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THE MASSIVE STAR NEWSLETTER

formerly known as the hot star newsletter

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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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(original deadline passed):

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Radiation mechanisms of astrophysical objects: classics today

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News

Candidacies for the Organizing Committee of the Massive Stars Commission (from May 16th to June 1st)

dear members of the MSWG,

now that the Massive Stars Commission has been approved by the IAU, we have to elect the Organizing Committee (OC) and the Vice-president. To be a candidate and vote for the OC you must be registered as a member of the Commission. Registration is open until May 15. To register you have to follow the instructions in the email sent by the General Secretary on April 29, 2015 using the "My vote" system. If you have not received an email, contact the IAU: iauinfos@iap.fr .

According to IAU rules, the OC shall consist of 4-8 members. The proponents of the new Commission (4 in our case) will be ex-officio members of the OC, and the first proponent will be president of the Commission. Thus our new OC Commission already has four members: Artemio Herrero (president), Gregor Rauw, Nicole St.-Louis and Jorick Vink.

Depending on the final number of members of our Commission, 1-4 new OC members will be elected by the Commission members. IAU regulations for the process indicate that candidates for the OC shall propose themselves.

Candidacies can be sent to the (future) Commission president (ahd-at-iac.es) from ** May, 16th to June, 1st **. Interested people shall send a brief CV and motivation, with a photo inserted. The four present OC members will be in charge of presenting a balanced slate of candidate for election by the Commission members. The dates for the votation will be announced later.

The Vice-president candidate will be proposed by the Commission president.

Please note that there has been a call for candidacies to the Division Steering Committees. Candidates shall be different.

with best regards,
Artemio Herrero
chair, Massive Stars Working Group
Email: ahd@iac.es

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Massive Stars Commission approved by IAU Executive Committee

dear friends,
as you have probably seen by the email distributed by the IAU General Secretary, the proposal for a new IAU Commision on Massive Stars has been approved. This is great news for our group.

Thanks to all of you who supported the proposal, and particular thanks to those that helped to prepare it.

IAU members please note that you will have from **April 30th until May 15th** to sign-up in up to three IAU Commissions. This will be required for the subsequent election processes of the Organizing Committes.

Again, congratulations to all members of the former IAU Working Group on Massive Stars.

best regards,
Artemio Herrero
chair, on behalf of the Massive Stars Working Group Organizing Committee
Email: ahd@iac.es

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Fizeau exchange visitors program - special call for applications

Dear colleagues!

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff), non-EU based missions will only be funded if considered essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.

IMPORTANT NOTE:
This is a special call to support attendance of the 8th VLTI summer school:
http://www.astro.uni-koeln.de/vltischool2015.
Therefore no research plan and invitation letter from the host institution are required.
The deadline for applications is May 30.

Further informations and application forms can be found at
www.european-interferometry.eu

The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

Weblink: www.european-interferometry.eu

Email: fizeau@european-interferometry.eu

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PAPERS

Abstracts of 16 accepted papers

The Massive Star Population of Cygnus OB2

Nicholas J. Wright, Janet E. Drew, Michael Mohr-Smith

Centre for Astrophysics Research, University of Hertfordshire

We have compiled a significantly updated and comprehensive census of massive stars in the nearby Cygnus OB2 association by gathering and homogenising data from across the literature. The census contains 169 primary OB stars, including 52 O-type stars and 3 Wolf-Rayet stars. Spectral types and photometry are used to place the stars in a Hertzprung-Russell diagram, which is compared to both non-rotating and rotating stellar evolution models, from which stellar masses and ages are calculated. The star formation history and mass function of the association are assessed, and both are found to be heavily influenced by the evolution of the most massive stars to their end states. We find that the mass function of the most massive stars is consistent with a `universal' power-law slope of $Gamma = 1.3$. The age distribution inferred from stellar evolutionary models with rotation and the mass function suggest the majority of star formation occurred more or less continuously between 1 and 7~Myr ago, in agreement with studies of low- and intermediate mass stars in the association. We identify a nearby young pulsar and runaway O-type star that may have originated in Cyg~OB2 and suggest that the association has already seen its first supernova. Finally we use the census and mass function to calculate the total mass of the association of 16500^{+3800}_{-2800}~M$_odot$, at the low end, but consistent with, previous estimates of the total mass of Cyg~OB2. Despite this Cyg~OB2 is still one of the most massive groups of young stars known in our Galaxy making it a prime target for studies of star formation on the largest scales.

Reference: MNRAS, accepted
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1502.05718

Email: nick.nwright@gmail.com

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2.5D global-disk oscillation models of the Be shell star ζ Tauri I. Spectroscopic and polarimetric analysis

C. Escolano (1), A. C. Carciofi (1), A. T. Okazaki (2), T. Rivinius (3), D. Baade (4), and S. Stefl (5)

(1) - Instituto de- Astronomia, Geofisica e Ciencias Atmosfeì·ricas (Sao Paulo, Brazil); (2) - Hokkai-Gakuen University (Sapporo, ESO (Santiago, Japan); (3) - ESO (Santiago, Chile); (4) - ESO (Garching, Germany); (5) - ALMA (Santiago, Chile)

Context. A large number of Be stars exhibit intensity variations of their violet and red emission peaks in their HI lines observed in emission. This is the so-called V/R phenomenon, usually explained by the precession of a one-armed spiral density perturbation in the circumstellar disk. That global-disk

oscillation scenario was confirmed, both observationally and theoretically, in the previous series of two papers analyzing the Be shell star ζ Tauri. The vertically averaged (2D) global-disk oscillation model used at the time was able to reproduce the V/R variations observed in Hα, as well as the spatially resolved interferometric data from AMBER/VLTI. Unfortunately, that model failed to reproduce the V/R phase of Br15 and the amplitude of the polarization variation, suggesting that the inner disk structure predicted by the model was incorrect.

Aims. The first aim of the present paper is to quantify the temporal variations of the shell-line characteristics of ζ Tauri. The second aim is to better understand the physics underlying the V/R phenomenon by modeling the shell-line variations together with the V/R and polarimetric variations. The third aim is to test a new 2.5D disk oscillation model, which solves the set of equations that describe the 3D perturbed disk structure but keeps only the equatorial (i.e., 2D) component of the solution. This approximation was adopted to allow comparisons with the previous 2D model, and as a first step toward a future 3D model.

Methods. We carried out an extensive analysis of ζ Tauri's spectroscopic variations by measuring various quantities characterizing its Balmer line profiles: red and violet emission peak intensities (for Hα, Hβ, and Br15), depth and asymmetry of the shell absorption (for Hβ, Hγ, and Hδ), and the respective position (i.e., radial velocity) of each component. We attempted to model the observed variations by implementing in the radiative transfer code HDUST the perturbed disk structure computed with a recently developed 2.5D global-disk oscillation model.

Results. The observational analysis indicates that the peak separation and the position of the shell absorption both exhibit variations following the V/R variations and, thus, may provide good diagnostic tools of the global-disk oscillation phenomenon. The shell absorption seems to become slightly shallower close to the V/R maximum, but the scarcity of the data does not allow the exact pattern to be identified. The asymmetry of the shell absorption does not seem to correlate with the V/R cycle; no significant variations of this parameter are observed, except during certain periods where Hα and Hβ exhibit perturbed emission profiles. The origin of these so-called triple-peak phases remains unknown. On the theoretical side, the new 2.5D formalism appears to improve the agreement with the observed V/R variations of Hα and Br15, under the proviso that a large value of the viscosity parameter, $\alpha = 0.8$, be adopted. It remains challenging for the models to reproduce consistently the amplitude and the average level of the polarization data. The 2D formalism provides a better match to the peak separation, although the variation amplitude predicted by both the 2D and 2.5D models is smaller than the observed value. Shell-line variations are difficult for the models to reproduce, whatever formalism is adopted.

Reference: A&A
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1503.00590

Email: cyril.escolano@gmail.com

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3D Printing Meets Computational Astrophysics: Deciphering the Structure of Eta Carinae's Inner Colliding Winds

Thomas I. Madura(1), Nicola Clementel(2), Theodore R. Gull(1), Chael J.H. Kruip(2), and Jan-Pieter Paardekooper(3,4)

1 - NASA Goddard Space Flight Center; 2 - Leiden Observatory; 3 - Universitat Heidelberg; 4 - Max Planck Institute for Extraterrestrial Physics

We present the first 3D prints of output from a supercomputer simulation of a complex astrophysical system, the colliding stellar winds in the massive (>120 M_Sun), highly eccentric (e~0.9) binary star system Eta Carinae. We demonstrate the methodology used to incorporate 3D interactive figures into a PDF journal publication and the benefits of using 3D visualization and 3D printing as tools to analyze data from multidimensional numerical simulations. Using a consumer-grade 3D printer (MakerBot Replicator 2X), we successfully printed 3D smoothed particle hydrodynamics (SPH) simulations of Eta Carinae's inner (r ~ 110 au) wind-wind collision interface at multiple orbital phases. The 3D prints and visualizations reveal important, previously unknown 'finger-like' structures at orbital phases shortly after periastron (phi~1.045) that protrude radially outward from the spiral wind-wind collision region. We speculate that these fingers are related to instabilities (e.g. thin-shell, Rayleigh-Taylor) that arise at the interface between the radiatively-cooled layer of dense post-shock primary-star wind and the fast (3000 km/s), adiabatic post-shock companion-star wind. The success of our work and easy identification of previously unrecognized physical features highlight the important role 3D printing and interactive graphics can play in the visualization and understanding of complex 3D time-dependent numerical simulations of astrophysical phenomena.

Reference: For publication in MNRAS
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1503.00716

Comments: To view 3D interactive figures and movie, use Adobe PDF viewer.

Email: thomas.i.madura@nasa.gov

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On the consistent treatment of the quasi-hydrostatic layers in hot star atmospheres

Andreas Sander (1), Tomer Shenar (1), Rainer Hainich (1), Angel Gímenez-García (2), Helge Todt (1), Wolf-Rainer Hamann (1)

(1) - Institut for Physics and Astronomy, University of Potsdam, Germany;
(2) - Departamento de Física, Ingeniería de Sistemas y Teoría de la Señal, Universidad de Alicante, Spain

CONTEXT: Spectroscopic analysis remains the most common method to derive masses of massive stars, the most fundamental stellar parameter. While binary orbits and stellar pulsations can provide much sharper constraints on the stellar mass, these methods are only rarely applicable to massive stars. Unfortunately, spectroscopic masses of massive stars heavily depend on the detailed physics of model atmospheres.

AIMS: We demonstrate the impact of a consistent treatment of the radiative pressure on inferred gravities and spectroscopic masses of massive stars. Specifically, we investigate the contribution of line and continuum transitions to the photospheric radiative pressure. We further explore the effect of model parameters, e.g., abundances, on the deduced spectroscopic mass. Lastly, we compare our results with the plane-parallel TLUSTY code, commonly used for the analysis of massive stars with photospheric spectra.

METHODS: We calculate a small set of O-star models with the Potsdam Wolf-Rayet (PoWR) code using different approaches for the quasi-hydrostatic part. These models allow us to quantify the effect of accounting for the radiative pressure consistently. We further use PoWR models to show how the Doppler widths of line profiles and abundances of elements such as iron affect the radiative pressure, and, as a consequence, the derived spectroscopic masses.

RESULTS: Our study implies that errors on the order of a factor of two in the inferred spectroscopic mass are to be expected when neglecting the contribution of line and continuum transitions to the radiative acceleration in the photosphere. Usage of implausible microturbulent velocities, or the neglect of important opacity sources such as Fe, may result in errors of approximately 50% in the spectroscopic mass. A comparison with TLUSTY model atmospheres reveals a very good agreement with PoWR at the limit of low mass-loss rates.

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

Weblink: http://arxiv.org/abs/1503.01338

Email: ansander@astro.physik.uni-potsdam.de

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A New Luminous Blue Variable in M31

Roberta M. Humphreys (1), John C. Martin (2) and Michael S. Gordon (1)

(1) University of Minnesota, (2) University of Illinois - Springfield

We report the fifth confirmed Luminous Blue Variable/S Doradus variable in M31. In 2006, J004526.62+415006.3 had the spectrum of hot Fe II emission line star with strong P Cygni profiles in the Balmer lines. In 2010, its absorption line spectrum resembled an early A-type supergiant with H and Fe II emission lines with strong P Cygni profiles, and in 2013 the spectrum had fully transitioned to an F-type supergiant due to the formation of the optically thick, cool wind which characterizes LBVs at maximum light. The photometric record supports the LBV/S Dor nature of the variability. Its bolometric luminosity ~ -9.65 mag places it on the HR Diagram near the known LBVs, AE And, Var C in M33 and S Dor.

Reference: To appear in the Publications of the Astronomical Society of the Pacific
Status: Manuscript has been accepted

Email: roberta@umn.edu

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Eta Carinae's 2014.6 Spectroscopic Event: The Extraordinary He II and N II Features

Kris Davidson(1), Andrea Mehner(2), Roberta M. Humphreys (1), John C. Martin (3), and Kazunori Ishibashi (4)

(1) University of Minnesota, (2) ESO, (3) University of Illinois - Springfield, (4) Nagoya Univ., Japan

Eta Carinae's spectroscopic events (periastron passages) in 2003, 2009, and 2014 differed progressively. He ii lambda4687 and nearby N ii multiplet 5 have special significance because they respond to very soft X-rays and the ionizing UV radiation field (EUV). Hubble Space Telescope (HST)/STIS observations in 2014 show dramatic increases in both features compared to the previous 2009.1 event. These results appear very consistent with a progressive decline in the primary wind density, proposed years ago on other grounds. If material falls onto the companion star near periastron, the accretion rate may now have become too low to suppress the EUV.

Reference: ApJ Letters, 801L, 15D
Status: Manuscript has been accepted

Email: roberta@umn.edu

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The Massive Star Population in M101. III. Spectra and Photometry of the Luminous and Variable Stars

Skyler H. Grammer and Roberta M. Humphreys

University of Minnesota

We discuss moderate resolution spectra, multicolor photometry, and light curves of thirty-one of the most luminous stars and variables in the giant spiral M101. The majority are intermediate A to F-type supergiants. We present new photometry and light curves for three known "irregular blue variables" V2, V4 and V9) and identify a new candidate. Their spectra and variability confirm that they are LBV candidates and V9 may be in an LBV-like maximum light state or eruption.

Reference: To appear in the Astronomical Journal
Status: Manuscript has been accepted

Weblink: http://etacar.umn.edu/LuminousStars/M101/

Email: roberta@umn.edu

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A coordinated X-ray and Optical Campaign of the Nearest Massive Eclipsing Binary, delta Orionis Aa: IV. A multiwavelength, non-LTE spectroscopic analysis

T. Shenar, L. Oskinova, W.-R. Hamann, M. F. Corcoran, A. F. J. Moffat, H. Pablo, N. D. Richardson, W. L. Waldron, D. P. Huenemoerder, J. Maíz Apellániz, J. S. Nichols, H. Todt, Y. Nazé, J. L. Hoffman, A. M. T. Pollock, I. Negueruela

University of Potsdam, Germany

Eclipsing systems of massive stars allow one to explore the properties of their components in great detail. We perform a multi-wavelength, non-LTE analysis of the three components of the massive multiple system delta Ori A, focusing on the fundamental stellar properties, stellar winds, and X-ray characteristics of the system.

The primary's distance-independent parameters turn out to be characteristic for its spectral type (O9.5 II), but usage of the Hipparcos parallax yields surprisingly low values for the mass, radius, and luminosity. Consistent values follow only if delta Ori lies at about twice the Hipparcos distance, in the vicinity of the sigma-Orionis cluster. The primary and tertiary dominate the spectrum and leave the secondary only marginally detectable. We estimate the V-band magnitude difference between primary and secondary to be 2.8 mag. The inferred parameters suggest the secondary is an early B-type dwarf (~B1 V), while the tertiary is an early B-type subgiant (~B0 IV). We find evidence for rapid turbulent velocities (∼200 km/s) and wind inhomogeneities, partially optically thick, in the primary's wind. The bulk of the X-ray emission likely emerges from the primary's stellar wind (log LX/LBol~ −6.85), initiating close to the stellar surface at R0∼1.1R∗. Accounting for clumping, the mass-loss rate of the primary is found to be log Mdot ~ 6.4 [Msun/yr], which agrees with hydrodynamic predictions, and provides a consistent picture along the X-ray, UV, optical and radio spectral domains.

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Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1503.03476

Email: shtomer@astro.physik.uni-potsdam.de

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On X-ray pulsations in beta Cephei-type variables

Oskinova, L. M.; Todt, H.; Huenemoerder, D. P.; Hubrig, S.; Ignace, R.; Hamann, W.-R.; Balona, L.

University of Potsdam, etc.

Beta Cephei-type variables are early B-type stars that are characterized by oscillations observable in their optical light curves. At least one Beta Cep-variable also shows periodic variability in X-rays. Here we study the X-ray light curves in a sample of beta Cep-variables to investigate how common X-ray pulsations are for this type of stars. We searched the Chandra and XMM-Newton X-ray archives and selected stars that were observed by these telescopes for at least three optical pulsational periods. We retrieved and analyzed the X-ray data for kappa Sco, beta Cru, and alpha Vir. The X-ray light curves of these objects were studied to test for their variability and periodicity. While there is a weak indication for

X-ray variability in beta Cru, we find no statistically significant evidence of X-ray pulsations in any of our sample stars. This might be due either to the insufficient data quality or to the physical lack of modulations. New, more sensitive observations should settle this question.

Reference: A&A
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1503.05749

Email: lida@astro.physik.uni-potsdam.de

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Photometric identification of the periods of the first candidate extragalactic magnetic stars

Yael Naze (1), Nolan R. Walborn (2), Nidia Morrell (3), Gregg A. Wade (4), Michal K. Szymanski (5)

1 - ULg, 2 - STScI, 3 - Las Campanas, 4 - RMC, 5 - Warsaw University

Galactic stars belonging to the Of?p category are all strongly magnetic objects exhibiting rotationally modulated spectral and photometric changes on timescales of weeks to years. Five candidate Of?p stars in the Magellanic Clouds have been discovered, notably in the context of ongoing surveys of their massive star populations. Here we describe an investigation of their photometric behaviour, revealing significant variability in all studied objects on timescales of one week to more than four years, including clearly periodic variations for three of them. Their spectral characteristics along with these photometric changes provide further support for the hypothesis that these are strongly magnetized O stars, analogous to the Of?p stars in the Galaxy.

Reference: accepted by A&A
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1503.07654

Email: naze@astro.ulg.ac.be

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A spectroscopic investigation of the O-type star population in four Cygnus OB associations. II. Determination of the fundamental parameters

L.Mahy(1), G.Rauw(1), M. De Becker (1), P. Eenens (2), and C. A. Flores(2)

(1): Institut d'Astrophysique et de Géophysique, Université de Liège, Bât. B5C, Allée du 6 Août 17, B-4000, Liège, Belgium
(2): Departamento de Astronomía, Universidad de Guanajuato, Apartado 144, 36000 Guanajuato, GTO, Mexico

Aims. Having established the binary status of nineteen O-type stars located in four Cygnus OB associations, we now determine their fundamental parameters to constrain their properties and their evolutionary status. We also investigate their surface nitrogen abundances, which we compare with other results from the literature obtained for galactic O-type stars.
Methods. Using optical spectra collected for each object in our sample and some UV data from the archives, we apply the CMFGEN atmosphere code to determine their main properties. For the binary systems, we have disentangled the components to obtain their individual spectra and investigate them as if they were single stars.
Results. We find that the distances of several presumably single O-type stars seem poorly constrained because their luminosities are not in agreement with the "standard" luminosities of stars with similar spectral types. The ages of these O-type stars are all less than 7 Myrs. Therefore, the ages of these stars agree with those, quoted in the literature, of the four associations, except for Cyg OB8 for which the stars seem older than the association itself. However, we point out that the distance of certain stars is debatable relative to values found in the literature. The N content of these stars put in perspective with N contents of several other galactic O-type stars seems to draw the same five groups as found in the "Hunter" diagram for the O and B-type stars in the LMC even though their locations are obviously different. We determine mass-loss rates for several objects from the Hα line and UV spectra. Finally, we confirm the "mass discrepancy" especially for O stars with masses smaller than 30Msun.

Reference: A&A in press
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1504.03107

Comments: 11 pages, 26 pages of Appendix

Email: mahy@astro.ulg.ac.be

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The origin of the puzzling hard X-ray emission of gamma Cassiopeiae

Christian Motch (1), Raimundo Lopes de Oliveira (2,3), and Myron A. Smith (4)

(1) Observatoire Astronomique, Université de Strasbourg, France;
(2) Universidade Federal de Sergipe, Brazil;
(3) Observatório Nacional, Brazil;
(4) National Optical Astronomy Observatory, USA.

Massive B and Be stars produce X-rays from shocks in high velocity winds with temperatures of a few million degrees and maximum X-ray luminosities of ~10^(31) erg/s. Surprisingly, a sub-group of early Be stars exhibits > 20 times hotter X-ray temperatures and > 10 times higher X-ray luminosities than normal. This group of Be stars, dubbed Gamma-Cas analogs, contains about 10 known objects. The origin of this bizarre behavior has been extensively debated in the past decades. Two mechanisms have been put forward, accretion of circumstellar disk matter onto an orbiting white dwarf, or magnetic field interaction between the star and the circumstellar disk (Smith & Robinson 1999). We show here that the X-ray and optical emissions of the prototype of the class, Gamma-Cas, are very well correlated on year time scales with no significant time delay. Since the expected migration time from internal disk regions that emit most of the optical flux to the orbit of the companion star is of several years, the simultaneity of the high energy and optical fluxes variations indicates that X-ray emission arises from close to the star. The systematic lack of magnetic field detection reported in recent spectro-polarimetric surveys of Be stars is consistent with the absence of strong magnetic wind braking in these fast spinning stars but put strong

constraints on the possible origin of the magnetic field. We propose that in Gamma-Cas the magnetic field emerges from equatorially condensed subsurface convecting layers the thickness of which steeply increases with rotation rate and that Gamma-Cas and its analogs are the most massive and closest to critical rotation Be stars.

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

Weblink: http://arxiv.org/abs/1504.01105

Email: christian.motch@unistra.fr
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The Herschel view of the nebula around the luminous blue variable star AG Carinae

C. Vamvatira-Nakou(1), D. Hutsemekers(1), P. Royer(2), N. L. J. Cox(2), Y. Naze(1), G. Rauw(1), C. Waelkens(2), M. A. T. Groenewegen(3)

1 - Institut d'Astrophysique et de Geophysique, Universite de Liege, Allee du 6 aout, 17 - Bat. B5c, B-4000 Liege, Belgium;
2 - Instituut voor Sterrenkunde, KU Leuven, Celestijnenlaan 200D, Bus 2401, B-3001 Leuven, Belgium;
3 - Koninklijke Sterrenwacht van Belgie, Ringlaan 3, B-1180 Brussels, Belgium

Far-infrared Herschel PACS imaging and spectroscopic observations of the nebula around the luminous blue variable (LBV) star AG Car have been obtained along with optical imaging in the Halpha+[NII] filter. In the infrared light, the nebula appears as a clumpy ring shell that extends up to 1.2 pc with an inner radius of 0.4 pc. It coincides with the Halpha nebula, but extends further out. Dust modeling of the nebula was performed and indicates the presence of large grains. The dust mass is estimated to be ~ 0.2 Msun. The infrared spectrum of the nebula consists of forbidden emission lines over a dust continuum. Apart from ionized gas, these lines also indicate the existence of neutral gas in a photodissociation region that surrounds the ionized region. The abundance ratios point towards enrichment by processed material. The total mass of the nebula ejected from the central star amounts to ~ 15 Msun, assuming a dust-to-gas ratio typical of LBVs. The abundances and the mass-loss rate were used to constrain the evolutionary path of the central star and the epoch at which the nebula was ejected, with the help of available evolutionary models. This suggests an ejection during a cool LBV phase for a star of ~ 55 Msun with little rotation.

Reference: A&A in press
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1504.03204

Email: chloevn@astro.ulg.ac.be

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A Survey of Extended H2 Emission from Massive YSOs

Felipe Navarete(1), Augusto Damineli(1), Cassio L. Barbosa(2), Robert D. Blum(3)

(1) Instituto de Astronomia, Geofisica e Ciencias Atmosfericas - University of Sao Paulo (IAG-USP)
(2) MCTI/Laboratorio Nacional de Astrofisica
(3) National Optical Astronomy Observatory (NOAO)

We present the results from a survey, designed to investigate the accretion process of massive young stellar objects (MYSOs) through near infrared narrow band imaging using the H2 ν=1-0 S(1) transition filter. A sample of 353 Massive Young Stellar Object (MYSO) candidates was selected from the Red MSX Source survey using photometric criteria at longer wavelengths (infrared and submillimeter) and chosen with positions throughout the Galactic Plane. Our survey was carried out at the SOAR Telescope in Chile and CFHT in Hawaii covering both hemispheres. The data reveal that extended H2 emission is a good tracer of outflow activity, which is a signpost of accretion process on young massive stars. Almost half of the sample exhibit extended H2 emission and 74 sources (21%) have polar morphology, suggesting collimated outflows. The polar-like structures are more likely to appear on radio-quiet sources, indicating these structures occur during the pre-UCHII phase. We also found an important fraction of sources associated with fluorescent H2 diffuse emission that could be due to a more evolved phase. The images also indicate only ∼23% (80) of the sample is associated with extant (young) stellar clusters. These results support the scenario in which massive stars are formed by accretion disks, since the merging of low mass stars would not produce outflow structures.

Reference: To appear in the MNRAS
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1504.06174

Comments:

Email: navarete@usp.br

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Surface abundances of ON stars

F. Martins^1, S. Simon-Diaz^2^{3}, A. Palacios^1, I. Howarth^4, C. Georgy^5, N.R. Walborn^6, J.-C. Bouret^7, R. Barba^8

1 - LUPM, CNRS & Montpellier University; 2 - IAC; 3 - La Laguna University; 4 - University College London; 5 - Keele University; 6 - Space Telescope Science Institute; 7 - LAM, CNRS & Aix-Marseille University; 8 - La Serena University

Massive stars burn hydrogen through the CNO cycle during most of their evolution. When mixing is efficient, or when mass transfer in binary systems happens, chemically processed material is observed at the surface of O and B stars. ON stars show stronger lines of nitrogen than morphologically normal counterparts. Whether this corresponds to the presence of material processed through the CNO cycle or not is not known. Our goal is to answer this question. We perform a spectroscopic analysis of a sample of ON stars with atmosphere models. We determine the fundamental parameters as well as the He, C, N, and O surface abundances. We also measure the projected rotational velocities. We compare the properties of the ON stars to those of normal O stars. We show that ON stars are usually helium-rich. Their CNO surface abundances are fully consistent with predictions of nucleosynthesis. ON stars are more chemically

evolved and rotate - on average - faster than normal O stars. Evolutionary models including rotation cannot account for the extreme enrichment observed among ON main sequence stars. Some ON stars are members of binary systems, but others are single stars as indicated by stable radial velocities. Hence, mass transfer is not a simple explanation for the observed chemical properties. We conclude that ON stars show extreme chemical enrichment at their surface, consistent with nucleosynthesis through the CNO cycle. Its origin is not clear at present.

Reference: A&A accepted
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1504.06194

Email: fabrice.martins@univ-montp2.fr

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The little-studied cluster Berkeley 90. I. LS III +46 11: a very massive O3.5 If* + O3.5 If* binary.

J. Maíz Apellániz, I. Negueruela, R. H. Barbá, N. R. Walborn, A. Pellerin, S. Simón-Díaz, A. Sota, A. Marco, J. Alonso-Santiago, J. Sanchez Bermudez, R. C. Gamen, and J. Lorenzo

CAB, UA, ULS, STScI, SUNY, IAC, ULL, IAA, and IALP.

CONTEXT. It appears that most (if not all) massive stars are born in multiple systems. At the same time, the most massive binaries are hard to find due to their low numbers throughout the Galaxy and the implied large distances and extinctions.

AIMS. We want to study: [a] LS III +46 11, identified in this paper as a very massive binary; [b] another nearby massive system, LS III +46 12; and [c] the surrounding stellar cluster, Berkeley 90.

METHODS. Most of the data used in this paper are multi-epoch high-S/N optical spectra though we also use Lucky Imaging and archival photometry. The spectra are reduced with devoted pipelines and processed with our own software, such as a spectroscopic-orbit code, CHORIZOS, and MGB.

RESULTS LS III +46 11 is identified as a new very-early-O-type spectroscopic binary [O3.5 If* + O3.5 If*] and LS III +46 12 as another early O-type system [O4.5 V((f))]. We measure a 97.2-day period for LS III +46 12 and derive minimum masses of 38.80±0.83 M_Sol and 35.60±0.77 M_Sol for its two stars. We measure the extinction to both stars, estimate the distance, search for optical companions, and study the surrounding cluster. In doing so, a variable extinction is found as well as discrepant results for the distance. We discuss possible explanations and suggest that LS III +46 12 may be a hidden binary system, where the companion is currently undetected.

Reference: Accepted for publication in A&A.
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1504.06977

Email: jmaiz@cab.inta-csic.es

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Abstracts of 1 conference proceedings

The IACOB spectroscopic database: recent updates and first data release

S. Simón-Díaz (1,2), I. Negueruela, J. Maíz Apellániz, N. Castro, A. Herrero, M. Garcia, J. A. Pérez-Prieto, N. Caon, J. M. Alacid, I. Camacho, R. Dorda, M. Godart, C. González-Fernández, G. Holgado, K. Rübke

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

The IACOB project is an ambitious long-term project which is contributing to step forward in our knowledge about the physical properties and evolution of Galactic massive stars. The project aims at building a large database of high-resolution, multi-epoch, spectra of Galactic OB stars, and the scientific exploitation of the database using state-of-the-art models and techniques. In this proceeding, we summarize the latest updates of the IACOB spectroscopic database and highlight some of the first scientific results from the IACOB project; we also announce the first data release and the first public version of the iacob-broad tool for the line-broadening characterization of OB-type spectra.

Reference: To appear in Highlights of Spanish Astrophysics VIII, Proceedings of the XI Scientific Meeting of the Spanish Astronomical Society held on September 8-12, 2014, in Teruel, Spain
Status: Conference proceedings

Weblink: http://arxiv.org/abs/1504.04257

Email: ssimon@iac.es

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Abstracts of 2 other publications

Very Massive Stars in the Local Universe

Jorick S. Vink (Ed.)

Armagh Observatory, Northern Ireland

Recent studies suggest the existence of very massive stars (VMS) up to 300 solar masses in the local Universe. As this finding may represent a paradigm shift for the canonical stellar upper-mass limit of 150 solar masses, it is timely to evaluate the physics specific to VMS, which is currently missing. For this reason, we decided to construct a book entailing both a discussion of the accuracy of VMS masses (Martins), as well as the physics of VMS formation (Krumholz), mass loss (Vink), instabilities (Owocki), evolution (Hirschi), and fate (theory -- Woosley & Heger; observations -- Smith).

Reference: Very Massive Stars in the Local Universe: , Astrophysics and Space Science Library, Volume 412. Springer 2015
Status: Other

Weblink: http://www.springer.com/astronomy/astrophysics+and+astroparticles/book/978-3-319-09595-0

Comments: Book (Springer). 8 Chapters.

Email: jsv@arm.ac.uk

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Mass-loss rates of Very Massive Stars

Jorick S. Vink

Armagh Observatory

We discuss the basic physics of hot-star winds and we provide mass-loss rates for (very) massive stars. Whilst the emphasis is on theoretical concepts and line-force modelling, we also discuss the current state of observations and empirical modelling, and we address the issue of wind clumping.

Reference: Vink, J.S., 2015, ASSL 412, 77
Status: Other

Weblink: http://adsabs.harvard.edu/abs/2015ASSL..412...77V

Comments: Chapter in VMS Book

Email: jsv@arm.ac.uk

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JOBS

Closed Job Offers (original deadline passed)

Job opening for two post-doctoral and two PhD positions in the field of evolved stars and laboratory experiments

Leen Decin

Institute of Astronomy, Leuven University
Celestijnenlaan 200D
B-3001 Heverlee (Leuven)
Belgium

Interdisciplinary project on the stellar winds around evolved stars at the Leuven University in Belgium funded by the ERC-CoG 2014 grant AEROSOL (PI. L. Decin).

The project

At the Leuven University (Belgium), we seek candidates for two post-doctoral and two PhD research positions, ready to play a key role in a new interdisciplinary project focusing on stellar winds around evolved (low-mass) stars. The candidates will interact closely with a team consisting of astrophysicists, chemists, and computational mathematicians, as the goal of the project is to boost our understanding of the physics and chemistry characterizing these stellar winds. The project builds upon novel data (including ALMA, Herschel, etc.), detailed theoretical wind models, and targeted laboratory experiments (see http://fys.kuleuven.be/ster/Projects/aerosol/aerosol).

Institute of Astronomy

The Institute of Astronomy of the Leuven University is a young and active research group of some 50 scientists, engineers and administrative staff (http://www.ster.kuleuven.be). The institute is involved in several international networks and research projects, involving telescopes at international observatories and space missions. The institute is also responsible for the organisation of the Master in Astronomy & Astrophysics of the Faculty of Science at the Leuven University. The institute has a long tradition in the observational and theoretical studies of the late stages of evolution of low and intermediate mass stars.

For the ERC-CoG AEROSOL project of Prof. L. Decin, we seek one post-doc and one PhD candidate to work on the reduction, analysis and (radiative transfer) modeling of a whole suit of observations ranging from the UV to mm wavelength regime with the aim to retrieve the geometrical, thermodynamical and chemical structures of stellar winds. The post-doc preferentially has experience with infrared and (sub)millimeter observations and has in any case sufficient experience in implementing and exploiting radiative transfer models. The post-doc will also be allowed to carry out (part-time) his/her own research in collaboration with affiliated group members. The successful candidates will have access to recently obtained and granted observational data, advanced radiative transfer and forward chemistry modeling tools and will have the possibility to develop their own (hydro)simulations.

Physical Chemistry

As part of this project, one post-doc and one PhD position is open in the research group of Prof. S. Carl in the field of experimental gas-phase reaction kinetics in the Department of Chemistry, division of Quantum and Physical chemistry, beginning preferably on 1st October 2015. The experimental work will be carried out in the modern and fully-equipped new research laboratories of the Department of Chemistry, opening in mid 2015. The experimental research concerns the determination of rate coefficients and product distributions of elementary gas-phase reactions involving key reactive species (Si- and S-bearing species and HCCO radicals) in stellar winds for which data is currently lacking. Specifically, several advanced laser-spectroscopic and chemiluminescence techniques will be employed by the PhD student to follow photolytically-generated reactive species in real time in a novel temperature-graded reaction vessel (200−900 K) coupled with cavity-ringdown/Fourier-transform infrared spectroscopy to elucidate reaction product channels. The post-doc will concentrate on the construction and exploitation of a novel low-temperature Laval-nozzle apparatus with the aim to obtain the rates of the same gas-phase reactions at temperatures below 200 K.
Candidates should have an interest in physical chemistry, high-resolution laser spectroscopy, and technical experimentation. The group currently enjoys and encourages further close collaboration with researches in the department employing high-level quantum chemical calculations on species related to this project.

The position

At the Leuven University, the candidates will join the Institute for Astronomy (Prof. L. Decin) or the Physical Chemistry section (Prof. S. Carl). The interdisciplinary project is carried out in collaboration with Prof. T. Millar (Belfast University) and Prof. J. Nuth (NASA, Greenbelt). The four candidates will interact closely with the other team members at the Institute of Astronomy and Department of Chemistry. At the Leuven University, we have access to parallel computing facilities, to be exploited extensively in this project.

Contract
The PhD candidates will be employed for a 2+2 (after positive evaluation) period at the Institute of Astronomy or a 2+1 period at the Department of Chemistry. The initial contract for the post-doc positions runs over 2 years and could be prolonged with another year after positive evaluation. The salary will be commensurate to the standard scale for PhD and post-doctoral researchers at the Leuven University. The preferred starting date is between 1 October 2015 and 1 December 2015, but will be adapted to the selected candidate's availability. Candidates are thus requested to indicate their preferred starting date in the application.

Interested?
The successful post-doc candidates must have a PhD degree in astrophysics or chemistry, while the PhD candidates must have obtained a master degree in (astro)physics, mathematics or chemistry. The application must include
• A Curriculum Vitae (including publication list).
• A statement of research interests and future plans (maximum 3 pages).
• A letter detailing your specific qualifications for the position and your career/educational goals (maximum 1 page).
• Two letters of recommendation from professors well acquainted with your academic achievements. The letters are to be submitted separately to the address mentioned below.

DEADLINE for the application: 1 May 2015

More information can be obtained by contacting
Prof. L. Decin
Institute for Astronomy
Department of Physics and Astronomy, KU Leuven
Celestijnenlaan 200D, 3001 Heverlee, Belgium
Leen.Decin@ster.kuleuven.be
++32-16-32 70 41
http://fys.kuleuven.be/ster/staff/senior-staff/leen
See also: http://www.fys.kuleuven.be/ster/

Prof. S. Carl
Physical Chemistry Section
Department of Chemistry, KU Leuven
Celestijnenlaan 200F, 3001 Heverlee, Belgium
Shaun.Carl@chem.kuleuven.be
++32-16-32 76 13

Attention/Comments:

Weblink: http://fys.kuleuven.be/ster/vacancies

Email: Leen.Decin@ster.kuleuven.be

Deadline: 01/05/2015

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MEETINGS

XXIX IAU General Assembly - Focus Meeting 10: "Stellar explosions in an ever-changing environment"

August 11-13, 2015

Venue: XXIX IAU General Assembly (Honolulu, HI)

Dear colleagues,

We want to draw your attention to Focus Meeting 10 "Stellar explosions in an ever-changing environment", which takes place during the XXIX IAU General Assembly this August in Hawai'i. The meeting itself is scheduled from August 11-13.

In this meeting we want to foster the interaction between the communities working on massive stellar explosions (GRBs, SNe, SLSNe) and those working on star-forming galaxies and galaxy evolution, to study their mutual influences. Both observational and theoretical contributions are welcome.

The key topics to be covered are the following:
-Host galaxies of GRBs, SNe and massive stars
-Starburst galaxies as potential host of massive stellar explosions
-Diversity of GRBs, SNe and their progenitors
-Dependence of stellar evolution on the properties of their progenitors and environments
-Resolved observations of the explosion environments
-Influence of stellar explosions on their environments
-Chemical evolution of galaxies due to massive stellar explosions
-Probing the first galaxies with GRBs
-Future facilities and techniques

Invited speakers (confirmed) are:
Chris Fryer, Nancy Elias de la Rosa, Selma de Mink, Giorgos Leloudas, Lisa Kewley, Janice Lee, Michal Michalowski, Sebastian Sánchez, Paul Vreeswijk, Emily Levesque and Chiaki Kobayashi

More information can be found on our meeting webpage:
www.iaa.es/iau2015_fm10

We would be happy to receive your contribution. Registration and abstract submission is done through the IAU GA pages, with a deadline of March 18: http://astronomy2015.org/
Students, postdocs and participants from countries in difficult economic situations can apply for some small funding for the meeting (deadline April 1). Participants applying for funding have to submit an abstract.

Christina Thöne and Lise Christensen
on behalf of the FM 10 SOC

Weblink: www.iaa.es/iau2015_fm10

Email: Emily.Levesque@colorado.edu

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Radiation mechanisms of astrophysical objects: classics today

September 21-25, 2015

Venue: St.Petersburg

Studies of radiation mechanisms and processes of spectra formation in astrophysical objects are among the fundamental tasks of modern astrophysics. A powerful tool for the solution of these problems is provided by the theory of radiative transfer, which has been substantially contributed to and developed by the full member of the Soviet (Russian) Academy of Sciences Victor Victorovich Sobolev. The Sobolev method to solve the radiative transfer equations, among his numerous results in the field of radiative transfer, became classical nowadays. In 1947-1998 V.V. Sobolev was the head of the Chair of Astrophysics of the Leningrad/St. Petersburg State University and a leader of the Leningrad/St. Petersburg astrophysical school, which had won international recognition for many valuable results.

The 100th birthday anniversary of V.V. Sobolev will be celebrated on September 2, 2015. On this occasion the Saint-Petersburg State University organizes an international conference “Radiation mechanisms of astrophysical objects: classics today”, which will be held in St. Petersburg from September, 21 to September, 25, 2015. The conference will highlight recent advances in the field of interests of V.V. Sobolev. The conference will include plenary sessions with review talks by internationally recognized Russian and foreign scientists and a memorial session.

Weblink: http://www.astro.spbu.ru/Sobolev100/?q=en

Email: lida@astro.physik.uni-potsdam.de

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