THE M A S S I V E STAR NEWSLETTER

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Accepted Papers

The Missing Luminous Blue Variables and the Bistability Jump

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We discuss an interesting feature of the distribution of luminous blue variables on the H-R diagram, and we propose a connection with the bistability jump seen in the winds of early-type supergiants. There appears to be a deficiency of quiescent LBVs on the S Doradus instability strip at luminosities between $\log(L/L_\odot) \simeq 5.6$ and 5.8. The upper boundary, interestingly, is also where the temperature-dependent S Doradus instability strip intersects the bistability jump at about $T_{\rm eff} \simeq 21\,000$ K. Due to increased opacity, winds of early-type supergiants are slower and denser on the cool side of the bistability jump, and we postulate that this may trigger optically-thick winds that inhibit quiescent LBVs from residing there. We conduct numerical simulations of radiation-driven winds for a range of temperatures, masses, and velocity laws at $\log(L/L_\odot)$=5.7 to see what effect the bistability jump should have. We find that for relatively low stellar masses the order of magnitude increase in the wind density at the bistability jump leads to the formation of a modest to strong pseudo photosphere that might alter a star's apparent position on the HR diagram. The effect is strongest for LBVs

approaching 10 $M_\odot$, where the pseudo-photospheres are sufficiently extended to make an early B-type star appear as a yellow hypergiant. Thus, the proposed mechanism will be most relevant for LBVs that are post-red supergiants (curiously, the upper boundary at $\log(L/L_\odot) \simeq 5.8$ coincides with the upper luminosity limit for red supergiants). Further work is obviously needed, especially with regard to a possible evolutionary connection between the "missing" LBVs and the most luminous red supergiants and yellow hypergiants. Specifically, yellow hypergiants like IRC+10420 and ρ Cas occupy the same luminosity range as the "missing" LBVs, and show apparent temperature variations at constant luminosity. If these yellow hypergiants do eventually become Wolf-Rayet stars, we speculate that they may skip the normal LBV phase, at least as far as their *apparent* positions on the HR diagram are concerned.

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Preprints from nathans@colorado.edu

Detection of He II λ4686 Å in η Carinae

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We report the detection of the emission line He II λ4686 Å in η Carinae. The equivalent width of this line is $\sim$100 mÅ along most of the 5.5–yr cycle and jumps to $\approx$900 mÅ just before phase 1.0, followed by a brief fading. We also find some evidence that a fraction of this emission is spatially extended. The similarity between the intensity variations of this line and of the X–ray light curve is remarkable, suggesting that they are physically connected. We show that the expected number of ionizing photons in the ultraviolet and soft X–rays expected to be emitted in the shock wave from the colliding winds is of the order of magnitude required to produce the He II emission via photoionization. The radial velocity of this line is $\sim$–100 Km s^{-1} outside the event, decreasing steadily just before the event, reaching –400 Km s^{-1} at ϕ =1.001. At this point, it suddenly reverses, reaching +20 Km s^{-1} in a mere week, at the same time that the emission intensity drops suddenly. We propose that the He II is emitted in the portion of the wind of the secondary star that is more directly exposed to the ionizing emission from the shock wave. The He II λ4686 Å seems to be eclipsed at ϕ =1.001, causing the rapid changes in velocity and intensity. The timing of peak of He II intensity is likely to be associated to the periastron and may be a reliable fiduciary mark, important for constraining the orbital parameters.

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For preprints, contact http://www.astro.iag.usp.br/texts/etacar_heII.pdf

New estimates of the contribution of Wolf–Rayet stellar winds to the Galactic ^{26}Al

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We present new yields of ^{26}Al from Wolf–Rayet stellar winds based on rotating stellar models which account well for numerous observed properties of massive stars. We study the impacts on the yields of a change of initial mass, metallicity and initial rotation velocity. We also consider the effects of a change of mass loss rates during the Wolf–Rayet phase.

We show that for surface rotation velocities during the core H–burning phase matching to the observed ones, the quantity of ^{26}Al ejected by a star of a given initial mass and metallicity is roughly doubled when the effects of rotation are taken into account. The metallicity dependence of the yield is, on the other hand, very similar to that obtained from non–rotating models.

We estimate that *at least* about 20% to 50% (e.g. $\sim 0.6 - 1.4$ M$_\odot$) of the live ^{26}Al detected in the Milky–Way originates from Wolf–Rayet stellar winds. We show the importance of a good knowledge of the present metallicity gradient and star formation rate in our galaxy for modeling both the variation of the ^{26}Al surface density with the galactocentric distance and the global contribution of the Wolf–Rayet stellar winds to the present galactic mass of ^{26}Al.

Accepted by Astronomy and Astrophysics
Preprints from palacios@astro.ulb.ac.be
or on the web at http://arxiv.org/abs/astro-ph/0409580

The ultraviolet and optical spectra of luminous B-type stars in the Small Magellanic Cloud

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We present ultraviolet spectra from the Space Telescope Imaging Spectrograph (STIS) of 12 early B-type stars in the Small Magellanic Cloud (SMC), comprising 9 supergiants and 3 giants. A morphological comparison with Galactic analogues is made using archival data from the International Ultraviolet Explorer (IUE). In general, the intensity of the P Cygni emission in the UV resonance lines is greater, and seen to later spectral types, in the Galactic spectra than in their metal-deficient SMC counterparts; we attribute these effects as most likely arising from weaker stellar winds in the SMC targets, as predicted by radiatively driven wind theory.

We also include unpublished STIS observations of two late O-type stars in the SMC. In combination with the B-type observations, and published O-type data, we now have an extensive ultraviolet spectral library of metal-deficient stars, of use in the study of unresolved starbursts and high redshift, star-forming galaxies. In this context, we present empirical measurements for the B-type spectra of the new '1978 index' suggested by Rix et al. as a probe of metallicity in such systems.

Accepted by PASP *For preprints, contact* cje@ing.iac.es
Preprints available from http://www.ing.iac.es/∼cje/bstars.ps.gz

Accretion Signatures from Massive Young Stellar Objects

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High resolution ($\lambda/\Delta\lambda$ = 50,000) $K-$band spectra of massive, embedded, young stellar objects are presented. The present sample consists of four massive young stars located in nascent clusters powering Galactic giant H II regions. Emission in the 2.3 μm 2–0 vibrational–rotational bandhead of CO is observed. A range of velocity broadened profiles seen in three of the objects is consistent with the emission arising from a circumstellar disk seen at various inclination angles. Brγ spectra of the same spectral and spatial resolution are also presented which support an accretion disk or torus model for massive stars. In the fourth object, Br emission suggesting a rotating torus is observed, but the CO profile is narrow, indicating that there may be different CO emission mechanisms in massive stars and this is consistent with earlier observations of the BN object and MWC 349. To–date, only young massive stars of late O or early B types have been identified with clear accretion disk signatures in such embedded clusters. Often such stars are found in the presence of other more massive stars which are revealed by their photospheric spectra but which exhibit no disk signatures. This suggests the timescale for dissipating their disks is much faster than the less massive OB stars or that the most massive stars do not form with accretion disks.

Accepted by the Astrophysical Journal

Preprints: `http://xxx.lanl.gov/abs/astro-ph/0409190`

On the importance of the few most massive stars: the ionizing cluster of NGC 588

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We present the results of a double analysis of the ionizing cluster in NGC 588, a giant HII region (GHR) in the outskirts of the nearby galaxy M33. For this purpose, we obtained ground based long-slit spectroscopy and combined it with archival ground based and space borne imaging and spectroscopy, in the wavelength range 1100–9800 Å. A first modeling of the cluster was performed using integrated properties, such as the spectral energy distribution (SED), broad band colors, nebular emission Hβ equivalent width, the main ultraviolet resonance lines, and the presence of Wolf-Rayet star features. By applying standard assumptions about the initial mass function (IMF), we were unable to fit satisfactorily these observational data. This contradictory result led us to carry out a second modeling, based on a resolved photometric analysis of individual stars in Hubble Space Telescope (HST) images, by means of finding the best fit isochrone in color-magnitude diagrams (CMD), and assigning a theoretical SED to each individual star. The overall SED of the cluster, obtained by integrating the individual stellar SEDs, is found to fit better the observed SED than the best solution found through the integrated first analysis, but at a significantly later stage of evolution of the cluster

of 4.2 Myr, as obtained from the best fit to the CMD. A comparative analysis of both methods traces the different results to the effects of statistical fluctuations in the upper end of the IMF, which are significant in NGC 588, with a computed cluster mass of 5600 $M_\odot$, as predicted by Cerviño et al. (2002). We discuss the results in terms of the strong influence of the few most massive stars, six in the case of NGC 588, that dominate the overall SED and, in particular, the ionizing far ultraviolet range beyond the Lyman limit.

Accepted by A&A *For preprints, contact* Luc.Jamet@obspm.fr
Preprints are available in PS format at
http://luth2.obspm.fr/ etu/jamet/publications.html

The Influence of Binaries on Galactic Chemical Evolution

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Understanding the galaxy in which we live is one of the great intellectual challenges facing modern science. With the advent of high quality observational data, the chemical evolution modeling of our galaxy has been the subject of numerous studies in the last years. However, all these studies have one missing element which is *the evolution of close binaries*. Reason: their evolution is very complex and single stars only perhaps can do the job. (Un)Fortunately at present we know that the majority of the observed stars are members of a binary or multiple system and that certain objects can only be formed through binary evolution. Therefore galactic studies that do not account for close binary evolution may be far from realistic.
Because of the large expertise developed through the years in stellar evolution in general and binary evolution in particular at the Brussels Astrophysical Institute, we found ourselves in a privileged position to be the first to do chemical evolutionary simulations with the inclusion of detailed binary evolution. The complexity of close binary evolution has kept many astronomers from including binary stars into their studies. However, it is not always the easiest way of living that gives you the most excitement and satisfaction.

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Massive Star Populations in Wolf-Rayet Galaxies

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We analyze longslit spectral observations of fourteen Wolf-Rayet galaxies from the sample of Schaerer, Contini & Pindao (1999). All 14 galaxies show broad Wolf-Rayet emission in the blue region of the spectrum, consisting of a blend of NIII4640, CIII4650, CIV4658, and HeII4686 emission lines, which is a spectral characteristic of WN stars. Broad CIV5808 emission, termed the red bump, is detected in 9 galaxies and CIII5996 is detected in 6 galaxies. These emission features are due to WC stars. We derive the numbers of late WN and early WC stars from the luminosity of the blue and red bumps, respectively. The number of O stars is estimated from the luminosity of the Hbeta emission line, after subtracting the contribution of WR stars. The Schaerer & Vacca 1998 (hereafter SV98) models predict that the number of WR stars relative to O stars, N_{WR}/N_O, increases with metallicity.

For low metallicity galaxies, the results agree with predictions of evolutionary synthesis models for galaxies with a burst of star formation, and indicates an IMF slope -2 < Gamma < -2.35 in the low metallicity regime. For high metallicity galaxies our observations suggest a Salpeter IMF (Gamma = -2.35) and an extended short burst. The main possible sources of error are the adopted luminosities for single WCE and WNL stars. We also report, for the first time, NGC 450 as a galaxy with WR characteristics.

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Web: `http://arxiv.org/abs/astro-ph/0409114`

Effects of Metallicity on the Rotation Rates of Massive Stars

Laura R. Penny, Amanda J. Sprague, George Seago, Douglas R. Gies

Recent theoretical predictions for low metallicity massive stars predict that these stars should have drastically reduced equatorial winds (mass loss) while on the main sequence, and as such should retain most of their angular momentum. Observations of both the Be/(B+Be) ratio and the blue-to-red supergiant ratio appear to have a metallicity dependence that may be caused by high rotational velocities. We have analyzed 39 archival Hubble Space Telescope Imaging Spectrograph (STIS), high resolution, ultraviolet spectra of O-type stars in the Magellanic Clouds to determine their projected rotational velocities V sin i. Our methodology is based on a previous study of the projected rotational velocities of Galactic O-type stars using International Ultraviolet Explorer (IUE) Short Wavelength Prime (SWP) Camera high dispersion spectra, which resulted in a catalog of V sin i values for 177 O stars. Here we present complementary V sin i values for 21 Large Magellanic Cloud and 22 Small Magellanic Cloud O-type stars based on STIS and IUE UV spectroscopy. The distribution of V sin i values for O type stars in the Magellanic Clouds is compared to that of Galactic O type stars. Despite the theoretical predictions and indirect observational evidence for high rotation, the O type stars in the Magellanic Clouds do not appear to rotate faster than their Galactic counterparts.

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A Spectroscopic study of the non-thermal radio emitter Cyg OB2 #8A: Discovery of a new binary system

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We present the results of a spectroscopic campaign revealing that the non-thermal radio emitter Cyg OB2 #8A is an O6 + O5.5 binary system. We propose the very first orbital solution indicating a period of about 21.9 days. The system appears to be eccentric (0.24 ± 0.04) and is likely seen under a rather low inclination angle. The mass ratio of the components is close to unity. The impact of the binarity of this star in the framework of our understanding of non-thermal radio emission from early-type stars is briefly discussed.

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or by anonymous ftp to `http://vela.astro.ulg.ac.be/Preprints/P93/index.html`
or on the web at `http://arxiv.org/abs/astro-ph/0408027`

Line profile variability in the spectra of Oef stars: II. HD 192281, HD 14442 and HD 14434

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We present the very first analysis of the spectroscopic variability of the three rapidly rotating Oef stars HD 192281 (O5(ef)), HD 14442 (O5.5ef) and HD 14434 (O6.5(ef)). Radial velocities of the HeII λ 4541 line reveal no evidence of binarity on time scales of a few days, or from one year to the next, for any of the targets. The HeII λ 4686 double-peaked emission and, to some extent, the Hβ absorption line display significant profile variability in the spectra of all three stars. Data gathered during different observing runs spread over six years reveal a rather stable time scale for HD 192281 and HD 14442, whereas the variability pattern changes significantly from one year to the other. The case of HD 14434 is less clear as no obvious time scale emerges from our analysis. In a tentative way to interpret this variability, stellar rotation remains a possible clock for HD 192281 and HD 14442. However, currently available models addressing stellar rotation fail to explain some crucial aspects of the observed variability behaviour, which appear to be even more complex in the case of HD 14434.

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Submitted Papers

On the multiplicity of the O-star Cyg OB2 #8A and its contribution to the γ-ray source 3EG J2033+4118

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We present the results of an intensive spectroscopic campaign in the optical waveband revealing that Cyg OB2 #8A is an O6 + O5.5 binary system with a period of about 21.9 d. Cyg OB2 #8A is a bright X-ray source, as well as a non-thermal radio emitter. We discuss the binarity of this star in the framework of a campaign devoted to the study of non-thermal emitters, from the radio waveband to γ-rays. In this context, we attribute the non-thermal radio emission from this star to a population of relativistic electrons, accelerated by the shock of the wind-wind collision. These relativistic electrons could also be responsible for a putative γ-ray emission through inverse Compton scattering of photospheric UV photons, thus contributing to the yet unidentified EGRET source 3EG J2033+4118.

To appear in the proceedings of the conference on *The Multiwavelength Approach to Unidentified Gamma-Ray Sources*, **Ap&SS**

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or on the web at http://arxiv.org/abs/astro-ph/0407641

Presupernova Evolution of Differentially Rotating Massive Stars Including Magnetic Fields

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As a massive star evolves through multiple stages of nuclear burning on its way to becoming a supernova, a complex, differentially rotating structure is set up. Angular momentum is transported by a variety of classic instabilities, and also by magnetic torques from fields generated by the differential rotation. We present the first stellar evolution calculations to follow the evolution of rotating massive stars including, at least approximately, all these effects, magnetic and non-magnetic, from the zero-age main sequence until the onset of iron-core collapse. The evolution and action of the magnetic fields is as described by Spruit (2002) and a range of uncertain parameters is explored. In general, we find that magnetic torques decrease the final rotation rate of the collapsing iron core by about a factor of 30 to 50 when compared with the non-magnetic counterparts. Angular momentum in that part of the presupernova star destined to become a neutron star is an increasing function of main sequence mass. That is, pulsars derived from more massive stars will rotate faster and rotation will play a more dominant role in the star's explosion. The final angular momentum of the core is determined - to within a factor of two - by the time the star ignites carbon burning. For the lighter stars studied, around $15\,\mathrm{M}_\odot$, we predict pulsar periods at birth near 15 ms, though a factor of two range is easily tolerated by the uncertainties. Several mechanisms for additional braking in a young neutron star, especially by fall back, are also explored.

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or on the web at http://arxiv.org/abs/astro-ph/0409422

A Period and a Prediction for the Of?p Spectrum Alternator HD 191612

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The observational picture of the enigmatic O-type spectrum variable HD 191612 has been sharpened substantially. A symmetrical, low-amplitude light curve with a period near 540 d has been found from *Hipparcos* photometry. This period satisfies all of the spectroscopy since at least 1982, including extensive new observations during 2003 and 2004, and it predicts that the next transition will occur in October 2004. Measurements of the Hα equivalent width reveal a sharp emission peak in the phase diagram, in contrast to the apparently sinusoidal light curve. The He II absorption-line strength is essentially constant, while He I varies strongly, possibly filled in by emission in the O6 state, thus producing the apparent spectral-type variations. The O8 phase appears to be the "normal" state. Two intermediate O7 observations have been obtained, which fall at the expected phases, but these are the only modern observations of the transitions to date. The period is too long for rotation or pulsation; although there is no direct evidence as yet for a companion, a model in which tidally induced oscillations drive an enhanced wind near periastron in an eccentric orbit appears promising. Further observations during the now predictable transitions may provide a critical test. Ultraviolet and X-ray observations during both states will likely also prove illuminating.

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Preprints from walborn@stsci.edu
or on the web at http://arxiv.org/abs/astro-ph/0409199

In Proceedings

X-ray and Radio Emission from Colliding Stellar Winds

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The collision of the hypersonic winds in early-type binaries produces shock heated gas, which radiates thermal X-ray emission, and relativistic electrons, which emit nonthermal radio emission. We review our current understanding of the emission in these spectral regions and discuss models which have been developed for the interpretation of this emission. Physical processes which affect the resulting emission are reviewed and ideas for the future are noted.

To appear in the Proceedings of "X-Ray and Radio Connections", Santa Fe, NM, 3-6 February, 2004
Preprints from jmp@ast.leeds.ac.uk

The evolution of massive stars: a selection of facts and questions

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In the present paper we discuss a selection of facts and questions related to observations and evo-

lutionary calculations of massive single stars and massive stars in interacting binaries. We focus on the surface chemical abundance's, the role of stellar winds, the early Be-stars, the high mass X-ray binaries, the effects of rotation on stellar evolution. Finally, we present an unconventionally formed object scenario (*UFO-scenario*) of WR binaries in dense stellar

Review presented at the meeting Massive Stars in Interacting Binaries, Sacacomie, 16-20 August 2004
Preprints from dvbevere@vub.ac.be

The effects of stellar dynamics on the evolution of young dense stellar systems

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In the present paper we report on first results of a project in Brussels where we study the effects of stellar dynamics on the evolution of young dense stellar systems using the 3 decades expertise in massive star evolution and our population (number and spectral) synthesis code. We highlight an unconventionally formed object scenario (*UFO-scenario*) for Wolf Rayet binaries and study the effects of a luminous blue variable-type instability wind mass loss formalism on the formation of intermediate mass black holes.

Paper presented at the meeting Massive Stars in Interacting Binaries, Sacacomie, 16-20 August
Preprints from dvbevere@vub.ac.be

The effects of binaries on population studies of stars and stellar phenomena

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The effects of binaries on population studies of stars and stellar phenomena have been investigated over the past 2 decades by many research groups. Here we will focus mainly on the work that has been done in Brussels and we will consider the following topics:

- the effect of binaries on overall galactic chemical evolutionary models
- the effect of binaries on the rates of different types of supernova
- binary evolution and the population of high mass X-ray binaries
- the maximum black hole mass predicted by conventional massive star evolution
- an unconventionally formed object scenario (*UFO-scenario*) for WR+OB binaries in dense stellar environments.
- the effect of rotation on population studies.

Invited paper presented at the meeting Interacting Binaries: Accretion, Evolution and Outcomes, Cefalu, Italy, 4-10 July 2004
Preprints from dvbevere@vub.ac.be

Centrifugal Breakout of Magnetically Confined Winds

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We present 2D MHD simulations of radiatively driven winds from a hot star having a dipole magnetic field aligned with the star's rotation axis. We focus in particular on a model with a moderately rapid rotation (about half the critical value), and also a strong magnetic confinement parameter, $\eta_* \equiv B_{\rm eq}^2 R_* 2/\dot{M} v_\infty = 600$. The magnetic field channels and torques the wind outflow into an equatorial, rigidly rotating disk extending from near the Keplerian co-rotation radius outwards. The strong centrifugal force on material in the outer edge of this disk stretches the magnetic loops, leading to episodic breakout of mass when the field reconnects. The associated dissipation of magnetic energy heats material to temperatures of nearly 10^8 K, high enough to emit hard (several keV) X-rays. Such *centrifugal mass ejection* represents a novel mechanism for explaining X-ray flares recently observed in the magnetic Bp star σ Ori E.

To be published in the conference proceedings on Hot Star Disks held in Johnson City, TN, 2004.

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Jobs

Tenure Track Astronomy Position
University of Toledo

The Department of Physics & Astronomy at the University of Toledo invites applications for a tenure-track position at the Assistant Professor level, to begin in August 2005. We are seeking an astronomer with expertise in star formation and infrared observations who can complement existing theoretical and observational efforts in astronomy and astrophysics. This position is the first of three planned new hires in astronomy/astrophysics over the next three years. Faculty members in the department are expected to develop strong externally-funded research programs which involve both graduate and undergraduate students. A Ph.D. in astronomy, astrophysics, or physics, plus postdoctoral experience, is required. An established history of external funding would be a plus. Successful applicants will be expected to demonstrate excellent teaching and communication skills and a commitment to quality teaching at all levels, including the introductory level. We particularly encourage applications from women and minority candidates.

Questions or requests for further information about the position may be addressed to Prof. Karen Bjorkman, Search Committee Chair (karen@astro.utoledo.edu). Prospective applicants can learn more about the department from our web page, http://www.physics.utoledo.edu , and information about the university, http://www.utoledo.edu . Applicants should submit a curriculum vitae, research and teaching statements, and the names, addresses (including e-mail), and phone numbers of at least three references to: Chair, Astrophysics Faculty Search Committee, Dept. of Physics & Astronomy, MS #111, University of Toledo, Toledo, OH 43606-3390.

The application deadline is January 20, 2005.

The University of Toledo is an Equal Access, Equal Opportunity, Affirmative Action Employer and Educator

Postdoctoral Positions in Theoretical Astrophysics
Los Alamos National Laboratory

Los Alamos National Laboratory
Theoretical Astrophysics Group, MS B227
Los Alamos, NM 87545
USA
Tel: 505-667-7380
FAX: 505-664-0007
URL1:http://qso.lanl.gov/
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The closing date for receipt of applications: 11/15/2004

The Theoretical Astrophysics group (T-6) at Los Alamos National Laboratory seeks candidates for several postdoctoral positions in theoretical and computational astrophysics. We have research programs in the fields of: formation and evolution of stars of all mass ranges; planets; core collapse and thermonuclear supernovae; compact objects including general relativistic phenomena, x-ray bursts, gamma-ray bursts, and active galactic nuclei; nuclear astrophysics; gravitational waves; gravitational lensing; and large-scale structure and cosmology. Physics expertise and interests range from magneto- and radiation hydrodynamics, to nuclear and dense matter physics, to cosmic magnetic fields and numerical relativity and gravitational N-body algorithms. We are currently starting a program on the formation, evolution, and nucleosynthesis of the first stars with emphasis on collapse of massive stars and their explosions that includes modeling of a MHD accretion disk around a black hole. Postdocs will have access to the vast computing resources at the lab, including the group's Beowulf cluster. LANL is a member of the Sloan Digital Sky Survey and the Joint Institute for Nuclear Astrophysics, and has a rich community of theoretical and observational astrophysicists and space science efforts beyond the theoretical astrophysics group. Joint appointments with other groups are available.

The initial appointments will be for two years, with a possible extension to a third year. Appointments carry a generous salary and an annual budget of $10,000 for equipment and travel. Outstanding candidates will also be considered for appointment as director-funded or named postdoctoral fellows. Details on appointments and salaries can be found at http://lanl.gov/science/postdocs. Starting dates can be as early as January 2005. Interested applicants must be within 5 years of their PhD at the time of appointment and should submit a CV and a statement of research interests and should arrange for three letters of reference to be sent to the address above and should also submit their data through the LANL online application system at http://www.hr.lanl.gov/FindJob/PostdocAppProcedures.shtml . Applications received by November 15, 2004 will be given first consideration.

Meetings

IAU Symposium 227
Massive Star Birth: A Crossroads of Astrophysics
May 16–20, 2005
Acireale (Catania), Italy

Scientific Organizing Committee

Ed Churchwell (USA) - Co-Chair; Peter S. Conti (USA) - Co-Chair; Philippe Eenens (Belgium/Mexico); Marcello Felli (Italy); Yasuo Fukui (Japan); Guido Garay (Chile); Suzana Lizano (Mexico); Malcolm Walmsley (Italy); Hans Zinnecker (Germany).

Local Organizing Committee

Marcello Felli (Italy) Chair; Riccardo Cesaroni (Italy); Corrado Trigilio (Italy); Grazia Umana (Italy).

Co-Editors of Proceedings: M. Walmsley and E. Churchwell

This IAU sponsored symposium will consider Massive Star Formation (MSF) from the perspective of their gas and dust *environments*, the physics of their *formation*, their initial phases of *evolution*, and their connections to *star birth clusters*. We will bring together astronomers from several disparate communities: interstellar medium, stellar astrophysics, stellar dynamics, and star formation in galaxies. Observations from a wide range of energies will be considered, including X-rays, optical, IR, and radio wavelengths. Related theoretical studies will be included, as will new and relevant data from the SPITZER mission.

We believe that: a better understanding of the problems of MSF can be achieved; an assessment of where we are in solving those problems will result; ideas for future programs to attack remaining issues will follow.

Unlike other fields of stellar astrophysics, MSF is nearly entirely hidden from view in the visible but amenable to observation at hard X-Ray, IR, mm, and radio wavelengths. These observations typically deal with the surrounding ionized medium and the natal dust clouds from which the properties of the underlying newly born stars need to be inferred. This conference will specifically consider massive star birth processes in terms of the evolution of the newly born stellar object and that of its environment.

Two competing hypotheses have been proposed for massive star birth; accretion of ambient gas in molecular cores and mergers of intermediate mass protostars. In this meeting, we plan to asses the observational and theoretical evidence of the role of these two processes, as well as to discuss issues such as the evolutionary sequence from Starless Molecular Cores, to Hot Molecular Cores, to Hypercompact HII regions, to Ultracompact HII regions, to Classical HII regions.

We also plan to address other important topics outlined in the program below.

Organization of the symposium

The symposium will consist of four and one-half days of meetings, from 08:30 to 18:30, with two one-half hour coffee breaks and three hours for lunch. Invited Talks of 30 minutes length each and Contributed Talks of 20 minutes length each will be scheduled. Posters will provide an important part of the presentations. The following draft of the program with the tentative Invited Talks is given to provide a framework of the main threads of the conference. The topics listed already have tentative speakers associated but they have not all been contacted as yet. Contributed talks are welcomed.

Outline of program

I. Introductory Framework

The Role of Massive Stars in Astrophysics; Orion, The Nearest MS Birth Region; MS Birth in the Galactic Center

II. Star Birth Sequence: The Natal Precursors

Initial Conditions for MS Birth; Ices as Tracers of MS Birth; Chemistry of the Molecular Cores; The Role of Magnetic Fields on MSF; Hot Molecular Cores; Formation of Discs; The Disc-Jet Connection; Dissipation of Stellar Disks; Hypercompact HII Regions; Radio Observations of UCHII Regions; Spitzer Observations of MSF Regions

III. Star Birth Sequence: The Stars

Stellar Evolution Before the ZAMS; Protostellar SEDs and IR Colors; Accretion Processes; Binary Mergers; Masive Star Outflows; Jets from YSOs; Chandra Observations of MSF; X-Ray Studies of MSF; Parameters of ZAMS Stars; Parameters of Massive YSOs; Winds in ZAMS O Stars

IV. Star Birth in a Cluster Environment

Clustered Massive Star Birth Cluster Formation in Molecular Clouds; MolecularCores/Clusters in the MCs; Turbulence and Star Birth; Infrared Studies of Newly Formed Clusters; IR Observations of UC HII Regions; Protoclusters: Massive Star Birth; NIR Studies of GHII Region Clusters; Super Star Clusters: Implication for MSF; Upper Mass Limit in Clusters; Population III stars

V. Conference Summary: What have we learned? What are the main unsolved problems? Where do we go from here?

Natal Molecular Clouds; Massive Star Birth Sequence; Star Birth in Clusters

Accommodation

The Symposium will be hosted in the Congress Center "La Perla Ionica"

http://www.laperlaionica.com/ITA/homepage.htm

in Sicily (Italy), in the town of Acireale, close to Catania. The place is a quiet and pleasant resort on the Ionic Coast, not far from Taormina and at the foot of the Etna Volcano. The Congress Center offers a range of room rates.

Iau grants

A limited number of IAU grants for individual participants will be available. The IAU grants can be used primarily for room and board of candidates unable to provide this by themselves. The application form for an IAU grant can be found in http://www.iau.org/IAU/Activities/meetings/travappl.html and should be submitted by e-mail or regular mail to:

Ed Churchwell, Washburn Observatory, University of Wisconsin-Madison, 475 North Charter Street, Madison, Wisconsin 53706, U.S.A.
(churchwell@astro.wisc.edu)

The deadline for application to an IAU grant is November 30 2004.

Registration

Registration is possible through the symposium web site:

http://www.arcetri.astro.it/iaus227