ISSN 1783-3426

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

formely known as *the hot star newsletter*

⋆

No. 114 2009 November-December

eenens@gmail.com
editor: Philippe Eenens
http://www.astroscu.unam.mx/massive_stars
University of Guanajuato
ftp://ftp.sron.nl/pub/karelh/UPLOADS/WRBIB/

Contents of this newsletter

Accepted Papers

The Orbital Decay of Embedded Binary Stars

Steven W. Stahler

Dept. of Astronomy U. of California Berkeley, CA 94720

Young binaries within dense molecular clouds are subject to dynamical friction from ambient gas. Consequently, their orbits decay, with both the separation and period decreasing in time. A simple analytic expression is derived for this braking torque. The derivation utilizes the fact that each binary acts as a quadrupolar source of acoustic waves. The acoustic disturbance has the morphology of a two-armed spiral and carries off angular momentum. From the expression for the braking torque, the binary orbital evolution is also determined analytically. This type of merger may help explain the origin of high-mass stars. If infrared dark clouds, with peak densities up to $10^7 \mathrm{cm}^{-3}$, contain low-mass binaries, those with separations less than 100 AU merge within about 10^5 yr. During the last few thousand years of the process, the rate of mechanical energy deposition in the gas exceeds the stars' radiative luminosity. Successive mergers may lead to the massive star formation believed to occur in these clouds.

Reference: http://arxiv.org/abs/0911.1177
Comments: to appear in MNRAS

Preprints from: SStahler@astro.berkeley.edu

IPHAS and the symbiotic stars. II. New discoveries and a sample of the most common mimics

R.L.M. Corradi (1), M. Valentini, U. Munari, J.E. Drew, E.R. Rodriguez-Flores, K. Viironen, R. Greimel, M. Santander-Garcia, L. Sabin, A. Mampaso, Q. Parker, K. De Pew, S.E. Sale, Y.C. Unruh, J.S. Vink, P. Rodriguez-Gil, M.J. Barlow, D.J. Lennon, P.J. Groot, C. Giammanco, A.A. Zijlstra, and N.A. Walton

(1) Instituto de Astrofisica de Canarias, Tenerife, Spain

Knowledge of the total population of symbiotic stars in the Galaxy is important for understanding basic aspects of stellar evolution in interacting binaries and the relevance of this class of objects in the formation of supernovae of type Ia. In a previous paper, we presented the selection criteria needed to search for symbiotic stars in IPHAS, the INT H_α survey of the Northern Galactic plane. IPHAS gives us the opportunity to make a systematic, complete search for symbiotic stars in a magnitude-limited volume. Follow-up spectroscopy at different telescopes worldwide of a sample of sixty two symbiotic star candidates from paper I is presented. Seven out of nineteen S-type candidates observed spectroscopically are confirmed to be genuine symbiotic stars. The spectral type of their red giant components, as well as reddening and distance, were computed by modelling the spectra. Only one new D-type symbiotic system, out of forty-three candidates observed, was found. This was as expected (see discussion in our paper on the selection criteria). The object shows evidence for a high density outflow expanding at a speed larger than 65 km/s. Most of the other candidates are lightly reddened classical T Tauri stars and more highly reddened young stellar objects that may be either more massive young stars of HAeBe type or classical Be stars. In addition, a few notable objects have been found, such as three new Wolf-Rayet stars and two relatively high-luminosity evolved massive stars. We also found a helium-rich source, possibly a dense ejecta hiding a WR star, which is surrounded by a large ionized nebula. These spectroscopic data allow us to refine the selection criteria for symbiotic stars in the IPHAS survey and, more generally, to better understand the behaviour of different H_α emitters in the IPHAS and 2MASS colour-colour diagrams.

Reference: Astronomy and Astrophysics

On the web at: `http://arxiv.org/abs/0910.5930v1`

Preprints from: `rcorradi@iac.es`

Near-IR integral field spectroscopy of ionizing stars and young stellar objects on the borders of HII regions

F. Martins [1], M. Pomares [2], L. Deharveng [2], A. Zavagno [2], J.-C. Bouret [2]

1- GRAAL-CNRS; 2- LAM-OAMP

We present near-IR SINFONI observations of three Galactic HII regions: RVW79, RCW82 and RCW120. We identify the ionizing stars of each region: they are early to late O stars, close to the main sequence. We derive their stellar and wind properties using atmosphere models computed with the code CMFGEN. The cluster ionizing RCW 79 formed 2.3+/-0.5 Myr ago. Similar ages are estimated, albeit with a larger uncertainty, for the ionizing stars of the other two regions. In RCW79 the mechanical wind luminosity represents only 0.1% of the ionizing luminosity, questioning the influence of stellar winds on the dynamics of the the HII region. The young stellar objects show four main

types of spectral features: H2 emission, Br γ emission, CO bandheads emission and CO bandheads absorption. These features are typical of young stellar objects surrounded by disks and/or envelopes. The radial velocities of most YSOs are consistent with that of the ionized gas, firmly establishing that star formation is taking place on the borders of the HII regions. Outflows are detected in a few YSOs. All YSOs have moderate to strong near-IR excess. In the [24] versus K-[24] diagram, the majority of the sources dominated by H2 emission lines stand out as redder and brighter than the rest of the YSOs. Their H2 emission is mainly due to shocks. We tentatively propose that they represent an earlier phase of evolution compared to sources dominated by Br γ and CO bandheads. We suggest that they still possess a dense envelope in which jets or winds create shocks. The other YSOs have partly lost their envelopes and show signatures of accretion disks.

Reference: A&A accepted

On the web at: `http://arxiv.org/abs/0911.2637`

Preprints from: `martins@graal.univ-montp2.fr`

On the velocity dispersion of young star clusters: super-virial or binaries?

M. Gieles (1), H. Sana (1,2), S.F. Portegies Zwart (3)

(1) ESO (2) Amsterdam (3) Leiden

Many young extra-galactic clusters have a measured velocity dispersion that is too high for the mass derived from their age and total luminosity, which has led to the suggestion that they are not in virial equilibrium. Most of these clusters are confined to a narrow age range centred around 10 Myr because of observational constraints. At this age the cluster light is dominated by luminous evolved stars, such as red supergiants, with initial masses of $\sim$13-22 $M_{\odot}$for which (primordial) binarity is high. In this study we investigate to what extent the observed excess velocity dispersion is the result of the orbital motions of binaries. We demonstrate that estimates for the dynamical mass of young star clusters, derived from the observed velocity dispersion, exceed the photometric mass by up-to a factor of 10 and are consistent with a constant offset in the square of the velocity dispersion. This can be reproduced by models of virialised star clusters hosting a massive star population of which $\sim$25 is in binaries, with typical mass ratios of $\sim$0.6 and periods of $\sim$1000 days. We conclude that binaries play a pivotal role in deriving the dynamical masses of young ($\sim$10 Myr) moderately massive and compact ($< 1e5 M_{\odot}; > 1pc$) star clusters.

Reference: MNRAS, in press

On the web at: `http://arxiv.org/abs/0911.1557`

Preprints from: `mgieles@eso.org`

Mass loss from inhomogeneous hot star winds I. Resonance line formation in 2D models

J.O. Sundqvist(1), J. Puls(1) and A. Feldmeier(2)

(1) Universitätssternwarte München, Germany (2) Institut für Physik und Astronomie, Potsdam-Golm, Germany

Context: The mass-loss rate is a key parameter of hot, massive stars. Small-scale inhomogeneities (clumping) in the winds of these stars are conventionally included in spectral analyses by assuming optically thin clumps, a void inter-clump medium, and a smooth velocity field. To reconcile investigations of different diagnostics (in particular, unsaturated UV resonance lines vs. H_α/radio emission) within such models, a highly clumped wind with very low mass-loss rates needs to be invoked, where particularly the resonance lines seem to indicate rates an order of magnitude (or even more) lower than previously accepted values. If found realistic, this would challenge the radiative line-driven wind theory and have dramatic consequences for the evolution of massive stars. Aims: We investigate basic properties of the formation of resonance lines in small-scale inhomogeneous hot star winds with non-monotonic velocity fields. Methods: We study inhomogeneous wind structures by means of 2D stochastic and pseudo-2D radiation-hydrodynamic wind models, constructed by assembling 1D snapshots in radially independent slices. A Monte-Carlo radiative transfer code, which treats the resonance line formation in an axially symmetric spherical wind (without resorting to the Sobolev approximation), is presented and used to produce synthetic line spectra. Results: The optically thin clumping limit is only valid for very weak lines. The detailed density structure, the inter-clump medium, and the non-monotonic velocity field are all important for the line formation. We confirm previous findings that radiation-hydrodynamic wind models reproduce observed characteristics of strong lines (e.g., the black troughs) without applying the highly supersonic 'microturbulence' needed in smooth models. For intermediate strong lines, the velocity spans of the clumps are of central importance. Current radiation-hydrodynamic models predict spans that are too large to reproduce observed profiles unless a very low mass-loss rate is invoked. By simulating lower spans in 2D stochastic models, the profile strengths become drastically reduced, and are consistent with higher mass-loss rates. To simultaneously meet the constraints from strong lines, the inter-clump medium must be non-void. A first comparison to the observed Phosphorus V doublet in the O6 supergiant lambda Cep confirms that line profiles calculated from a stochastic 2D model reproduce observations with a mass-loss rate approximately ten times higher than that derived from the same lines but assuming optically thin clumping. Tentatively this may resolve discrepancies between theoretical predictions, evolutionary constraints, and recent derived mass-loss rates, and suggests a re-investigation of the clump-structure predicted by current radiation-hydrodynamic models.

Reference: accepted by A&A, available on astro-ph

On the web at: `http://arxiv.org/abs/0911.3361`

Preprints from: `jon@usm.uni-muenchen.de`

The massive star binary fraction in young open clusters - II. NGC 6611 (Eagle Nebula)

H. Sana[1,2], E. Gosset[3], C.J. Evans[4]

1. European Southern Observatory, Chile 2. Amsterdam University, The Netherlands 3. Liege University, Belgium 4. UK Astronomy Technology Centre, Royal Observatory Edinburgh, UK

Abstract: Based on a set of over 100 medium- to high-resolution optical spectra collected from 2003 to 2009, we investigate the properties of the O-type star population in NGC6611 in the core of the

Eagle Nebula (M16). Using a much more extended data set than previously available, we revise the spectral classification and multiplicity status of the nine O-type stars in our sample. We confirm two suspected binaries and derive the first SB2 orbital solutions for two systems. We further report that two other objects are displaying a composite spectrum, suggesting possible long-period binaries. Our analysis is supported by a set of Monte-Carlo simulations, allowing us to estimate the detection biases of our campaign and showing that the latter do not affect our conclusions. The absolute minimal binary fraction in our sample is f_{min}=0.44 but could be as high as 0.67 if all the binary candidates are confirmed. As in NGC6231 (see Paper I), up to 75% of the O star population in NGC6611 are found in an O+OB system, thus implicitly excluding random pairing from a classical IMF as a process to describe the companion association in massive binaries. No statistical difference could be further identified in the binary fraction, mass-ratio and period distributions between NGC6231 and NGC6611, despite the difference in age and environment of the two clusters.

Reference: MNRAS (doi: 10.1111/j.1365-2966.2009.15545.x)

On the web at: `http://arxiv.org/abs/0909.0486`

Preprints from: `H.Sana@uva.nl`

The circumstellar disk, envelope, and bi-polar outflow of the Massive Young Stellar Object W33A

Ben Davies (1,2), Stuart L. Lumsden (1), Melvin G. Hoare (1), Rene D. Oudmaijer (1), Willem-Jan de Wit (1)

1. University of Leeds, UK 2. Rochester Institute of Technology, NY

The Young Stellar Object (YSO) W33A is one of the best known examples of a massive star still in the process of forming. Here we present Gemini North ALTAIR/NIFS laser-guide star adaptive-optics assisted K-band integral-field spectroscopy of W33A and its inner reflection nebula. In our data we make the first detections of a rotationally-flattened outer envelope and fast bi-polar jet of a massive YSO at near-infrared wavelengths. The predominant spectral features observed are Br-γ, H_2, and a combination of emission and absorption from CO gas. We perform a 3-D spectro-astrometric analysis of the line emission, the first study of its kind. We find that the object's Br-γ emission reveals evidence for a fast bi-polar jet on sub-milliarcsecond scales, which is aligned with the larger-scale outflow. The hybrid CO features can be explained as a combination of hot CO emission arising in a disk close to the central star, while cold CO absorption originates in the cooler outer envelope. Kinematic analysis of these features reveals that both structures are rotating, and consistent with being aligned perpendicularly to both the ionised jet and the large-scale outflow. Assuming Keplerian rotation, we find that the circumstellar disk orbits a central mass of $> 10M_{\odot}$, while the outer envelope encloses a mass of $\sim 15M_{\odot}$. Our results suggest a scenario of a central star accreting material from a circumstellar disk at the centre of a cool extended rotating torus, while driving a fast bi-polar wind. These results therefore provide strong supporting evidence for the hypothesis that the formation mechanism for high-mass stars is qualitatively similar to that of low-mass stars.

Reference: To appear in MNRAS

On the web at: `http://arxiv.org/abs/0911.4592`

Preprints from: `b.davies@leeds.ac.uk`

Hot and cool: two emission-line stars with constrasting behaviours in the same XMM-Newton field

Yael Naze, Gregor Rauw, Asif ud-Doula

1, 2 : ULg ; 3 : Morrisville State Col.

High-energy emissions are good indicators of peculiar behaviours in stars. We have therefore obtained an XMM-Newton observation of HD155806 and 1RXSJ171502.4-333344, and derived their spectral properties for the first time. The X-ray spectrum of HD155806 appears soft, even slightly softer than usual for O-type stars (as shown by a comparison with the O9 star HD155889 in the same XMM field). It is well-fitted with a two-component thermal model with low temperatures (0.2 and 0.6 keV), and it shows no overluminosity (log[LX/Lbol]=-6.75). The high-resolution spectrum, though noisy, reveals a few broad, symmetric X-ray lines (FWHM ∼2500 km/s). The X-ray emission is compatible with the wind-shock model and therefore appears unaffected by the putative dense equatorial regions at the origin of the Oe classification. 1RXSJ171502.4-333344 is a nearby flaring source of moderate X-ray luminosity (log[LX/Lbol]=-3), with a soft thermal spectrum composed of narrow lines and presenting a larger abundance of elements (e.g. Ne) with a high first ionization potential (FIP) compared to lower-FIP elements. All the evidence indicates a coronal origin for the X-ray emission, in agreement with the dMe classification of this source.

Reference: accepted by A&A

On the web at: `http://arxiv.org/abs/0912.0379`

Preprints from: `naze@astro.ulg.ac.be`

VLT/NACO near-infrared imaging and spectroscopy of N88A in the SMC

G. Testor (1), J.L. Lemaire (1,2), M. Heydari-Malayeri (1), L. E. Kristensen (3), S.Diana (2), D. Field (4)

1 - LERMA, UMR 8112 du CNRS, Observatoire de Paris, 92195 Meudon, France 2 - Universit'e de Cergy-Pontoise, 95031 Cergy Cedex, France 3 - Leiden Observatory, Leiden University, Niels Bohrweg 2, 2333 CA Leiden, The Netherlands 4 - Department of Physics and Astronomy, Arhus University, 8000 Arhus C, Denmark.

We present near-infrared imaging and spectroscopic high spatial resolution observations of the SMC region N88 containing the bright, excited, extincted and compact H II region N88A of size ∼1 pc. To investigate its stellar content and reddening, N88 was observed using spectroscopy and imagery in the JHKs- and L'-band at a spatial resolution of ∼0.1-0.3", using the VLT UT4 equipped with the NAOS adaptive optics system. In order to attempt to establish if the origin of the infra-red (IR) excess is due to bright nebulosity, circumstellar material and/or local dust, we used Ks vs J-K colour-magnitude (CM) and JHK colour-colour (CC) diagrams, as well as L' imagery. Our IR-data reveal in the N88 area an IR-excess fraction of >= 30 per cent of the detected stars, as well as an unprecedently detailed morphology of N88A. It consists of an embedded cluster of ∼3.5" (∼1 pc) in diameter, of at least thirteen resolved stars superposed with an unusual bright continuum centered on a very bright star. The four brightest stars in this cluster lie red-ward of H-K >= 0.45 mag, and could be classified as young stellar object (YSO) candidates. Four other probable YSO candidates are also detected in N88

along a south-north bow-shaped thin H_2 filament at $\sim$ 7" east of the young central bright star. At 0.2" east of this star, a heavily embedded core is detected in the L'-band that could be a massive class I protostar candidate. The 2.12 μm H_2 image of N88A resembles a shell of diameter $\sim$ 3" ($\sim$ 0.9 pc) centered on the bright star. The line ratios of H_2 2-1 S(1) and 1-0 S(0) relative to 1-0 S(1), as well as the presence of high v lines, are indicative of photodissociation regions, rather than shocks.

Reference: Astronomy & Astrophysics

On the web at: `http://arxiv.org/pdf/0911.5490`

Preprints from: `gerard.testor@obspm.fr`

A new investigation of the binary HD 48099

L. Mahy, G. Rauw, F. Martins, Y. Naze, E. Gosset, M. De Becker, H. Sana, P. Eenens

1,2,4,5,6 : University of Liege, Belgium 3 : GRAAL, University of Montpellier II, France 7 : ESO, Chile and Sterrenkundig Instituut of Amsterdam, The Netherlands 8 : Universidad de Gunajuato, Mexico

With an orbital period of about 3.078 days, the double-lined spectroscopic binary HD 48099 is, still now, the only short-period O+O system known in the Mon OB2 association. Even though an orbital solution has already been derived for this system, few information are available about the individual stars. We present, in this paper, the results of a long-term spectroscopic campaign. We derive a new orbital solution and apply a disentangling method to recover the mean spectrum of each star. To improve our knowledge concerning both components, we determine their spectral classifications and their projected rotational velocities. We also constrain the main stellar parameters of both stars by using the CMFGEN atmosphere code and provide the wind properties for the primary star through the study of IUE spectra. This investigation reveals that HD 48099 is an O5.5 V((f))+O9 V binary with $M_1 \sin^3 i = 0.70 M_{\rm sun}$ and $M_2 \sin^3 i = 0.39 M_{\rm sun}$, implying a rather low orbital inclination. This result, combined with both a large effective temperature and log g, suggests that the primary star (v sini $\sim$ 91 km s^{-1}) is actually a fast rotator with a strongly clumped wind and a nitrogen abundance of about 8 times the solar value.

Reference: Accepted by ApJ

On the web at: `http://arxiv.org/abs/0912.0605`

Preprints from: `mahy@astro.ulg.ac.be`

Understanding the X-Ray Flaring from eta Carinae

A. F. J. Moffat[1,2] and M. F. Corcoran[3,4]

1-Dpartement de Physique, Universit de Montral, Succursale Centre-Ville, Montral, QC, H3C 3J7, Canada 2-Centre de recherche en astrophysique du Qubec, Canada 3-CRESST and X-ray Astrophysics Laboratory, NASA/GSFC, Greenbelt, MD 20771, USA 4-Universities Space Research Association, 10211 Wincopin Circle, Suite 500 Columbia, MD 21044, USA.

We quantify the rapid variations in X-ray brightness ("flares") from the extremely massive colliding wind binary eta Carinae seen during the past three orbital cycles by the Rossi X-ray Timing Explorer.

The observed flares tend to be shorter in duration and more frequent as periastron is approached, although the largest ones tend to be roughly constant in strength at all phases. Plausible scenarios include (1) the largest of multi-scale stochastic wind clumps from the Luminous Blue Variable (LBV) component entering and compressing the hard X-ray-emitting wind-wind collision (WWC) zone, (2) large-scale corotating interacting regions in the LBV wind sweeping across the WWC zone, or (3) instabilities intrinsic to the WWC zone. The first one appears to be the most consistent with the observations, requiring homologously expanding clumps as they propagate outward in the LBV wind and a turbulence-like power-law distribution of clumps, decreasing in number toward larger sizes, as seen in Wolf-Rayet winds.

Reference: ApJ,707,693

On the web at: `http://www.iop.org/EJ/abstract/0004-637X/707/1/693/`

Preprints from: `michael.F.Corcoran@nasa.gov`

Near-Infrared Counterparts to Chandra X-ray Sources Toward the Galactic Center. II. Discovery of Wolf-Rayet Stars and O Supergiants

Jon C. Mauerhan , Michael P. Muno , Mark R. Morris , Susan R. Stolovy , Angela S. Cotera

NASA Infrared Processing and Analysis Center, Caltech

We present new identifications of infrared counterparts to the population of hard X-ray sources near the Galactic center detected by the Chandra X-ray Observatory. We have confirmed 16 new massive stellar counterparts to the X-ray population, including nitrogen-type (WN) and carbon-type (WC) Wolf-Rayet stars, and O supergiants. For the majority of these sources, the X-ray photometry is consistent with thermal emission from plasma having temperatures in the range of kT=1-8 keV or non-thermal emission having power-law indices in the range of $-1 < \gamma < 3$, and X-ray luminosities in the range of Lx $\sim$1e^{32}-1e^{34} erg/s. Several sources have exhibited X-ray variabilit of several factors between separate observations. The X-ray properties are not a ubiquitous feature of single massive stars but are typical of massive binaries, in which the high-energy emission is generated by the collision of supersonic winds, or by accretion onto a compact companion. However, the possibility of intrinsic hard X-ray generation from single stars cannot be completely ruled out. The spectral energy distributions of these sources exhibit significant infrared excess, attributable to free-free emission from ionized stellar winds, supplemented by hot dust emission in the case of the WC stars. With the exception of one object located near the outer regions of the Quintuplet cluster, most of the new stars appear isolated or in loose associations. Seven hydrogen-rich WN and O stars are concentrated near the Sagittarius B HII region, while other similar stars and more highly evolved hydrogen-poor WN and WC stars lie scattered within $\sim$50 pc, in projection, of Sagitarius A West. We discuss various mechanisms capable of generating the observed X-rays and the implications these stars have for massive star formation in the Galaxy's Central Molecular Zone.

Reference: ApJ, accepted

On the web at: `http://arxiv.org/abs/0912.1055`

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

Disk Loss and Disk Renewal Phases in Classical Be Stars I: Analysis of Long-Term Spectropolarimetric Data

John P. Wisniewski(1), Zachary H. Draper(1), Karen S. Bjorkman(2), Marilyn R. Meade(3), Jon E. Bjorkman(2), and Adam F. Kowalski(1)

(1) University of Washington; (2) University of Toledo; (3) University of Wisconsin

Classical Be stars are known to occasionally transition from having a gaseous circumstellar disk ("Be phase") to a state in which all observational evidence for the presence of these disks disappears ("normal B-star phase"). We present one of the most comprehensive spectropolarimetric views to date of such a transition for two Be stars, pi Aquarii and 60 Cygni. 60 Cyg's disk loss episode was characterized by a generally monotonic decrease in emission strength over a time-scale of 1000 days from the maximum V-band polarization to the minimum H-α equivalent width, consistent with the viscous time-scale of the disk, assuming alpha is 0.14. pi Aqr's disk loss was episodic in nature and occurred over a time-scale of 2440 days. An observed time lag between the behavior of the polarization and H-α in both stars indicates the disk clearing proceeded in an "inside-out" manner. We determine the position angle of the intrinsic polarization to be 166.7 +/- 0.1 degrees for pi Aqr and 107.7 +/- 0.4 degrees for 60 Cyg, and model the wavelength dependence of the observed polarization during the quiescent diskless phase of each star to determine the interstellar polarization along the line of sight. Minor outbursts observed during the quiescent phase of each star shared similar lifetimes as those previously reported for mu Cen, suggesting that the outbursts represent the injection and subsequent viscous dissipation of individual blobs of material into the inner circumstellar environments of these stars. We also observe deviations from the mean intrinsic polarization position angle during polarization outbursts in each star, indicating deviations from axisymmetry. We propose that these deviations might be indicative of the injection (and subsequent circularization) of new blobs into the inner disk, either in the plane of the bulk of the disk material or in a slightly inclined (non-coplanar) orbit.

Reference: ApJ (in press)

On the web at: `http://arxiv.org/abs/0912.1504`

Preprints from: `jwisnie@u.washington.edu`

The origin of mid-infrared emission in massive young stellar objects: multi-baseline VLTI observations of W33A

W.J. de Wit, M.G. Hoare, R.D. Oudmaijer, S.L. Lumsden

University of Leeds

The circumstellar structure on 100 AU scales of the massive young stellar object W33A is probed using the VLTI and the MIDI instrument. N-band visibilities on 4 baselines are presented which are inconsistent with a spherically symmetric geometry. The visibility spectra and SED are simultaneously compared to 2D axi-symmetric dust radiative transfer models with a geometry including a rotationally flattened envelope and outflow cavities. We assume an O7.5 ZAMS star as the central source, consistent with the observed bolometric luminosity. The observations are also compared to models with and without (dusty and gaseous) accretion disks. A satisfactory model is constructed which reproduces

the visibility spectra for each (u,v) point. It fits the silicate absorption, the mid-IR slope, the far-infrared peak, and the (sub)mm of the SED. It produces a 350 micron morphology consistent with observations. The 10 micron emission on 100 AU scales is dominated by the irradiated walls of the cavity sculpted by the outflow. The visibilities rule out the presence of dust disks with total (gas and dust) masses more than 0.01 $M_{\odot}$. However, optically thick accretion disks, interior to the dust sublimation radius, are allowed to accrete at rates equalling the envelope's mass infall rate (up to 10^{-3} $M_{\odot}$/yr) without substantially affecting the visibilities due to the extinction by the extremely massive envelope of W33A.

Reference: http://xxx.lanl.gov/abs/0912.2869

Preprints from: `w.j.m.dewit@leeds.ac.uk`

The RMS Survey: Far-Infrared Photometry of Young Massive Stars

J. C. Mottram (1,2), M. G. Hoare (1), R. D. Oudmaijer (1), J. S. Urquhart (1,3), M. R. Meade (4), T. J. T. Mootr (5), J. J. Stead (1)

1 - School of Physics and Astronomy, University of Leeds, Leeds, LS2 9JT, UK 2 - School of Physics, University of Exeter, Exeter, Devon, EX4 4QL, UK 3 - Australia Telescope National Facility, CSIRO, Sydney, NSW 2052, Australia 4 - Univ. of Wisconsin - Madison, Dept. of Astronomy, 475 N. Charter St., Madison, WI 53716, USA 5 - Astrophysics Research Institute, Liverpool John Moores University, Twelve Quays House, Egerton Wharf, Birkenhead, CH41 1LD, UK

Context: The Red MSX Source (RMS) survey is a multi-wavelength campaign of follow-up observations of a colour-selected sample of candidate massive young stellar objects (MYSOs) in the galactic plane. This survey is returning the largest well-selected sample of MYSOs to date, while identifying other dust contaminant sources with similar mid-infrared colours including a large number of new ultra-compact (UC) HII regions. Aims: To measure the far-infrared (IR) flux, which lies near the peak of the spectral energy distribution (SED) of MYSOs and UCHII regions, so that, together with distance information, the luminosity of these sources can be obtained. Methods: Less than 50% of RMS sources are associated with IRAS point sources with detections at 60 micron and 100 micron, though the vast majority are visible in Spitzer MIPSGAL or IRAS Galaxy Atlas (IGA) images. However, standard aperture photometry is not appropriate for these data due to crowding of sources and strong spatially variable far-IR background emission in the galactic plane. A new technique using a 2-dimensional fit to the background in an annulus around each source is therefore used to obtain far-IR photometry for young RMS sources. Results: Far-IR fluxes are obtained for a total of 1113 RMS candidates identified as young sources. Of these 734 have flux measurements using IGA 60 micron and 100 micron images and 724 using MIPSGAL 70 micron images, with 345 having measurements in both data sets.

Reference: A&A

On the web at: `http://adsabs.harvard.edu/abs/2009arXiv0912.2682M`

Preprints from: `joe@astro.ex.ac.uk`

Chandra Observations of WR147 Reveal a Double X-ray Source

Svetozar A. Zhekov[1] **and Sangwook Park** [2]

1 - JILA, University of Colorado, Boulder, CO 80309-0440, USA 2 - Department of Astronomy and Astrophysics, Pennsylvania State University, 525 Davey Laboratory, University Park, PA 16802, USA

We report the first results from deep X-ray observations of the Wolf-Rayet binary system WR147 with the Chandra HETG. Analysis of the zeroth order data reveals that WR147 is a double X-ray source. The northern counterpart is likely associated with the colliding wind region, while the southern component is certainly identified with the WN star in this massive binary. The latter is the source of high energy X-rays (including the Fe K_α complex at 6.67 keV) whose production mechanism is yet unclear. For the first time, X-rays are observed directly from a WR star in a binary system.

Reference: The ApJ Letters; http://arxiv.org/abs/0912.3554

Preprints from: `zhekovs@colorado.edu`