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From the editor

I apologize for the long delay before the publication of this issue. This delay, caused by circumstances beyond my control, made this a massive issue, with 16 abstracts of accepted papers, three of submitted papers, four in conference proceedings and one thesis. You will also find the announcement of two meetings.

A preliminary version of **the 7th Galactic Wolf-Rayet catalog** has been made available by Karel van der Hucht, to whom we are grateful. You can grab a copy from the Hot Star web pages or request it directly from the author, e-mail: `karelh@sron.ruu.nl`. A more detailed, documented and fully referenced catalog will become available before IAU Symposium 193.

The **Wolf-Rayet bibliography** is regularly updated by Karel. The most recent update was done in November. See our web pages.

Accepted Papers

On the Form of the H II Region Luminosity Function

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Observed variations in the H II region luminosity function (H II LF) seen in spiral arm vs. interarm regions, and different galactic Hubble type, can be explained simply by evolutionary effects and maximum number of ionizing stars per cluster. We present Monte Carlo simulations of the H II LF, drawing the number of ionizing stars N_* from a power-law distribution of constant slope, and the stellar masses from a Salpeter IMF with an upper-mass limit of $100\,M_\odot$. We investigate the evolution of the H II LF, as determined by stellar main-sequence lifetimes and ionizing luminosities, for a single burst case and continuous creation of the nebular population. Shallower H II LF slopes measured for the arms of spiral galaxies can be explained as a composite slope, expected for a zero-age burst population, whereas the interarm regions tend to be dominated by evolved rich clusters described by a single, steeper slope. Steeper slopes in earlier-type galaxies can be explained simply by a lower maximum N_*

cutoff found for the parent OB associations. The form of the H II LF can reveal features of the most recent ($\lesssim 10$ Myr) star formation history in nearby galaxies.

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or http://xxx.lanl.gov/abs/astro-ph/9712157 *and mirrors.*

A radiation-driven disk wind model for massive young stellar objects.

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A radiation-driven disk wind model is proposed that offers great promise of explaining the extreme mass loss signatures of massive young stellar objects (the BN-type objects and more luminous Herbig Be stars). It is argued that the dense low-velocity winds associated with young late-O/early-B stars would be the consequence of continuing optically-thick accretion onto them. The launch of outflow from a Keplerian disk allows wind speeds of $\sim$200 km s^{-1} that are substantially less than the escape speed from the stellar surface. The star itself is not required to be a rapid rotator. Disk irradiation is taken into account in the hydrodynamical calculation presented, and identified as an important issue both observationally and from the dynamical point of view.

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Preprints on the web at http://xxx.lanl.gov/abs/astro-ph/9801035

On the physical model of dust around Wolf-Rayet stars

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The observational infrared spectra of a number of Wolf-Rayet stars of WC8–9 spectral classes are shown to be quite satisfactorily explained by making use of the detailed theoretical model of a dust shell made up of spherical amorphous carbon grains, the dynamics, growth-destruction, thermal and electrical charge balance of which are taken into account. The dust grains acquire mainly positive electrical charge, move with suprathermal drift velocities and may grow up to 100–200 Å as a result of implantation of impinging carbon ions. For most of the stars the fraction of condensed carbon does not exceed 1 per cent. While the nature of the grain nucleation remains unknown, the condensation distances and the grain seed productions can be estimated by fitting the observational spectra with theoretical ones.

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The long-term behaviour of the Be star HD 163868

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In this paper we discuss the light variations of HD 163868 on the basis of all available photometric data originating from photometric monitoring during the last two decades. We suggest that one explanation of the on-and-off type variability can be a binary configuration with a compact companion and a period of the order of 850 days, though the observed effects could also be seen in the context of positive interference of NRPs. The bright stages are associated with strong reddening consistent with an increase in circumstellar material. We draw the attention to the similarity with cyclically-recurrent mild S Dor phases of LBVs.

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Cyclicities in the light variations of LBVs. II. R 40 developing an S Dor phase

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Strömgren differential photometry of R 40 collected during the time interval 1986–1996 is analysed together with Walraven photometry. The gradual brightening of the star over the last 10 years can be described by a linear trend with superimposed oscillations (in v, b and y) with frequency 0.0008 cd ($\sim$ 1300 d cycle). We interpret these oscillations as "normal S Dor" phases, and suggest that the quasi-linear brightening of the star is the ascending branch of a growing very-long-term S Dor phase (VLT–SD), as found by van Genderen et al. (1997a) in AG Car and S Dor itself. As R 40 is now becoming fainter and bluer, the length of the VLT–SD cycle is about 20 years.

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The nitrogen spectra of Wolf-Rayet stars

A grid of models and its application to the Galactic WN sample

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Adopting the "standard model" for Wolf-Rayet atmospheres, non-LTE radiation transfer calculations are performed which account for helium and nitrogen. Grids of theoretical models are presented for the whole relevant parameter range. The WN classification criteria are employed in order to identify

the subtype domains, and inconsistencies are discussed. The (almost complete) sample of known Galactic WN stars is analyzed by comparing the observed spectra with the synthetic spectra of the grid models. This is the first time that nitrogen line analyses are performed for the whole WN sample, while previous comprehensive studies were restricted to helium models.

The obtained parameters roughly confirm the results from the previous helium analyses, as far as late subtypes (WNL) and early subtypes with strong lines (WNE-s) are concerned. For early subtypes with weak lines (WNE-w), however, the parameters are substantially revised. The hottest WN star, with a stellar (effective) temperature of 140 kK, is WR 2, which could not be analyzed previously from its helium lines due to the lack of He I. The other members of the WNE-w subgroup have stellar temperatures between 40 and 90 kK, thus populating the same temperature range as the strong-lined WNE-w, but with less dense winds.

The luminosities are revised according to the new parameters. Moreover, reddening corrections are newly determined form comparing IUE data with the UV model fluxes. The average luminosity is now $\log L/L_\odot = 5.5$ for WNE stars (both, strong and weak lined), and $\log L/L_\odot = 5.9$ for WNL (not significantly revised). The empirical minimum WN luminosity is $10^{5.0}\,L_\odot$, reducing former incompatibilities with predictions from evolutionary calculations. The ratio between mechanical and radiative momentum flow is slightly affected by the revisions, but remains much higher than unity: 9, 9 and 29 for the WNL, WNE-w and WNE-s subclass, respectively.

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A re-evaluation of profile shapes from resonance line scattering in spherical stellar winds

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It is common to treat the scattering of light by resonance lines as isotropic, but in fact it has been known for some time that general resonance line scattering is partially isotropic and partially dipolar, the relative strength of the two components depending on the specific transition. As a result, the profile shapes of lines that scatter with strong dipole distributions could in principle differ markedly from those that scatter isotropically. This paper explores the consequences of general resonance line scattering in spherically symmetric stellar envelopes. As a simplified example, a resonance line profile arising in a constant expansion wind is shown *not* to be flat-top in shape, as commonly accepted, but can in fact exhibit a symmetric *double-horned* shape. Although interesting, the case of constant expansion has limited application. Using the Sobolev-P method, sample line profiles are computed for a typical wind velocity distribution that is often assumed in hot star winds. These simulated lines reveal that anisotropic scattering yields profile shapes that are centrally depressed and broadened. Taking account of finite star effects, the emission profile of an optically thin resonant line that is purely Rayleigh scattering (like a free electron) differs from that of the isotropic scattering case at only the 10% level, and the two types of profiles become indistiguishable for increasing line optical depths owing to the effects of multiple scattering. Relative to the case of isotropic scattering, the anisotropic scattering has little effect in altering the emission profile shape, a consequence of (a) stellar occultation and (b) finite star depolarization. Thus, except for the case of a shell of considerable radius,

the accuracy of resonance line profile computations in *spherically symmetric* extended envelopes are hardly compromised by the effects of anisotropic scattering.

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A spectropolarimetric survey of northen-hemisphere Wolf-Rayet stars

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We present a homogeneous, high-signal-to-noise spectropolarimetric survey of 16 northern-hemisphere Wolf-Rayet (WR) stars. A reduction in polarization at emission-line wavelengths – the 'line effect' – is identified in four stars: WRs 134, 137, 139, and 141. The magnitude of the effect in WR 139 (V444 Cyg) is variable, while WR 136, previously reported to show the line effect, does not show it in our data. Assuming the line effect generally to arise from axisymmetric distortions of stellar winds, we show that a model in which all WRs have the same intrinsic (equator-on) polarization, with the observed variation solely due to inclination effects, is inconsistent with the observations. A model in which the intrinsic polarizations are uniformly distributed is more plausible, but best-fit results are obtained if the distribution of polarizations is biased towards small values, with only ∼20% of stars having intrinsic polarizations greater than ∼0.3%. Radiative-transfer calculations indicate that the observed continuum polarizations can be matched by models with equator:pole density ratios of 2–3. The model spectra have electron-scattering wings that are significantly stronger than observed (in both intensity and polarized flux), confirming that the winds of stars showing intrinsic polarization must be clumped on small scales as well as being distorted on large scales.

We combine the results of our survey with observations from the literature to give a sample of 29 stars which have both accurate spectropolarimetric observations and physical parameters derived from standard-model analyses. We find that the line-effect stars are clustered at high $\dot{M}, L$ in the luminosity–mass-loss-rate plane (although they are unexceptional in the terminal velocity–subtype and the surface-mass-flux–temperature planes). The mass-loss rates derived from radio-continuum observations for these stars are in good accord with the results of optical emission-line analyses, suggesting that (i) the wind structure of line-effect stars has a density contrast which is effectively constant with radius, and (ii) the high $\dot{M}$ values may be an artefact of large-scale wind structure. Assuming that observed spectroscopic and photometric variability of the line-effect stars is related to the WR rotation period, we compute equatorial rotation velocities. These velocities correspond to $\sim 10\%$ of the core break-up rates, and may be large enough to produce significant wind-compression effects according to the models of Ignace, Cassinelli & Bjorkman (1996).

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A Spherical Non-LTE Line-Blanketed Stellar Atmosphere Model of the Early B Giant ϵ CMa.

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We use a spherical non-LTE fully line blanketed model atmosphere to fit the full multi-wavelength spectrum, including the extreme ultraviolet (EUV) continuum observed by the *Extreme Ultraviolet Explorer*, of the B2 II star ϵ CMa. The available spectrophotometry of ϵ CMa from 350 Å to 25 μm is best fit with model parameters $T_{\rm eff} = 21750\,{\rm K}$, $\log g = 3.5$, and an angular diameter of 0.77 mas. Our best fit model predicts a hydrogen ionizing flux, q_0, of 1.59×10^{21} photons cm^{-2} s^{-1} at the star's surface and 2290 photons cm^{-2} s^{-1} at the surface of the Local Cloud.

The close agreement between the model and the measured EUV flux from ϵ CMa is a result of the higher temperatures at the formation depths of the H I and He I Lyman continua compared to other models. The realistic model treatment of early B giants with spherical geometry and NLTE metal line blanketing results in the prediction of significantly larger EUV fluxes compared with plane-parallel models. We find that our metal line blanketed spherical models show significantly warmer temperature structures, 1-3 kK at the formation depth of the Lyman continua, and predict stronger EUV fluxes, up to a factor of 5 in the H I Lyman continuum, compared with plane-parallel atmospheres that have identical model parameters. In contrast, we find spherical and plane-parallel models that do not include metal line blanketing are nearly identical. Our $T_{\rm eff} = 21000$ K, $\log g = 3.2$, spherical NLTE model predicts more than twice as many hydrogen ionizing photons and over 200 times more neutral helium ionizing photons than a standard hydrostatic plane-parallel LTE model with the same stellar parameters.

Our synthetic spectra are in reasonably good agreement with observed continuum and line fluxes from echelle spectra obtained with the Goddard High Resolution Spectrograph. While we find agreement between the absolute UV flux of ϵ CMa as measured by *GHRS* and our model atmosphere, these fluxes are ∼30% higher in the UV than those measured by *IUE*, *OAO-2*, and *TD-1*, in excess of the published errors in the absolute calibration of these data.

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The Possibility of Thermal Instability in Early-Type Stars Due to Alfvén Waves

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It was shown by dos Santos et al. the importance of Alfvén waves to explain the winds of Wolf-Rayet stars. We investigate here the possible importance of Alfvén waves in the creation of inhomogeneities

in the winds of early-type stars. The observed infrared emission (at the base of the wind) of early-type stars is often larger than expected. The clumping explains this characteristic in the wind, increasing the mean density and hence the emission measure, making possible to understand the observed infrared, as well as the observed enhancement in the blue wing of the H_α line. In this study, we investigate the formation of these clumps a via thermal instability. The heat-loss function used, $H(T, n)$, includes physical processes such as: emission of (continuous and line) recombination radiation; resonance line emission excited by electron collisions; thermal bremsstrahlung; Compton heating and cooling; and damping of Alfvén waves. As a result of this heat-loss function we show the existence of two stable equilibrium regions. The stable equilibrium region at high temperature is the diffuse medium and at low temperature the clumps. Using this reasonable heat-loss function, we show that the two stable equilibrium regions can coexist over a narrow range of pressures describing the diffuse medium and the clumps.

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Evolved Massive Stars in the Local Group: I. Identification of Red Supergiants in NGC 6822, M31, and M33

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Knowledge of the red supergiant (RSG) population of nearby galaxies allows us to probe massive star evolution as a function of metallicity; however, contamination by foreground Galactic dwarfs dominates surveys for red stars in Local Group galaxies beyond the Magellanic Clouds. Model atmospheres predict that low-gravity supergiants will have $B-V$ values that are redder by several tenths of a magnitude than foreground dwarfs at a given $V-R$ color, a result that is largely independent of reddening. We conduct a BVR survey of several fields in the Local Group galaxies NGC 6822, M 33, and M 31, as well as neighboring control fields, and identify RSG candidates from CCD photometry. The survey is complete to $V = 20.5$, corresponding to $M_V = -4.5$ or an M_{bol} of -6.3 for the reddest stars. Followup spectroscopy at the Ca II triplet of 130 stars is used to demonstrate that our photometric criterion for identifying RSGs is highly successful (96% for stars brighter than $V = 19.5$; 82% for for V=19.5-20.5). Classification spectra are also obtained for a number of stars in order to calibrate color with spectral type empirically. We find that there is a marked progression in the average $(B-V)_o$ and $(V-R)_o$ colors of RSGs in these three galaxies; with the higher metallicity systems having a later average spectral type, consistent with previous findings by Elias, Frogel, & Humphreys for the Milky Way and Magellanic Clouds. More significantly, we find that there is a clear progression with metallicity in the relative number of the highest luminosity RSGs, a trend that is apparent both in absolute visual magnitude and in bolometric luminosity. Thus any use of RSGs as distance indicators requires correction for the metallicity of the parent galaxy. Our findings are in accord with the predictions of the "Conti scenario" in which higher metallicities result in higher mass-loss rates, resulting in a star of a given luminosity spending an increasing fraction of its He-burning lifetime as a WR star rather than as a RSG with increasing metallicity. The fact that the distribution of luminosities have extended tails extending to higher luminosity (with the possible exception of the M 31 sample, which contains only one high luminosity RSG), suggests that many WRs may pass through a RSG phase, albeit for a short period. We find that over the factor of 5 difference in

metallicity from NGC 6822 to M 31 the masses of the most luminous RSGs change by about a factor of two, with the highest mass RSGs having masses of $25 - 30\mathcal{M}_\odot$ in NGC 6822, $18\mathcal{M}_\odot$ in M33, and $13 - 15\mathcal{M}_\odot$ in M31. These masses are lower than the usually assumed limits for evolution to the WR stage, but are not necessarily in conflict with the number of unevolved O and B stars if the time spent as a He-burning object is split between the RSG and WR phases over a large mass range.

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A Bipolar Outflow in the M1-67 Nebula around the Wolf-Rayet Star WR124

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Ground based high resolution coronographic images of the inner M1-67 nebula ($\simeq 40'' \times 60''$) around the Wolf Rayet WR124 have been obtained with the Johns Hopkins Adaptive Optic Coronograph at the Swope 40″ telescope, Las Campanas, in the light of Hα + [NII]. The inner M1-67 nebula appears very clumpy and remarkably axisymmetric. In addition, we present new high signal-to-noise long slit spectroscopic data, with full spatial coverage of the nebula ($\simeq 90'' \times 75''$), which have been used the derive its radial velocity map (from the [NII] 6583 Å line profile). The radial velocity data reveal the presence of two different motions in the enviroment of WR124: a spherical hollow shell, 46″ in radius, expanding with a velocity of 46 km s^{-1}, and a newly discovered bipolar outflow, with a velocity of 88 km s^{-1}. Their dynamical ages are estimated to be 2×10^4 yrs and 1.2×10^4 yrs respectively, and their overall N enriched composition seem to indicate that they formed during the post-main sequence evolution of WR124. This scenario is consistent with two subsequent outbursts, possibly occurred during a previous LBV phase.

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The OB associations LH 101 and LH 104 in the HII region N158 of the LMC

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We present photometric and spectroscopic observations of stars in the Large Magellanic Cloud OB associations LH 101 and LH 104, located in the HII region N158, which we have also imaged. From our observations we have constructed upper H-R diagrams for these OB associations, which we find to consist mainly of three populations, one of 2-6 Myr for the stars inside the northern bubble (LH 104), and two populations in the southern HII region (LH 101), one of ≤ 2 Myr and the other one aged 3-6 Myr. We have obtained for LH 101 a normal IMF, with a slope of $\Gamma = -1.29 \pm 0.20$ whereas for LH

104 the IMF is flatter with a slope of $\Gamma = -1.05 \pm 0.12$. These IMF slopes are consistent with that of other OB associations in the LMC. Our observations reveal in the region of LH 101 the presence of both unevolved and evolved very massive stars, whose ionizing flux is in excess of that derived from our Hβ images of the HII region. The north-west nebulosity in the region of LH 101 thus appears to be matter bound.

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Velocity Law in the Extended Photosphere of the WN5 Star in the Eclipsing Binary V444 Cygni

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An algorithm for the solution of Fredholm's equations of the first kind describing light curves of WR+O binary systems on a set of nonnegative monotonically decreasing convex functions is developed. The algorithm is applied to a narrow-band continuum λ4244Å light curve of the eclipsing binary V444 Cygni (WN5+O6). Reliable information about the distribution of the linear absorption coefficient $\alpha(r)$ and the velocity law in the extended photosphere of the WN5 star was obtained from the analysis. Recent accurate spectrophotometric estimate of the luminosity ratio of the components in the binary was used to establish the relationship between the two geometrical parameters of the model: the radius of the O6 star and the orbital inclination. It is shown that the flow of matter in the WN5 photosphere is accelerating and that the value of the acceleration is relatively low. The expansion velocity at the distance $r \simeq 3.8R_{\odot}$ (at which $\tau_{4244}(r) \simeq 1$) reaches a few hundreds km/s, *i.e.*, the flow at this point is supersonic.

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Determination of mass-loss rates of PG 1159 stars from FUV spectroscopy

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We determine mass-loss rates of four hot, low-gravity PG 1159 stars which are regarded as immediate descendants of Wolf-Rayet central stars of planetary nebulae (i.e. early spectral type [WCE]). The sample consists of classical hydrogen-deficient PG 1159 stars (K1-16, NGC 246, RX J2117.1+3412) as well as one object of the very rare "hybrid" subtype which also exhibits hydrogen lines (NGC 7094). The sample is complemented by the famous [WC]–PG 1159 transition object Abell 78. Our analysis is based on the O VI 1032/1038Å resonance line which is the strongest wind-feature in these objects. FUV observations were performed with the Berkeley spectrograph during the ORFEUS-SPAS II mission. One spectrum is taken from archive data of the ORFEUS-SPAS I mission and another one was

obtained with the Hopkins Ultraviolet Telescope during the Astro-2 mission. We find mass-loss rates ranging between $\dot{M} = -8 \ldots -7$, as compared to the [WCE] stars which have mass-loss rates of about $\dot{M} = -5.5 \ldots -6.5$. By comparison with theory we conclude that the wind of PG 1159 stars is driven by radiation pressure.

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ORFEUS-SPAS II EUV Spectroscopy of ϵ Canis Majoris (B2 II)

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We report on EUV spectroscopic observations of the B bright giant ϵ CMa made during the *ORFEUS-SPAS II* mission. We assess the performance of the instrument in the EUV and find that the effective area is roughly three times that of the *EUVE* long wavelength spectrometer and that the spectral resolution is $\lambda/\Delta\lambda \approx 1250$. We identify most of the features, qualitatively compare different models, and examine the wind-broadened O 5 and Si 4 lines, which display blue edge velocities up to 800 km s^{-1}.

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Submitted Papers

Hα Spectroscopy of the Unusual Binary V Sagittae

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We present high quality spectra of the Hα emission line of the nova-like variable, V Sge, obtained during a photometric bright state during 1986 July. The profiles have several components including: (1) a very broad, flat-topped emission line which forms in the optically thin wind of one of the stars, (2) a central, narrow peak which probably originates in a circumbinary shell, and (3) a moving component which attains an extreme velocity of approach just prior to secondary eclipse (when the brighter, lower mass, Roche-filling, primary star is in the foreground). We review models for the emission based on the expected collision of the stellar winds of both stars, and we suggest that the moving component originates in a high density region that extends from between the stars to above the leading hemisphere

of the primary. The example of V Sge shows that interacting binaries may cease mass transfer in favor of mass ejection from the system at some stage in their evolution.

Submitted to AJ
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High resolution spectroscopy of the galactic B[e]–supergiant MWC 314

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The results of high–resolution optical spectroscopy obtained for a recently suggested LBV candidate, MWC 314, are presented. Photospheric lines mostly of N II and S II have been found for the first time with a resolution of 0.4 - 0.8 Å. They imply a N/O overabundance previously reported for AG and HR Car since no O II absorptions were detected. Nearly 400 emission lines have been identified in the spectrum between 4190 and 8864 Å. Detection of emission lines of Fe III and He II in the spectrum constrains stellar temperature at a level of 26000 K. Many emission lines appear double–peaked. No significant P Cyg-type absorption components have been found for the optically thick Balmer lines. This allows to suggest that the stellar wind of MWC 314 is non-spherical and the circumstellar envelope is viewed not edge-on. The systemic velocity measured using the emission lines of ionized metals turned out to be +55 km s^{-1}, which corresponds to a distance towards the object of 3.0 ± 0.2 kpc, according to the galactic rotation curve. The stellar parameters were found to be as follows: $\log L_{bol}/L\odot = 6.1$, $R_* = 60R\odot$. Their uncertainties are nearly 30 % in luminosity and 50 % in radius. Our study confirms that MWC 314 is one of the most luminous stars in the Milky Way.

Submitted to Astronomy and Astrophysics
Preprints from anatoly@physics.utoledo.edu

Ejected Nebulae as Probes of the Evolution of Massive Stars in the Large Magellanic Cloud

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We present new *HST/FOS* and ground-based long slit spectroscopic observations of the nebulae around

the two LMC Luminous Blue Variables R127 (=HDE269858) and R143 (=HDE269929), and the Ofpe/WN9 star S119 (=HDE269687).

We have used the ground-based long slit spectra to investigate the kinematics of the nebulae around R127 and R143. We find that the circumstellar environment of R127 is complex and suggestive of two discrete ejections in the mass loss history of the central star. There is an inner expanding shell, with a radius of 0.6 pc, an expansion velocity of 29 km s^{-1} and a dynamical age of 2×10^4 yr. There is also material beyond the bright, inner nebula which may represent an outer expanding shell with a radius of 1.9 pc, and a dynamical age of 7×10^4 yr. For R143, we find that the velocity field in the northern and southern circumstellar regions (1–20″) is predominantly constant. Therefore, the nebular emission previously believed to be associated with R143 (*the fingers*) is most likely part of the 30 Doradus complex, with the exception of a small emission line region located $\simeq 2''$ north of the star. This compact region displays a blueshifted motion with a differential velocity of $\simeq 130$ km s^{-1} with respect to the central star. The spectrum of this *clump* shows a high [N II]/Hα ratio, suggestive of nitrogen-enriched material that has been ejected from the star some 3.7×10^3 yrs ago.

We have used the optical *HST+FOS* spectra to determine reddenings, electron temperatures and densities, and N and O abundances for the three nebulae. For R143, our derived abundances indicate that the region we observed to the south of the star is 30 Doradus H II gas since it shows a typical LMC H II region N/O ratio. For R127, we find that N is enriched by a factor of 10.7 ± 2.2, and O depleted by a factor of 2.0 ± 1.0 with N/O= 0.89 ± 0.40. For the S119 nebula, we do not have a secure electron temperature but find N/O=1.41–2.45, similar to the value found for R127. We compare the nebular abundances with the expected surface abundances of LBVs and discuss the likely stellar evolutionary state at the time of nebular ejection. If the atmospheres of LBVs consist of CNO-processed material, this implies that the event that formed the nebula took place before, or at the very start of, the LBV phase.

Comparison of the observed nebular abundances with other objects shows that the abundance pattern for the R127 nebula is remarkably similar to that determined for the inner ring of SN 1987A (Fransson et al. 1989; Panagia et al. 1997) which is thought to be composed of RSG wind material. This coincidence, together with the observed low expansion velocity, suggests that the nebula was once the CN-processed convective envelope of an RSG. We consider whether the R127 nebular parameters can be reproduced with the evolutionary models of Meynet et al. (1994), and find that the pre-LBV mass loss has to be low enough for redward evolution such that a surface N/O ratio of ~ 1 is achieved while the star is a cool supergiant inside the Humphreys-Davidson limit. Our findings are broadly in accord with the model of Stothers & Chin (1996) which incorporates a brief RSG phase. We also consider the possibility of a pseudo-RSG phase by discussing the suggestion of Owocki & Gayley (1997) that a star in a super-Eddington condition may develop a very extended outer convective envelope which may become detached.

We also present a coarse analysis of the *FOS* stellar spectrophotometry using the Q-method to estimate reddenings and spectral types, and compare our results with more sophisticated methods.

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In Proceedings

Winds in OB-type stars

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The International Ultraviolet Explorer satellite has made a tremendous contribution to the study of hot-star winds. Its long lifetime has resulted in the collection of ultraviolet spectra for a large sample of OB stars. Its unique monitoring capability has enabled detailed time-series analyses to investigate the stellar-wind variability for individual objects. IUE has also been a major driver for the development of the radiation-driven-wind theory; the synergy between theory and observations is one of the main reasons for the large progress that has been made in our understanding of hot-star winds and their impact on the atmospheres and evolution of massive stars.

Review paper to appear in "Ultraviolet Astrophysics Beyond the IUE Final Archive", Proceedings of the Sevilla meeting, 11-14 November 1997, ESA-SP 413
Preprints from `lkaper@eso.org`

BeppoSAX Observations of Eta Carinae: A Multicolour Study of its Recent Low and High States

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We report on a ongoing campaign of multiwavelength observations of the superluminous galactic object η Carinae, following its mid 1992 low state. The BeppoSAX LECS and MECS observations of December 1996 detected many sources in the η Car field. η Car itself is by far the brightest, with a multi-component spectrum. The object was in a high state in agreement with ASCA and RossiXTE observations. Optical (LNA), ultraviolet (IUE), and radio observations indicate a general flux modulation following the 5.52 y cycle. A gradual decrease of these fluxes since 1995 are suggestive of the approaching of the next low state.

To appear in "The Active X-Ray Sky", Proceedings of the Symposium held in Roma on 21-24 October 1997, Eds. L. Scarsi et al., Nuclear Physics B Proceedings Supplement, in press (1998)
Preprints from `uvspace@ias.rm.cnr.it` *or by anonymous ftp to* `ftp.ias.rm.cnr.it/pub/uvspace`

Modelling Variability in Hot-Star Winds

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I review 2-D hydrodynamical simulations of rotating hot-star winds with azimuthal structure induced by modulation of the radiative driving force near the wind base. As a first step toward examining

more realistic perturbation mechanisms (e.g., nonradial pulsations, or magnetic fields), the driving modulation here is taken to arise from bright and dark spots in the stellar photophere. These spots induce decreases or increases in wind flow speed, and as the star rotates, spiral "Co-Rotating Interaction Regions" (CIRs) form, much as in the solar wind, from from interaction between fast and slow flow streams. A new feature unique to line-driven flow is a velocity-gradient kink that propagates inward from interaction fronts at a fast radiative-acoustic mode speed. The slowly evolving velocity plateaus that form behind such kinks give rise to absorption features with a slow apparent acceleration, much like the Discrete Absorption Components (DACs) often observed in UV wind lines from hot-stars. In simulation models with base driving sinusoidally modulated between increase and decrases, there arise alternating spiral streams of enhanced or decreased density, associated respectively with decreased or increase flow speeds. These speed variations have substantial impact on the line profile, and so these dynamical simulation are not as successful as analogous kinematic models of corotating density streams in reproducing the "phase-bowing" of periodic absorption modulations observed in the recent IUE 'Mega' project.

To appear in "Cyclical Variability in Stellar Winds", proceedings of workshop held in Garching, Germany, Oct. 1997, L. Kaper and A. Fullerton, eds.
Preprints from `owocki@bartol.udel.edu`

A Revised Classification Scheme for B[e] Stars

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We review the classification criteria for the B[e] stars. These criteria can be met in different kinds of stars of different evolutionary phases. We argue that the name "B[e] phenomenon" is more appropriate than the name "B[e] stars". We propose a new definition of five classes of stars which show the B[e] phenomenon with names that indicate the evolutionary phase:

(a) B[e] supergiants or "sgB[e] stars"
(b) pre-main sequence B[e]-type stars or "HAeB[e] stars"
(c) compact planetary nebulae B[e]-type stars or "cPNB[e] stars"
(d) symbiotic B[e]-type stars or "SymB[e] stars"
(e) unclassified B[e]-type stars or "unclB[e] stars"

If a star meets the criteria of more than one of the classes (a), (b), (c) and (d) it is automatically assigned to class unclB[e].

To appear in "Dusty B[e]-stars", proceedings of the colloquium held in Paris in June 1997
Preprints from `hennyl@sron.ruu.nl`

Theses

Colliding Winds in Massive Binaries

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Stellar winds are a well-observed phenomenon, and in massive stars this process may result in significant mass-loss from the system with dramatic evolutionary ramifications. In close binary systems of massive stars, the individual stellar winds will collide and form a shock front between the stars. The existence of this shock can be established through orbital phase-related variations in UV wind features and optical emission lines. High density regions in the wind (near the photospheres and the shock region) will produce Hα and He I emission which can be used to map out the mass-flow structure of the system. The existence of a shock front between the stars may influence the balance of mass-loss versus mass-transfer in massive binary evolution, as matter lost to one star due to Roche lobe overflow may hit the shock and be deflected before it can accrete onto the other star.

In my dissertation, I report the results of an all-sky, high-resolution spectroscopic survey of 37 massive binaries and identify which show evidence of excess emission. I obtained data in both the southern and northern hemispheres and I have also include d spectra from two other groups of observers, Gies et al. and Kaper et al. For four systems, the detection of Hα emission is new to this survey. I compare my results with two independent surveys of massive stars and find that binaries show a higher incidence and intensity of emission when compared to single stars of similar spectral type. The exact phase of stellar evolution in which colliding winds become significant is uncertain, but my results suggest that one or both stars of a binary system must be evolved off the main sequence to produce measurable colliding wind effects.

Seven systems in my survey (plus four identified by earlier surveys), show significant phase-related variations in emission, and I identify these as likely colliding wind candidates. For three systems, HD 149404, HD 152248, and HD 163181, I present a simple model of the mass distribution and flow based on Hα, ionHe1 λ 6678, and in some cases, the UV resonance lines. HD 152248 and HD 163181 are eclipsing binaries, and I used Hipparcos light-curves to correct for changing continuum flux levels that may have complicated the detection of colliding winds. An argument can be made that all these systems contain a colliding wind bow shock, although more data will be needed to make a conclusive detection.

Thesis done under the direction of Doug Gies at Georgia State University and accepted in December 1997
Copies from `thaller@ipac.caltech.edu`

Meetings

A Small Conference on Eta Carinae

July 19 - 23 , 1998

320 Guest Ranch, Montana (in the Gallatin Canyon, near Yellowstone National Park)

The motivations for a meeting on Eta Carinae at this time are many - the remarkable discoveries in the past few years about the spectrum of the star and its ejecta, its bipolar lobes and mysterious, spray-like equatorial ejecta, its peculiar X-ray behavior in the past several months with an 85 day period, and of course the discovery of a 5.5 year period in its spectroscopic behavior. The latest "spectroscopic event" was expected January and Eta has been living up to all of our expectations and more so the past several weeks. The spectroscopic event began on schedule. The X-ray behavior has been even more dramatic; the flux plummeted drastically a few weeks ago. And there is now credible evidence that the equatorial ejecta dates from 1890(!) not from the great eruption of 1840 (Smith and Gehrz, AJ submitted).

So a meeting on Eta Car a few months after the "event" seems an appropriate time to bring together what we know about Eta, and equally important what we don't understand.

The web page is now ready for registration and with general meeting information:
`http://isis.spa.umn.edu/etamtg/`

Members of the SOC are: Joe Cassinelli(Univ. Wisconsin), Mike Corcoran (NASA- Goddard), Augusto Damineli, (Univ. Colorado and Brazil), Kris Davidson (Univ. Minn.) Reggie Dufour(Rice Univ.), Sveneric Johansson (Lund Univ., Sweden), Peter McGregor(Mt. Stromlo, Australia), Jon Morse (Univ. Colorado), Otmar Stahl(Heidelberg, Germany), Nolan Walborn(STScI), and Patricia Whitelock(SAAO, South Africa).

Local arrangements - in Montana - are being taken care of by Roberta Humphreys(Univ. Minn)

Because we expect this to be a relatively small, topical meeting, we are planning a more informal format organized around discussions of the outstanding questions and problems that can be addressed by the following major areas of investigation:
- The 1997/98 "Spectroscopic Event",
- The X-ray, infrared and radio variability and relation to the 5.5 year period,
- Spectroscopy of the central star and the ejecta, the [Fe II] emission spectrum,
- Imaging and proper motions,
- Hydrodynamic Modelling,
- The origin of the "Great Eruption" and Eta's instability.

There will be a limited number of review talks plus posters with an emphasis on discussion of the questions.

Please send your "expression of interest" to `etamtg@isis.spa.umn.edu`

ESO Conference on:
Chemical Evolution from Zero to High Redshift

A 3-day conference on observational determination and interpretation of chemical abundances and evolution from stars, inter-stellar medium and local group galaxies at zero redshift to distant galaxies, clusters of galaxies and inter-galactic medium at high redshift is to be held in **Garching, Germany on 14-16 October 1998**. The broad aim of the conference is to assess the interplay between methods of measuring chemical abundances with the astrophysical models of galaxy evolution. Particular emphasis is to be given to discussion of the intrinsic uncertainties and merits of the various abundance determination methods, as well as on the prospects for future instrumentation.

Anticipated topics
Solar and Solar System abundances
Agreement between Solar Neighbourhood stellar and ISM abundances
Abundance patterns in the Galaxy and comparison of observations with models
Abundances of integrated populations in the Local Group
Abundance fluctuations and gradients in galaxies
Abundances anomalies in the nearby Universe
Trends in abundances in clusters of galaxies
Abundances from QSO absorption lines
Abundances in high z starburst galaxies
Dust and molecules at high z
New windows - NGST, FIRST, MMA, etc

Scientific Organising Committee
F. Combes (Obs. de Paris, Meudon); D. Garnett (Univ. Minnesota, Minneapolis); G. Kauffmann (MPA, Garching); C. Leitherer (STScI, Baltimore); D. Lennon (Univ. Sternwarte, Munich); J. Mathis [Chair] (Univ. Wisconsin, Madison); M. Pettini (RGO, Cambridge); M. Rosa (ST-ECF, Garching); P. Shaver (ESO, Garching); E. Terlevich (RGO, Cambridge) D. Tytler (Univ. California, San Diego)

Local Organizing Committee
G. Contardo, C. Stoffer, J. R. Walsh (all ESO, Garching)

Contacts:
Further information can be found on the conference Web page:
http://www.eso.org/gen-fac/meetings/chemi98/

Please contact Gertrud Contardo (gcontard@eso.org) for details and registration and John Mathis (mathis@madraf.astro.wisc.edu) for scientific input.