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# THE M$^{\mathrm{A}}$S$^{\mathrm{S}}$I$_{\mathrm{V}}$E STAR NEWSLETTER

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## Contents of this newsletter



## News

### The Interferometric View on Hot Stars

**Th. Rivinius[1] and M. Curé[2]**

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The Proceedings of the workshop "The Interferometric View on Hot Stars", held in Viña del Mar, Chile, March 2 - 6, 2009, editors: Thomas Rivinius and Michel Curé, are now available on the web at: `http://www.astroscu.unam.mx/~rmaa/rmsc38_frameset.html`

**Reference: RevMexAA(SC) Vol 38 (hardcopies in press)**

*Preprints from:* `triviniu@eso.org`

Accepted Papers

## A mass-loss rate determination for zeta Puppis from the quantitative analysis of X-ray emission line profiles

**David H. Cohen (1), Maurice A. Leutenegger (2), Emma E. Wollman (1,3), Janos Zsargó (4,5), D. John Hillier (4), Richard H. D. Townsend (6,7), Stanley P. Owocki (6)**

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We fit every emission line in the high-resolution Chandra grating spectrum of zeta Pup with an empirical line profile model that accounts for the effects of Doppler broadening and attenuation by the bulk wind. For each of sixteen lines or line complexes that can be reliably measured, we determine a best-fitting fiducial optical depth, $\tau_* = \kappa * \dot{M}/4\pi R_* v_\infty$, and place confidence limits on this parameter. These sixteen lines include seven that have not previously been reported on in the literature. The extended wavelength range of these lines allows us to infer, for the first time, a clear increase in $\tau_*$ with line wavelength, as expected from the wavelength increase of bound-free absorption opacity. The small overall values of $\tau_*$, reflected in the rather modest asymmetry in the line profiles, can moreover all be fit simultaneously by simply assuming a moderate mass-loss rate of $3.5 \pm 0.3 \times 10^{-6}$ Msun/yr, without any need to invoke porosity effects in the wind. The quoted uncertainty is statistical, but the largest source of uncertainty in the derived mass-loss rate is due to the uncertainty in the elemental abundances of zeta Pup, which affects the continuum opacity of the wind, and which we estimate to be a factor of two. Even so, the mass-loss rate we find is significantly below the most recent smooth-wind H-alpha mass-loss rate determinations for zeta Pup, but is in line with newer determinations that account for small-scale wind clumping. If zeta Pup is representative of other massive stars, these results will have important implications for stellar and galactic evolution.

**Reference: Monthly Notices of the Royal Astronomical Society, in press.**
*Comments:* 17 pages, including 14 figures (7 color)

*On the web at:* `http://arxiv.org/abs/1003.0892`

*Preprints from:* `dcohen1@swarthmore.edu`

## The nature of V39: an LBV candidate or LBV impostor in the very low metallicity galaxy IC 1613?

**A. Herrero (1,2), M. Garcia(1,2), K. Uytterhoeven (1,3), F. Najarro (4), D.J. Lennon (5), J.S. Vink (6) & N. Castro(1,2)**

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Context: Very few examples of luminous blue variable (LBV) stars or LBV candidates (LBVc) are known, particularly at metallicities below the SMC. The LBV phase is crucial for the evolution of massive stars, and its behavior with metallicity is poorly known. V39 in IC 1613 is a well-known photometric variable, with B-band changes larger than 1mag. over its period. The star, previously proposed to be a projection of a Galactic W Virginis and an IC 1613 red supergiant, shows features that render it a possible LBVc.

Method: We investigate mid-resolution blue and red VLT-VIMOS spectra of V39, covering a time span of 40 days, and perform a quantitative analysis of the combined spectrum using the model atmosphere code CMFGEN.

Results: We identify strong Balmer and FeII P-Cygni profiles, and a hybrid spectrum resembling a B-A supergiant in the blue and a G-star in the red. No significant Vrad variations are detected, and the spectral changes are small over the photometric period. Our analysis places V39 in the low-luminosity part of the LBV and LBVc region, but it is also consistent with a sgB[e] star.

Conclusions: The radial velocity indicates that V39 belongs to IC 1613. The lack of Vrad changes and spectroscopic variations excludes binary scenarios. The features observed are not consistent with a W Virginis star, and this possibility is also discarded. We propose that the star is a B-A LBVc or sgB[e] star surrounded by a thick disk precessing around it.

If confirmed, V39 would be the lowest metallicity resolved LBV candidate known to date. Alternatively, it could represent a new transient phase of massive star evolution, an LBV impostor.

**Reference: 1003.0875**

*On the web at:* `http://arxiv.org/abs/1003.0875`

*Preprints from:* `mgg@iac.es`

## The nature of B supergiants: clues from a steep drop in rotation rates at 22000 K. The possibility of Bi-stability braking

**Jorick S. Vink, I. Brott, G. Graefener, N. Langer, A. de Koter, D.J. Lennon**

Armagh Observatory

The location of B supergiants in the Hertzsprung-Russell diagram (HRD) represents a long-standing problem in massive star evolution. Here we propose their nature may be revealed utilising their rotational properties, and we highlight a steep drop in massive star rotation rates at an effective temperature of 22000 K. We discuss two potential explanations for it. On the one hand, the feature might be due to the end of the main sequence, which could potentially constrain the core overshooting parameter. On the other hand, the feature might be the result of enhanced mass loss at the predicted location of the bi-stability jump. We term this effect "bi-stability breaking" and discuss its potential consequences for the evolution of massive stars.

**Reference: Astronomy & Astrophysics Letters**

*On the web at:* `http://arxiv.org/abs/1003.1280`
*Preprints from:* `jsv@arm.ac.uk`

## High-dispersion spectroscopic monitoring of the Be/X-ray binary A0535+26/V725 Tau I. The long-term profile variability

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We report on optical high-dispersion spectroscopic monitoring observations of the Be/X-ray binary A0535+26/V725 Tau, carried out from November 2005 to March 2009. The main aim of these monitoring observations is to study spectral variabilities in the Be disc, on both the short (a week or so) and long (more than hundreds of days) time-scales, by taking long-term frequent observations. Our four-year spectroscopic observations indicate that the V/R ratio, i.e., the relative intensity of the violet (V) peak to the red (R) one, of the double-peaked H-alpha line profile varies with a period of 500 days. The H-beta line profile also varies in phase with the H-alpha profile. With these observations covering two full cycles of the V/R variability, we reconstruct the 2-D structure of the Be disc by applying the Doppler tomography method to the H-alpha and H-beta emission line profiles, using a rigidly rotating frame with the V/R variability period. The resulting disc structure reveals non-axisymmetric features, which can be explained by a one-armed perturbation in the Be disc. It is the first time that an eccentric disc structure is directly detected by using a method other than the interferometric one.

**Reference: To be published in MNRAS**

*On the web at:* `http://arxiv.org/abs/1002.2063`

*Preprints from:* `moritani@kusastro.kyoto-u.ac.jp`

## A MAD view of Trumpler 14

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We present adaptive optics (AO) near-infrared observations of the core of the Tr 14 cluster in the Carina region obtained with the ESO multi-conjugate AO demonstrator, MAD. Our campaign yields AO-corrected observations with an image quality of about 0.2 arcsec across the 2 arcmin field of view, which is the widest AO mosaic ever obtained. We detected almost 2000 sources spanning a dynamic range of 10 mag. The pre-main sequence (PMS) locus in the colour-magnitude diagram is well reproduced by Palla & Stahler isochrones with an age of 3 to 5 1E+05 yr, confirming the very young age of the cluster. We derive a very high (deprojected) central density $n_0 \sim 4.5(\pm 0.5)10^4 pc^{-3}$ and estimate the total mass of the cluster to be about $\sim 4.3^{+3.3}_{-1.5}10^3$ Msun, although contamination of the field of view might have a significant impact on the derived mass. We show that the pairing process is largely dominated by chance alignment so that physical pairs are difficult to disentangle

from spurious ones based on our single epoch observation. Yet, we identify 150 likely bound pairs, 30% of these with a separation smaller than 0.5arcsec (∼1300AU). We further show that at the 2-sigma level massive stars have more companions than lower-mass stars and that those companions are respectively brighter on average, thus more massive. Finally, we find some hints of mass segregation for stars heavier than about 10 Msun. If confirmed, the observed degree of mass segregation could be explained by dynamical evolution, despite the young age of the cluster.

**Reference: Astronomy & Astrophysics**

*On the web at:* `http://arxiv.org/abs/1003.2208`

*Preprints from:* `h.sana@uva.nl`

## The Massive Star Forming Region Cygnus OB2. II. Integrated Stellar Properties and the Star Formation History

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Cygnus OB2 is the nearest example of a massive star forming region, containing over 50 O-type stars and hundreds of B-type stars. We have analysed the properties of young stars in two fields in Cyg OB2 using the recently published deep catalogue of Chandra X-ray point sources with complementary optical and near-IR photometry. Our sample is complete to 1 Msun (excluding A and B-type stars that do not emit X-rays), making this the deepest study of the stellar properties and star formation history in Cyg OB2 to date. From Siess et al. (2000) isochrone fits to the near-IR color-magnitude diagram, we derive ages of 3.5 (+0.75/-1.0) and 5.25 (+1.5/-1.0) Myrs for sources in the two fields, both with considerable spreads around the pre-MS isochrones. The presence of a stellar population somewhat older than the present-day O-type stars, also fits in with the low fraction of sources with inner circumstellar disks (as traced by the K-band excess) that we find to be very low, but appropriate for a population of age ∼5 Myrs. We also find that the region lacks a population of highly embedded sources that is often observed in young star forming regions, suggesting star formation in the vicinity has declined. We measure the stellar mass functions in this limit and find a power-law slope of Gamma = -1.09 +/- 0.13, in good agreement with the global mean value estimated by Kroupa (2002). A steepening of the slope at higher masses is observed and suggested as due to the presence of the previous generation of stars that have lost their most massive members. Finally, combining our mass function and an estimate of the radial density profile of the association suggests a total mass of Cyg OB2 of $\sim 3 \times 10^4$ Msun, similar to that of many of our Galaxy's most massive star forming regions.

**Reference: ApJ, in press.**

*On the web at:* `http://arxiv.org/abs/1003.2463`

*Preprints from:* `nwright@cfa.harvard.edu`

## Periodic mass loss episodes due to an oscillation mode with variable amplitude in the hot supergiant HD 50064

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We aim to interpret the photometric and spectroscopic variability of the luminous blue variable supergiant HD 50064 ($V = 8.21$).CoRoT space photometry and follow-up high-resolution spectroscopy, with a time base of 137 d and 169 d, respectively, was gathered, analysed and interpreted using standard time series analysis and light curve modelling methods as well as spectral line diagnostics.The space photometry reveals one period of 37 d, which undergoes a sudden amplitude change with a factor 1.6. The pulsation period is confirmed in the spectroscopy, which additionally reveals metal line radial velocity values differing by $\sim 30\,\mathrm{km\,s^{-1}}$ depending on the spectral line and on the epoch. We estimate teff$\sim$13 500 K, $\log g \sim$1.5 from the equivalent width of Si lines. The Balmer lines reveal that the star undergoes episodes of changing mass loss on a time scale similar to the changes in the photometric and spectroscopic variability, with an average value of $\log \dot{M} \simeq -5$ (in $\mathrm{M_\odot\,yr^{-1}}$). We tentatively interpret the 37 d period as due to a strange mode oscillation.

**Reference: Accepted for publication in A&A Letters**

*On the web at:* `http://adsabs.harvard.edu/abs/2010arXiv1003.5551A`

*Preprints from:* `conny@ster.kuleuven.be`

## Magnetic field detection in the B2Vn star HR 7355

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The B2Vn star HR7355 is found to be a He-rich magnetic star. Spectropolarimetric data were obtained with FORS1 at UT2 on Paranal observatory to measure the disk-averaged longitudinal magnetic field at various phases of the presumed 0.52d cycle. A variable magnetic field with strengths between $\langle B_z \rangle = -2200$ and +3200G was found, with confidence limits of 100 to 130G. The field topology is that of an oblique dipole, while the star itself is seen about equator-on. In the intensity spectra the HeI-lines show the typical equivalent width variability of He-strong stars, usually attributed to surface abundance spots. The amplitudes of the equivalent width variability of the HeI lines are extraordinarily strong compared to other cases. These results not only put HR7355 unambiguously among the early-type magnetic stars, but confirm its outstanding nature: With $v \sin i = 320\,\mathrm{km\,s^{-1}}$ the parameter space in which He-strong stars are known to exist has doubled in terms of rotational velocity.

**Reference: MNRAS Letter, in press**

*Comments:* Also available on astro-ph as arXiv:1003.3601

*On the web at:* http://dx.doi.org/10.1111/j.1745-3933.2010.00856.x

*Preprints from:* triviniu@eso.org

## Deviations from a uniform period spacing of gravity modes in a massive star

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The life of a star is dominantly determined by the physical processes in the stellar interior. Unfortunately, we still have a poor understanding of how the stellar gas mixes near the stellar core, preventing precise predictions of stellar evolution. The unknown nature of the mixing processes as well as the extent of the central mixed region is particularly problematic for massive stars. Oscillations in stars with masses a few times that of the Sun offer a unique opportunity to disentangle the nature of various mixing processes, through the distinct signature they leave on period spacings in the gravity mode spectrum. Here we report the detection of numerous gravity modes in a young star with a mass of about seven solar masses. The mean period spacing allows us to estimate the extent of the convective core, and the clear periodic deviation from the mean constrains the location of the chemical transition zone to be at about 10 per cent of the radius and rules out a clear-cut profile.

**Reference: Nature, Volume 464, Issue 7286, pp. 259-261 (2010)**

*On the web at:* http://www.nature.com/nature/journal/v464/n7286/full/nature08864.html

*Preprints from:* pieter.degroote@ster.kuleuven.be

## Discovery of a strong magnetic field in the rapidly rotating B2 Vn star HR 7355

**M.E. Oksala[1,2], G.A. Wade[2], W.L.F. Marcolino[3,4], J. Grunhut[2,5], D. Bohlender[6], N. Manset[7], R.H.D. Townsend[8], and the MiMeS Collaboration**

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We report the detection of a strong, organized magnetic field in the helium-variable early B-type star HR 7355 using spectropolarimetric data obtained with ESPaDOnS on the 3.6-m Canada-France-Hawaii Telescope within the context of the Magnetism in Massive Stars (MiMeS) Large Program. HR 7355 is both the most rapidly rotating known main-sequence magnetic star and the most rapidly rotating helium-strong star, with $v \sin i = 300 \pm 15$ km s$^{-1}$ and a rotational period of $0.5214404 \pm 0.0000006$ days. We have modeled our eight longitudinal magnetic field measurements assuming an oblique dipole magnetic field. Constraining the inclination of the rotation axis to be between 38° and 86°, we find the magnetic obliquity angle to be between 30° and 85°, and the polar strength of the magnetic field at the stellar surface to be between 13-17 kG. The photometric light curve constructed from HIPPARCOS archival data and new CTIO measurements shows two minima separated by 0.5 in rotational phase and occurring 0.25 cycles before/after the magnetic extrema. This photometric behavior coupled with previously-reported variable emission of the H$\alpha$ line (which we confirm) strongly supports the proposal that HR 7355 harbors a structured magnetosphere similar to that in the prototypical helium-strong star, $\sigma$ Ori E.

**Reference: MNRAS Letter, in press**
*Comments:* Also available through astro-ph: arXiv:1003.3626

*On the web at:* `http://dx.doi.org/10.1111/j.1745-3933.2010.00857.x`

*Preprints from:* `meo@udel.edu`

## Discovery of Rotational Braking in the Magnetic Helium-Strong Star Sigma Orionis E

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We present new U-band photometry of the magnetic Helium-strong star Sigma Ori E, obtained over 2004-2009 using the SMARTS 0.9-m telescope at Cerro Tololo Inter-American Observatory. When combined with historical measurements, these data constrain the evolution of the star's 1.19 d rotation period over the past three decades. We are able to rule out a constant period at the $p_{null} = 0.05\%$ level, and instead find that the data are well described ($p_{null} = 99.3\%$) by a period increasing linearly at a rate of 77 ms per year. This corresponds to a characteristic spin-down time of 1.34 Myr, in good agreement with theoretical predictions based on magnetohydrodynamical simulations of angular momentum loss from magnetic massive stars. We therefore conclude that the observations are consistent with Sigma Ori E undergoing rotational braking due to its magnetized line-driven wind.

**Reference: ApJ Letters**

*On the web at:*
`http://www.astro.wisc.edu/~townsend/resource/publications/preprints/spindown.pdf`

*Preprints from:* `townsend@astro.wisc.edu`

## NLTE wind models of hot subdwarf stars

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We calculate NLTE models of stellar winds of hot compact stars (central stars of planetary nebulae and subdwarf stars). The studied range of subdwarf parameters is selected to cover a large part of these stars. The models predict the wind hydrodynamical structure and provide mass-loss rates for different abundances. Our models show that CNO elements are important drivers of subdwarf winds, especially for low-luminosity stars. We study the effect of X-rays and instabilities on these winds. Due to the line-driven wind instability, a significant part of the wind could be very hot.

**Reference: To appear in Astrophysics and Space Science. The final publication will be available at springerlink.com.**

*On the web at:* `http://lanl.arxiv.org/abs/1004.3121`

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

## Chandra Detects the Rare Oxygen-type Wolf-Rayet Star WR 142 and OB Stars in Berkeley 87

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We present first results of a *Chandra* X-ray observation of the rare oxygen-type Wolf-Rayet star WR 142 (= Sand 5 = St 3) harbored in the young, heavily-obscured cluster Berkeley 87. Oxygen type WO stars are thought to be the most evolved of the WRs and progenitors of supernovae or gamma ray bursts. As part of an X-ray survey of supposedly single Wolf-Rayet stars, we observed WR 142 and the surrounding Berkeley 87 region with *Chandra* ACIS-I. We detect WR 142 as a faint, yet extremely hard X-ray source. Due to weak emission, its nature as a thermal or nonthermal emitter is unclear and thus we discuss several emission mechanisms. Additionally, we report seven detections and eight non-detections by *Chandra* of massive OB stars in Berkeley 87, two of which are bright yet soft X-ray sources whose spectra provide a dramatic contrast to the hard emission from WR 142.

**Reference: ApJ**

*On the web at:* `http://arxiv.org/abs/1004.0462`

*Preprints from:* kimberly.sokal@colorado.edu

## Can massive Be/Oe stars be progenitors of long gamma ray bursts?

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Context: The identification of long-gamma-ray-bursts (LGRBs) is still uncertain, although the collapsar engine of fast-rotating massive stars is gaining a strong consensus.
Aims: We propose that low-metallicity Be and Oe stars, which are massive fast rotators, as potential LGRBs progenitors.
Methods: We checked this hypothesis by 1) testing the global specific angular momentum of Oe/Be stars in the ZAMS with the SMC metallicity, 2) comparing the ZAMS $(\Omega/\Omega_{\rm c}, M/M_{\odot})$ parameters of these stars with the area predicted theoretically for progenitors with metallicity $Z = 0.002$, and 3) calculating the expected rate of LGRBs/year/galaxy and comparing them with the observed ones. To this end, we determined the ZAMS linear and angular rotational velocities for SMC Be and Oe stars using the observed vsini parameters, corrected from the underestimation induced by the gravitational darkening effect.
Results: The angular velocities of SMC Oe/Be stars are on average $\langle\Omega/\Omega_{\rm c}\rangle = 0.95$ in the ZAMS. These velocities are in the area theoretically predicted for the LGRBs progenitors. We estimated the yearly rate per galaxy of LGRBs and the number of LGRBs produced in the local Universe up to z=0.2. We have considered that the mass range of LGRB progenitors corresponds to stars hotter than spectral types B0-B1 and used individual beaming angles from 5 to 15 degr. We thus obtain $R^{\rm pred}_{\rm LGRB} \sim 10^{-7}$ to $\sim 10^{-6}$ LGRBs/year/galaxy, which represents on average 2 to 14 LGRB predicted events in the local Universe during the past 11 years. The predicted rates could widely surpass the observed ones [(0.2-3)$\times 10^{-7}$ LGRBs/year/galaxy; 8 LGRBs observed in the local Universe during the last 11 years] if the stellar counts were made from the spectral type B1-B2, in accordance with the expected apparent spectral types of the appropriate massive fast rotators.
Conclusion: We conclude that the massive Be/Oe stars with SMC metallicity could be LGRBs progenitors. Nevertheless, other SMC O/B stars without emission lines, which have high enough specific angular momentum, can enhance the predicted $R_{\rm LGRB}$ rate.

**Reference: A&A**
*Comments:* Manuscript in press

*On the web at:* http://adsabs.harvard.edu/abs/2010arXiv1004.3362M

*Preprints from:* cmartaya@eso.org

## A very young component in the pre-eminent starburst region of the Small Magellanic Cloud

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We present a study of the compact H II region N66A in the SMC pre-eminent starburst region N66/NGC346. Despite extensive research on various components of the N66/NGC346 complex, few studies have so far focused on N66A, which is a special object in the whole complex and therefore deserves scrutiny. The study of this compact H II region and its fellow objects seems important in the framework of massive star formation in the Magellanic Clouds. This analysis is mainly based on our ESO NTT observations, both imaging and spectroscopy, coupled with archive HST ACS data and Spitzer IRAC data. We derive a number of physical characteristics of the compact H II region N66A. Moreover, we present the spectral classification of the main exciting star of N66A for the first time using spectroscopy. Its spectral features indicate a main sequence massive star of type O8. We compare this result with that based on the stellar Lyman continuum flux estimated from the ionized gas H-beta flux. The compact H II region belongs to a rare class of H II regions in the Magellanic Clouds, called High-excitation Blobs (HEBs). N66A most probably represents a very young massive star formation event in the N66 complex, which has a range of ages.

**Reference: Accepted for publication in Astronomy & Astrophysics**

*On the web at:* `arXiv:1004.0657`

*Preprints from:* `romain.selier@obspm.fr`

## Weak wind effects in CNO driven winds of hot first stars

**Jiri Krticka, Viktor Votruba, Jiri Kubat**

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During the evolution of rotating first stars, which initially consisted of only hydrogen and helium, CNO elements may emerge to their surface. These stars may therefore have winds that are driven only by CNO elements. We study weak wind effects (Gayley-Owocki heating and multicomponent effects) in stellar winds of first generation stars driven purely by CNO elements. We apply our NLTE multicomponent models and hydrodynamical simulations. The multicomponent effects (frictional heating and decoupling) are important particularly for low metallicity winds, but they influence mass loss rate only if they cause decoupling for velocities lower than the escape velocity. The multicomponent effects also modify the feedback from first stars. As a result of the decoupling of radiatively accelerated metals from hydrogen and helium, the first low-energy cosmic ray particles are generated. We study the interaction of these particles with the interstellar medium concluding that these particles easily penetrate the interstellar medium of a given minihalo. We discuss the charging of the first stars by means of their winds. Gayley-Owocki heating, frictional heating, and the decoupling of wind components occur in the winds of evolved low-metallicity stars and the solar metallicity main-sequence stars.

**Reference: Astronomy and Astrophysics, in press**

*On the web at:* `http://lanl.arxiv.org/abs/1004.3853`

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

Submitted Papers

## GC-IRS13E - An association of three puzzling early-type stars

**T. K. Fritz (1), S. Gillessen (1), K. Dodds-Eden (1), F. Martins (2), H. Bartko (1), R. Genzel (1,3), T. Paumard (4), T. Ott (1), O. Pfuhl (1), S. Trippe (5), F. Eisenhauer (1), D. Gratadour (4)**

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We present a detailed analysis of high resolution near-infrared imaging and spectroscopy of the potential star cluster IRS13E very close to the massive black hole in the Galactic Center. We detect 19 objects in IRS13E from Ks-band images, 15 of which are also detected reliably in H-band. We derive consistent proper motions for these objects from the two bands. Most objects share a similar westward proper motion. We characterize the objects using spectroscopy (1.45 to 2.45 micrometer) and (narrow-band) imaging from H- (1.66 mircrometer) to L'-band (3.80 micrometer).Nine of the objects detected in both Ks- and H-band are very red, and we find that they are all consistent with being warm dust clumps. The dust emission may be caused by the colliding winds of the two Wolf-Rayet stars in the cluster. Three of the six detected stars do not share the motion or spectral properties of the three bright stars. This leaves only the three bright, early-type stars as potential cluster members. It is unlikely that these stars are a chance configuration. Assuming the presence of an IMBH, a mass of about 14000 solar masses follows from the velocities and positions of these three stars. However, our acceleration limits make such an IMBH nearly as unlikely as a chance occurrence of such a star association. Furthermore, there is no variable X-ray source in IRS13E despite the high density of dust and gas. Therefore, we conclude that is unlikely that IRS13E hosts a black hole massive enough to bind the three stars.

**Reference: The Astrophysical Journal**
*Comments:* 17 pages, 13 figures, 2 tables

*On the web at:* `http://arxiv.org/abs/1003.1717`

*Preprints from:* `tfritz@mpe.mpg.de`

Proceedings

## X-ray Spectroscopy of the Radiation-Driven Winds of Massive Stars: Line Profile and Line Ratio Diagnostics

**David H. Cohen**

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Massive stars drive powerful, supersonic winds via the radiative momentum associated with the thermal UV emission from their photospheres. Shock phenomena are ubiquitous in these winds, heating

them to millions, and sometimes tens of millions, of degrees. The emission line spectra from the shock heated plasma provide powerful diagnostics of the winds' physical conditions, which in turn provide constraints on models of wind shock heating. Here I show how x-ray line transfer is affected by photoelectric absorption in the partially ionized component of the wind and how it can be modeled to determine the astrophysically important mass-loss rates of these stellar winds. I also discuss how photoexcitation out of metastable excited levels of helium-like ions can provide critical information about the location of the hot plasma in magnetically channeled massive star winds.

**Reference: Appears in AIP conf. ser. 1161, p. 132 (2009)**
*Comments:* Invited talk presented at the 16th International Conference on Atomic Processes in Plasmas, Monterey, CA, March 2009

*On the web at:* `http://arxiv.org/abs/0905.3557`

*Preprints from:* `dcohen1@swarthmore.edu`

## Is macroturbulent broadening in OB Supergiants related to pulsations?

**S. Simón-Díaz (1), K. Uytterhoeven, A. Herrero, N. Castro, J. Puls, C. Aerts**

(1) Instituto de Astrofísica de Canarias (Spain)

The spectrum of O and B Supergiants is known to be affected by an important extra line-broadening (usually called macroturbulence) that adds to stellar rotation. Recent analysis of high resolution spectra has shown that the interpretation of this line-broadening as a consequence of large-scale turbulent motions would imply highly super-sonic velocity fields, making this scenario quite improbable. Stellar oscillations have been proposed as a likely alternative explanation. We present first encouraging results of an observational project aimed at investigating the macroturbulent broadening in O and B Supergiants, and its possible connection with spectroscopic variability phenomena and stellar oscillations: a) all the studied B Supergiants show line profile variations, quantified by means of the first ($< v >$) and third velocity ($< v^3 >$) moments of the lines, b) there is a strong correlation between the peak-to-peak amplitudes of the $< v >$ and $< v^3 >$ variability and the size of the extra-broadening.

**Reference: http://arxiv.org/abs/1004.2524**
*Comments:* Proceeding of the IV Helas International Conference: "Seismological challenges for stellar structure". Editors: Teodoro Roca Cortés, Pere Pallé and Sebastián Jiménez Reyes

*Preprints from:* `ssimon@iac.es`

# Jobs

## Postdoctoral position in single and binary star evolution

Alain Jorissen
Institut d'Astronomie et d'Astrophysique U.L.B. - CP 226 - Boulevard du triomphe B 1050 Bruxelles

- Belgium

The Institute of Astronomy and Astrophysics (IAA - ULB, Brussels) is opening a postdoctoral position for a period up to 36 months within the Coordinated Research Action project entitled : "Heavy elements in the universe: stellar evolution,nucleosynthesis and abundance determinations" (http://www.astro.ulb.ac.be/ARC/).

**Eligibility**
At the time of engagement, the applicant must have obtained his/her PhD no more than 8 years ago. The net salary will be in the range 2000-2300 euros/month depending on the age and experience of the applicant.

**Profile**
Preference will be given to candidates with expertise in stellar evolution, binary evolution, modelling of binary interactions and/or hydrodynamical simulations.

**The Institute**
The successful candidate will be working in a stimulating environment with local experts in stellar evolution, nucleosynthesis, spectroscopy, hydrodynamics, nuclear physics and binary stars (http://www-astro.ulb.ac.be/).

**How to apply**
Interested candidates should send a CV, publication list, description of research interest, and two letters of recommendation to Pr. Alain Jorissen (ajorisse@astro.ulb.ac.be). The position can start as early as April 1st 2010 and will remain open until it is filled.

*Weblink:* `http://www-astro.ulb.ac.be/`

*Email contact:* `ajorisse@astro.ulb.ac.be`

## Research position - stellar radiative transfer and hydrodynamics

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The Astronomical Institute of the Academy of Sciences of the Czech Republic opens one temporary position in its Stellar department in the field of stellar radiative transfer and hydrodynamics to work on a project "Mass loss rate predictions for hot stars". The applicant is expected to have experience in the field of the proposed project and to have a university degree, preferably PhD, at the time of arrival.

The Stellar Department of the Astronomical Institute is located on the observatory campus in Ondrejov, which is situated approximately 30 km south-east of Prague. The stellar department operates

a 2m telescope with a coude spectrograph, which is suitable for studies of bright objects (e.g., B stars, hot subdwarfs). Czech Republic is a member state of both ESO and ESA, and have access to ESO facilities. The department includes about a dozen active researchers, with a total of about 60 scientists working at the Astronomical Institute. The department offersexcellent computing facilities, running under Linux. Researchers of the stellar department also have free access to the computer cluster (http://wave.asu.cas.cz/ocas/).

The salary will be based on the standard domestic scale. The starting date is as soon as possible and the appointment is initially for 1 year. Further extension will be possible upon satisfactory scientific results, publication output, and availability of funding.

The candidates should send their applications (list of publications, curriculum vitae, and summary of their research work) and two letters of recommendation to Dr. J. Kubat.

Applications should be received before 31st May 2010.

*Weblink:* `http://www.asu.cas.cz/news/215_research-position/`

*Email contact:* `kubat@sunstel.asu.cas.cz`

*Closing date:* 31st May 2010

## Meetings

### The Late Stages of Stellar Evolution: Some Problems and Prospects

### July 17th 2010
### Tübingen/Germany

This one day mini-workshop dedicated to some problems and prospects regarding the late stages of stellar evolution takes place on the occasion of the 60th birthday of Tony Lynas-Gray. There are invited speakers only, and there is no conference fee. Old and younger friends are particularly welcome.

*Weblink:* `http://astro.uni-tuebingen.de/~rauch/AELG60.html`

*Email contact:* `uh101aw@usm.uni-muenchen.de`