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Editors: Jacco van Loon and Albert Zijlstra

Marie-Odile MENNESSIER (1940-2004)

Marie-Odile Mennessier passed away on December 15, 2004 at the age of 64. After graduating in Applied Mathematics, she started her career in Astronomy at Paris Observatory where, under the guidance of Jean Delhaye, she prepared a PhD on the statistical exploitation of proper motions and radial velocities of stars in the solar vicinity. Then, she worked in kinematics and dynamics of galactic stars. Later she concentrated on AGB stars with the aim of characterizing their properties (age, mass, luminosity, etc.).

She had been deeply involved in the Hipparcos mission, and, in particular she had been in charge of the ephemerides needed to observe Long Period Variables. For that task, she used to coordinate ground-based observations obtained by many different groups, including amateurs and professionals. She also developed innovative methods to predict the magnitudes of stars at the exact times they were observed by Hipparcos. After the satellite launch, she used to continuously update these ephemerides by incorporating recently acquired data. Thanks to her efforts Hipparcos delivered to the astronomical community more reliable astrometric data for AGB stars.

In 1977, she moved to Montpellier, in Southern France, where she initiated a group working on AGB stars. This group grew under her leadership, and had become an active and important center (GRAAL) at the time she left the direction in 1998. Within France she supported this field of research by organizing meetings between people dispersed among several different institutes and by weaving a network of scientists working on AGB stars. She also developed many international collaborations, in particular with the late Janet Mattei. Under her impulse, two international conferences on AGB stars were held in Montpellier, firstly in 1989 "From Miras to planetary nebulae: Which path for stellar evolution?", then in 1998 "Asymptotic Giant Branch Stars", the first I.A.U. Symposium entirely devoted to AGB stars, both very successful.

In the last years, she had invested her energy in building a data base on AGB stars, called ASTRID, with a structure inspired by biologists. She was caught prematurely by an heart attack, while in full activity on ASTRID. She was a very engaging person, open minded, and particularly helpful to young scientists. It is with a great emotion that her friends and collaborators learned her sudden departure.

Ana Gómez and Thibaut Le Bertre

Editorial

We would like to express our thanks to Ana and Thibaut for writing an obituary for Marie-Odile Mennessier, whose life we celebrate. She gave our science a human face.

This 113$^{\rm th}$ issue of the AGB Newsletter features an especially large variety of contributions, starting with progress in unravelling the sequences observed in the period-luminosity diagram and important detections of neutral hydrogen in circumstellar environments. Several papers discuss exciting results on the white dwarf end products, such as the accretion of asteroids and the formation of very massive white dwarfs including super-Chandrasekhar-mass objects detonating as supernovae of Type Ia.

Also, don't miss the job advertisements for tenure-track positions at the University of Denver and the University of Hong Kong.

The next issue will be distributed on the 2$^{\rm nd}$ of November; the deadline for contributions is the 1$^{\rm st}$ of November.

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

Long Secondary Periods in red giant variables are caused by pulsation

Reactions to this statement or suggestions for next month's statement can be e-mailed to agbnews@astro.keele.ac.uk (please state whether you wish to remain anonymous)

Refereed Journal Papers

Ellipsoidal Variability and Long Secondary Periods in MACHO Red Giant Stars

A. Derekas[1]*, L.L. Kiss*[1]*, T.R. Bedding*[1]*, H. Kjeldsen*[2]*, P. Lah*[3] *and Gy.M. Szabó*[4,5]

[1]School of Physics, University of Sydney, NSW 2006, Australia

[2]Department of Physics and Astronomy, University of Aarhus, DK-8000 Aarhus C, Denmark

[3]Research School of Astronomy & Astrophysics, Australian National University, Canberra, Australia

[4]Department of Experimental Physics, University of Szeged, Dóm tér 9. Szeged 6720, Hungary

[5]Magyary Zoltán Postdoctoral Research Fellow

We present a period-luminosity-amplitude analysis of 5899 red giant and binary stars in the Large Magellanic Cloud, using publicly available observations of the MACHO project. For each star, we determined new periods, which were double-checked in order to exclude aliases and false periods. The period-luminosity relations confirm the existence of a short-period, small-amplitude P-L sequence at periods shortward of Seq. A. We point out that the widely accepted sequence of eclipsing binaries between Seqs. C and D, known as Seq. E, does not exist. The correct position for Seq. E is at periods a factor of two greater, and the few stars genuinely lying between Seq. C and D are under-luminous Mira variables, presumably enshrouded in dust. The true Seq. E overlaps with the sequence of Long Secondary Periods (Seq. D) and their P-L relation is well described by a simple model assuming Roche geometry. The amplitudes of LSPs have properties that are different from both the pulsations and the ellipsoidal variations, but they are more similar to the former than the latter, arguing for pulsation rather than binarity as the origin of the LSP phenomenon.

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H I in circumstellar environments

E. Gérard[1] *and T. Le Bertre*[1]

[1]GEPI, UMR 8111, Observatoire de Paris, 5 place J. Janssen, F-92195 Meudon Cedex, France

[2]LERMA, UMR 8112, Observatoire de Paris, 61 av. de l'Observatoire, F-75014 Paris, France

We present new results of a spectroscopic survey of circumstellar H I in the direction of evolved stars made with the Nançay Radiotelescope. The H I line at 21 cm has been detected in the circumstellar shells of a variety of evolved stars: AGB stars, oxygen-rich and carbon-rich, Semi-Regular and Miras, and Planetary Nebulae. The emissions are generally spatially resolved, i.e. larger than $4'$, indicating shell sizes of the order of 1 pc which opens the possibility to trace the history of mass loss over the past $\sim 10^4 - 10^5$ years. The line-profiles are sometimes composite. The individual components have generally a quasi-Gaussian shape; in particular they seldom show the double-horn profile that would be expected from the spatially resolved optically thin emission of a uniformly expanding shell. This probably implies that the expansion velocity decreases outwards in the external shells (0.1–1 pc) of these evolved stars.
The H I line-profiles do not necessarily match those of the CO rotational lines. Furthermore, the centroid velocities do not always a gree with those measured in the CO lines and/or the stellar radial velocities. The H I emissions may also be shifted in position with respect to the central stars. Without excluding the possibility of asymmetric mass ejection, we suggest that these two effects could also be related to a non-isotropic interaction with the local interstellar medium.
H I was detected in emission towards several sources (ρ Per, α Her, δ^2 Lyr, U CMi) that otherwise have not been detected in any radio lines. Conversely it was not detected in the two oxygen-rich stars with substantial mass-loss rate, NML Tau and WX Psc, possibly because these sources are young with hydrogen in molecular form, and/or because the temperature of the circumstellar H I gas is very low (< 5 K).

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Available from astro-ph/0609022

Water maser observations of R Doradus and W Hydrae

J.M. Oliveira[1], *J.Th. van Loon*[1], *S. Stanimirović*[2] *and A.A. Zijlstra*[3]

[1]School of Physical and Geographical Sciences, Lennard-Jones Laboratories, Keele University, Staffordshire ST5 5BG, UK

[2]Radio Astronomy Lab, University of California at Berkeley, 601 Campbell Hall, Berkeley CA 94720, USA

[3]Department of Physics and Astronomy, University of Manchester, Sackville Street, P.O.Box 88, Manchester M60 1QD, UK

In an appendix to the paper "Massive Young Stellar Objects in the Large Magellanic Cloud: water masers and ESO-VLT 3–4 μm spectroscopy" we present new water maser observations of the nearby galactic red giants R Doradus and W Hydrae. The data on R Doradus shows variability on a timescale of a week in part of the line profile, and the line profile is compared with those observed one year and 25 years previously. The line profile of W Hydrae suggests a combination of radial and tangential amplification. In both cases we estimate wind velocities of 2–4 km s^{-1} in the water masing zone increasing to ~ 6 km s^{-1} in the outer wind as traced by CO emission.

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Lithium and zirconium abundances in massive Galactic O-rich AGB stars

D.A. García-Hernández[1], *P. García-Lario*[1,2], *B. Plez*[3], *A. Manchado*[4,5], *F. D'Antona*[6], *J. Lub*[7] *and H. Habing*[7]

[1]ISO Data Centre, Research and Scientific Support Department of ESA. European Space Astronomy Centre (ESAC), Villafranca del Castillo. P.O. Box 50727. E-28080 Madrid, Spain

[2]Herschel Science Centre, Research and Scientific Support Department of ESA. European Space Astronomy Centre (ESAC), Villafranca del Castillo. P.O. Box 50727. E-28080 Madrid, Spain

[3]GRAAL, CNRS UMR 5024, Université de Montpellier 2, F-34095 Montpellier Cedex 5, France

[4]Instituto de Astrofísica de Canarias, La Laguna, E-38200, Tenerife, Spain

[5]Consejo Superior de Investigaciones Científicas (CSIC), Spain

[6]Osservatorio Astronomico di Roma, via Frascati 33, I-00040 MontePorzio Catone, Italy

[7]Sterrewacht Leiden, Niels Bohrweg 2, NL-2333 RA Leiden, The Netherlands

Lithium and zirconium abundances (the latter taken as representative for s-process enrichment) are determined for a large sample of massive Galactic O-rich AGB stars, for which high resolution optical spectroscopy has been obtained (R∼40,000−50,000). This is done by computing synthetic spectra based on classical hydrostatic model atmospheres for cool stars using extensive line lists. The results obtained are discussed in the framework of "hot bottom burning" (HBB) and nucleosynthesis models. The complete sample is studied attending to various observational properties such as the position of the stars in the IRAS two-colour diagram ([12] − [25] *vs* [25] − [60]), Galactic distribution, expansion velocity (derived from the OH maser emission) and period of variability (when available). We conclude that a considerable fraction of the sources observed are actually massive AGB stars ($M > 3$–4 $M_{\odot}$) experiencing HBB, as deduced from the strong Li overabundances found. A comparison of our results with similar studies carried out in the past for the Magellanic Clouds (MCs) reveals that, in contrast to MC AGB stars, our Galactic sample does not show any indication of s-process element enrichment. The differences observed are explained as a consequence of metallicity effects. Finally, we discuss the results obtained in the framework of stellar evolution by comparing our results with the data available in the literature for Galactic post-AGB stars and PNe.

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Carbon-Deficiency in Externally-Polluted White Dwarfs: Evidence for Accretion of Asteroids

M. Jura[1]

[1]UCLA, USA

Existing determinations shows that n(C)/n(Fe) is more than a factor of 10 below solar in the atmospheres of three white dwarfs that appear to be externally-polluted. These results are not easily explained if the stars have accreted interstellar matter, and we re-interpret these measurements as evidence that these stars have accreted asteroids with a chondritic composition.

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On the self-enrichment scenario of galactic globular clusters: Constraints on the IMF

Nikos Prantzos[1] *and Corinne Charbonnel*[2,3]

[1]Institut d'Astrophysique de Paris, UMR7095 CNRS, Univ.P. & M.Curie, 98bis Bd. Arago, 75104 Paris, France

[2]Geneva Observatory, CH 1290 Sauverny, Switzerland

[3]LATT UMR 5572 CNRS, 14, av.E.Belin, 31400 Toulouse, France

Galactic globular cluster (GC) stars exhibit abundance patterns that are not shared by their field counterparts, e.g. the well-documented O-Na and Mg-Al anticorrelations. Recent spectroscopic observations of GC turnoff stars have provided compelling evidence that these abundance anomalies were already present in the gas from which the observed stars formed. A widely held hypothesis is that the gas was "polluted" by stars that were more massive (and evolving faster) than the presently observed low-mass stars. In the framework of this "self-enrichment" scenario for GCs, we present a new method of deriving the initial mass function (IMF) of the polluters,by using the O/Na abundance distribution.

We focus on NGC 2808, a GC for which the largest sample of O and Na abundance determinations is presently available. We use the abundance distribution of [O/Na] to derive the amount of polluted material with respect to the original composition. We explore two scenarios in detail for the self-enrichment of the cluster, which differ by the assumptions made on the composition of the polluter ejecta. In each case we consider two classes of possible "culprits" : massive asymptotic giant branch (AGB) stars (4–9 $M_\odot$) and winds of massive stars (WMS) in the mass range 10–100 $M_\odot$.

We obtain upper limits for the slope of the IMF (assumed to be given by a power-law) of the stars initially more massive than the present turnoff mass. We also derive lower limits for the amount of stellar residues in NGC 2808.

We find that the polluter IMF had to be much flatter than the presently observed IMFs in stellar clusters, which agrees with the results of two other GC IMF determination methods, which we also discuss. Likewise, we find that the present mass of the GC should be totally dominated by stellar remnants if the polluters were AGB stars, which is not the case if the culprits are WMS. We critically analyse the advantages and shortcomings of each potential polluter class and find the WMS scenario more attractive.

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The Spitzer IRS view of V4334 Sgr (Sakurai's Object)

A. Evans[1], *T.R. Geballe*[2], *V.H. Tyne*[1], *J.Th. van Loon*[1], *B. Smalley*[1], *R.D. Gehrz*[3], *C.E. Woodward*[3], *A.A. Zijlstra*[4], *E. Polomski*[3], *M.T. Rushton*[1], *S.P.S. Eyres*[5], *S.G. Starrfield*[6], *J. Krautter*[7] *and R.M. Wagner*[8]

[1]Astrophysics Group, Keele University, UK

[2]Gemini Observatory, USA

[3]Dept of Astronomy, University of Minnesota, USA

[4]Dept of Physics & Astronomy, University of Manchester, UK

[5]Centre for Astrophysics, University of Central Lancashire, UK

[6]Department of Physics & Astronomy, Arizona State University, USA

[7]Landessternwarte, Heidelberg, Germany

[8]Large Binocular Telescope Observatory, University of Arizona, USA

We present an observation of the very late thermal pulse object V4334 Sgr (Sakurai's Object) with the Infrared Spectrometer (IRS) on the Spitzer Space Telescope. The emission from 5–38 μm is dominated by the still-cooling dust shell. A number of features are seen in absorption against the dust shell, which we attribute to HCN and polyyne molecules. We use these features to determine the $^{12}C/^{13}C$ ratio for the absorbing gas to be $\sim 3.2^{+3.2}_{-1.6}$; this implies that, despite the H-content of the molecules, the hydrocarbon-bearing gas must have originated in material produced in the very late thermal pulse. We see no evidence of emission lines, despite the recently-reported optical and radio observations that suggest the effective temperature of the stellar remnant is rising.

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Diamonds and PAHs in the Circumstellar Environment of the Herbig Ae/Be Star Elias 1

R. Topalovic[1], *J. Russell*[1], *J. McCombie*[1], *T.H. Kerr*[2] *and P.J. Sarre*[1]

[1]School of Chemistry, The University of Nottingham, University Park, Nottingham NG7 2RD, UK

[2]UKIRT, Joint Astronomy Centre, 660 N. A'ohoku Place, University Park, Hilo, Hawaii, USA

We report long-slit spectroscopic observations of the Herbig Ae/Be star Elias 1 in the 3.2 - 3.6 μm region covering the C-H stretch emission features of hydrogen-terminated diamonds and PAHs. The data were recorded at UKIRT using UIST and yield information on the profiles and intensities of the bands as a function of offset along the N-S and E-W axes centred on the close binary. The diamond and nearby IR continuum emission arises from a symmetrical inner core region ($\leq 0.34''$ or 48 AU). The 3.3 μm PAH emission is extended along the E-W axis up to *c.* 100 AU each side of the star. This result supports a suggestion of Haas, Leinert & Richichi of an E-W oriented bipolar nebula in Elias 1.

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Carbon-Enhanced Metal-Poor Stars. Osmium and Iridium Abundances in the Neutron-Capture-Enhanced Subgiants CS 31062–050 and LP 625–44

Wako Aoki[1], *Sara Bisterzo*[2,3], *Roberto Gallino*[2,4], *Timothy C. Beers*[5], *John E. Norris*[6], *Sean G. Ryan*[7,8] *and Stelios Tsangarides*[7]

[1]National Astronomical Observatory of Japan, Japan

[2]Dipartimento di Fisica Generale dell'Università di Torino, Italy

[3]Forschungszentrum Karlsruhe, Institut für Kernphysik, Germany

[4]Monash University, Australia

[5]Michigan State University, USA

[6]The Australian National University, Mount Stromlo Observatory, Australia

[7]The Open University, UK

[8]University of Hertfordshire, UK

We have investigated the abundances of heavy neutron-capture elements, including osmium (Os) and iridium (Ir), in the two Carbon-Enhanced Metal-Poor (CEMP) subgiants CS 31062–050 and LP 625–44. CS 31062–050 is known to be a so-called CEMP-r/s star, which exhibits large excesses of s-process elements such as barium (Ba) and lead (Pb), as well as a significant enhancement of europium (Eu) that cannot be explained by conventional s-process production in Asymptotic Giant Branch star models. Our analysis of the high-resolution spectrum for this object has determined, for the first time, the abundances of Ir and Os, elements in the third peak of the r-process nucleosynthesis. They also exhibit significant excesses relative to the predictions of standard s-process calculations. These two elements are not detected in a similar-quality spectrum of LP 625–44; the derived upper limits on their abundances are lower than the abundances in CS 31062–050. We compare the observed abundance patterns of neutron-capture elements, including Os and Ir, in these two stars with recent model calculations of the s-process, and discuss possible interpretations.

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Optical Emission Band Morphologies of the Red Rectangle

Uma P. Vijh[1,2], *Adolf N. Witt*[2], *Donald D. York*[3], *Vikram V. Dwarkadas*[3], *Bruce E. Woodgate*[4] *and Povilas Palunas*[5]

[1]Space Telescope Science Institute, USA

[2]University of Toledo, USA

[3]University of Chicago, USA

[4]NASA GSFC, USA

[5]University of Texas, Austin, USA

We present narrow-band images of the Red Rectangle (RR) nebula which reveal the distinct morphologies of this intriguing nebula in different optical emission bands. The morphology of the RR nebula in blue luminescence (BL) and extended red emission (ERE) are almost mutually exclusive. We also present the optical detection of the circumbinary disk of the RR in the light of the BL. The total intensities from the two optical band emissions (BL and ERE) when summed over the nebula are of comparable magnitude. Their spatial distributions with respect to the embedded illumination sources lead us to suggest that they may be attributed to different ionization stages of the same family of carriers.

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The properties of V838 Mon in 2002 November

Ya. V. Pavlenko[1,2], J.Th. van Loon[3], A. Evans[3], M.T. Rushton[3], B.M. Kaminsky[2], A.V. Filippenko[4], R.J. Foley[4], W. Li[4], B. Smalley[3] and L.A. Yakovina[2]

[1]Centre for Astrophysics Research, University of Hertfordshire, College Lane, Hatfield, Hertfordshire AL10 9AB, UK

[2]Main Astronomical Observatory, Academy of Sciences of the Ukraine, Golosiiv Woods, Kyiv-127, 03680 Ukraine

[3]Astrophysics Group, School of Physical & Geographical Sciences, Keele University, Keele Staffordshire, ST5 5BG, UK

[4]Department of Astronomy, 601 Campbell Hall, University of California, Berkeley, CA 94720-3411, USA

We present the results of modelling the 0.45–1 μm spectral energy distribution of V838 Mon for 2002 November. Synthetic spectra were calculated using the NextGen model atmospheres of Hauschildt et al. (1999), which incorporate line lists for H_2O, TiO, CrH, FeH, CO, and MgH, as well as the VALD atomic line list. Fits to the observed spectra show that, in 2002 November, the effective temperature of V838 Mon was approximately 2000 ± 100 K. Our theoretical spectra show a comparatively weak dependence on $\log g$. Preliminary analysis of the hot star observed together with V838 Mon shows it to be a normal B3V dwarf.

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Pulsations detected in the line profile variations of red giants: Modelling of line moments, line bisector and line shape

S. Hekker[1], C. Aerts[2,3], J. De Ridder[2] and F. Carrier[2,4]

[1]Leiden Observatory, Leiden University, The Netherlands

[2]Instituut voor Sterrenkunde, Katholieke Universiteit Leuven, Belgium

[3]Department of Astrophysics, University of Nijmegen, The Netherlands

[4]Observatoire de Genéve, Switzerland

Context: So far, red giant oscillations have been studied from radial velocity and/or light curve variations, which reveal frequencies of the oscillation modes. To characterise radial and non-radial oscillations, line profile variations are a valuable diagnostic. Here we present for the first time a line profile analysis of pulsating red giants, taking into account the small line profile variations and the predicted short damping and re-excitation times. We do so by modelling the time variations in the cross correlation profiles in terms of oscillation theory.
Aims: The performance of existing diagnostics for mode identification is investigated for known oscillating giants which have very small line profile variations. We modify these diagnostics, perform simulations, and characterise the radial and non-radial modes detected in the cross correlation profiles.
Methods: Moments and line bisectors are computed and analysed for four giants. The robustness of the discriminant of the moments against small oscillations with finite lifetimes is investigated. In addition, line profiles are simulated with short damping and re-excitation times and their line shapes are compared with the observations.
Results: For three stars, we find evidence for the presence of non-radial pulsation modes, while for ξ Hydrae perhaps only radial modes are present. Furthermore the line bisectors are not able to distinguish between different pulsation modes and are an insufficient diagnostic to discriminate small line profile variations due to oscillations from exoplanet motion.

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The Spitzer-IRS spectrum of SMP LMC 11

J. Bernard-Salas[1], *E. Peeters*[2], *G.C. Sloan*[1], *J. Cami*[2], *S. Guiles*[1] *and J.R. Houck*[1]

[1]Cornell University, USA
[2]SETI Institute, USA

We present the first mid-infrared spectra of SMP LMC 11 in the Large Magellanic Cloud. While this object resembles a planetary nebula in the optical, its infrared properties are more similar to an object in transition from the asymptotic giant branch to the planetary nebula phase. A warm dust continuum dominates the infrared spectrum. The peak emission corresponds to a mean dust temperature of 330 K. The spectrum shows overlapping molecular absorption bands from 12 to 17 μm corresponding to acetylene and polyacetylenic chains and benzene. This is the first detection of C_4H_2, C_6H_2, C_6H_6 and other molecules in an extragalactic object. The infrared spectrum of SMP LMC 11 is similar in many ways to that of the pre-planetary nebula AFGL 618. The IRS spectrum shows little evidence of nitrogen-based molecules which are commonly seen in Galactic AGB stars. Polycyclic aromatic hydrocarbons are also absent from the spectrum. The detection of the [Ne II] 12.8 μm line in the infrared and other forbidden emission lines in the optical indicates that an ionized region is present.

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On the origin of the ultramassive white dwarf GD50

P. D. Dobbie[1], *R. Napiwotzki*[2], *N. Lodieu*[1], *M. R. Burleigh*[1], *M. A. Barstow*[1] *and R. F. Jameson*[1]

[1]University of Leicester, UK
[2]University of Hertfordshire, UK

We argue on the basis of astrometric and spectroscopic data that the ultramassive white dwarf GD50 is associated with the star formation event that created the Pleiades and is possibly a former member of this cluster. Its cooling age ($\sim$60Myrs) is consistent with it having evolved essentially as a single star from a progenitor with a mass $M > 6$ M$_\odot$ so we find no need to invoke a white dwarf-white dwarf binary merger scenario to account for its existence. This result may represent the first direct observational evidence that single star evolution can produce white dwarfs with $M > 1.1$ M$_\odot$, as predicted by some stellar evolutionary theories. On the basis of its tangential velocity we also provisionally identify the ultramassive ($M \sim 1.2$ M$_\odot$) white dwarf PG0136+251 as being related to the Pleiades. These findings may help to alleviate the difficulties in reconciling the observed number of hot nearby ultramassive white dwarfs with the smaller number predicted by binary evolution models under the assumption that they are the products of white dwarf mergers.

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Interpretation of the expansion law of planetary nebulae

Hiroko Matsumoto[1,2], *Tsubasa Fukue*[2] *and Hideyuki Kamaya*[2]

[1]Department of Astronomy, The University of Tokyo, Japan
[2]Department of Astronomy, Kyoto University, Japan

We reproduce the expansion velocity–radius ($V_{\rm exp}$–$R_{\rm n}$) relation in planetary nebulae by considering a simple dynamical model, in order to investigate the dynamical evolution and formation of planetary nebulae. In our model, the planetary nebula is formed and evolving by interaction of a fast wind from the central star with a slow wind from its progenitor, the AGB star. In particular, taking account of the mass loss history of the AGB star makes us succeed in the reproduction of the observed $V_{\rm exp}$-$R_{\rm n}$ sequence. As a result, examining the ensemble of the observational and theoretical evolution

models of PNe, we find that if the AGB star pulsates and its mass loss rate changes with time (from $\sim 10^{-6.4}$ $M_\odot$ yr^{-1} to $\sim 10^{-5}$ $M_\odot$ yr^{-1}), the model agrees with the observations. In terms of observation, we suggest that there are few planetary nebulae with larger expansion velocity and smaller radius because the evolutionary time-scale of such nebulae is so short and the size of nebulae is so compact that it is difficult for us to observe them.

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The 10 μm infrared band of silicate dust: A laboratory study comparing the aerosol and KBr pellet techniques

Akemi Tamanai[1], *Harald Mutschke*[1], *Jürgen Blum*[2] *and Gwendolyn Meeus*[3]

[1]Astrophysical Institute and University Observatory, FSU Jena, Germany

[2]Institut für Geophysik und Extraterrestrische Physik, Technische Universität Braunschweig, Germany

[3]Astrophysikalisches Institut Potsdam, Germany

The profile of the silicate 10 μm IR band contains important information about the evolutional stage of dust in circumstellar environments and the possible ongoing process of planetesimal formation. In order to extract this information, the observed band profiles are compared with calculated or laboratory-measured absorption cross sections of amorphous and crystalline grains with different sizes and compositions. We present in this study the first laboratory measurements of the 10 μm band profiles of nonembedded, i.e. free-flying, particles of amorphous and crystalline Mg_2SiO_4 (with two different particle shapes), amorphous and crystalline $MgSiO_3$, and crystalline olivine. We compare the spectra with those measured on embedded grains and discuss the potential of the new experimental method for comparison with observed spectra, as well as for future studies of agglomeration and surface manipulation of the grains.

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X-ray emission from Planetary Nebulae. I. Spherically symmetric numerical simulations

Matthias Stute[1] *and Raghvendra Sahai*[1]

[1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA

The interaction of a fast wind with a spherical Asymptotic Giant Branch (AGB) wind is thought to be the basic mechanism for shaping Pre-Planetary Nebulae (PPN) and later Planetary Nebulae (PN). Due to the large speed of the fast wind, one expects extended X-ray emission from these objects, but X-ray emission has only been detected in a small fraction of PNs and only in one PPN. Using numerical simulations we investigate the constraints that can be set on the physical properties of the fast wind (speed, mass-flux, opening angle) in order to produce the observed X-ray emission properties of PPNs and PNs. We combine numerical hydrodynamical simulations including radiative cooling using the code *FLASH* with calculations of the X-ray properties of the resulting expanding hot bubble using the atomic database *ATOMDB*. In this first study, we compute X-ray fluxes and spectra using one-dimensional models. Comparing our results with analytical solutions, we find some agreements and many disagreements. In particular, we test the effect of different time histories of the fast wind on the X-ray emission and find that it is determined by the final stage of the time history during which the fast wind velocity has its largest value. The disagreements which are both qualitative and quantitative in nature argue for the necessity of using numerical simulations for understanding the X-ray properties of PNs. The X-ray luminosity in the 0.2 – 10 keV range (1.24 – 62 Å) covered by the CHANDRA/*ACIS* instrument shows a very slow decrease with time over the range of evolutionary ages explored in our models (up to 3750 years). Furthermore, investigating the emission in other wavelengths ranges, we find that most of the luminosity

emerges at longer wavelengths ($\lambda \gtrsim 140$ Å) from the cooler outer edge of the hot bubble. We apply our spherical models to the objects BD+30°3639 and NGC 40. We find that the model values of the X-ray temperature and luminosity for these objects are significantly higher than observed values and discuss several mechanisms for resolving the discrepancies.

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The giant star of the symbiotic system YY Her: Rotation, Tidal wave, Solar-type cycle and Spots

Liliana Formiggini [1,2] *and Elia M. Leibowitz* [1]

[1]The Wise Observatory and the School of Physics and Astronomy, Tel Aviv University, Israel
[2]INAF-Istituto di Radioastronomia, Bologna, Italy

We analyze the historical light curve of the symbiotic star YY Her, from 1890 up to December 2005. A secular declining trend is detected, at a rate of ∼.01 magn in 1000 d, suggesting that the system could belong to the sub-class of symbiotic novae. Several outburst events are superposed on this slow decline. Three independent periodicities are identified in the light curve. A quasi-periodicity of 4650.7 d is detected for the outburst occurrence. We suggest that it is a signature of a solar-type magnetic dynamo cycle in the giant component. A period of 593.2 d modulates the quiescent light curve and it is identified as the binary period of the system. During outburst events the system shows a stable periodic oscillation of 551.4 d. We suggest that it is the rotation period of the giant.The secondary minima detected at some epochs of quiescence are probably due to dark spots on the surface of the rotating giant. The difference between the frequencies of these two last periods is the frequency of a tidal wave in the outer layers of the giant. A period which is a beat between the magnetic cycle and the tidal wave period is also apparent in the light curve. YY Her is a third symbiotic system exhibiting these cycles in their light curve, suggesting that a magnetic dynamo process is prevalent in the giant components of symbiotic stars, playing an important role in the outburst mechanism of some of these systems.

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Detailed Far-UV to Optical Analysis of Four [WR] Stars

W.L.F. Marcolino[1]*, D.J. Hillier*[2]*, F.X. de Araujo*[1] *and C.B. Pereira*[1]

[1]Observatorio Nacional/MCT, Brazil
[2]University of Pittsburgh, USA

We present far-UV to optical analyses of four hydrogen deficient central stars of planetary nebulae: BD+303639, NGC 40, NGC 5315 and NGC 6905. Using the radiative transfer code CMFGEN, we determined new physical parameters and chemical abundances for these stars. The results were analyzed in the context of the [WR] → PG 1159 evolution via the transformed radius(R_t)-temperature and HR diagrams. NGC 5315 showed itself as an odd object among the previously analyzed central stars. Its temperature (∼76kK) is considerably lower than other early-type [WR] stars (∼120-150kK). From our models for NGC 5315 and NGC 6905, it is unclear if early-type [WR] stars have smaller C/He mass ratios than other spectral classes, as claimed in the literature. A ratio of ∼0.8 is found for NGC 6905. We analyzed FUSE spectra of these stars for the first time, and identified phosphorus in the spectra of BD+303639, NGC 40 and NGC 5315 through the transitions P V 1118,1128. The Fe, Si, P, S and Ne abundances were analyzed in the context of the nucleosynthesis occurring in previous evolutionary phases. We found evidence for Fe deficiency in BD +30 3639 and NGC 5315, and from fits to the Si IV lines we determined a solar Si abundance for BD+303639 and NGC 40. For phosphorus, an oversolar abundance in the NGC 5315 model was preferred, while in the other stars a solar

phosphorus abundance cannot be discarded. Regarding sulfur, we estimated upper limits for its abundance, since no conspicuous lines can be seen in the observed spectra. We found that Ne is overabundant in BD +30 3639. In the other stars, Ne is weak or undetectable and upper limits for its abundance were estimated. Our results are in agreement with theoretical predictions and show the usefulness of [WR] stars as testbeds for nucleosynthesis calculations in the AGB and post-AGB phases.(abridged)

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Orientation effects in Bipolar nebulae

Hugo E. Schwarz[1]*, Hektor Monteiro*[2] *and Ryan R. Peterson*[3]

[1]Cerro Tololo Inter-American Observatory, Casilla 603, Colina El Pino S/N, La Serena, Chile
[2]Department of Physics and Astronomy, Georgia State University, 1, Park Place South, Atlanta, GA 30302, USA
[3]Lawrence University, Appleton, Wisconsin, USA

We show that the inclination to the line of sight of bipolar nebulae strongly affects some of their observed properties. We model these objects as having a spherically symmetric Planetary Nebula and a dusty equatorial density enhancement that produces extinction that varies with the viewing angle. Our sample of 29 nebulae taken from the literature shows a clear correlation between the inclination angle and the near-IR and optical photometric properties as well as the apparent luminosity of the objects. As the inclination angle increases –the viewing angle is closer to the equatorial plane– the objects become redder, their average apparent luminosity decreases, and their average projected expansion velocity becomes smaller.
We compute two-dimensional models of stars embedded in dusty disks of various shapes and compositions and show that the observed data can be reproduced by disk-star combinations with reasonable parameters. To compare with the observational data, we generate sets of model data by randomly varying the star and disk parameters within a physically meaningful range.
We conclude that a only a smooth pole to equator density gradient agrees with the observed phenomena and that thin, equatorially concentrated disks can be discarded.

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The type Ia supernova SNLS-03D3bb from a super-Chandrasekhar-mass white dwarf star

D. Andrew Howell et al.[1]

[1]University of Toronto, Canada

The acceleration of the expansion of the universe, and the need for Dark Energy, were inferred from the observations of Type Ia supernovae (SNe Ia). There is consensus that SNe Ia are thermonuclear explosions that destroy carbon-oxygen white dwarf stars that accrete matter from a companion star, although the nature of this companion remains uncertain. SNe Ia are thought to be reliable distance indicators because they have a standard amount of fuel and a uniform trigger – they are predicted to explode when the mass of the white dwarf nears the Chandrasekhar mass – 1.4 $M_{\odot}$. Here we show that the high redshift supernova SNLS-03D3bb has an exceptionally high luminosity and low kinetic energy that both imply a super-Chandrasekhar mass progenitor. Super-Chandrasekhar mass SNe Ia should preferentially occur in a young stellar population, so this may provide an explanation for the observed trend that overluminous SNe Ia only occur in young environments. Since this supernova does not obey the relations that allow them to be calibrated as standard candles, and since no counterparts have been found at low redshift, future cosmology

studies will have to consider contamination from such events.

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The TP-AGB phase. Lifetimes from C and M star counts in Magellanic Cloud clusters

Léo Girardi[1] *and Paola Marigo*[2]

[1]Oss.Ast.Padova-INAF, Italy
[2]Dip.Astron.Padova, Italy

Using available data for C and M giants with $M_{\rm bol} < -3.6$ in Magellanic Cloud clusters, we derive limits to the lifetimes of the corresponding evolutionary phases, as a function of stellar mass. The C-star phase is found to have a duration between 2 and 3 Myr for stars in the mass range from 1.5 to 2.8 $M_\odot$. There is also an indication that the peak of C-star lifetime shifts to lower masses (from slightly above to slightly below 2 $M_\odot$) as we move from LMC to SMC metallicities. The M-giant lifetimes also peak at 2 $M_\odot$ in the LMC, with a maximum value of about 4 Myr, whereas in the SMC their lifetimes appear much shorter but, actually, they are poorly constrained by the data. These numbers constitute useful constraints to theoretical models of the TP-AGB phase. We show that several models in the literature underestimate the duration of the C-star phase at LMC metallicities.

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ISO Mid-Infrared Spectroscopy of Galactic Bulge AGB Stars

J. Blommaert[1]*, M. Groenewegen*[1]*, K. Okumura*[2]*, S. Ganesh*[3]*, A. Omont*[4]*, J. Cami*[5]*, I. Glass*[6]*, H.J. Habing*[7]*, M. Schultheis*[8]*, G. Simon*[9] *and J.Th. van Loon*[10]

[1]Inst. voor Sterrenkunde, KU Leuven, Belgium
[2]Service d'Astrophysique, CEA/DAPNIA, Saclay, France
[3]Physical Research Laboratory, Ahmedabad, India
[4]Institut d'Astrophysique de Paris, CNRS, Paris, France
[5]SETI Institute, NASA Ames Research Center, USA
[6]South African Astronomical Observatory, South Africa
[7]Leiden Observatory, Leiden, The Netherlands
[8]CNRS UMR6091, Observatoire de Besançon, Besançon, France
[9]GEPI, Observatoire de Paris, France
[10]Astrophysics Group, School of Physical & Geographical Sciences, Keele University, UK

To study the nature of Bulge AGB stars and in particular their circumstellar dust, we have analysed mid-infrared spectra obtained with the ISOCAM CVF spectrometer in three Bulge fields. The ISOCAM 5-16.5 μm CVF spectra were obtained as part of the ISOGAL infrared survey of the inner Galaxy. A classification of the shape of the 10 micron dust feature was made for each case. The spectra of the individual sources were modelled using a radiative transfer model. Different combinations of amorphous silicates and aluminium-oxide dust were used in the modelling. Spectra were obtained for 29 sources of which 26 are likely to be Bulge AGB stars. Our modelling shows that the stars suffer mass loss rates in the range of $10^{-8} - 5 \times 10^{-7}$ $M_\odot$ yr^{-1}, which is at the low end of the mass-loss rates experienced on the Thermally Pulsing AGB. The luminosities range from 1,700 to 7,700 $L_\odot$ as expected for a population of AGB stars with $M_{\rm init}$ of 1.5 - 2 $M_\odot$. In agreement with the condensation sequence scenario, we find that the dust content is dominated by Al_2O_3 grains in this sample of low mass-loss rate stars.

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Carbon Enhanced Metal-Poor Stars. I. Chemical Compositions of 26 Stars

Wako Aoki[1], *Timothy C. Beers*[2], *Norbert Christlieb*[3], *John E. Norris*[4], *Sean G. Ryan*[5] *and Stelios Tsangarides*[5]

[1]National Astronomical Observatory of Japan, Japan

[2]Michigan State University, USA

[3]University of Hamburg, Germany

[4]The Australian National University, Australia

[5]The Open University, UK

The chemical compositions of 26 metal-poor stars that exhibit strong CH and/or C_2 molecular bands are determined based on high-resolution spectroscopy. We define carbon-enhanced stars taking account of the carbon abundance ratio ([C/Fe]) and the evolutionary status, which is a slight modification over previous definitions. Twenty two stars in our sample satisfy our modified definition for Carbon-Enhanced Metal-Poor (CEMP) stars. In addition, we measure Na abundances for nine other carbon-enhanced stars for which abundances of other elements have been previously reported. Combining our new sample with the results of previous work, we investigate the abundance and evolutionary status of a total of 64 CEMP stars. The following results are obtained: (1) All but one of the 37 stars with [Fe/H] ≥ -2.6 exhibit large excesses of barium ([Ba/Fe] $> +0.5$), while the other 27 stars with lower metallicity exhibit a large scatter in their barium abundance ratios ($-1.2 <$ [Ba/Fe]$< +3.3$). (2) A correlation between the carbon and barium abundance ratios ([C/Fe] and [Ba/Fe]) is found in Ba-enhanced objects (comprising 54 stars), suggesting that the origin of the observed carbon excess in Ba-enhanced stars is nucleosynthesis in asymptotic giant branch (AGB) stars, where the main *s*-process occurs. The correlation between the barium abundance ratio and that of carbon plus nitrogen ([(C+N)/Fe]) is relatively weak, because of the large excesses of nitrogen in some extremely metal-poor stars. (3) The majority of the Ba-enhanced stars have $-1.0 <$ [C/H] < 0.0, and a clear cutoff exists at [C/H] ~ 0, which we take as the limit of carbon-enrichment by metal-poor AGB stars. Within the above range, the [C/H] of the Ba-enhanced CEMP stars decreases, on average, by up to 0.6 dex from the main-sequence turnoff up the red-giant branch, suggesting some dilution of carbon enhancement during their evolution. The [C/H] values of Ba-normal stars are relatively low, with a wide distribution. (4) The difference in the distributions of evolutionary status between Ba-enhanced and Ba-normal CEMP stars suggested by our previous work is not statistically confirmed by the present, enlarged sample. (5) Excesses of Na are found in stars with extremely large enhancements of C, N and Ba, suggesting efficient production of this element by AGB nucleosynthesis. The implications of these results on the origins of carbon in CEMP stars, in particular for Ba-normal stars, are discussed.

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s-Process Nucleosynthesis in Advanced Burning Phases of Massive Stars

Lih-Sin The[1], *Mounib F. El Eid*[2] *and Bradley S. Meyer*[1]

[1]Department of Physics and Astronomy, Clemson University, Clemson, SC 29634-0978, USA

[2]Department of Physics, American University of Beirut, Beirut, Lebanon

We present a detailed study of s-process nucleosynthesis in massive stars of solar-like initial composition and masses 15, 20, 25, and 30 $M_\odot$. We update our previous results of s-process nucleosynthesis during the core He-burning of these stars and then focus on an analysis of the s-process under the physical conditions encountered during the shell-carbon burning. We show that the recent compilation of the $^{22}\mathrm{Ne}(\alpha,\mathrm{n})^{25}\mathrm{Mg}$ rate leads to a remarkable reduction of the efficiency of the s-process during core He-burning. In particular, this rate leads to the lowest overproduction factor of ^{80}Kr found to date during core He-burning in massive stars. The s-process yields resulting from shell carbon burning turn out to be very sensitive to the structural evolution of the carbon shell. This structure is influenced by the mass fraction of ^{12}C attained at the end of core helium burning, which in turn is mainly determined by the $^{12}\mathrm{C}(\alpha,\gamma)^{16}\mathrm{O}$ reaction. The still present uncertainty in the rate for this reaction implies that the s-process in massive stars is also subject to this uncertainty. We identify some isotopes like ^{70}Zn and ^{87}Rb as the signatures of the s-process during shell carbon burning in massive stars. In determining the relative contribution of our s-only stellar yields to the solar

abundances, we find it is important to take into account the neutron exposure of shell carbon burning. When we analyze our yields with a Salpeter Initial Mass Function, we find that massive stars contribute at least 40% to s-only nuclei with mass A $\leq$ 87. For s-only nuclei with mass A $>$ 90, massive stars contribute on average $\sim$7%, except for ^{152}Gd, ^{187}Os, and ^{198}Hg which are $\sim$14%, $\sim$13%, and $\sim$11%, respectively.

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Conference Papers

C- and O-Rich Miras and Galactic Structure

Michael Feast[1]

[1]University of Cape Town, South Africa

This paper summarizes the conclusions of an extensive investigation of variable carbon AGB stars in our Galaxy. The zero-point of the period - $M_{\rm bol}$ relation for Galactic C-Miras is found to be close to that in the LMC. The mean age of Galactic C-Miras is $\sim$ 1.8Gyr and their initial masses $\sim 1.8 M_{\odot}$ with some evidence that age decreases and initial mass increases with increasing pulsation period. Kinematic studies of Galactic C- and O-Miras show that the relative frequency of these two Mira classes depends on the age of the parent population. The lack of carbon stars in the Galactic Bulge seems to be due to a high oxygen abundance. The velocity dispersion of O-Miras allows one to distinguish between two possible models of Galactic kinematics.

Oral contribution, published in "Why Galaxies Care About AGB stars", Vienna 2006, ASP Conf.Ser.
Available from astro-ph/0609318

The impact of red giant mass loss on star cluster evolution

Jacco Th. van Loon[1] *and Iain McDonald*[1]

[1]School of Physical and Geographical Sciences, Lennard-Jones Laboratories, Keele University, Staffordshire ST5 5BG, UK

We discuss the importance for the long-term cluster evolution of the mass loss from intermediate-mass stars (0.8–8 $M_{\odot}$). We present constraints on the mass loss from red giants in clusters in the Magellanic Clouds, a search for the intra-cluster medium in galactic globular clusters, and a simple estimate for the cluster evolution due to red giant mass loss compared to stellar escape.

Poster contribution, published in "Mass loss from stars and the evolution of stellar clusters", a conference in honour of Henny Lamers, eds. A. de Koter, L. Smith and L.B.F.M. Waters, ASP Conf.Ser.
Available from astro-ph/0609445

Optical and Infrared Observations of Stellar Mass Loss in Globular Cluster Red Giants

Iain McDonald[1] *and Jacco Th. van Loon*[1]

[1]Keele University, UK

We are examining mass loss from globular clusters giant stars, focussing on metallicity dependance. We present three sets of observations: TIMMI-2 mid-IR spectra of 47 Tuc, UVES high-resolution optical spectra of several clusters, and an infrared atlas of omega Cen using the Spitzer Space Telescope.

Poster contribution, published in "Mass loss from stars and the evolution of stellar clusters", Lunteren, The Netherlands, May 29 - June 1, 2006
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SRVs in the Solar Neighbourhood

I.S. Glass[1]

[1]SAAO, South Africa

Period-luminosity sequences have been shown to exist among the Semi-Regular Variables (SRVs) of the Magellanic Clouds (Wood et al, 1999), the Bulge of the Milky Way galaxy (Glass and Schultheis, 2003) and elsewhere. It would clearly be useful to have absolute (trigonometric) calibrations of these relations. This paper investigates whether the sequences can be seen among the M-giant SRVs of the solar neighbourhood. Mass-loss phenomena among these stars and their dependence on period and spectral sub-type are also discussed.

Poster contribution, published in "Why Galaxies Care about AGB Stars", ASP Conf.Ser.
Available from astro-ph/0609482

Asymptotic giant branch evolution and its impact on the chemical evolution of the Milky Way and the Magellanic Clouds

Letizia Stanghellini[1]

[1]National Optical Astronomy Observatory, USA

The asymptotic giant branch (AGB) phase of stellar evolution is common to most stars of low and intermediate mass. Most of the carbon and nitrogen in the Universe is produced by AGB stars. The final fate of the AGB envelopes are represented by planetary nebulae (PN). By studying PN abundances and compare them with the yields of stellar evolution is possible to quantify carbon and nitrogen production, and to study cosmic recycling in galactic and Magellanic Cloud populations. In this paper we present the latest results in PN chemical abundance analysis and their implication to the chemical evolution of the galaxy and the Magellanic Clouds, with particular attention to carbon abundance, available only thanks to ultraviolet spectroscopy.

Oral contribution, published in "The UV Universe: Stars from birth to death", invited talk, JD04 of the IAU General Assembly, Prague 2006
Available from astro-ph/0609610

Modelling the spectrum and SED of V838 Mon

Ya.Pavlenko[1], *B. Kaminsky*[1], *Yu. Lyubchik*[1] *and La. Yakovina*[1]

[1]MAO NASU, Ukraine

We model the spectra and spectral energy distribution of V838 Mon which were observed in February, March, and November, 2002. Theoretical spectra are calculated using the classical model atmospheres taking into account absorption of atomic and molecular lines. By fitting the observed spectra we determine the physical parameters of the atmosphere of V838 Mon. These parameters are determined to be $T_{\rm eff} = 5330 \pm 300$ K, 5540 ± 270 K, 4960 ± 190 K, and 2000 ± 200 K for February 25, March 2, March 26, and November 6, respectively.

Oral contribution, published in "The Nature of V838 Mon and its Light Echo", 16-18 May 2006, La Palma, eds. R. Corradi & U. Munari
Available from astro-ph/0609604

Job Adverts

University of Denver

Three tenure-track positions at the Department of Physics & Astronomy

The Department of Physics and Astronomy at the University of Denver began expanding last spring with two tenure-track assistant-professor hires. This year, the department invites applications for three tenure-track assistant professorships beginning September 2007, with a possibility to hire at the associate professor level, if exceptional candidates are identified. A B.S. in Physics and Ph.D. in Physics, Materials Science and Engineering, or Astronomy is required. Applicants should possess enthusiasm for teaching both undergraduate and graduate courses and be capable of developing an independent program in an area that builds on the department's current research interests in both experimental and theoretical condensed matter physics, experimental astrophysics, astrobiology, experimental atmospheric spectroscopy, and experimental low-energy atomic collisions. The department offers degrees through the Ph.D. Applications for these positions must be submitted through https://www.dujobs.org and should include a curriculum vitae, a description of research and teaching experience, statements of teaching philosophy and research plans, an estimate of start-up costs, and names of at least three references. The selection process will begin on November 17, 2006, and continue until the positions are filled. The University of Denver is committed to enhancing the diversity of its faculty and staff and encourages applications from women, minorities, people with disabilities and veterans. DU is an EEO/AA employer.

URL1: https://www.dujobs.org (DU Job Application website)
URL2: http://www.physics.du.edu (Dept. of Physics & Astronomy website)

Email Inquiries: bstephen@du.edu

The closing date for receipt of applications: 05/15/2007

See also https://www.dujobs.org

University of Hong Kong
Tenure track assistant/associate professor in observational astronomy

Tenure-track assistant/associate professorships in IR/submm astronomy

Applications are invited for appointments as Assistant Professor or Associate Professor in observational infrared/submillimetre astronomy (Ref.: RF-2006/2007-160), tenable from July 1, 2007 or as soon as possible thereafter. The initial appointment will be made on a three-year fixed-term (renewable) basis. Candidates with exceptional qualifications may be considered for tenured appointment.

The University of Hong Kong is at the international forefront of higher learning and research, with more than 100 teaching departments and sub-divisions of studies, and more than 60 research institutes and centres. It has over 20,000 undergraduate and postgraduate students from 48 countries. English is the medium of instruction. The University is committed to international standards for excellence in scholarship and research.

The Department of Physics has strong groups in condensed matter physics, including nanoscience and nanotechnology, as well as in theoretical and observational astronomy. We seek an astronomer with observational experience with ground-based or space-based infrared/submm telescopes and can initiate programs in future facilities such as SOFIA, Herschel, ALMA, etc.

Applicants should have a demonstrated record in research and a commitment to excellence in undergraduate and graduate teaching. Research start-up funds will be available.

Annual salary for an Assistant Professor ranges from HK$452 - 698 K and Associate Professor HK$593 - 917 K (at current exchange rate, 1 HK$=0.13 USD) (subject to review from time to time at the entire discretion of the University). The appointments also attract a contract-end gratuity and University contribution to a retirement benefits scheme, totaling up to 15% of basic salary.

At current rates, salaries tax does not exceed 16% of gross income. The appointments carry leave, housing benefits and medical and dental benefits.

Further particulars and application forms (272/302 amended) can be obtained at https://extranet.hku.hk/apptunit/; or from the Appointments Unit (Senior), Human Resource Section, Registry, The University of Hong Kong, Hong Kong (Fax: (852) 2540 6735 or 2559 2058; E-mail: apptunit@hkucc.hku.hk). For enquiries of the existing research activities and the specifics of the job requirements, please write to Prof. Sun Kwok, Dean of Science (sunkwok@hku.hk). Closes December 31, 2006.

See also https://extranet.hku.hk/apptunit/