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Editors: Philippe Eenens (University of Guanajuato) eenens@gmail.com

Raphael Hirschi (Keele University) http://www.astroscu.unam.mx/massive_stars

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Abstracts of 20 accepted papers

Runaway stars as progenitors of supernovae and gamma-ray bursts

John J. Eldridge^1, Norbert Langer^2,3 & Christopher A. Tout^1

(1) Institute of Astronomy, The Observatories, University of Cambridge, Madingley Road, Cambridge, CB3 0HA.
(2) Argelander-Institut f"ur Astronomie, Bonn University, Auf dem H"ugel 71, 53121 Bonn, Germany
(3) Astronomical Institute, University of Utrecht, Postbus 80000, 3508 TA Utrecht, The Netherlands

When a core collapse supernova occurs in a binary system, the surviving star as well as the compact remnant emerging from the supernova, may reach a substantial space velocity. With binary population synthesis modelling at solar and one fifth of solar metallicity, we predict the velocities of such runaway stars or binaries. We compile predictions for runaway OB stars, red supergiants and Wolf-Rayet stars, either isolated or with a compact companion. For those stars or binaries which undergo a second stellar explosion we compute their further evolution and the distance travelled until a Type~II or Type~Ibc supernova or a long or short gamma-ray burst occurs. We find our predicted population of OB runaway stars broadly matches the observed population of stars but, to match the fastest observed Wolf-Rayet runaway stars, we require that black holes receive an asymmetric kick upon formation. We find that at solar metallicity Type~Ic supernova progenitors travel shorter distances than the progenitors of other supernova types because they are typically more massive and thus have shorter lifetimes. Those of Type~IIP supernovae can fly farthest about 48,pc {em on average} at solar metallicity, with about 8 per cent of them reaching 100,pc. In considering the consequences of assuming that the progenitors of long gamma-ray bursts are spun-up secondary stars that experience quasi-homogeneous evolution, we find that such evolution has a dramatic effect on the population of runaway Wolf-Rayet stars and that some 30 per cent of GRBs could occur a hundred parsecs or more from their initial positions. We also consider mergers of double compact object binaries consisting of neutron stars and/or black holes. We find the most common type of visible mergers are neutron star--black hole mergers that are roughly ten times more common than neutron star--neutron star mergers. All compact mergers have a wide range of merger times from years to Gyrs and are predicted to occur three hundred times less often than supernovae in the Milky Way. We also find that there may be a population of low-velocity neutron stars that are ejected from a binary rather than by their own natal kick. These neutrons stars need to be included when the distribution of neutron
star kicks is deduced from observations.

Reference: MNRAS in press
Status: Manuscript has been accepted

Weblink: http://arxiv.org/pdf/1103.1877

Comments:

Email: jje@ast.cam.ac.uk

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Time-Dependent Behavior of Linear Polarization in Unresolved Photospheres, With Applications for The Hanle Effect

R Ignace (1), K T Hole (1), J P Cassinelli (2), G D Henson (1)

(1) East Tennessee State University, (2) University of Wisconsin

Aims: This paper extends previous studies in modeling time varying linear polarization due to axisymmetric magnetic fields in rotating stars. We use the Hanle effect to predict variations in net line polarization, and use geometric arguments to generalize these results to linear polarization due to other mechanisms. Methods: Building on the work of Lopez Ariste et al., we use simple analytic models of rotating stars that are symmetric except for an axisymmetric magnetic field to predict the polarization lightcurve due to the Hanle effect. We highlight the effects for the variable line polarization as a function of viewing inclination and field axis obliquity. Finally, we use geometric arguments to generalize our results to linear polarization from the weak transverse Zeeman effect. Results: We derive analytic expressions to demonstrate that the variable polarization lightcurve for an oblique magnetic rotator is symmetric. This holds for any axisymmetric field distribution and arbitrary viewing inclination to the rotation axis. Conclusions: For the situation under consideration, the amplitude of the polarization variation is set by the Hanle effect, but the shape of the variation in polarization with phase depends largely on geometrical projection effects. Our work generalizes the applicability of results described in Lopez Ariste et al., inasmuch as the assumptions of a spherical star and an axisymmetric field are true, and provides a strategy for separating the effects of perspective from the Hanle effect itself for interpreting polarimetric lightcurves.

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Status: Manuscript has been accepted

Weblink: http://lanl.arxiv.org/abs/1103.4155

Comments:

Email: ignace@etsu.edu

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Spectroscopic and physical parameters of Galactic O-type stars. I. Effects of rotation and spectral resolving power in the spectral classification of dwarfs and giants

N. Markova^1, J. Puls^2, S. Scuderi^3,
S. Simon-D'iaz^4,5 & A. Herrero^4,5

(1) Institute of Astronomy with NAO, BAS, P.O. Box 136, 4700 Smolyan, Bulgaria
(2) Universitats-Sternwarte, Scheinerstrasse 1, D-81679 Munchen, Germany
(3) INAF - Osservatorio Astrofisico di Catania, Via S. Sofia 78, I-95123 Catania, Italy
(4) Instituto de Astrof'isica de Canarias, E38200 La Laguna, Tenerife, Spain
(5) Departamento de Astrofisica, Universidad de La Laguna, E-38205 La Laguna, Tenerife, Spain

The modern-era spectral classification of O-stars relies on either the Walborn or the Conti-Mathys scheme. Since both of these approaches have been developed using low- quality photographic data, their application to high-quality digital data might not be straightforward and be hampered by problems and complications that have not yet been appreciated. We investigate the correspondence between photographic and digital classification of low luminosity O-type stars (dwarfs and giants) of solar metallicity. Using high-resolution spectra obtained with the ESO/MPG 2.2m telescope in La Silla and following the premises of the Walborn and Conti classification schemes, we determined the spectral types and luminosity classes of 19 Galactic O-type stars and compared them to those attributed by Walborn and Mathys based on low-quality data. Our analysis reveals that the morphological spectral types assigned using high-resolution data are systematically later (by up to 1.5 subtypes) then those attributed by Walborn. By means of line-profile simulations, we show that part of this discrepancy is more likely caused by the combined effect of stellar rotation and high spectral resolution on the depth of helium lines used as spectral type indica- tors. In addition, we demonstrate that at least for narrow-lined stars the ``rotational effect'' does not disappear when the high-resolution spectra are degraded to the resolution of the Walborn standards. We also find evidence of a systematic difference between our high-resolution quantitative spectral types and those assigned by Mathys.

Reference: A & A in press
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Weblink:

Comments:

Email: nmarkova@astro.bas.bg

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The VLT-FLAMES Tarantula Survey I: Introduction and observational overview

C. J. Evans (1) & 41 co-authors

(1) UKATC

The VLT-FLAMES Tarantula Survey (VFTS) is an ESO Large Programme that has obtained multi-epoch optical spectroscopy of over 800 massive stars in the 30 Doradus region of the Large Magellanic Cloud (LMC). Here we introduce our scientific motivations and give an overview of the survey targets,

including optical and near-infrared photometry and comprehensive details of the data reduction. One of the principal objectives was to detect massive binary systems via variations in their radial velocities, thus shaping the multi-epoch observing strategy. Spectral classifications are given for the massive emission-line stars observed by the survey, including the discovery of a new Wolf-Rayet star (VFTS 682, classified as WN5h), 2' to the northeast of R136. To illustrate the diversity of objects encompassed by the survey, we investigate the spectral properties of sixteen targets identified by Gruendl & Chu from Spitzer photometry as candidate young stellar objects or stars with notable mid-infrared excesses. Detailed spectral classification and quantitative analysis of the O- and B-type stars in the VFTS sample, paying particular attention to the effects of rotational mixing and binarity, will be presented in a series of future articles to address fundamental questions in both stellar and cluster evolution.

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Comments:

Email: cje@roe.ac.uk

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The VLT-FLAMES Tarantula Survey II: R139 revealed as a massive binary system

W. D. Taylor (1), C. J. Evans, H. Sana, N. R. Walborn, S. E. de Mink, V. E. Stroud, A. Alvarez-Candal, R. H. Barbá, J. M. Bestenlehner, A. Z. Bonanos, I. Brott, P. A. Crowther, A. de Koter, K. Friedrich, G. Gräfener, V. Hénault-Brunet, A. Herrero, L. Kaper, N. Langer, D. J. Lennon, J. Maíz Apellániz, N. Markova, N. Morrell, L. Monaco, J. S. Vink

(1) Institute for Astronomy, Royal Observatory Edinburgh, UK. EH9 3HJ

We report the discovery that R139 in 30 Doradus is a massive spectroscopic binary system. Multi-epoch optical spectroscopy of R139 was obtained as part of the VLT-FLAMES Tarantula Survey, revealing a double-lined system. The two components are of similar spectral types; the primary exhibits strong C III 4650 emission and is classified as an O6.5 Iafc supergiant, while the secondary is an O6 Iaf supergiant. The radial-velocity variations indicate a highly eccentric orbit with a period of 153.9 days. Photometry obtained with the Faulkes Telescope South shows no evidence for significant variability within an 18 month period. The orbital solution yields lower mass limits for the components of M1sin^3 i = 78 +/- 8 Msun and M2sin^3 i = 66 +/- 7 Msun. As R139 appears to be the most massive binary system known to contain two evolved Of supergiants, it will provide an excellent test for atmospheric and evolutionary models.

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Comments:

Email: wdt@roe.ac.uk

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The Wolf-Rayet Content of M33

Kathryn F. Neugent and Philip Massey

Lowell Observatory

Wolf-Rayet stars (WRs) are evolved massive stars, and the relative number of WC-type and WN-type WRs should vary with metallicity, providing a sensitive test of stellar evolutionary theory. The observed WC/WN ratio is much higher than that predicted by theory in some galaxies but this could be due to observational incompleteness for WN-types, which have weaker lines. Previous studies of M33's WR content show a galactocentric gradient in the relative numbers of WCs and WNs, but only small regions have been surveyed with sufficient sensitivity to detect all of the WNs. Here we present a sensitive survey for WRs covering all of M33, finding 55 new WRs, mostly of WN type. Our spectroscopy also improves the spectral types of many previously known WRs, establishing in one case that the star is actually a background quasar. The total number of spectroscopically confirmed WRs in M33 is 206, a number we argue is complete to about 5%, with most WRs residing in OB associations, although about 2% are truly isolated. The WC/WN ratio in the central regions (<2kpc) of M33 is much higher than that predicted by the current Geneva evolutionary models, while the WC/WN ratios in the outer regions are in good accord, as are the values in the SMC and LMC. The WC/WN ratio and the WC subtype distribution both argue that the oxygen abundance gradient in M33 is significantly larger than found by some recent studies, but are consistent with the two-component model proposed by Magrini et al.

Reference: ApJ, in press
Status: Manuscript has been accepted

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Comments:

Email: phil.massey@lowell.edu

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Global X-ray properties of the O and B stars in Carina

Y. Naze, P.S. Broos, L. Oskinova, L.K. Townsley, D. Cohen, M.F. Corcoran, N.R. Evans, M. Gagne, A.F.J. Moffat, J.M. Pittard, G. Rauw, A. ud-Doula, N.R. Walborn

Univ. of Liege and co

The key empirical property of the X-ray emission from O stars is a strong correlation between the bolometric and X-ray luminosities. In the framework of the Chandra Carina Complex Project, 129 O and B stars have been detected as X-ray sources; 78 of those, all with spectral type earlier than B3, have enough counts for at least a rough X-ray spectral characterization. This leads to an estimate of the Lx/Lbol ratio for an exceptional number of 60 O stars belonging to the same region and triples the number of Carina massive stars studied spectroscopically in X-rays. The derived log(Lx/Lbol) is -7.26 for single objects, with a dispersion of only 0.21dex. Using the properties of hot massive stars listed in the literature, we compare the X-ray luminosities of different types of objects. In the case of O stars, the Lx/Lbol ratios are similar for bright and faint objects, as well as for stars of different luminosity classes or spectral types. Binaries appear only slightly harder and slightly more luminous in X-rays than single objects; the differences are not formally significant (at the 1% level), except for the Lx/Lbol ratio in the medium (1.0--2.5keV) energy band. Weak-wind objects have similar X-ray luminosities but they display

slightly softer spectra compared to "normal" O stars with the same bolometric luminosity. Discarding three overluminous objects, we find a very shallow trend of harder emission in brighter objects. The properties of the few B stars bright enough to yield some spectral information appear to be different overall (constant X-ray luminosities, harder spectra), hinting that another mechanism for producing X-rays, besides wind shocks, might be at work. However, it must be stressed that the earliest and X-ray brightest amongst these few detected objects are similar to the latest O stars, suggesting a possibly smooth transition between the two processes.

Reference: Accepted for the ApJS Special Issue on the Chandra Carina Complex Project (CCCP)
Status: Manuscript has been accepted

Weblink: http://cochise.astro.psu.edu/Carina_public/special_issue.html

Comments: ArXiV:1103.0101 ; 30 pages, 9 figures. All 16 CCCP Special Issue papers are available at the above http URL through 2011 at least

Email: naze@astro.ulg.ac.be

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Carina OB Stars: X-ray Signatures of Wind Shocks and Magnetic Fields

Marc Gagne^1, Garrett Fehon^1, Michael R. Savoy^1, David H. Cohen^2, Leisa K. Townsley^3, Patrick S. Broos^3, Matthew S. Povich^3, Michael F. Corcoran^4, Nolan R. Walborn^5, Nancy Remage Evans^6, Anthony F.J. Moffat^7, Yael Naze^8 and Lida M. Oskinova^9

1 - Department of Geology and Astronomy, West Chester University, West Chester, PA 19383
2 - Department of Physics and Astronomy, Swarthmore College, Swarthmore, PA 19081
3 - Department of Astronomy & Astrophysics, 525 Davey Laboratory, Pennsylvania State University, University Park, PA 16802
4 - CRESST and X-ray Astrophysics Laboratory, NASA/GSFC, Greenbelt, MD 20771
5 - Space Telescope Science Institute, Baltimore, MD 21218
6 - Smithsonian Astrophysical Observatory, MS 4, 60 Garden St., Cambridge, MA 02138
7 - Departement de Physique, Universite de Montreal, Succursale Centre-Ville, Montr'eal, QC, H3C 3J7, Canada
8 - GAPHE, D'epartement AGO, Universit'e de Li`ege, Allee du 6 Aout 17, Bat. B5C, B4000-Liege, Belgium and Research Associate FRS-FNRS
9 - Institute for Physics and Astronomy, University of Potsdam, 14476 Potsdam, Germany

The Chandra Carina Complex contains 200 known O- and B type stars. The Chandra survey detected 68 of the 70 O stars and 61 of 127 known B0-B3 stars. We have assembled a publicly available optical/X-ray database to identify OB stars that depart from the canonical Lx/Lbol relation, or whose average X-ray temperatures exceed 1 keV. Among the single O stars with high kT we identify two candidate magnetically confined wind shock sources: Tr16-22, O8.5 V, and LS 1865, O8.5 V((f)). The O4 III(fc) star HD 93250 exhibits strong, hard, variable X-rays, suggesting it may be a massive binary with a period of >30 days. The visual O2 If* binary HD 93129A shows soft 0.6 keV and hard 1.9 keV emission components, suggesting embedded wind shocks close to the O2 If* Aa primary, and colliding wind shocks between Aa and Ab. Of the 11 known O-type spectroscopic binaries, the long orbital-period systems HD 93343, HD 93403 and QZ Car have higher shock temperatures than short-period systems such as HD 93205 and FO 15. Although the X-rays from most B stars may be produced in the coronae of unseen, low-mass pre-main-sequence companions, a dozen B stars with high Lx cannot be explained by a

distribution of unseen companions. One of these, SS73 24 in the Treasure Chest cluster, is a new candidate Herbig Be star.

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Comments: be published in a special issue of the Astrophysical Journal Supplement on the Chandra Carina Complex Project to appear in May, 2011.

Email: mgagne@wcupa.edu

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Candidate X-ray-Emitting OB Stars in the Carina Nebula Identified Via Infrared Spectral Energy Distributions

Povich, Matthew S.; Townsley, Leisa K.; Broos, Patrick S.; Gagné, Marc; Babler, Brian L.; Indebetouw, Rémy; Majewski, Steven R.; Meade, Marilyn R.; Getman, Konstantin V.; Robitaille, Thomas P.; Townsend, Richard H. D.

Penn State University and co

We report the results of a new survey of massive, OB stars throughout the Carina Nebula using the X-ray point source catalog provided by the Chandra Carina Complex Project (CCCP) in conjunction with infrared (IR) photometry from the Two Micron All-Sky Survey and the Spitzer Space Telescope Vela--Carina survey. Mid-IR photometry is relatively unaffected by extinction, hence it provides strong constraints on the luminosities of OB stars, assuming that their association with the Carina Nebula, and hence their distance, is confirmed. We fit model stellar atmospheres to the optical (UBV) and IR spectral energy distributions (SEDs) of 182 OB stars with known spectral types and measure the bolometric luminosity and extinction for each star. We find that the extinction law measured toward the OB stars has two components: Av=1--1.5 mag produced by foreground dust with a ratio of total-to-selective absorption Rv=3.1 plus a contribution from local dust with Rv>4.0 in the Carina molecular clouds that increases as Av increases. Using X-ray emission as a strong indicator of association with Carina, we identify 94 candidate OB stars with Lbolgeq10^4 Lsun by fitting their IR SEDs. If the candidate OB stars are eventually confirmed by follow-up spectroscopic observations, the number of cataloged OB stars in the Carina Nebula will increase by ~50%. Correcting for incompleteness due to OB stars falling below the Lbol cutoff or the CCCP detection limit, these results potentially double the size of the young massive stellar population.

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Comments: ArXiV:1102.5366 ; 19 pages, 8 figures. All 16 CCCP Special Issue papers are available at the above http URL through 2011 at least

Email: naze@astro.ulg.ac.be

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Astrophysical parameters of LS2883 and implications for the PSR B1259-63 gamma-ray binary

Ignacio Negueruela(1), Marc Ribó (2), Artemio Herrero(3,4), Javier Lorenzo(1), Dmitry Khangulyan(5), Felix A. Aharonian(6,7)

(1) Universidad de Alicante
(2) Universitat de Barcelona
(3) IAC
(4) Universidad de La Laguna
(5) ISAS/JAXA
(6) DIAS, Dublin
(7) MPIfK

Only a few binary systems with compact objects display TeV emission. The physical properties of the companion stars represent basic input to understand the physical mechanisms behind the particle acceleration, emission, and absorption processes in these so-called gamma-ray binaries. Here we present high-resolution and high signal-to-noise optical spectra of LS2883, the Be star forming a gamma-ray binary with the young non-accreting pulsar PSR B1259-63, showing it to rotate faster and be significantly earlier and more luminous than previously thought. Analysis of the interstellar lines suggest that the system is located at the same distance as (and thus is likely a member of) CenOB1. Taking the distance to the association, d=2.3kpc, and a color excess of E(B-V)=0.85 for LS2883, results in Mv=-4.4. Because of fast rotation, LS2883 is oblate (R_eq=9.7R_sun and R_pole=8.1R_sun) and presents a temperature gradient (T_eq=27500K, log g_eq=3.7; T_pole=34000K, log g_pole=4.1). If the star did not rotate, it would have parameters corresponding to a late O-type star. We estimate its luminosity at log(L*/L_sun)=4.79, and its mass at M=30M_sun. The mass function then implies an inclination of the binary system i_orb=23deg,slightly smaller than previous estimates. We discuss the implications of these new astrophysical parameters of LS2883 for the production of high energy and very high energy gamma rays in the PSR B1259-63/LS2883 gamma-ray binary system. In particular, the stellar properties are very important for prediction of the line-like bulk Comptonization component from the unshocked ultra-relativistic pulsar wind.

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Weblink: http://stacks.iop.org/2041-8205/732/L11

Comments:

Email: ignacio.negueruela@ua.es

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The Search for Low-mass Companions of B Stars in the Carina Nebula Cluster Trumpler 16

Nancy Remage Evans, Kathleen DeGioia-Eastwood, Marc Gagne, Leisa Townsley, Patrick Broos, Scott Wolk, Yael Naze, Michael Corcoran, Lida Oskinova, Anthony F. J. Moffat, Junfeng Wang, Nolan R. Walborn

Smith. Astroph. Observ. and co

We have developed lists of likely B3--A0 stars (called "late B" stars) in the young cluster Trumpler 16. The following criteria were used: location within 3' of Eta Car, an appropriate V and B-V combination, and proper motion (where available). Color and magnitude cuts have been made assuming an E(B-V) =0.55 mag +/- 0.1, which is a good approximation close to the center of Trumpler 16. These lists have been cross-correlated with X-ray sources found in the Chandra Carina Complex Project (CCCP). Previous studies have shown that only very rarely (if at all) do late main sequence B stars produce X-rays. We present evidence that the X-ray detected sources are binaries with low-mass companions, since stars less massive than 1.4 Msun are strong X-ray sources at the age of the cluster. Both the median X-ray energies and X-ray luminosities of these sources are in good agreement with values for typical low-mass coronal X-ray sources. We find that 39% of the late B stars based on a list with proper motions have low-mass companions. Similarly, 32% of a sample without proper motions have low-mass companions. We discuss the X-ray detection completeness. These results on low-mass companions of intermediate mass stars are complementary to spectroscopic and interferometric results, and probe new parameter space of low mass companions at all separations. They do not support a steeply rising distribution of mass ratios to low masses for intermediate-mass (5 Msun) primaries, such as would be found by random pairing from the Initial Mass Function.

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Email: evans@head.cfa.harvard.edu

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X-RAY EMISSION FROM THE DOUBLE-BINARY OB-STAR SYSTEM QZ CAR (HD 93206)

E. R. Parkin, P. S. Broos, L. K. Townsley, J. M. Pittard, A. F. J. Moffat, Y. Naze, G. Rauw, L. M. Oskinova, W. L. Waldron

Universite de Liege et al.

X-ray observations of the double-binary OB-star system QZ~Car
(HD~93206) obtained with the Chandra X-ray Observatory over a period
of roughly 2 years are presented. The orbit of systems A (O9.7~I+b2~v,
P_A=21 d) and B (O8~III+o9~v, P_B=6 d) are
reasonably well sampled by the observations, allowing the origin of
the X-ray emission to be examined in detail. The X-ray spectra can be
well fitted by an attenuated three temperature thermal plasma model,
characterised by cool, moderate, and hot plasma components at kT ~ 0.2, 0.7 and 2 keV, respectively, and a circumstellar
absorption of ~ 0.2e22 cm^{-2}. Although the hot
plasma component could be indicating the presence of wind-wind
collision shocks in the system, the model fluxes calculated from
spectral fits, with an average value of
~ 7e-13 erg~s^{-1}~cm^{-2}, do not show a clear
correlation with the orbits of the two constituent binaries. A

semi-analytical model of QZ~Car reveals that a stable momentum balance may not be established in either system A or B. Yet, despite this, system B is expected to produce an observed X-ray flux well in excess of the observations. If one considers the wind of the O8~III star to be disrupted by mass transfer the model and observations are in far better agreement, which lends support to the previous suggestion of mass-transfer in the O8~III + o9~v binary. We conclude that the X-ray emission from QZ~Car can be reasonably well accounted for by a combination of contributions mainly from the single stars and the mutual wind-wind collision between systems A and B.

Reference: Accepted for the ApJS Special Issue on the Chandra Carina Complex Project (CCCP), scheduled for publication in May 2011. All 16 CCCP Special Issue papers are available at the listed weblink.
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Comments: 11 pages, 7 figures.

Email: parkin@mso.anu.edu.au

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A global study of the HII region M43 and its ionizing star: I. Stellar parameters and nebular empirical analysis

Simón-Díaz, S.(1,2); García-Rojas, J.; Esteban, C.; Stasińska, G.; López-Sánchez, A. R.; Morisset, C.

(1) Instituto de Astrofísica de Canarias
(2) Universidad de La Laguna

We have selected the Galactic HII region M43, a close-by apparently spherical nebula ionized by a single star (HD37061) to investigate several topics of recent interest in the field of HII regions and massive stars. In a series of two papers we perform a combined, comprehensive study of the nebula and its ionizing star by using as many observational constraints as possible. We collected for this study a set of high-quality observations, including the optical spectrum of HD37061, along with nebular optical imaging and long-slit spatially resolved spectroscopy. The first part of our study comprises a quantitative spectroscopic analysis of the ionizing star, and the empirical analysis of the nebular images and spectroscopy. We determine the stellar parameters of HD37061 and the total number of ionizing photons emitted by the star. We find observational evidence of the presence of scattered light from the Huygens region (brightest part of the Orion nebula) in the M43 region. We show the importance of an adequate correction of this scattered light from the imagery and spectroscopic observations of M43 for a proper determination of the total nebular H_alpha luminosity, the nebular physical conditions and chemical abundances. We perform a detailed nebular empirical analysis of 9 apertures extracted from a long-slit located to the west of HD37061, obtaining the spatial distribution of the physical conditions and ionic abundances. For three of the analyzed elements (O, S, and N) we could determine total abundances directly from observable ions (no ionization correction factors were needed). The comparison of these abundances with those derived from the spectrum of the Orion nebula indicates the importance of the atomic data and, specially in the case of M,42, the considered ionization correction factors.

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Comments:

Email: ssimon@iac.es

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The chemical composition of the Orion star forming region. I. Homogeneity of O and Si abundances in B-type stars

S. Simon-Diaz

IAC, ULL

Recent accurate abundance analyses of B-type main sequence stars in the solar vicinity has shown that abundances derived from these stellar objects are more homogeneous and metal-rich than previously thought.

We investigate whether the inhomogeneity of abundances previously found in B-type stars in the Ori OB1 association is real (hence a signature of enrichment of the newly formed stars in an induced star formation scenario) or a consequence of intrinsic errors induced by the use of photometric indices to establish the stellar parameters prior to the abundance analysis.

We obtained a new (improved) spectroscopic data set comprising 13 B-type stars in the various Ori OB1 associations, and performed a detailed, self-consistent spectroscopic abundance analysis by means of the modern stellar atmosphere code fastwind.

We detect systematic errors in the stellar parameters determined previously which affect the derived abundances. Once these errors are accounted for, we find a high degree of homogeneity in the O and Si abundances for stars in the four Ori OB1 subgroups. The derived abundances are in very good agreement with recent determinations in other B-type stars in the solar vicinity. We also compare our results with those obtained for the Sun during the epoch of the ”solar crisis”, and the Orion nebula.

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Email: ssimon@iac.es

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The chemical composition of the Orion star forming region. II. Stars, gas, and dust: the abundance discrepancy conundrum

S. Simon-Diaz, G. Stasinska

IAC, ULL, OPM

We re-examine the recombination/collisional emission line (RL/CEL) nebular abundance discrepancy problem in the light of recent high-quality abundance determinations in young stars in the Orion star-forming region.

We re-evaluate the CEL and RL abundances of several elements in the Orion nebula and estimate the associated uncertainties, taking into account the uncertainties in the ionization correction factors for unseen ions. We estimate the amount of oxygen trapped in dust grains for several scenarios of dust formation. We compare the resulting gas+dust nebular abundances with the stellar abundances of a sample of 13 B-type stars from the Orion star-forming region (Ori OB1), analyzed in Papers I and III of this series.

We find that the oxygen nebular abundance based on recombination lines agrees much better with the stellar abundances than the one derived from the collisionally excited lines. This result calls for further investigation. If the CEL/RL abundance discrepancy were caused by temperature fluctuations in the nebula, as argued by some authors, the same kind of discrepancy should be seen for the other elements, such as C, N and Ne, which is not what we find in the present study. Another problem is that with the RL abundances, the energy balance of the Orion nebula is not well understood. We make some suggestions concerning the next steps to undertake to solve this problem.

Reference: A&A, 2011, 526, 48
Status: Manuscript has been accepted

Weblink: http://adsabs.harvard.edu/abs/2011A%26A...526A..48S

Comments: This is the second of a series of 3 papers published between 2010 and 2011

Email: ssimon@iac.es

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Blue luminous stars in nearby galaxies-UIT 005: a possible link to the Luminous Blue Variable stage

M.A. Urbaneja (1), A. Herrero (2,3), D.J. Lennon (4), L.J. Corral (5), G. Meynet (6)

(1) IfA, Hawaii, USA
(2) IAC, La Laguna, Spain
(3) ULL, La Laguna, Spain
(4) STScI, Baltimore, USA
(5) IAM, Guadalajara, Mexico
(6) Geneva Obs., Switzerland

A detailed study of the blue supergiant UIT 005 (B2-2.5Ia+) in M33 is presented. The results of our quantitative spectral analysis indicate that the star is a very luminous, log $(L/L_odot)sim5.9$ dex, and massive, Msim50,M$_odot$, object, showing a very high nitrogen-to-oxygen ratio in its surface (N/Osim8, by mass).
Based on the derived Mg and Si abundances, we argue that this high N/O ratio cannot be the result of an initial low O content due to its location on the disk of M33, a galaxy known to present a steep metallicity gradient. In combination with the He abundance, the most plausible interpretation is that UIT005 is in an advanced stage of evolution, showing in its surface N enrichment and O depletion resulting from mixing

with CNO processed material from the stellar interior.
A comparison with the predictions of current stellar evolutionary models indicates that there are significant discrepancies, in particular with regard to the degree of chemical processing, with the models predicting a much lower degree of O depletion than observed. At the same time, the mass-loss rate derived in our analysis is an order of magnitude lower than the values considered in the evolutionary calculations.
Based on a study of the surrounding stellar population and the nearby cluster, NGC588, using HST/WFPC2 photometry, we suggest that UIT005 could be in fact a runaway star from this cluster. Regardless of its origin, the derived parameters place the star in a region of the Hertzsprung--Russell diagram where Luminous Blue Variables are usually found, but we find no evidence supporting photometric or spectroscopic variability, except for small H$alpha$ changes, otherwise observed in Galactic B-type supergiants.
Whether UIT005 is an LBV in a dormant state or a regular blue supergiant could not be discerned in this study. Subsequent monitoring would help us to improve our knowledge of the more massive stars, bridging the gap between regular and more exotic blue supergiants.

Reference: Astrophysical Journal
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1104.2928

Comments:

Email: ahd@iac.es

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The masses, and the mass discrepancy of O-type stars

C. Weidner^1, J. Vink^2

1 - Scottish Universities Physics Alliance (SUPA), School of Physics and Astronomy, University of St Andrews, North Haugh,
St Andrews, Fife KY16 9SS, UK
2 - Armagh Observatory, College Hill, Armagh BT61 9DG, UK

Context. The “mass discrepancy” in massive O stars represents a long-standing problem in stellar astrophysics with far-reaching implications for the chemical and dynamical feedback in galaxies.
Aims. Our goal is to investigate this mass discrepancy by comparing state-of-the-art model masses with model-independent masses determined from eclipsing binaries.
Methods. Using stellar evolution models and a recent calibration of stellar parameters for O-star spectral sub-classes, we present a convenient way to convert observed solar metallicity O star spectral types into model masses, which we subsequently compare to our dynamical mass compilation. We also derive similar conversions for Large and Small Magellanic Cloud metallicities.
Results. We obtain a good agreement between model and dynamical masses, suggesting the long-standing problem of a systematic mass discrepancy problem may have been solved. We also provide error ranges for the model masses, as well as minimal and maximal age estimates for when the model stars are in a given spectral type box.

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Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1010.2204

Comments:

Email: cw60@st-andrews.ac.uk

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A 10-hour period revealed in optical spectra of the highly variable WN8 Wolf-Rayet star WR 123

A.-N. Chené (1,2,3), C. Foellmi, S.V. Marchenko (4), N. St-Louis (5), A. F. J. Moffat (5), D. Ballereau (6), J. Chauville (6), J. Zorec (7), C. A. Poteet (8)

1. U. de Concepción
2. U. de Valparaíso
3. NRC/HIA
4. Science Systems and Applications, Inc.
5. U. de Montréal, 6. Observatoire de Paris-Meudon
7. IAP
8. Ritter Observatory

Aims. What is the origin of the large-amplitude variability in Wolf-Rayet WN8 stars in general and WR123 in particular? A dedicated spectroscopic campaign targets the ten-hour period previously found in the high-precision photometric data obtained by the MOST satellite. Methods. In June-August 2003 we obtained a series of high signal-to-noise, mid-resolution spectra from several sites in the 4000 - 6940 A domain. We also followed the star with occasional broadband (Johnson V) photometry. The acquired spectroscopy allowed a detailed study of spectral variability on timescales from ~ 5 minutes to months. Results. We find that all observed spectral lines of a given chemical element tend to show similar variations and that there is a good correlation between the lines of different elements, without any significant time delays, save the strong absorption components of the Hei lines, which tend to vary differently from the emission parts. We find a single sustained periodicity, P ~ 9.8 h, which is likely related to the relatively stable pulsations found in MOST photometry obtained one year later. In addition, seemingly stochastic, large-amplitude variations are also seen in all spectral lines on timescales of several hours to several days.

Reference: A&A Research Notes, in press
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1104.5182

Comments:

Email: achene@astro-udec.cl

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Chandra X-ray spectroscopy of the very early O supergiant HD 93129A: constraints on wind shocks and the mass-loss rate

David H. Cohen (1), Marc Gagn'e (2), Maurice A. Leutenegger (3,4), James P. MacArthur (1), Emma E. Wollman (1,5), Jon O. Sundqvist (6), Alex W. Fullerton (7), Stanley P. Owocki (6)

(1) Swarthmore College (2) West Chester University (3) NASA/Goddard Space Flight Center (4) CRESST and University of Maryland, Baltimore County (5) Caltech, Department of Physics (6) University of Delaware, Bartol Research Institute (7) Space Telescope Science Institute

We present analysis of both the resolved X-ray emission line profiles and the broadband X-ray spectrum of the O2 If* star HD 93129A, measured with the Chandra HETGS. This star is among the earliest and most massive stars in the Galaxy, and provides a test of the embedded wind shock scenario in a very dense and powerful wind. A major new result is that continuum absorption by the dense wind is the primary cause of the hardness of the observed X-ray spectrum, while intrinsically hard emission from colliding wind shocks contributes less than 10% of the X-ray flux. We find results consistent with the predictions of numerical simulations of the line-driving instability, including line broadening indicating an onset radius of X-ray emission of several tenths Rstar. Helium-like forbidden-to-intercombination line ratios are consistent with this onset radius, and inconsistent with being formed in a wind-collision interface with the star's closest visual companion at a distance of ~100 AU. The broadband X-ray spectrum is fit with a dominant emission temperature of just kT = 0.6 keV along with significant wind absorption. The broadband wind absorption and the line profiles provide two independent measurements of the wind mass-loss rate: Mdot = 5.2_{-1.5}^{+1.8} times 10^{-6} Msun/yr and Mdot = 6.8_{-2.2}^{+2.8} times 10^{-6} Msun/yr, respectively. This is the first consistent modeling of the X-ray line profile shapes and broadband X-ray spectral energy distribution in a massive star, and represents a reduction of a factor of 3 to 4 compared to the standard H-alpha mass-loss rate that assumes a smooth wind. Finally, we also model the H-alpha emission line, using our lower mass-loss rate and a clumping factor of f_V = 0.08. We find that a clump onset radius of 1.05 Rstar is required to fit the data.

Reference: Monthly Notices of the Royal Astronomical Society, in press
Status: Manuscript has been accepted

Weblink: http://adsabs.harvard.edu/abs/2011arXiv1104.4786C

Comments: 12 pages; 2 tables; 10 figures (5 color).
Further information available at http://astro.swarthmore.edu/~cohen/papers.html#hd93129

Email: dcohen1@swarthmore.edu

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Magnetic Fields in Massive Stars, their Winds, and their Nebulae

Rolf Walder (1), Doris Folini (1), Georges Meynet (2)

(1) CRAL, ENS-Lyon, France
(2) Observatoire de Genève, Switzerland

Massive stars are crucial building blocks of galaxies and the universe, as production sites of heavy elements and as stirring agents and energy providers through stellar winds and supernovae. The field of magnetic massive stars has seen tremendous progress in recent years. Different perspectives -- ranging from direct field measurements over dynamo theory and stellar evolution to colliding winds and the stellar environment -- fruitfully combine into a most interesting and still evolving overall picture, which we attempt to review here. Zeeman signatures leave no doubt that at least some O- and early B-type stars have a surface magnetic field. Indirect evidence, especially non-thermal radio emission from colliding winds, suggests many more. The emerging picture for massive stars shows

similarities with results from intermediate mass stars, for which much more data are available. Observations are often compatible with a dipole or low order multi-pole field of about 1 kG (O-stars) or 300 G to 30 kG (Ap / Bp stars). Weak and unordered fields have been detected in the O-star zeta Ori A and in Vega, the first normal A-type star with a magnetic field. Theory offers essentially two explanations for the origin of the observed surface fields: fossil fields, particularly for strong and ordered fields, or different dynamo mechanisms, preferentially for less ordered fields. Numerical simulations yield the first concrete stable (fossil) field configuration, but give contradictory results as to whether dynamo action in the radiative envelope of massive main sequence stars is possible. Internal magnetic fields, which may not even show up at the stellar surface, affect stellar evolution as they lead to a more uniform rotation, with more slowly rotating cores and faster surface rotation. Surface metallicities may become enhanced, thus affecting the mass-loss rates.

Reference: Accepted to Space Science Review
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Weblink:

Comments:

Email: rolf.walder@ens-lyon.fr

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Abstracts of 1 other publications

The chemical composition of the Orion star-forming region. III. C, N, Ne, Mg and Fe abundances in B-type stars revisited

M.F. Nieva & S. Simon-Diaz

MPI, IAC, ULL

Early B-type stars are invaluable indicators for elemental abundances of their birth environments. In contrast to the surrounding neutral interstellar matter (ISM) and HII regions their chemical composition is unaffected by depletion onto dust grains and by the derivation of different abundances from recombination and collisional lines. In combination with ISM or nebular gas-phase abundances they facilitate the dust-phase composition to be constrained. Precise abundances of C, N, Mg, Ne, Fe in early B-type stars in the Orion star-forming region are determined in order to: a) review previous determinations using a self-consistent quantitative spectral analysis based on modern stellar atmospheres and recently updated model atoms, b) complement results found in Paper I for oxygen and silicon, c) establish an accurate and reliable set of stellar metal abundances to constrain the dust-phase composition of the Orion HII region in Paper II of the series. A detailed, self-consistent spectroscopic study of a sample of 13 narrow-lined B0V-B2V stars in Ori OB1 is performed. High-quality spectra obtained with FIES@NOT are analysed using a non-LTE method and line-profile fitting techniques, validating the approach by comparison with results obtained in Paper I using line-blanketed non-LTE model atmospheres and a curve-of-growth analysis. The two independent analysis strategies give consistent results for basic stellar parameters and abundances of oxygen and silicon. The extended analysis to C, N,

Mg, Ne, and Fe finds a high degree of chemical homogeneity, with the 1sigma-scatter adopting values of 0.03--0.07 dex around the mean for the various elements. Present-day abundances from B-type stars in Ori OB1 are compatible at similar precision with cosmic abundance standard values as recently established from early-type stars in the solar neighbourhood and also with the Sun.

Reference: Recomended for acceptance in A&A
Status: Other

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Comments: This is the third of a series of 3 papers published between 2010 and 2011

Email: fnieva@MPA-Garching.MPG.DE

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MEETINGS

Four Decades of Research on Massive Stars
A Scientific Meeting in the Honour of Anthony F.J. Moffat

Second announcement -- Erratum

11-15 July 2011

Venue: Auberge du Lac Taureau , Lanaudière, Québec, Canada

THERE HAS BEEN A MISTAKE IN THE DATES OF SELECTION OF THE TALKS IN OUR SECOND ANNOUNCEMENT; IT WILL BE IN LATE APRIL/EARLY MAY. WE ARE ALSO EXTENDING THE DEADLINE FOR EARLY REGISTRATION TO 10 APRIL. HERE IS THE CORRECTED VERSION OF THE ANNOUCEMENT.

We are organizing a meeting to celebrate four decades of contributions of Professor Anthony F.J. Moffat to massive-star research. Since his first papers on open clusters in the early 70's, Tony's research interests have expanded in many directions to cover a multitude of aspects of massive stars. The meeting will encompass the main subjects on which he has worked during his career. Please go to our Web site for more details.

We invite you to the Auberge du Lac Taureau in the beautiful region of Lanaudière, Québec, Canada to present your latest research and for stimulating presentations and discussions.

Official registration is now open! For those who have pre-registered please note that it is not considered an official registration, but only a statement of interest. You will be able to submit an abstract and appear on the list of participants only after you have officially registered and paid the registration fees. We will have posters, 20-minute contributed talks (around 50) and about a dozen 30-minute invited talks. If necessary, the SOC will decide by LATE APRIL/EARLY MAY, which participants are chosen for contributed talks and which will present a poster.

Our registration fee will be 230$CAN (late fee=300$CAN) and will include a printed copy of the

proceedings, which will be published by the Astronomical Society of the Pacific in their Conference Series, taxes, programs and an abstract book.

Important dates:

Web site opens and start of pre-registration: 18 October 2010
Deadline for early registration: 10 April 2011
Abstract submission deadline: 15 April 2011
Registration fee and hotel reservation deadline: 16 May 2011
Deadline for registration (higher registration fee): 10 June 2011

The Scientific Organizing Committee

Nicole St-Louis, Université de Montréal
Laurent Drissen, Université Laval
Carmelle Robert, Université Laval
Paul Crowther, The University of Sheffield
Doug Gies, Georgia State University, CHARA
Stan Owocki, The Bartol Research Institute, University of Delaware
Julian Pittard, The University of Leeds
Mike Shara, The American Museum of Natural History, New York
Gregg Wade, Royal Military College of Canada, Kingston
Hans Zinnecker, Astrophysikalisches Institut Potsdam
Contact: stlouis@astro.umontreal.ca

The Local Organising Committee:

Nicole St-Louis, Université de Montréal
Laurent Drissen, Université Laval
Carmelle Robert, Université Laval
Robert Lamontagne, Université de Montréal
Luc Turbide, Université de Montréal
Antoine de la Chevrotière, Université de Montréal
Rémi Fahed, Université de Montréal
Alexandre David-Uraz, Université de Montréal
Sébastien Desforges, Université de Montréal
Contact: stlouis@astro.umontreal.ca

Weblink: http://craq-astro.ca/moffat/

Email: stlouis@astro.umontreal.ca

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