ISSN 1783-3426

THE MASSIVE STAR NEWSLETTER

formerly known as the hot star newsletter

*

No. 160 2017 July-August

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

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

Jose Groh (Trinity College Dublin)

CONTENTS OF THIS NEWSLETTER:

News

Abstracts of 10 accepted papers

Abstracts of 1 conference proceedings

News

Selma de Mink awarded the EAS MERAC Prize -- Congratulations

Our colleague, Dr. Selma de Mink from the University of Amsterdam was awarded the MERAC Prize in Theoretical Astrophysics of the European Astronomical Society (EAS) for her contributions to the understanding of the role of massive binaries. The Executive Committee of the Massive Stars Commission proudly congratulates Selma for this well deserved achievement, that enlightens our whole field of research. Selma gave an excellent & inspiring talk during the European Week of Astronomy and Space Science (EWASS) in Prague, emphasizing to a broad audience of Astrophysicists, the role of massive stars for our understanding of the Universe. Thanks, Selma, and congratulations!

the Massive Stars Commission Executive Committee
(A. Herrero, J. Vink, N. St-Louis, G. Rauw, A. ud-Doula, Y. Hua-Chu, J. Groh)

Weblink:

Email: ahd@iac.es

Back to contents

Webpage of EWASS SS10 "Winds from massive stars: What are the real rates?"

The presentations from EWASS SS10 "Winds from massive stars: What are the real rates?" are available online.

Weblink: http://space.asu.cas.cz/~ewass17-soc/Presentations/SS10.html

Email: krticka@physics.muni.cz

Back to contents

Call for proposals to organize the next massive star meeting -- Reminder

Dear Colleagues,

After the fantastic meeting in Auckland (thanks to JJ Eldridge and the whole organizing team) we have to start preparing the next Massive Stars Meeting. We expect this to take place some time in 2020.

With this call the Organizing Committee (OC) of our Massive Stars Commission invites any interested individuals/institutions to send an email before September 1st, 2017 expressing an interest in organizing the next meeting. IAU has the final authority to select a symposium, but the Massive Star Commission OC will support one application based on a number of criteria. Once selected, the OC will assist the meeting organizer in the whole application to IAU process, including preparation and submission, SOC selection, etc. Our criteria for selection include:

- the meeting location (traditionally, our group prefers locations near a beach with a relaxed atmosphere that encourages personal contacts)
- the availability of hotels with large conference rooms (at least 200 people) and meeting facilities at affordable prices
- the support of a local astronomical community
- the balance of locations hosting all our previous meetings

If possible, your email to the OC should contain the following information:

- A list of local volunteers willing to help organizing the meeting
- A list of hotels that can guarantee accommodation of at least 200 participants, and with appropriate conference facilities
- Approximate hotel room prices
- Approximate distance from the nearest airport to the meeting venue/hotel
- Alternative sponsors or ways to support the meeting
- The best dates for the meeting, and/or black out dates
(because of school holidays or high touristic season, etc.)
- Add any other information you consider will be useful to OC.

The email should be sent directly to the President of the Commission, Artemio Herrero (ahd-at-iac.es).

The massive stars meeting is one of the central pillars of
our community and therefore the OC thanks in advance anyone interested in organizing this important meeting.

with best regards,
Artemio Herrero,
on behalf of the Organizing Committee of the G2 Commission

Weblink:

Email: ahd@iac.es

Back to contents

PAPERS

Abstracts of 10 accepted papers

MULTI-EPOCH BVRI PHOTOMETRY OF LUMINOUS STARS IN M31 AND M33

John C. Martin^1 and Roberta M. Humphreys^2

1. University of Illinois Springfield
2. University of Minnesota

We present the first four years of BVRI photometry from an on-going survey to annually monitor the photometric behavior of evolved luminous stars in M31 and M33. Photometry was measured for 199 stars at multiple epochs, including 9 classic Luminous Blue Variables (LBVs), 22 LBV candidates, 10 post-RGB A/F type hypergiants, and 18 B[e] supergiants. At all epochs the brightness is measured in V and at least one other band to a precision of 0.04 – 0.10 magnitudes down to a limiting magnitude of 19.0 – 19.5. Thirty three (33) stars in our survey exhibit significant variability, including at least two classic LBVs caught in S Doradus type outbursts. A hyper-linked version of the photometry catalog is at http://go.uis.edu/m31m33photcat.

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

Weblink:

Comments:

Email: roberta@umn.edu

Back to contents

Luminous and Variable Stars in M31 and M33 V. The Upper HR Diagram}

Roberta M Humphreys^1, Kris Davidson^1, David Hahn^1, John C. Martin^2 and Kerstin Weis^3

1. University of Minnesota
2. University of Illinois, Springfield
3. Ruhr-Universitaet Bochum, Germany

We present HR Diagrams for the massive star populations in M31 and M33 including several different types of emission-line stars: the confirmed Luminous Blue Variables (LBVs), candidate LBVs, B[e] supergiants and the warm hypergiants. We estimate their apparent temperatures and luminosities for

comparison with their respective massive star populations and to evaluate the possible relationships of these different classes of evolved, massive stars, and their evolutionary state. Several of the LBV candidates lie near the LBV/S Dor instability strip which supports their classification. Most of the B[e] supergiants, however, are less luminous than the LBVs. Many are very dusty with the infrared flux contributing one-third or more to their total flux. They are also relatively isolated from other luminous OB stars. Overall, their spatial distribution suggests a more evolved state. Some may be post-RSGs like the warm hypergiants, and there may be more than one path to becoming a B[e] star. There are sufficient differences in the spectra, luminosities, spatial distribution, and the presence or lack of dust between the LBVs and B[e] supergiants to conclude that one group does not evolve into the other.

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

Weblink:

Comments:

Email: roberta@umn.edu

Back to contents

A modern study of HD166734: a massive supergiant system

L. Mahy (1,5), Y. Damerdji (2,1), E. Gosset (1), C. Nitschelm (3), P. Eenens (4), H. Sana (5), and A. Klotz (6)

(1) Space sciences, Technologies, and Astrophysics Research (STAR) Institute, Université de Liège, Quartier Agora, Bât B5c, Allée du 6 août, 19c, B-4000 Liège, Belgium
(2) Centre de Recherche en Astronomie, Astrophysique et Géophysique, route de l'Observatoire BP 63 Bouzareah, 16340 Algiers, Algeria
(3) Unidad de Astronomía, Facultad de Ciencias Básicas, Universidad de Antofagasta, Antofagasta, Chile

(4) Departamento de Astronomía, Universidad de Guanajuato, Apartado 144, 36000 Guanajuato, GTO, Mexico
(5) Instituut voor Sterrenkunde, KU Leuven, Celestijnenlaan 200D, Bus 2401, B-3001 Leuven, Belgium
(6) Université de Toulouse, UPS-OMP, IRAP, Toulouse, France

Aims. HD166734 is an eccentric eclipsing binary system composed of two supergiant O-type stars, orbiting with a 34.5-day period. In this rare configuration for such stars, the two objects mainly evolve independently, following single-star evolution so far. This system provides a chance to study the individual parameters of two supergiant massive stars and to derive their real masses.
Methods. An intensive monitoring was dedicated to HD166734.We analyzed mid- and high-resolution optical spectra to constrain the orbital parameters of this system. We also studied its light curve for the first time, obtained in the VRI filters. Finally, we disentangled the spectra of the two stars and modeled them with the CMFGEN atmosphere code in order to determine the individual physical parameters.
Results. HD166734 is a O7.5If+O9I(f) binary.We confirm its orbital period but we revise the other orbital parameters. In comparison to what we found in the literature, the system is more eccentric and, now, the hottest and the most luminous component is also the most massive one. The light curve exhibits only one eclipse and its analysis indicates an inclination of 63.0° ± 2.7°. The photometric analysis provides us with a good estimation of the luminosities of the stars, and therefore their exact positions in the Hertzsprung-Russell diagram. The evolutionary and the spectroscopic masses show good agreement with the dynamical masses of 39.5 M⊙ for the primary and 33.5 M⊙ for the secondary, within the uncertainties. The two components are both enriched in helium and in nitrogen and depleted in carbon. In addition, the primary also shows a depletion in oxygen. Their surface abundances are however not different from those derived from single supergiant stars, yielding, for both components, an evolution similar to that of single

stars.

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

Weblink: http://arxiv.org/abs/1707.02060

Comments: 13 pages, 13 figures

Email: mahy@astro.ulg.ac.be

Back to contents

An X-ray view of HD166734, a massive supergiant system

Yael Naze, Eric Gosset, Laurent Mahy, Elliot Ross Parkin

Univ. Liege, Belgium

The X-ray emission of the O+O binary HD166734 was monitored using Swift and XMM-Newton observatories, leading to the discovery of phase-locked variations. The presence of an f line in the He-like triplets further supports a wind-wind collision as the main source of the X-rays in HD166734. While temperature and absorption do not vary significantly along the orbit, the X-ray emission strength varies by one order of magnitude, with a long minimum state (Delta(phi)~0.1) occurring after a steep decrease. The flux at minimum is compatible with the intrinsic emission of the O-stars in the system, suggesting a possible disappearance of colliding wind emission. While this minimum cannot be explained by eclipse or occultation effects, a shock collapse may occur at periastron in view of the wind properties. Afterwards, the recovery is long, with an X-ray flux proportional to the separation d (in hard band) or to d^2 (in soft band). This is incompatible with an adiabatic nature for the collision (which would instead lead to "F_X propto 1/d"), but could be reconciled with a radiative character of the collision, though predicted temperatures are lower and more variable than in observations. An increase in flux around phi~0.65 and the global asymmetry of the light curve remain unexplained, however.

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

Weblink: https://arxiv.org/abs/1707.02064

Comments:

Email: naze@astro.ulg.ac.be

Back to contents

CMF models of hot star winds
II. Reduction of O star wind mass-loss rates in global models

Jiri Krticka, Jiri Kubat

Institute of Theoretical Physics and Astrophysics, Masaryk University, Brno, Czech Republic
Astronomical Institute, Academy of Sciences of the Czech Republic, Ondrejov, Czech Republic

We calculate global (unified) wind models of main-sequence, giant, and supergiant O stars from our

Galaxy. The models are calculated by solving hydrodynamic, kinetic equilibrium (also known as NLTE) and comoving-frame (CMF) radiative transfer equations from the (nearly) hydrostatic photosphere to the supersonic wind. For given stellar parameters, our models predict the photosphere and wind structure and in particular the wind mass-loss rates without any free parameters. Our predicted mass-loss rates are by a factor of 2--5 lower than the commonly used predictions. A possible cause of the difference is abandoning of the Sobolev approximation for the calculation of the radiative force, because our models agree with predictions of CMF NLTE radiative transfer codes. Our predicted mass-loss rates agree nicely with the mass-loss rates derived from observed near-infrared and X-ray line profiles and are slightly lower than mass-loss rates derived from combined UV and Halpha diagnostics. The empirical mass-loss rate estimates corrected for clumping may therefore be reconciled with theoretical predictions in such a way that the average ratio between individual mass-loss rate estimates is not higher than about 1.6. On the other hand, our predictions are by factor of 4.7 lower than pure Halpha mass-loss rate estimates and can be reconciled with these values only assuming a microclumping factor of at least eight.

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

Weblink: http://adsabs.harvard.edu/abs/2017arXiv170606194K

Comments:

Email: krticka@physics.muni.cz

Back to contents

The variability of the BRITE-est Wolf-Rayet binary, γ^2 Velorum I. Photometric and spectroscopic evidence for colliding winds

Noel Richardson et al.

University of Toledo

We report on the first multi-color precision light curve of the bright Wolf-Rayet binary γ^2 Velorum, obtained over six months with the nanosatellites in the BRITE- Constellation fleet. In parallel, we obtained 488 high-resolution optical spectra of the system. In this first report on the datasets, we revise the spectroscopic orbit and report on the bulk properties of the colliding winds. We find a dependence of both the light curve and excess emission properties that scales with the inverse of the binary separation. When analyzing the spectroscopic properties in combination with the photometry, we find that the phase dependence is caused only by excess emission in the lines, and not from a changing continuum. We also detect a narrow, high-velocity absorption component from the He I λ5876 transition, which appears twice in the orbit. We calculate smoothed-particle hydrodynamical simulations of the colliding winds and can accurately associate the absorption from He I to the leading and trailing arms of the wind shock cone passing tangentially through our line of sight. The simulations also explain the general strength and kinematics of the emission excess observed in wind lines such as C III λ5696 of the system. These results represent the first in a series of investigations into the winds and properties of γ^2 Velorum through multi-technique and multi-wavelength observational campaigns.

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

Weblink: https://arxiv.org/abs/1707.03390

Comments:

Email: noel.richardson@UToledo.edu

Back to contents

Exact Analytic Solutions for a Ballistic Orbiting Wind

Francis P. Wilkin, Harry Hausner

Union College, University of Wisconsin

Much theoretical and observational work has been done on stellar winds within binary systems. We present a new solution for a ballistic wind launched from a source in a circular orbit. Our method emphasizes the curved streamlines in the corotating frame, where the flow is steady-state, allowing us to obtain an exact solution for the mass density at all pre-shock locations. Assuming an initially isotropic wind, fluid elements launched from the interior hemisphere of the wind will be the first to cross other streamlines, resulting in a spiral structure bounded by two shock surfaces. Streamlines from the outer wind hemisphere later intersect these shocks as well. An analytic solution is obtained for the geometry of the two shock surfaces. Although the inner and outer shock surfaces asymptotically trace Archimedean spirals, our tail solution suggests many crossings where the shocks overlap, beyond which the analytic solution cannot be continued. Our solution can be readily extended to an initially anisotropic wind.

Reference: Published in ApJ July 20, 2017
Status: Manuscript has been accepted

Weblink: https://arxiv.org/pdf/1707.02505.pdf

Comments:

Email: wilkinf@union.edu

Back to contents

A deep near-infrared spectroscopic survey of the Scutum-Crux arm for Wolf-Rayet stars

C K Rosslowe, Paul A Crowther

University of Sheffield

We present an NTT/SOFI spectroscopic survey of infrared selected Wolf-Rayet candidates in the Scutum-Crux spiral arm ($298 < l < 340$, $|b| < 0.5$). We obtained near-IR spectra of 127 candidates, revealing 17 Wolf-Rayet stars - a ~13% success rate - of which 16 are newly identified here. The majority of the new Wolf-Rayet stars are classified as narrow-lined WN5-7 stars, with 2 broad-lined WN4-6 stars and 3 WC6-8 stars. The new stars, with distances estimated from previous absolute magnitude calibrations, have no obvious association with the Scutum-Crux arm. Refined near-infrared (YHJK) classification criteria based on over a hundred Galactic and Magellanic Cloud WR stars, providing diagnostics for hydrogen in WN stars, plus the identification of WO stars and intermediate WN/C stars. Finally, we find that only a quarter of WR stars in the survey region are associated with star clusters and/or HII regions, with similar statistics found for Luminous Blue Variables in the Milky Way. The relative isolation of evolved massive stars is discussed, together with the significance of the co-location of LBVs and WR stars in young star clusters.

Reference: MNRAS in press
Status: Manuscript has been accepted

Weblink:

Comments: Supplementary information incl. near-IR spectroscopic classification of Wolf-Rayet stars

Email: Paul.Crowther@sheffield.ac.uk

Back to contents

A combined HST and XMM-Newton campaign for the magnetic O9.7 V star HD 54879: constraining the weak-wind problem of massive stars

T. Shenar(1), L. M. Oskinova, S. P. Järvinen, P. Luckas, R. Hainich, H. Todt, S. Hubrig, A. A. C. Sander, I. Ilyin, W.-R. Hamann

1 - University of Potsdam, Germany

Context: HD 54879 (O9.7 V) is one of a dozen O-stars for which an organized atmospheric magnetic field has been detected. To gain insights into the interplay between atmospheres, winds, and magnetic fields of massive stars, we acquired UV and X-ray data of HD 54879 using the Hubble Space Telescope and the XMM-Newton satellite. In addition, 35 optical amateur spectra were secured to study the variability of HD 54879. A multiwavelength (X-ray to optical) spectral analysis is performed using the Potsdam Wolf-Rayet (PoWR) model atmosphere code and the xspec software.
Results: The photospheric parameters are typical for an O9.7 V star. The microturbulent, macroturbulent, and projected rotational velocities are lower than previously suggested (<4 km/s). An initial mass of 16 M⊙ and an age of 5 Myr are inferred from evolutionary tracks. We derive a mean X-ray emitting temperature of log TX = 6.7 [K] and an X-ray luminosity of log LX = 32 [erg/s]. Short- and long-scale variability is seen in the H-alpha line, but only a very long period of P ≈ 5yr could be estimated. Assessing the circumstellar density of HD 54879 using UV spectra, we can roughly estimate the mass-loss rate HD 54879 would have in the absence of a magnetic field as log Mdot(B=0) ≈ −9.0 [M⊙/yr]. The magnetic field traps the stellar wind up to the Alfv\'en radius > 12 R⊙, implying that its true mass-loss rate is log Mdot < −10.2[M⊙/yr]. Hence, density enhancements around magnetic stars can be exploited to estimate mass-loss rates of non-magnetic stars of similar spectral types, essential for resolving the weak wind problem.
Conclusions: Our study confirms that strongly magnetized stars lose little or no mass, and supplies important constraints on the weak-wind problem of massive main sequence stars.

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

Weblink: https://arxiv.org/abs/1708.01261

Comments:

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

Back to contents

Variable millimetre radiation from the colliding-wind binary Cyg OB2 #8A

R. Blomme (1), D. M. Fenech (2), R. K. Prinja (2), J. M. Pittard (3), J. C. Morford (2)

1 - Royal Observatory of Belgium, Ringlaan 3, B-1180 Brussels, Belgium
2 - Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK
3 - School of Physics & Astronomy, E.C. Stoner Building, The University of Leeds, Leeds, LS2 9JT, UK

Massive binaries have stellar winds that collide. In the colliding-wind region, various physically interesting processes occur, leading to enhanced X-ray emission, non-thermal radio emission, as well as non-thermal X-rays and gamma-rays. Non-thermal radio emission (due to synchrotron radiation) has so far been observed at centimetre wavelengths. At millimetre wavelengths, the stellar winds and the colliding-wind region emit more thermal free-free radiation, and it is expected that any non-thermal contribution will be difficult or impossible to detect. We aim to determine if the material in the colliding-wind region contributes substantially to the observed millimetre fluxes of a colliding-wind binary. We also try to distinguish the synchrotron emission from the free-free emission. We monitored the massive binary Cyg OB2 #8A at 3 mm with the NOrthern Extended Millimeter Array (NOEMA) interferometer of the Institut de Radioastronomie Millimetrique (IRAM). The data were collected in 14 separate observing runs (in 2014 and 2016), and provide good coverage of the orbital period. The observed millimetre fluxes range between 1.1 and 2.3 mJy, and show phase-locked variability, clearly indicating that a large part of the emission is due to the colliding-wind region. A simple synchrotron model gives fluxes with the correct order of magnitude, but with a maximum that is phase-shifted with respect to the observations. Qualitatively this phase shift can be explained by our neglect of orbital motion on the shape of the colliding-wind region. A model using only free-free emission results in only a slightly worse explanation of the observations. Additionally, on the map of our observations we also detect the O6.5 III star Cyg OB2 #8B, for which we determine a 3 mm flux of 0.21 +- 0.033 mJy. The question of whether synchrotron radiation or free-free emission dominates the millimetre fluxes of Cyg OB2 #8A remains open. More detailed modelling of this system, based on solving the hydrodynamical equations, is required to give a definite answer.

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

Weblink: https://arxiv.org/abs/1708.04834

Comments:

Email: Ronny.Blomme@oma.be

Back to contents

Abstracts of 1 conference proceedings

Properties of O dwarf stars in 30 Doradus

Carolina Sab\'in-Sanjuli\'an

(1) Departamento de F\'sica y Astronom\'a, Universidad de La Serena, Av. Cisternas 1200 Norte, La Serena, Chile

(2) Instituto de Investigaci\'on Multidisciplinar en Ciencia y Tecnolog\'ia, Universidad de La Serena, Ra\'ul Bitr\'an 1305, La Serena, Chile

We perform a quantitative spectroscopic analysis of 105 presumably single O dwarf stars in 30 Doradus, located within the Large Magellanic Cloud. We use mid-to-high resolution multi-epoch optical spectroscopic data obtained within the VLT-FLAMES Tarantula Survey. Stellar and wind parameters are derived by means of the automatic tool IACOB-GBAT, which is based on a large grid of FASTWIND models. We also benefit from the Bayesian tool BONNSAI to estimate evolutionary masses. We provide a spectral calibration for the effective temperature of O dwarf stars in the LMC, deal with the mass discrepancy problem and investigate the wind properties of the sample.

Reference: arXiv1707.04209
Status: Conference proceedings

Weblink:

Comments:

Email: cssj@dfuls.cl

Back to contents