and renewed attempts to detect CO.

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On the role of continuum-driven eruptions in the evolution of very massive stars and Population III stars

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We suggest that the mass lost during the evolution of very massive stars may be dominated by optically thick, continuum-driven outbursts or explosions, instead of by steady line-driven winds. In order for a massive star to become a Wolf-Rayet star, it must shed its hydrogen envelope, but new estimates of the effects of clumping in winds from O-type stars indicate that line driving is vastly insufficient. We discuss massive stars above roughly 40–50 $M_\odot$, which do not become red supergiants, and for which the best alternative is mass loss during brief eruptions of luminous blue variables (LBVs). Our clearest example of this phenomenon is the 19th century outburst of η Carinae, when the star shed 12–20 $M_\odot$ or more in less than a decade. Other examples are circumstellar nebulae of LBVs and LBV candidates, extragalactic η Car analogs (the so-called "supernova impostors"), and massive shells around supernovae and gamma-ray bursters. We do not yet fully understand what triggers LBV outbursts or what supplies their energy, but they occur nonetheless, and present a fundamental mystery in stellar astrophysics. Since line opacity from metals becomes too saturated, the extreme mass loss probably arises from a continuum-driven wind or a hydrodynamic explosion, both of which are insensitive to metallicity. As such, eruptive mass loss could have played a pivotal role in the evolution and ultimate fate of massive metal-poor stars in the early universe. If they occur in these Population III stars, such eruptions would also profoundly affect the chemical yield and types of remnants from early supernovae and hypernovae thought to be the origin of long gamma ray bursts.

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Multicomponent radiatively driven stellar winds IV. On the helium decoupling in the wind of sigma Ori E

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We study the possibility of the helium decoupling in the stellar wind of sigma Ori E. To obtain reliable wind parameters for this star we first calculate an NLTE wind model and derive wind mass-loss rate and

terminal velocity. Using corresponding force multipliers we study the possibility of helium decoupling. We find that helium decoupling is not possible for realistic values of helium charge (calculated from NLTE wind models). Helium decoupling seems only possible for a very low helium charge. The reason for this behaviour is the strong coupling between helium and hydrogen. We also find that frictional heating becomes important in the outer parts of the wind of sigma Ori E due to the collisions between some heavier elements and the passive components – hydrogen and helium. For a metallicity ten times lower than the solar one both hydrogen and helium decouple from the metals and may fall back onto the stellar surface. However, this does not explain the observed chemical peculiarity since both these components decouple together from the absorbing ions. Although we do not include the effects of the magnetic field into our models, we argue that the presence of a magnetic field will likely not significantly modify the derived results because in such case model equations describe the motion parallel to the magnetic field.

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Preprints from: `krticka@physics.muni.cz`

An XMM-Newton view of the young open cluster NGC 6231 – I. The catalogue

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This paper is the first of a series dedicated to the X-ray properties of the young open cluster NGC 6231. Our data set relies on an XMM-Newton campaign of a nominal duration of 180 ks and reveals that NGC 6231 is very rich in the X-ray domain too. Indeed, 610 X-ray sources are detected in the present field of view, centered on the cluster core. The limiting sensitivity of our survey is approximately 6E-15 erg/s/cm^2 but clearly depends on the location in the field of view and on the source spectrum. Using different existing catalogues, over 85% of the X-ray sources could be associated with at least one optical and/or infrared counterpart within a limited cross-correlation radius of 3 arcsec at maximum. The surface density distribution of the X-ray sources presents a slight N-S elongation. Once corrected for the spatial sensitivity variation of the EPIC instruments, the radial profile of the source surface density is well described by a King profile with a central density of about 8 sources per arcmin^2 and a core radius close to 3.1 arcmin. The distribution of the X-ray sources seems closely related to the optical source distribution. The expected number of foreground and background sources should represent about 9% of the detected sources, thus strongly suggesting that most of the observed X-ray emitters are physically belonging to NGC 6231. Finally, beside a few bright but soft objects – corresponding to the early-type stars of the cluster – most of the sources are relatively faint ($\sim$ 5E-15 erg/s/cm^2) with an energy distribution peaked around 1.0-2.0 keV.

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Comments: Tables 3 and 6 are available at the CDS only

On the web at: `http://vela.astro.ulg.ac.be/Preprints/P105/index.html`

Preprints from: `hsana@eso.org`

The K-band Spectrum of The Hot Star in IRS 8: An Outsider in the Galactic Center?

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Using adaptive optics at the Gemini North telescope we have obtained a K-band spectrum of the star near the center of the luminous Galactic center bowshock IRS 8, as well as a spectrum of the bowshock itself. The stellar spectrum contains emission and absorption lines characteristic of an O5-O6 giant or supergiant. The wind from such a star is fully capable of producing the observed bowshock. However, both the early spectral type and the apparently young age of the star, if it is single, mark it as unique among hot stars within one parsec of the center.

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Preprints from: `tgeballe@gemini.edu`

The Effect of Porosity on X-ray Emission Line Profiles from Hot-Star Winds

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We investigate the degree to which the nearly symmetric form of X-ray emission lines seen in *Chandra* spectra of early-type supergiant stars could be explained by a possibly porous nature of their spatially structured stellar winds. Such porosity could effectively reduce the bound-free absorption of X-rays emitted by embedded wind shocks, and thus allow a more similar transmission of red- vs. blue-shifted emission from the back vs. front hemispheres. To obtain the localized self-shielding that is central to this porosity effect, it is necessary that the individual clumps be optically thick. In a medium consisting of clumps of size ℓ and volume filling factor f, we argue that the general modification in effective opacity should scale approximately as $\kappa_{eff} \approx \kappa/(1+\tau_c)$, where, for a given atomic opacity κ and mean density ρ, the clump optical thickness scales as $\tau_c = \kappa\rho\ell/f$. For a simple wind structure parameterization in which the 'porosity length' $h \equiv \ell/f$ increases with local radius r as $h = h'r$, we find that a substantial reduction in wind absorption requires a quite large porosity scale factor, $h' > 1$, implying large porosity lengths $h > r$. The associated wind structure must thus have either a relatively large scale $\ell \approx r$, or a small volume filling factor $f \approx \ell/r \ll 1$, or some combination of these. We argue that the relatively small-scale, moderate compressions generated by intrinsic instabilities in line-driving are unlikely to give such large porosity lengths. This raises questions about whether porosity effects could play a significant role in explaining nearly symmetric X-ray line profiles, leaving

again the prospect of instead having to invoke a substantial (ca. factor 5) downward revision in the assumed mass-loss rates.

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On the web at: `http://www.bartol.udel.edu/~owocki/preprints/xporosity.pdf`

Preprints from: `owocki@bartol.udel.edu`

Very low metallicity massive star models: Pre-SN evolution and primary nitrogen production.

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CONTEXT: Precise measurements of surface abundances of extremely low metallicity stars have recently been obtained and provide new constraints for the stellar evolution models.

AIMS: Compute stellar evolution models in order to explain the surface abundances observed, in particular of nitrogen.

METHODS: Two series of models were computed. The first series consists of 20 $M_\odot$ models with varying initial metallicity ($Z = 0.02$ down to $Z = 10^{-8}$) and rotation ($\upsilon_{\rm ini} = 0 - 600\,{\rm km\,s^{-1}}$). The second one consists of models with an initial metallicity of $Z = 10^{-8}$, masses between 9 and 85 $M_\odot$ and fast initial rotation velocities ($\upsilon_{\rm ini} = 600 - 800\,{\rm km\,s^{-1}}$).

RESULTS: The most interesting models are the models with $Z = 10^{-8}$ ([Fe/H]~ -6.6). In the course of helium burning, carbon and oxygen are mixed into the hydrogen burning shell. This boosts the importance of the shell and causes a reduction of the CO core mass. Later in the evolution, the hydrogen shell deepens and produces large amount of primary nitrogen. For the most massive models ($M \gtrsim 60\,M_\odot$), significant mass loss occurs during the red supergiant stage. This mass loss is due to the surface enrichment in CNO elements via rotational and convective mixing. The 85 $M_\odot$ model ends up as a WO type Wolf-Rayet star. Therefore the models predict SNe of type Ic and possibly long and soft GRBs at very low metallicities.

The rotating 20 $M_\odot$ models can best reproduce the observed CNO abundances at the surface of extremely metal poor (EMP) stars and the metallicity trends when their angular momentum content is the same as at solar metallicity (and therefore have an increasing surface velocity with decreasing metallicity). The wind of the massive star models can also reproduce the CNO abundances of the most metal-poor carbon–rich star known to date, HE1327-2326.

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GCIRS16SW: a massive eclisping binary in the Galactic Center

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We report on the spectroscopic monitoring of GCIRS16SW, an Ofpe/WN9 star and LBV candidate in the central parsec of the Galaxy. SINFONI observations show strong daily spectroscopic changes in the K band. Radial velocities are derived from the HeI 2.112 um line complex and vary regularly with a period of 19.45 days, indicating that the star is most likely an eclipsing binary. Under various assumptions, we are able to derive a mass of $\sim$ 50 Msun for each component.

Reference: ApJ Letters, accepted

Status: Manuscript has been accepted

On the web at: http://arxiv.org/abs/astro-ph/0608215

Preprints from: martins@mpe.mpg.de

The X-ray binary 2S0114+650=LSI+65 010:A slow pulsar or tidally-induced pulsations?

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The X-ray source 2S0114+650=LSI+65 010 is a binary system containing a B-type primary and a low mass companion believed to be a neutron star. The system has three reported periodicities: the orbital period, P_{orb} ~11.6 days, X-ray flaring with P_{flare} ~2.7 hours and a "superorbital" X-ray periodicity P_{super} =30.7 days. The objective of this paper is to show that the puzzling periodicities in the system may be explained in the context of scenarios in which tidal interactions drive oscillations in the B-supergiant star. We calculate the solution of the equations of motion for one layer of small surface elements distributed along the equator of the star, as they respond to the forces due to gas pressure, centrifugal, coriolis, viscous forces, and the gravitational forces of both stars, which provides variability timescales that can be compared with those observed for 2S0114+650. In addition, we use observational data obtained at the Observatorio Astronómico Nacional en San Pedro Mártir (OAN/SPM) between 1993-2004 to determine which periodicities may be present in the optical region. The models for circular orbits predict "superorbital" periods while the eccentric orbit models predict strong variations on orbital timescales, associated with periastron passage. Both also predict oscillations on timescales of $\sim$ 2 hrs. We suggest that the tidal oscillations lead to a structured stellar wind which, when fed to the neutron star, produces the X-ray modulations.The connection between the stellar oscillations and the modulation of the mass ejection may lie in the shear energy dissipation generated by the tangential motions that are produced by the tidal effects, particularly in the tidal bulge region. From an observational standpoint, we find indications for variability in the He I 5875 Å line on $\sim$ 2 hrs timescale and, possibly, the "superorbital" timescale. However, the line profile variability exceeds that which is predicted by the tidal interaction model and can be understood in terms of variable emission that is superposed on the photospheric absorption. This emission appears to be associated with the B-supergiant's stellar wind rather than the vicinity of the companion.

The model calculations lead us to conclude that the B-supergiant may be the origin of the periodicities observed in the X-ray data, through a combination of a localized structured wind that is fed to the collapsed object and, possibly, by production of X-ray emission on its own surface. This scenario weakens the case for 2S0114+650 containing a magnetar descendent.

Reference: A&A
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Preprints from: `gloria@astroscu.unam.mx`

Variations of the HeII 1640A Line in B0e–B2.5e Stars

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Using the IUE data archive, we have examined the SWP-camera echellograms of 74 B0–B2.5e stars for statistically significant fluctuations in the HeII ("Halpha") 1640A line profile. In this sample we found that the HeII line is occasionally variable in 10 stars over short to long timescales. The HeII-variable stars discovered are lambda Eri, omega Ori, mu Cen, 6 Cep, HD 67536, psi-1 Ori, eta Cen, pi Aqr, 2 Vul, and 19 Mon. The most frequent two types of variability are an extended blue wing absorption and a weakening of the line along the profile. Other types of variability are a weak emission in the red wing and occasionally a narrow emission feature. In the overwhelming number of cases, the CIV resonance doublet exhibits a similar response; rarely, it can exhibit a variation in the opposite sense. Similar responses are also often seen in the SiIV doublet, and occasionally even the SiIII 1206A line. We interpret the weakenings of HeII and of high-velocity absorptions of CIV to localized decreases in the photospheric temperature, although this may not be a unique interpretation. We discuss the variable blue wing absorptions and red wing emissions in terms of changes in the velocity law and mass flux carried by the wind. In the latter case, recent experimental models by Venero, Cidale, & Ringuelet require that during such events the wind must be heated to 35kK at some distance from the star.

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Preprints from: `msmith@stsci.edu`

A census of the Wolf-Rayet content in Westerlund 1 from near-infrared imaging and spectroscopy

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New NTT/SOFI imaging and spectroscopy of the Wolf-Rayet population in Westerlund 1 are presented. Narrow-band near-IR imaging together with follow up spectroscopy reveals four new WR stars, of which three were independently identified recently by Groh et al., bringing the confirmed WR content to 24 (23 excluding source S) [..] A quantitative near-IR spectral classification scheme for

WR stars is presented and applied to members of Westerlund 1. Late subtypes are dominant, with no subtypes earlier than WN5 or WC8 for the nitrogen and carbon sequences, respectively. A qualitative inspection of the WN stars suggests that most (75%) are highly H-deficient. The WR binary fraction is high (¿62%), on the basis of dust emission from WC stars, in addition to a significant WN binary fraction from hard X-ray detections according to Clark et al. We exploit the large WN population of Westerlund 1 to reassess its distance ($\sim$ 5.0kpc) and extinction (A_Ks $\sim$ 0.96 mag), such that it is located at the edge of the Galactic bar, [..]. The observed ratio of WR stars to red and yellow hypergiants, N(WR)/N(RSG+YHG)$\sim$ 3, favours an age of 4.5-5.0 Myr, with individual WR stars descended from progenitors of initial mass $\sim$ 40-55 Msun. Qualitative estimates of current masses for non-dusty, H-free WR stars are presented, revealing 10-18 Msun, such that $\sim$ 75% of the initial stellar mass has been removed via stellar winds or close binary evolution. We present a revision to the cluster turn-off mass for other Milky Way clusters in which WR stars are known, based upon the latest temperature calibration for OB stars. Finally, comparisons between the observed WR population and subtype distribution in Westerlund 1 and instantaneous burst evolutionary synthesis models are presented.

Reference: MNRAS
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Comments: 20 pages, 11 figures

On the web at: http://arxiv.org/abs/astro-ph/0608356

Preprints from: Paul.crowther@sheffield.ac.uk

An XMM-Newton view of the young open cluster NGC 6231 – II. The OB star population

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In this second paper of the series, we pursue the analysis of the 180 ks XMM-Newton campaign towards the young open cluster NGC 6231 and we focus on its rich OB star population. We present a literature-based census of the OB stars in the field of view with more than one hundred objects, among which 30% can be associated with an X-ray source. All the O-type stars are detected in the X-ray domain as soft and reasonably strong emitters. In the 0.5-10.0 keV band, their X-ray luminosities scale with their bolometric luminosities as log(Lx)-log(Lbol)=-6.912+/-0.153. Such a scaling law holds in the soft (0.5-1.0 keV) and intermediate (1.0-2.5 keV) bands but breaks down in the hard band. While the two colliding wind binaries in our sample clearly deviate from this scheme, the remaining O-type objects show a very limited dispersion (40% or 20% according to whether 'cool' dwarfs are included or not), much smaller than that obtained from previous studies. At our detection threshold and with our sample, the sole identified mechanism that produces significant modulations in the O star X-ray emission is related to wind interaction. We thus propose that the intrinsic X-ray emission of non-peculiar O-type stars can be considered as constant for a given star. In addition, the level of X-ray emission is accurately related to the star luminosity or, equivalently, to its wind properties.

Among B-type stars, the detection rate is only about 25% in the sub-type range B0-B4 and remains mostly uniform throughout the different sub-populations while it drops significantly at later sub-types.

The associated X-ray spectra are harder than those of O-type stars. Our analysis points towards the detected emission being associated with a physical (in a multiple system) PMS companion. However, we still observe a correlation between the bolometric luminosity of the B stars and the measured X-ray luminosity. The best fit power law in the 0.5-10.0 keV band yields log(Lx) = 0.22(+/-0.06) log(Lbol)+22.8(+/-2.4).

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Preprints from: hsana@eso.org

Pinwheels in the Quintuplet Cluster

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The five enigmatic "Cocoon stars" after which the Quintuplet cluster was christened have puzzled astronomers since their discovery. Their extraordinary cool, featureless thermal spectra have been attributed to various stellar types from young to highly evolved, while their absolute luminosities places them among the supergiants. We present diffraction-limited images from the Keck I telescope which resolves this debate with the discovery of rotating spiral plumes characteristic of colliding-wind binary "pinwheel" nebulae. Such elegant spiral structures, found around high-luminosity Wolf-Rayet stars, have recently been implicated in the behavior of supernovae lightcurves in the radio and optical.

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Proceedings

Stellar winds from massive stars - What are the REAL mass-loss rates?

Puls, J., Markova, N. & Scuderi, S.

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We discuss recent evidence that currently accepted mass-loss rates may need to be revised downwards, as a consequence of previously neglected "clumping" of the wind. New results on the radial stratifica-

tion of the corresponding clumping factors are summarized. We investigate the influence of clumping on the ionization equilibrium of phosphorus, which is of major relevance when deriving constraints on the clumping factors from an analysis of the FUV PV resonance lines.

Reference: Proc. workshop "Mass loss from stars and the evolution of stellar clusters", eds. A. de Koter, L. Smith & R. Waters, ASP conf. ser.
Status: Conference proceedings

On the web at: `http://www.usm.uni-muenchen.de/people/puls/papers/lunteren.pdf`

Preprints from: `uh101aw@usm.uni-muenchen.de`

The evolution of massive stars in the context of V838 Monocerotis

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The aim of this paper is to look at the evolution of massive stars in order to determine whether or not the progenitor of V838 Mon may be a massive star. In the first part of this paper, the evolution of massive stars around solar metallicity is described, especially the evolution in the Hertzsprung-Russell (HR) diagram. Then, using the observational constraints, the probable progenitors (and their evolution) are described.

Using models of single stars, no progenitor can be found amongst massive stars that can satisfy all the observational constraints. Wolf-Rayet stars (stars with initial masses above about 30 $M_\odot$, which have lost their hydrogen rich envelopes) could explain 10 to 100 $M_\odot$ of circumstellar material but they are very luminous ($L \gtrsim 10^5\, L_\odot$). Main sequence stars crossing the HR diagram and becoming red supergiants (RSG) can have very low effective temperatures but take thousands of years to cross over. Be stars (fast rotating stars with a mass around 10 $M_\odot$), which form disk or B stars accreting matter from a binary companion of a similar mass would need to be compared in detail with the observational constraints.

In the future, there will hopefully be further observational constraints on the models coming from the mass and nature (interstellar or circumstellar) of the material producing the light echo and from a frequency estimate of spectacular objects such as V838 Mon.

Reference: To appear in ASP Conf. Ser.,The Nature of V838 Mon and its Light Echo, May 16-19th 2006, ed. R.L.M. Corradi and U. Munari
Status: Conference proceedings
Comments: 8 pages, 3 figures

On the web at: `http://arxiv.org/abs/astro-ph/0607558`

Preprints from: `raphael.hirschi@unibas.ch`

Postdoctoral Research Position in Liege (Belgium)

Astrophysical Institute, Liege University, Allée du 6 aout, 17 B-4000 Liege, BELGIUM

Please see link to: http://vela.astro.ulg.ac.be/themes/highen/postdoc2.pdf

Attention/Comments: Eric Gosset, Grégor Rauw

Weblink: `http://vela.astro.ulg.ac.be/themes/highen/postdoc2.pdf`

Email contact: `gosset@astro.ulg.ac.be`

Postdoctoral position on Massive stars

Jean-Claude Bouret
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Applications are invited for a postdoctoral position to work on FUSE data at Laboratoire d'Astrophysique de Marseille, France. Theappointment will be for an initial period of one year,with the possibility foran extension up to three years.

The successful applicantwillwork with Jean-Claude Boureton the spectral modeling of a large sample of massive early-type stars, for which a complete spectral coverage has been obtained (from FUV with FUSE, to mid-IR with VLT/VISIR and SPITZER). Previous experience in spectroscopic analysis and working with codes such as TLUSTY and CMFGEN would greatly be appreciated. The candidate will also be encouraged to pursue his/herown research program ininteraction with the group working withFUSE data at LAM. Theinterests of the group include massive early-type stars,interstellar matter,circumstellar disks and stellar activity of young objects, extrasolar planets.

Additional informations can be asked to Jean-Claude Bouret (Jean-Claude.Bouret@oamp.fr) and/or Cecile Gry (Cecile.Gry@oamp.fr). Interested people should send a letter of interest with a curriculumvitae, bibliography, research planand arrange for three letters of recommandation. Completed applications received by September 30, 2006 are assured full consideration.

Email contact: `Jean-claude.bouret@oamp.fr`

Closing date: 2006, September 30

Workshop on Clumping in Hot-Star Winds

18 - 22 June 2007
Potsdam, Germany

Stellar winds from hot stars are not homogeneous, spherically symmetric or stationary. There are multiple lines of evidence for "wind clumping", coming from
- spectroscopy
- multi-wavelength studies
- polarimetry
- variability
- stellar ejecta
- X-rays
- hydrodynamic modeling

No consistent understanding exists yet about the physics, geometry and parameters of the wind clumping. The urgent interest in this problem is boosted by its far-reaching implications. Most important, all techniques to derive empirical mass-loss rates are more or less corrupted by wind clumping. Consequently, mass-loss rates are extremely uncertain. Within this range of uncertainty, completely different scenarios for the evolution of massive stars are obtained. Settling these questions for Galactic OB, LBV and Wolf-Rayet stars is prerequisite to understanding stellar clusters and galaxies, or predicting the properties of first-generation stars.

Wind clumping is under investigation from various observational and theoretical approaches. When combining all different pieces of information, it should be possible to obtain a picture that unifies the empirical manifestations with a theoretical understanding of inhomogeneous stellar winds.

The intention of the workshop is to bring together all experts in the field, in order to develop such a consistent picture and understanding of clumped stellar winds during one week of extensive exchange and discussion.

The workshop will concentrate on oral presentations and extended discussions. Only very few posters can be accepted. The capacity of the workshop is limited to 50 participants. Pre-registration is open from now onwards. Please send an email to: workshop@astro.physik.uni-potsdam.de, stating your
- Name
- Affiliation
- Tentative subject of intended talk

Weblink: `www.astro.physik.uni-potsdam.de/~workshop`

Email contact: `workshop@astro.physik.uni-potsdam.de`