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THE M$^{\mathrm{A}}$$^{\mathrm{S}}$$^{\mathrm{S}}$$^{\mathrm{I}}V_{\mathrm{E}}$ STAR NEWSLETTER

formely known as *the hot star newsletter*

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Contents of this newsletter

News

Gaia Scientific Data Exploitation

We would like to call on your help in preparing the science exploitation of data that will be collected by the Gaia satellite and by observational programmes supplementing these Gaia data.

The Gaia satellite will provide astrometric, photometric and spectroscopic information about a huge number of stars in our Galaxy. The satellite will be launched in 2012 and will provide a final catalogue in 2020.

Although this may seem a long way away, the astronomical community is already organizing itself, not only to exploit these data but also to collect substantial amounts of supplementary observations. The GREAT (Gaia Research for European Astronomy Training) consortium has been set up to bring together the relevant scientific expertise to address the Gaia scientific issues.

Discussion within the GREAT consortium has clearly revealed the need for spectroscopic data for a considerable number of stars. Opportunities for such large spectroscopic surveys will arise following the recommendations of two Astronet committees (on the future of the European 2-4 m class telescopes and on Wide-Field Spectroscopy), as well as the soon-to-be-expected call for very large proposals on the ESO-VLT.

The Gaia satellite and the supplemental observing programmes reflect a substantial commitment of various funding agencies in stellar astrophysics. We believe the massive star community should make use of this unique opportunity.

Various working groups have been defined in the GREAT consortium, one of which is entitled "Massive Stars". The first task of this working group is to provide a 'White Paper' detailing specific science cases for spectroscopic follow-up of Gaia and the corresponding instrumental requirements. This White Paper will be merged with those of other GREAT working groups and will serve as input to the Astronet committee on Wide-Field Spectroscopy. Another application will be to answer the call for very large proposals on the ESO-VLT.

We are therefore looking for persons who are willing to contribute to writing such a White Paper and get involved in the science exploitation of these data. Please have a look at the websites below and let us know if you can help us (send an email to Ronny Blomme or add your name to the GREAT-Massive stars wiki page).

Ronny Blomme (Ronny.Blomme@oma.be)
Janet Drew

More information:
Gaia: http://sci.esa.int/science-e/www/area/index.cfm?fareaid=26
GREAT: http://www.ast.cam.ac.uk/GREAT/index.html
GREAT - Massive stars: http://camd08.ast.cam.ac.uk/Greatwiki/WGB5MassiveStars
Astronet: http://www.strw.leidenuniv.nl/2to4mtelescopes/

Email contact: `Ronny.Blomme@oma.be`

Kick-off of GREAT working group on Stellar Variability with Gaia

GREAT (Gaia Research for European Astronomy Training) is an approved European Science Foundation (ESF) network programme that aims to build scientific collaborations across Europe to exploit the avalanche of Gaia data, and to deliver the major scientific advances around the main objectives of Gaia. The programme will provide funding for training events, workshops, major conferences, proceedings, grants for short and exchange visits, and outreach material.

Already about 90 research groups from 17 countries across Europe have shown interest to participate in this large network. GREAT defines several working groups, including a working group dedicated to stellar variability. Gaia is predicted to discover millions of new variable stars, for which it not only will provide photometric time series, but also their 3D position in our Milky Way.

The goals of this working group are to explore which synergies exist between the different research groups, to define and to set up new collaborations that will optimally exploit the Gaia data, to discuss and prepare for complementary ground-based follow-up, and to define interesting workshops, training events and/or conferences related to Gaia and stellar variability for the coming years.

Researchers from European institutes interested in participating in this working group, are invited to email their name and institute to the WG's co-facilitator Joris De Ridder (joris@ster.kuleuven.ac.be).

Relevant links:
GREAT: http://www.ast.cam.ac.uk/GREAT/index.html
GAIA: http://www.esa.int/esaSC/120377_index_0_m.html

Email contact: `joris@ster.kuleuven.ac.be`

BOOK: Asteroseismology

Dear colleague,

we are happy to announce you the release of our monograph **Asteroseismology**

http://www.springer.com/astronomy/practical+astronomy/book/978-1-4020-5178-4

We hope you find it a useful reference work in stellar physics.

Best regards,
Conny Aerts, Joergen Christensen-Dalsgaard, Don Kurtz

Email contact: `conny@ster.kuleuven.be`

Results for Organizing Committee (OC) election

In the recent election for the 7 open slots on the Organizing Committee of the IAU Massive Star Working Group, the following candidates are among the top 7 vote recipients and are thus duly elected to the OC:

Paul Crowther
Margaret Hanson
Artemio Herrero
Claus Leitherer
Joachim Puls
Gregor Rauw
Rich Townsend

The election is for a 3-year term (till fall 2012), with service for a second 3-year term at the member's discretion.

I congratulate the winning candidates and welcome them to the OC.

They replace retiring members Alex Fullerton, Gloria Koenigsberger, Phil Massey and Georges Meynet, whom I thank for their service.

Continuing OC members include Norbert Langer, Nicole St-Louis, and myself, Stan Owocki.

Regards,
Stan Owocki, Chair
MSWG OC

Email contact: `owocki@udel.edu`

Accepted Papers

Predicted γ-ray line emission from the Cygnus complex

Pierrick Martin, Jürgen Knodlseder, Georges Meynet and Roland Diehl

Max Planck Institut für extraterrestrische Physik Centre d'Etude Spatiale des Rayonnements Observatoire de Genève Max Planck Institut für extraterrestrische Physik

The Cygnus region harbours a huge complex of massive stars at a distance of 1.0-2.0kpc from us. About 170 O stars are distributed over several OB associations, among which the Cyg OB2 cluster is by far the most important with about 100-120 O stars. These massive stars inject large quantities of radioactive nuclei into the interstellar medium, such as 26Al and 60Fe, and their gamma-ray line decay signals can provide insight into the physics of massive stars and core-collapse supernovae. Past studies of the nucleosynthesis activity of Cygnus have concluded that the level of 26Al decay emission as deduced from CGRO/COMPTEL observations was a factor 2-3 above the predictions based on the theoretical yields available at that time and on the observed stellar content of the Cygnus region. We reevaluate the situation from new measurements of the gamma-ray decay fluxes with INTEGRAL/SPI (presented in a previous paper) and new predictions based on recently improved stellar models. We built a grid of nucleosynthesis yields from recent models of massive stars. Compared to previous works, our data include some of the effects of stellar rotation for the higher mass stars and a coherent estimate of the contribution from SNIb/c. We then developed a population synthesis code to predict the nucleosynthesis activity and corresponding decay fluxes of a given stellar population of massive stars. The observed decay fluxes from the Cygnus complex are found to be consistent with the values predicted by population synthesis at solar metallicity; and yet, when extrapolated to the possible subsolar metallicity of the Cygnus complex, our predictions fail to account for the INTEGRAL/SPI measurements. The observed extent of the 1809keV emission from Cygnus is found to be consistent with the result of a numerical simulation of the diffusion of 26Al inside the superbubble blown by Cyg OB2. Our work indicates that the past dilemma regarding the gamma-ray line emission from Cygnus resulted from an overestimate of the 1809keV flux of the Cygnus complex, combined with an underestimate of the nucleosynthesis yields. Our results illustrate the importance of stellar rotation and SNIb/c in the nucleosynthesis of 26Al and 60Fe. The effects of binarity and metallicity may also be necessary to account for the observations satisfactorily.

Reference: To be published in A&A

Comments: 13 pages, 9 figures

On the web at: `http://arxiv.org/abs/1001.1522`

Preprints from: `martinp@mpe.mpg.de`

The H-alpha Variations of η Carinae During the 2009.0 Spectroscopic Event

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We report on Hα spectroscopy of the 2009.0 spectroscopic event of η Carinae collected via SMARTS observations using the CTIO 1.5 m telescope and echelle spectrograph. Our observations were made almost every night over a two month interval around the predicted minimum of η Car. We observed a significant fading of the line emission that reached a minimum seven days after the X-ray minimum. About 17 d prior to the Hα flux minimum, the Hα profile exhibited the emergence of a broad, P Cygni type, absorption component (near a Doppler shift of -500 km/s) and a narrow absorption component (near -144 km/s and probably associated with intervening gas from the Little Homunculus Nebula). All these features were observed during the last event in 2003.5 and are probably related to the close periastron passage of the companion. We argue that these variations are consistent with qualitative expectations about changes in the primary star's stellar wind that result from the wind-wind collision with a massive binary companion and from atmospheric eclipses of the companion.

Reference: To be published in AJ

On the web at: `http://arxiv.org/abs/1001.3414`

Preprints from: `richardson@chara.gsu.edu`

Multiwavelength Observations of the Runaway Binary HD 15137

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HD 15137 is an intriguing runaway O-type binary system that offers a rare opportunity to explore the mechanism by which it was ejected from the open cluster of its birth. Here we present recent blue optical spectra of HD 15137 and derive a new orbital solution for the spectroscopic binary and physical parameters of the O star primary. We also present the first XMM-Newton observations of the system. Fits of the EPIC spectra indicate soft, thermal X-ray emission consistent with an isolated O star. Upper limits on the undetected hard X-ray emission place limits on the emission from a proposed compact companion in the system, and we rule out a quiescent neutron star in the propellor regime or a weakly accreting neutron star. An unevolved secondary companion is also not detected in our optical spectra of the binary, and it is difficult to conclude that a gravitational interaction could have ejected this runaway binary with a low mass optical star. HD 15137 may contain an elusive neutron star in the ejector regime or a quiescent black hole with conditions unfavorable for accretion at the time of our observations.

Reference: AJ, 2010, in press

On the web at: `http://arxiv.org/abs/0912.5133`

Preprints from: `mcswain@lehigh.edu`

γ Cassiopeiae: an X-ray Be star with personality

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An exciting unsolved problem in the study of high energy processes of early type stars concerns the physical mechanism for producing X-rays near the Be star γ Cassiopeiae. By now we know that this source and several "γ Cas analogs" exhibit an unusual hard thermal X-ray spectrum, compared both to normal massive stars and the non-thermal emission of known Be/X-ray binaries. Also, its light curve is variable on almost all conceivable timescales. In this study we reanalyze a high dispersion spectrum obtained by it Chandra in 2001 and combine it with the analysis of a new (2004) spectrum and light curve obtained by XMM-it Newton. We find that both spectra can be fit well with 3–4 optically thin, thermal components consisting of a hot component having a temperature $kT_Q \sim$ 12–14 keV, it perhaps one with a value of $\sim$ 2.4 keV, and two with well defined values near 0.6 keV and 0.11 keV. We argue that these components arise in discrete (almost monothermal) plasmas. Moreover, they cannot be produced within an integral gas structure or by the cooling of a dominant hot process. Consistent with earlier findings, we also find that the Fe abundance arising from K-shell ions is significantly subsolar and less than the Fe abundance from L-shell ions. We also find novel properties not present in the earlier it Chandra spectrum, including a dramatic decrease in the local photoelectric absorption of soft X-rays, a decrease in the strength of the Fe and possibly of the Si K fluorescence features, underpredicted lines in two ions each of Ne and N (suggesting abundances that are $\sim$ 1.5–3$\times$ and $\sim$ 4$\times$ solar, respectively), and broadening of the strong Ne X Lyα and O VIII Lyα lines. In addition, we note certain traits in the γ Cas spectrum that are different from those of the fairly well studied analog HD 110432 - in this sense the stars have different "personalities." In particular, for γ Cas the hot X-ray component remains nearly constant in temperature, and the photoelectric absorption of the X-ray plasmas can change dramatically. As found by previous investigators of γ Cas, changes in flux, whether occurring slowly or in rapidly evolving flares, are only seldomly accompanied by variations in hardness. Moreover, the light curve can show a "periodicity" that is due to the presence of flux minima that recur semiregularly over a few hours, and which can appear again at different epochs.

Reference: Astronomy & Astrophysics (in press)
Comments: Astronomy & Astrophysics (in press)

On the web at: `http://arxiv.org/abs/0903.2600`

Preprints from: `rlopes@astro.iag.usp.br`

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

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Recent accurate abundance analyses of B-type main sequence stars in the solar vicinity has shown that abundances derived from these stellar objects are more homogeneous and metal-rich than previously thought. We investigate whether the inhomogeneity of abundances previously found in B-type stars in the Ori OB1 association is real (hence a signature of enrichment of the newly formed stars in an

induced star formation scenario) or a consequence of intrinsic errors induced by the use of photometric indices to establish the stellar parameters prior to the abundance analysis. We obtained a new (improved) spectroscopic data set comprising 13 B-type stars in the various Ori OB1 associations, and performed a detailed, self-consistent spectroscopic abundance analysis by means of the modern stellar atmosphere code FASTWIND. We detect systematic errors in the stellar parameters determined previously which affect the derived abundances. Once these errors are accounted for, we find a high degree of homogeneity in the O and Si abundances for stars in the four Ori OB1 subgroups. The derived abundances are in very good agreement with recent determinations in other B-type stars in the solar vicinity. We also compare our results with those obtained for the Sun during the epoch of the "solar crisis", and the Orion nebula.

Reference: A&A, in press

On the web at: `http://adsabs.harvard.edu/abs/2009arXiv0912.4103S`

Preprints from: `ssimon@iac.es`

The Importance of XUV Radiation as a Solution to the P V Mass Loss Rate Discrepancy in O-Stars

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A controversy has developed regarding the stellar wind mass loss rates in O-stars. The current consensus is that these winds may be clumped which implies that all previously derived mass loss rates using density-squared diagnostics are overestimated by a factor of ~ 2. However, arguments based on FUSE observations of the P V resonance line doublet suggest that these rates should be smaller by another order of magnitude, provided that P V is the dominant phosphorous ion among these stars. Although a large mass loss rate reduction would have a range of undesirable consequences, it does provide a straightforward explanation of the unexpected symmetric and un-shifted X-ray emission line profiles observed in high energy resolution spectra. But acceptance of such a large reduction then leads to a contradiction with an important observed X-ray property: the correlation between He-like ion source radii and their equivalent X-ray continuum optical depth unity radii. Here we examine the phosphorous ionization balance since the P V fractional abundance, q(P V), is fundamental to understanding the magnitude of this mass loss reduction. We find that strong "XUV" emission lines in the He II Lyman continuum can significantly reduce q(P V). Furthermore, owing to the unique energy distribution of these XUV lines, there is a negligible impact on the S V fractional abundance (a key component in the FUSE mass loss argument). We conclude that large reductions in O-star mass loss rates are not required, and the X-ray optical depth unity relation remains valid.

Reference: Astro-ph arXiv:1001.4512v1, ApJ Letters (in press)

Preprints from: `wwaldron@satx.rr.com`

A Spitzer Space Telescope far-infrared spectral atlas of compact sources in the Magellanic Clouds. II. The Small Magellanic Cloud

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We present far-infrared spectra, $\lambda = 52 - 93$ micron, obtained with the Spitzer Space Telescope in the Spectral Energy Distribution mode of its MIPS instrument, of a selection of luminous compact far-infrared sources in the Small Magellanic Cloud. These comprise nine Young Stellar Objects (YSOs), the compact HII region N81 and a similar object within N84, and two red supergiants (RSGs). We use the spectra to constrain the presence and temperature of cool dust and the excitation conditions within the neutral and ionized gas, in the circumstellar environments and interfaces with the surrounding interstellar medium. We compare these results with those obtained in the LMC. The spectra of the sources in N81 (of which we also show the ISO-LWS spectrum between 50-170 micron) and N84 both display strong [OI] λ63-micron and [OIII] λ88-micron fine-structure line emission. We attribute these lines to strong shocks and photo-ionized gas, respectively, in a "champagne flow" scenario. The nitrogen content of these two HII regions is very low, definitely N(N)/N(O)<0.04 but possibly as low as N(N)/N(O)<0.01. Overall, the oxygen lines and dust continuum are weaker in star-forming objects in the SMC than in the LMC. We attribute this to the lower metallicity of the SMC compared to that of the LMC. Whilst the dust mass differs in proportion to metallicity, the oxygen mass differs less; both observations can be reconciled with higher densities inside star-forming cloud cores in the SMC than in the LMC. The dust in the YSOs in the SMC is warmer (37-51 K) than in comparable objects in the LMC (32-44 K). We attribute this to the reduced shielding and reduced cooling at the low metallicity of the SMC. On the other hand, the efficiency of the photo-electric effect to heat the gas is found to be indistinguishable to that measured in the same manner in the LMC, 0.1-0.3%. This may result from higher cloud-core densities, or smaller grains, in the SMC. The dust associated with the two RSGs in our SMC sample is cool, and we argue that it is swept-up interstellar dust, or formed (or grew) within the bow-shock, rather than dust produced in these metal-poor RSGs themselves. Strong emission from crystalline water ice is detected in at least one YSO. The spectra constitute a valuable resource for the planning and interpretation of observations with the Herschel Space Observatory and the Stratospheric Observatory For Infrared Astronomy (SOFIA).

Reference: The Astronomical Journal

On the web at: `http://adsabs.harvard.edu/abs/2010arXiv1001.4487V`

Preprints from: `jacco@astro.keele.ac.uk`

A near IR imaging survey of high and intermediate-mass young stellar outflow candidates

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We have carried out a near-infrared imaging survey of luminous young stellar outflow candidates using the United Kingdom Infrared Telescope. Observations were obtained in the broad band K (2.2 μm) and through narrow band filters at the wavelengths of H_2 v =1–0 S(1) (2.1218,μm) and Brγ (2.166,μm) lines. Fifty regions were imaged with a field of view of $2.2\times2.2\,\mathrm{arcmin}^2$. Several young embedded clusters are unveiled in our near-infrared images. 76% of the objects exhibit H_2 emission and 50% or more of the objects exhibit aligned H_2 emission features suggesting collimated outflows, many of which are new detections. These observations suggest that disk accretion is probably the leading mechanism in the formation of stars, at least up to late O spectral types. The young stellar objects responsible for many of these outflows are positively identified in our images based on their locations with respect to the outflow lobes, 2MASS colours and association with MSX, IRAS, millimetre and radio sources. The close association of molecular outflows detected in CO with the H_2 emission features produced by shock excitation by jets from the young stellar objects suggests that the outflows from these objects are jet-driven. Towards strong radio emitting sources, H_2 jets were either not detected or were weak when detected, implying that most of the accretion happens in the pre-UCH II phase; accretion and outflows are probably weak when the YSO has advanced to its UCH II stage.

Reference: Accepted for publication in MNRAS

On the web at: `http://adsabs.harvard.edu/abs/2010arXiv1001.2708V`

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Hard diffuse X-ray emission in the star-forming region ON2: discovery with XMM-Newton

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We obtained X-ray XMM-Newton observations of the open cluster Berkely 87 and the massive star-forming region (SFR) ON 2. In addition, archival infrared Spitzer Space Telescope observations were used. It is likely that the SFR ON 2 and Berkeley 87 are at the same distance, 1.23 kpc, and hence are associated. The XMM-Newton observations detected X-rays from massive stars in Berkeley 87 as well as diffuse emission from the SFR ON 2. The two patches of diffuse X-ray emission are encompassed in the shell-like H II region GAL 75.84+0.40 in the northern part of ON 2 and in the ON 2S region in the southern part of ON 2. The diffuse emission from GAL 75.84+0.40 suffers an absorption column equivalent to A_V approx. 28 mag. Its spectrum can be fitted either with a thermal plasma model at T $<$ 30 MK or by an absorbed power-law model with gamma; approx. -2.6. The X-ray luminosity of GAL 75.84+0.40 is L_X approx. 1 10^{32} erg/s. The diffuse emission from ON 2S is adjacent to the ultra-compact H II (UCHII) region Cygnus 2N, but does not coincide with it or with any other known UCHII region. It has a luminosity of L_X approx. 6 10^{31} erg/s. The spectrum can be fitted with an absorbed power-law model with gamma; approx.-1.4. We adopt the view of Turner and Forbes (1982) that the SFR ON 2 is physically associated with the massive star cluster Berkeley 87 hosting the WO type star WR 142. We suggest that SFR ON 2 emits hard diffuse X-rays by a synchrotron mechanism, invoked by the co-existence of strongly shocked stellar winds and turbulent magnetic fields in the star-forming complex.

Reference: ApJ

Comments: arXiv:1001.4798

On the web at: http://www.astro.physik.uni-potsdam.de/research/abstracts/oskinova-ber87.html

Preprints from: lida@astro.physik.uni-potsdam.de

Modelling the radio emission from Cyg OB2 #5: a quadruple system?

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Fifty observations at frequencies between 1.4 GHz and 43 GHz of the 6.6-day O6.5-7+O5.5-6 binary Cyg OB2 #5 using the Very Large Array over 20 years are re-examined. The aim is to determine the location and character of the previously detected variable radio emission. The radio emission from the system consists of a primary component that is associated with the binary, and a non-thermal source (NE), $0.8''$ to the NE of the binary that has been ascribed to a wind-collision region (WCR) between the stellar winds of the binary and that of a B-type star (Star D) to the NE. Previous studies have not accounted for the potential contribution of NE to the total radio emission, most especially in observations where the primary and NE sources are not resolved as separate sources. NE shows no evidence of variation in 23 epochs where it is resolved separately from the primary radio component, demonstrating that the variable emission arises in the primary component. Since NE is non-variable, the radio flux from the primary can now be well determined for the first time, most especially in observations that do not resolve both the primary and NE components. The variable radio emission from the primary component has a period of 6.7 ± 0.3 years which is described by a simple model of a non-thermal source orbiting within the stellar wind envelope of the binary. Such a model implies the presence of a third, unresolved stellar companion (Star C) orbiting the 6.6-day binary with a period of 6.7 years and independent of Star D to the NE. The variable non-thermal emission arises from either a WCR between Star C and the binary system, or possibly from Star C directly. The model gives a mass-loss rate of 3.4×10^{-5} $M_{\odot}$,yr^{-1} for Cyg OB2 #5, unusually high for an Of supergiant and comparable to that of WR stars, and consistent with an unusually strong He I 1.083-μm emission line, also redolent of WR stars. An examination of radial velocity observations available from the literature suggests reflex motion of the binary due to Star C, for which a mass of 23^{+22}_{-14} $M_{\odot}$ is deduced. The natures of NE and Star D are also examined. If NE is a WCR, as suggested by other authors, then the required mass-loss rate is an order of magnitude higher than expected for an early B-type dwarf, and only just consistent with a supergiant. This raises the question of NE as a WCR, but its non-thermal luminosity is consistent with a WCR and a comparison of reddening between Cyg OB2 #5 and Star D do not rule out an association, implying Cyg OB2 #5 is a quadruple system. Pursuing alternative models for NE, such as an unassociated background source, would require very challenging observations.

Reference: Astrophysical Journal, v. 709 (2010), pp 632-643

On the web at: arXiv:0911.5674

Preprints from: sean.dougehrty@nrc.ca

Radio emission from the massive stars in the Galactic Super Star Cluster Westerlund 1

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Aims: Current mass-loss rate estimates imply that main sequence line-driven winds are not sufficient to strip away the H-rich envelope to yield Wolf-Rayet (WR) stars. The rich transitional population of the young massive cluster Westerlund 1 (Wd 1) provides an ideal laboratory to observe and constrain mass-loss processes throughout the transitional phase of stellar evolution.

Methods: We present an analysis of deep radio continuum observations of Wd 1 obtained with the Australia Telescope Compact Array at four frequency bands that permit investigation of the intrinsic characteristics of the radio emission.

Results: We detect 18 cluster members, a sample dominated by the cool hypergiants, with additional detections amongst the hotter OB supergiants and WR stars. The radio properties of the sample are diverse, with thermal, non-thermal and composite thermal/non-thermal sources present. Mass-loss rates determined for stars with partially optically thick stellar winds are $\sim 10^{-5}\,M_{\odot}\,yr^{-1}$ across all spectral types, insufficient to enable the formation of WRs during a massive star lifetime, and the stars must undergo a period of greatly enhanced mass loss. The sgB[e] star W9, the brightest radio source in Wd 1, may provide an example, with a current mass-loss rate an order of magnitude higher than the other cluster members, and an extended nebula interpreted as a wind from an earlier epoch with a density $\sim 3\times$ the current wind. Such an envelope structure in W9 is reminiscent of luminous blue variables, and one that shows evidence of two eras of high, possibly eruptive mass loss. Surprisingly, three of the OB supergiants are detected, implying unusually dense winds, though they are embedded in more extended emission regions that may influence the derived parameters. They also may have composite spectra, suggesting binarity, which can lead to a higher flux than expected from a stellar wind. Spatially resolved nebulae are associated with three of the four RSGs and three of the six YHGs in the cluster, which are due to quiescent mass loss rather than outbursts. The extended nebulae of W20 and W26 have a cometary morphology, implying significant interaction with either the intracluster medium or cluster wind. For some of the cool star winds, the ionizing source may be a companion star though the cluster radiation density is sufficiently high to provide the necessary ionizing radiation. Five WR stars are detected with composite spectra, interpreted as arising in colliding-wind binaries.

Reference: Astronomy and Astrophysics

On the web at: arXiv:0912.4165

Preprints from: sean.dougherty@nrc.ca

The High-metallicity Explosion Environment of the Relativistic Supernova 2009bb

E. M. Levesque (1,2), A. M. Soderberg (2,18), R. J. Foley (2,19), E. Berger (2),

L. J. Kewley (1), S. Chakraborti (3), A. Ray (3), M. A. P. Torres (2), P. Challis (2), R. P. Kirshner (2), S. D. Barthelmy (4), M. F. Bietenholz (5,6), P. Chandra (7), V. Chaplin (8), R. A. Chevalier (9), N. Chugai (10), V. Connaughton (8), A. Copete (2), O. Fox (9), C. Fransson (11), J. E. Grindlay (2), M. A. Hamuy (12), P. A. Milne (13), G. Pignata (12,14), M. D. Stritzinger (15,16) and M. H. Wieringa (17)

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We investigate the environment of the nearby (d $\sim$ 40 Mpc) broad-lined Type Ic supernova (SN) 2009bb. This event was observed to produce a relativistic outflow likely powered by a central accreting compact object. While such a phenomenon was previously observed only in long-duration gamma-ray bursts (LGRBs), no LGRB was detected in association with SN 2009bb. Using an optical spectrum of the SN 2009bb explosion site, we determine a variety of interstellar medium properties for the host environment, including metallicity, young stellar population age, and star formation rate. We compare the SN explosion site properties to observations of LGRB and broad-lined SN Ic host environments on optical emission line ratio diagnostic diagrams. Based on these analyses, we find that the SN 2009bb explosion site has a metallicity between 1.7 $Z_{\odot}$and 3.5 $Z_{\odot}$, in agreement with other broad-lined SN Ic host environments and at odds with the low-redshift LGRB host environments and recently proposed maximum metallicity limits for relativistic explosions. We consider the implications of these findings and the impact that SN 2009bb's unusual explosive properties and environment have on our understanding of the key physical ingredient that enables some SNe to produce a relativistic outflow.

Reference: 2010 ApJ 709 L26

On the web at: `http://www.iop.org/EJ/abstract/2041-8205/709/1/L26/`

Preprints from: `sayan@tifr.res.in`

A relativistic type Ibc supernova without a detected Gamma-ray burst

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Long duration Gamma-ray bursts (GRBs) mark the explosive death of some massive stars and are a rare sub-class of type Ibc supernovae. They are distinguished by the production of an energetic and collimated relativistic outflow powered by a central engine (an accreting black hole or neutron star). Observationally, this outflow is manifested in the pulse of Gamma-rays and a long-lived radio afterglow. Until now, central-engine-driven supernovae have been discovered exclusively through their Gamma-ray emission, yet it is expected that a larger population goes undetected because of limited satellite sensitivity or beaming of the collimated emission away from our line of sight. In this framework, the recovery of undetected GRBs may be possible through radio searches for type Ibc supernovae with relativistic outflows. Here we report the discovery of luminous radio emission from the seemingly ordinary type Ibc SN 2009bb, which requires a substantial relativistic outflow powered by a central engine. A comparison with our radio survey of type Ibc supernovae reveals that the fraction harbouring central engines is low, about one per cent, measured independently from, but consistent with, the inferred rate of nearby GRBs. Independently, a second mildly relativistic supernova has been reported.

Reference: Nature, Volume 463, Issue 7280, pp. 513-515 (2010).

On the web at: `http://www.nature.com/nature/journal/v463/n7280/abs/nature08714.html`

Preprints from: `sayan@tifr.res.in`

NGC 300 X-1 is a Wolf-Rayet/Black-Hole binary

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We present VLT/FORS2 time-series spectroscopy of the Wolf-Rayet star #41 in the Sculptor group galaxy NGC 300. We confirm a physical association with NGC 300 X-1, since radial velocity variations of the HeII 4686 line indicate an orbital period of 32.3 +/- 0.2 hr which agrees at the 2 sigma level with the X-ray period from Carpano et al. We measure a radial velocity semi-amplitude of 267 +/- 8 km/s, from which a mass function of 2.6 +/- 0.3 $M_\odot$ is obtained. A revised spectroscopic mass for the WN-type companion of 26+7-5 $M_\odot$ yields a black hole mass of 20 +/- 4 $M_\odot$ for a preferred inclination of 60-75 deg. If the WR star provides half of the measured visual continuum flux, a reduced WR (black hole) mass of 15 +4 -2.5 $M_\odot$ (14.5 +3 -2.5 $M_\odot$) would be inferred. As such, #41/NGC 300 X-1 represents only the second extragalactic Wolf-Rayet plus black-hole binary system, after IC 10 X-1. In addition, the compact object responsible for NGC 300 X-1 is the second highest stellar-mass black hole known to date, exceeded only by IC 10 X-1.

Reference: MNRAS Letters in press

Comments: Images and Simulations available from ESO: http://www.eso.org/public/news/eso1004/

On the web at: `http://lanl.arxiv.org/abs/1001.4616`

Preprints from: `Paul.Crowther@sheffield.ac.uk`

A Detailed Far-Ultraviolet Spectral Atlas of Main Sequence B Stars

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Catholic University of America

We have constructed a detailed spectral atlas covering the wavelength region 930-1225 Angstroms for 10 sharp-lined B0-B9 stars near the main sequence. Most of the spectra we assembled are from the archives of the FUSE satellite, but for nine stars wavelength coverage above 1188A was taken from high-resolution IUE or echelle HST/STIS spectra. To represent the tenth star at type B0.2V we used the Copernicus atlas of tau Sco. We made extensive line identifications in the region 949-1225A of all atomic features having published oscillator strengths at types B0, B2, and B8. These are provided as a supplementary data product, - hence the term detailed atlas. Our list of found features totals 2288, 1612, and 2469 lines, respectively. We were able to identify 92%, 98%, and 98% of these features with known atomic transitions with varying degrees of certainty in these spectra. The remaining lines do not have published oscillator strengths. Photospheric lines account for 94%, 87%, and 91%, respectively, of all our identifications, with the remainder being due to interstellar (usually molecular H_2 lines. We also discuss the numbers of lines with respect to the distributions of various ions for these three most studied spectral subtypes. A table is also given of 167 least blended lines that can be used as possible diagnostics of physical conditions in B star atmospheres.

Reference: Smith, M. A. 2010, ApJS, 186, 175

Preprints from: `msmith@stsci.edu`

Discovery of a Luminous Blue Variable with an Ejection Nebula Near the Quintuplet Cluster

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We report the discovery of a Luminous Blue Variable (LBV) lying ∼7 pc in projection from the Quintuplet cluster. This source, which we call LBV G0.120-0.048, was selected for spectroscopy owing to its detection as a strong source of Paschen-α excess in a recent narrow-band imaging survey of the Galactic center region with HST/NICMOS. The K-band spectrum is similar to that of the Pistol Star and other known LBVs. The new LBV was previously cataloged as a photometric variable star, exhibiting brightness fluctuations of up to ∼1 magnitude between 1994 and 1997, with significant variability also occurring on month-to-month time scales. The luminosity of LBV G0.120-0.048, as derived from 2MASS photometry, is approximately equivalent to that of the Pistol Star. However, the time-averaged brightness of LBV G0.120-0.048 between 1994 and 1997 exceeded that of the Pistol Star; LBV G0.120-0.048 also suffers more extinction, which suggests that it was intrinsically more luminous in the infrared than the Pistol Star between 1994 and 1997. Paschen-α images reveal a thin circular nebula centered on LBV G0.120-0.048 with a physical radius of ∼0.8 pc. We suggest that this nebula is a shell of ejected material launched from a discrete eruption that occurred between 5000 and 10,000 years ago. Because of the very short amount of time that evolved massive stars spend in the LBV phase, and the close proximity of LBV G0.120-0.048 to the Quintuplet cluster, we suggest that this object might be coeval with the cluster and may have once resided within it.

Reference: ApJ Letters

On the web at: `http://arxiv.org/abs/1002.3379`

Preprints from: `mauerhan@ipac.caltech.edu`

Jobs

PhD position in Massive Star Evolution

Georges Meynet
Geneva Observatory, Geneva University CH-1290 Versoix Switzerland

The PhD work is planned to last for four years.

Among possible subjects are the following topics

Massive star formation with accretion

Aim: to explore the physical processes occurring during the pre-Main Sequence evolution of massive stars, to study how the axial rotation evolves during this phase, to suggest observations for constraining the models.

Massive star evolution with magnetic fields

Aim: to study the effects of the magnetic fields on the transport mechanisms in stellar interiors, the magnetic braking. Link with the observations of magnetic fields in massive stars, with the rotation rates and magnetic fields of pulsars, with the progenitors of long Gamma Ray Bursts.

Candidates are requested to submit
- a Curriculum Vitae
- a brief letter indicating the fields of interests in astrophysics
- the names of two persons who agree to write a letter of reference

Some knowledge in stellar physics and in computer programming is an advantage.

For full consideration, applications must be received by 31 January 2009.

Email contact: `georges.meynet@unige.ch`

Closing date: The position is available from the 1 April 2010.

Meetings

39th Liege Astrophysical Colloquium The Multi-Wavelength View of Hot, Massive Stars—

12-16 July, 2010
Liege, Belgium

2nd announcement:

Registration is now open and you are kindly invited to register and submit abstracts for contributed talks or posters before 15 March 2010. Early registration closes on 15 May 2010. All abstracts will be reviewed by the SOC and the selection will be announced by 15 April 2010. The registration fee is 250 euros and includes refreshments and lunches during the conference, but it does not include transportation or hotel accommodation.

Please note that due to an unfortunate clash with a major sports event (Tour de France 2010 stage arrival near Liège), we had to change the dates of the colloquium compared to the first announcement.

More details about the venue, the travel to Liège as well as contact details for some hotels can be found on our website

http://www.ago.ulg.ac.be/PeM/Coll/Liac39/

A couple of grants, including student dormitory accommodation, for young PhD students will be offered by the LOC. Students who wish to apply for a grant should submit the abstract of their contribution via the web-interface and send their application to: liac2010@misc.ulg.ac.be

The application must reach us before 15 March 2010.

We remind you that the proceedings of the conference will be published electronically as a spe-

cial issue of the bulletin of the Liège Royal Scientific Society http://www.srsl-ulg.net/ which is an open-access, refereed publication. The template for the proceedings is available on our web site http://www.ago.ulg.ac.be/PeM/Coll/Liac39/ (link "Proceedings").

We look forward to seeing you in Liège,

Peredur Williams and Gregor Rauw on behalf of the SOC and LOC

Weblink: `http://www.ago.ulg.ac.be/PeM/Coll/Liac39/`

Email contact: `liac2010@misc.ulg.ac.be`