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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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Fizeau exchange visitors program in optical interferometry - supplemental call for applications

J. Hron, L. Mosoni

European Interferometry Initiative

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.

The deadline for applications is June 15. Fellowships can be awarded for missions carried out until the end of 2016! For missions in 2017 please wait for further announcements!

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)

Reference: www.european-interferometry.eu
Status: Other

Weblink: www.european-interferometry.eu

Comments:

Email: fizeau@european-interferometry.eu

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PAPERS

Abstracts of 6 accepted papers

The Wind of Rotating B Supergiants. I. Domains of Slow and Fast Solution Regimes.

R. O. J. Venero(1), M. Curé(2), L. S. Cidale(1), I. Araya(2)

1 - Departamento de Espectroscopía,
Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata (UNLP), and Instituto de Astrofísica La Plata, CCT La Plata, CONICET-UNLP, Paseo del Bosque S/N, 1900 La Plata, Argentina.

2 - Instituto de Física y Astronomía, Facultad de Ciencias,
Universidad de Valparaíso -
Av. Gran Bretaña 1111, Casilla 5030, Valparaíso, Chile.

In the scenario of rotating radiation-driven wind theory for massive stars, three types of hydrodynamic solutions are currently known: the classical "fast" m-CAK solution, the "Omega-slow" solution that arises

for fast rotators, and the so-called "delta-slow" solution for high values of the delta line-force parameter are allowed independently of the rotation speed. Compared to the "fast" solutions, both "slow solutions" have lower terminal velocities.
As the study of the "slow" solution parameters domain is still incomplete, we perform a comprehensive analysis of the distinctive solution regimes for B supergiants that emerge from a fine grid of rotation values, Omega, and various ionization conditions in the wind, the delta parameter. The wind ionization defines two domains: one for "fast" outflowing winds and the other for "slow" expanding flows. Both domains are clear-cut by a gap, where no solution is found for a finite interval of delta. The location and width of the forbidden region depend on Teff and Omega. There is a smooth and continuous transition between the "Omega-slow" and "delta-slow" regimes, a single "Omega-delta-slow" regime.
We discuss different situations where the "slow" solutions can be found and the possibility of a switch between "fast" and "slow" solutions in the B supergiant winds. We compare the theoretical terminal velocity with observations of B and A supergiants and find that the "fast" regime prevails mostly for early B supergiants while the "slow" wind regime matches better for A and B mid- and late-type supergiants.

Reference: ApJ, 822, 28.
Status: Manuscript has been accepted

Weblink:

Comments:

Email: roberto@fcaglp.unlp.edu.ar

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Spectral type, temperature and evolutionary stage in cool supergiants

Ricardo Dorda (1), Ignacio Negueruela (1), Carlos González-Fernández (2), Hugo M. Tabernero (1 and 3)

(1) DFISTS, Universidad de Alicante, (2) Institute of Astronomy, University of Cambridge, (3) Departamento de Astrofísica, Universidad Complutense de Madrid

In recent years, temperature scales in cool supergiants (CSGs) have been disputed, and the possibility that spectral types (SpTs) do not depend primarily on temperature has been raised. We explore the relations between different observed parameters and the capability of deriving accurate intrinsic stellar parameters from them through the analysis of the largest spectroscopic sample of CSGs to date from SMC and LMC. We explore possible correlations between different observational parameters, also making use of near- and mid-infrared colours and literature on photometric variability. Direct comparison between the behaviour of atomic lines (Fe I, Ti I, and Ca II) in the observed spectra and synthetic atmospheric models provides compelling evidence that effective temperature is the prime underlying variable driving the SpT sequence in CSGs. However, there is a clear correlation between SpT and luminosity, with later ones tending to correspond to more luminous stars with heavier mass loss. The population of CSGs in the SMC is characterised by a higher degree of spectral variability, early spectral types (centred on type K1) and low mass-loss rates (at least as measured by dust-sensitive mid-infrared colours). The population in the LMC displays less spectroscopic variability and later spectral types. The distribution of spectral types is not single-peaked. Instead, the brightest CSGs have a significantly different distribution from less luminous objects, presenting mostly M subtypes (centred on M2), and increasing mass-loss rates for later types. In conclusion, the observed properties of CSGs in the SMC and the LMC cannot be described correctly by standard evolutionary models. The very strong correlation between spectral type and bolometric luminosity, supported by all data from the Milky Way, cannot be reproduced at all by current evolutionary tracks.

Reference: Accepted for subscription for publication in Astronomy and Astrophysics
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1605.03239

Comments:

Email: ricardo.dorda@ua.es

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The Red Supergiant Content of M31

Philip Massey (1), Kate Anne Evans (1, 2)

(1) Lowell Observatory, (2) Caltech

We investigate the red supergiant (RSG) population of M31, obtaining radial velocities of 255 stars. These data substantiate membership of our photometrically-selected sample, demonstrating that Galactic foreground stars and extragalactic RSGs can be distinguished on the basis of B-V, V-R two-color diagrams. In addition, we use these spectra to measure effective temperatures and assign spectral types, deriving physical properties for 192 RSGs. Comparison with the solar-metallicity Geneva evolutionary tracks indicates astonishingly good agreement. The most luminous RSGs in M31 are likely evolved from 25-30 Mo stars, while the vast majority evolved from stars with initial masses of 20 Mo or less. There is an interesting bifurcation in the distribution of RSGs with effective temperatures that increases with higher luminosities, with one sequence consisting of early K-type supergiants, and with the other consisting of M-type supergiants that become later (cooler) with increasing luminosities. This separation is only partially reflected in the evolutionary tracks, although that might be due to the mis-match in metallicities between the solar Geneva models and the higher-than-solar metallicity of M31. As the luminosities increase the median spectral type also increases; i.e., the higher mass RSGs spend more time at cooler temperatures than do those of lower luminosities, a result which is new to this study. Finally we discuss what would be needed observationally to successfully build a luminosity function that could be used to constrain the mass-loss rates of RSGs as our Geneva colleagues have suggested.

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

Weblink: http://arxiv.org/abs/1605.07900

Comments:

Email: phil.massey@lowell.edu

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Modelling the Central Constant Emission X-ray component of η Carinae

Christopher M. P. Russell (1), Michael F. Corcoran (2,3), Kenji Hamaguchi (2,4), Thomas I. Madura (3,5), Stanley P. Owocki (6), and D. John Hillier (7)

1 - X-ray Astrophysics Laboratory, Code 662, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, USA
2 - CRESST and X-ray Astrophysics Laboratory, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, USA
3 - Universities Space Research Association, 7178 Columbia Gateway Drive, Columbia, MD 21044, USA

4 - Department of Physics, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, USA
5 - CRESST and Astrophysics Science Division, Code 667, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, USA
6 - Bartol Research Institute, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716, USA
7 - Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260, USA

The X-ray emission of η Carinae shows multiple features at various spatial and temporal scales. The central constant emission (CCE) component is centred on the binary and arises from spatial scales much smaller than the bipolar Homunculus nebula, but likely larger than the central wind–wind collision region between the stars as it does not vary over the ∼2–3 month X-ray minimum when it can be observed. Using large-scale 3D smoothed particle hydrodynamics (SPH) simulations, we model both the colliding-wind region between the stars, and the region where the secondary wind collides with primary wind ejected from the previous periastron passage. The simulations extend out to one hundred semimajor axes and make two limiting assumptions (strong coupling and no coupling) about the influence of the primary radiation field on the secondary wind. We perform 3D radiative transfer calculations on the SPH output to synthesize the X-ray emission, with the aim of reproducing the CCE spectrum. For the preferred primary mass-loss rate $\dot{M}_A \approx 8.5 \times 10^{-4} M_\odot$\,yr^{-1}, the model spectra well reproduce the observation as the strong- and no-coupling spectra bound the CCE observation for longitude of periastron ω ≈ 252◦, and bound/converge on the observation for ω ≈ 90◦. This suggests that η Carinae has moderate coupling between the primary radiation and secondary wind, that both the region between the stars and the comoving collision on the backside of the secondary generate the CCE, and that the CCE cannot place constraints on the binary's line of sight. We also discuss comparisons with common X-ray fitting parameters.

Reference: MNRAS, 458, 3
Status: Manuscript has been accepted

Weblink: http://adsabs.harvard.edu/abs/2016MNRAS.458.2275R

Comments:

Email: crussell@udel.edu

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The Prevalence and Impact of Wolf-Rayet Stars in Emerging Massive Star Clusters

Kimberly R. Sokal$^(1, 2}$, Kelsey E. Johnson^1, R\'{e}my Indebetouw^1, and Philip Massey^{2,3}

1-Department of Astronomy, University of Virginia, P.O. Box 3818, Charlottesville, VA 22903, USA; krs9tb@virginia.edu.
2-Visiting astronomer, Kitt Peak National Observatory, National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy (AURA) under a cooperative agreement with the National Science Foundation.
3-Lowell Observatory, 1400 W Mars Hill Road, Flagstaff, AZ 86001, USA.

We investigate Wolf-Rayet (WR) stars as a source of feedback contributing to the removal of natal material in the early evolution of massive star clusters. Despite previous work suggesting that massive star clusters clear out their natal material before the massive stars evolve into the WR phase, WR stars have been detected in several emerging massive star clusters. These detections suggest that the timescale for clusters to emerge can be at least as long as the time required to produce WR stars (a few million years), and could also indicate that WR stars may be providing the tipping point in the combined feedback processes that drive a massive star cluster to emerge. We explore the potential overlap between the emerging phase and the WR phase with an observational survey to search for WR stars in emerging massive star clusters hosting WR stars. We select candidate emerging massive star clusters from known radio continuum sources with thermal emission and obtain optical spectra with the 4m Mayall Telescope at Kitt Peak National Observatory and the 6.5m MMT. We identify 21 sources with significantly detected WR signatures, which we term ``emerging WR clusters." WR features are detected in ~50\% of the radio-selected sample, and thus we find that WR stars are commonly present in massive star clusters currently emerging. The observed extinctions and ages suggest that clusters without WR detections remain embedded for longer periods of time, and may indicate that WR stars can aid, and therefore accelerate, the emergence process.

Reference: ApJ (in press)
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1605.08044

Comments:

Email: krs9tb@virginia.edu

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Multiple short-lived stellar prominences on O stars: The O6.5I(n)fp star lambda Cephei

N.P. Sudnik (1,2), H.F. Henrichs (1)

(1) University of Amsterdam, (2) Saint-Petersburg State University

Most O-type stars and many B stars show unexplained cyclical variability in their spectral lines, i.e., modulation on the rotational timescale, but not strictly periodic. The variability occurs in the so-called discrete absorption components (DACs) that accelerate through the UV-wind line profiles and also in many optical lines. For such OB stars no dipolar magnetic fields have been detected with upper limits of ~ 300 G.

We investigate whether multiple magnetic loops on the surface rather than non-radial pulsations (NRPs) or a dipolar magnetic field can explain the observed cyclical UV and optical spectral line variability.
We present time-resolved, high-resolution optical spectroscopy of the O6.5I(n)fp star lambda Cephei. We apply a simplified phenomenological model in which multiple spherical blobs attached to the surface represent magnetic-loop structures, which we call stellar prominences, by analogy with solar prominences. We compare the calculated line profiles as a function of rotational phase, adopting a rotation period of 4.1 d, with observed relative changes in subsequent quotient spectra.
We identify many periodicities in spectral lines, almost none of which is stable over timescales from months to years. We show that the relative changes in various optical absorption and emission lines are often very similar. Our proposed model applied to the He II 4686 line can typically be fitted with 2--5 equatorial blobs with lifetimes between ~ 1 and 24 h.
Given the irregular timescales involved, we propose that the azimuthal distribution of DACs correspond to the locations of stellar prominences attached to the surface. This could explain the observed variability of optical and UV lines, and put constraints on the strength and lifetime of these structures, which can be compared with recent theoretical predictions, in which bright magnetic surface spots are formed by the action of the subsurface convection zone.

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

Weblink: https://arxiv.org/abs/1606.00404

Comments: Accepted May 02, 2016, 30 pages, 48 figures

Email: h.f.henrichs@uva.nl

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JOBS (open positions)

Research Associate in Theoretical Stellar Astrophysics

Raphael Hirschi

Keele University, UK

Faculty of Natural Sciences

Faculty Research Office

Research Associate in Theoretical Stellar Astrophysics

Fixed Term until October 2017

Starting salary: Grade 7 £31,656

Keele University wishes to appoint a Research Associate starting in October 2016, in order to conduct research on theoretical stellar astrophysics.

The appointed Research Associate will work in the group of Dr Raphael Hirschi within the Astrophysics Group at Keele University as part of an ERC-funded project entitled “Stellar HYdrodynamics, Nucleosynthesis and Evolution” (SHYNE). The ERC starting grant awarded to Dr Hirschi provides

funding for a dedicated 1200+-CPU-core computer cluster, including 288 CPU-cores sharing memory via numascale technology.

You will lead the component of this project related to 3D-1D modelling of stellar interiors. This will include a range of computer simulations including 1D stellar evolution and 3D hydrodynamics simulations with as main goal to improve modelling of convection and rotation in stellar evolution. The Research Associate will also contribute to the other components of the project and be encouraged to develop their own research program and their leadership skills. The post holder will work closely with a collaborator in America and the appointment will involve frequent travel to the USA.

Applicants should have or expect to obtain a PhD in theoretical stellar astrophysics or a related area and should have a demonstrated aptitude for research. Experience in stellar evolution modelling and 3D hydrodynamic simulations is highly desirable.

For more details of this post and the Keele Astrophysics Group, and for information on how to apply, see http://www.astro.keele.ac.uk.

For further enquiries please contact Dr Raphael Hirschi at r.hirschi@keele.ac.uk.

Keele University is committed to the principles of the Athena SWAN charter, and values equality and diversity across our workforce. We strive to ensure that our workforce is representative of broader society, and therefore, we would actively welcome applications from women for this role.

For full post details please visit: www.keele.ac.uk/vacancies

Keele University employees wishing to apply should login to Employee Self Service and click on the 'View current vacancies' link.

Closing date for applications: 4 August 2016

Interviews will most probably be conducted remotely (via skype or similar technology)

Post reference: KU00000093

Attention/Comments:

Weblink: https://forums.keele.ac.uk/viewtopic.php?f=14&t=15679

Email: r.hirschi@keele.ac.uk

Deadline: 4 August 2016

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