THE AGB NEWSLETTER

An electronic publication dedicated to Asymptotic Giant Branch stars and related phenomena

No. 105 — 1 February 2006

http://www.astro.keele.ac.uk/AGBnews

Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

it is our pleasure to present you with a new issue of the AGB Newsletter. We wish to express our sincere thanks to Thierry Forveille and Claudine Kahane, who started the first AGB Newsletter and kept it running for a decade. They provided an important platform for those who work on AGB stars to keep themselves and others informed of the latest results, relevant workshops and job opportunities.

The AGB Newsletter now continues with new editors and a new web site, hosted at Keele University (many thanks to Barry Smalley for his help). It now uses a web form for submission of items. We accept standard LaTeX in any of the fields, making it easy to copy/paste material from its original source. Important announcements may be posted on the web site itself; simply contact the editors via the web site.

The AGB Newsletter welcomes all contributions related to the structure and evolution of Asymptotic Giant Branch stars, including the pre- and post-AGB stages and Planetary Nebula phase where this furthers our understanding of AGB stars, as well as the rôle of AGB stars in the chemical evolution of the Universe and their use as tracers of the underlying intermediate-mass stellar populations in galaxies.

Although the main purpose of the AGB Newsletter remains unchanged, we wish to emphasize the opportunity to post announcements of new tools or databases, of which you find an example in the current issue, as well as job opportunities — especially for PhD and postdoctoral positions that help our younger colleagues establish a career and feed the AGB research with fresh ideas.

We are delighted to see so many contributions in the current issue, including a recent PhD thesis and several upcoming conferences. The plan is for the AGB Newsletter to appear monthly. In the future, issues of the AGB newsletter will only be e-mailed to registered addresses. If you would like to continue to receive the newsletter, please make sure that you have registered with the mailing list. This can be done on the web site. Do not forget to tell your students and colleagues about it, and let us know if you have any comments about the newsletter.

The next issue is expected to appear on the 1st of March, with items submitted by the 28th of February.

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Refereed Journal Papers

The real-time stellar evolution of Sakurai's Object (V4344 Sgr)

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After a hot white dwarf ceases its nuclear burning, its helium may briefly and explosively reignite. This causes the star to evolve back into a cool giant, whereupon it experiences renewed mass ejection before reheating. A reignition event of this kind was observed in 1996 in V4334 Sgr (Sakurai's object). Its temperature decrease was 100 times the predicted rate. To understand its unexpectedly fast evolution, we have developed a model in which convective mixing is strongly suppressed under the influence of flash burning. The model predicts equally rapid reheating of the star. Radio emission from freshly ionized matter now shows that this reheating has begun. Such events may be an important source of carbon and carbonaceous dust in the Galaxy.

Published in Science, 308, 231 (2005)
Available from http://iapetus.phy.umist.ac.uk/Science308/Science308.html

AGB stars in the Magellanic Clouds. II. The rate of star formation across the LMC.

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This article compares the distribution of K_s magnitudes of Large Magellanic Cloud (LMC) asymptotic giant branch (AGB) stars obtained from the DENIS and 2MASS data with theoretical distributions. These have been constructed using up-to-date stellar evolution calculations for low and intermediate-mass stars, and in particular for thermally pulsing AGB stars. A fit of the magnitude distribution of both carbon- and oxygen-rich AGB stars allowed us to constrain the metallicity distribution across the LMC and its star formation rate (SFR). The LMC stellar population is found to be on average 5-6 Gyr old and is consistent with a mean metallicity corresponding to Z=0.006. These values may however be affected by systematic errors in the underlying stellar models, and by the limited exploration of the possible SFR histories. Instead our method should be particularly useful for detecting variations in the mean metallicity and SFR across the LMC disk. There are well defined regions where both the metallicity and the mean-age of the underlying stellar population span the whole range of grid parameters. The C/M ratio discussed in paper I is a tracer of the metallicity distribution if the underlying stellar population is older than about a few Gyr. A similar study across the Small Magellanic Cloud is given in paper III of this series.

Accepted for publication in Astronomy & Astrophysics

Available from astro-ph/0509881

The Draco dwarf galaxy in the near-infrared

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With the William Herschel Telescope in La Palma we made IJKs observations of an area of about $40' \times 30'$ of the Local Group galaxy Draco. This allows us to describe Draco's late-type stellar population across the whole galaxy at a photometric level 2 mag deeper than the 2MASS survey. We detected the red giant branch (RGB) and measured the magnitude of the tip of the RGB in the three bands. From that in the I band we obtain a distance modulus of $(m-M)_0 = 19.49 \pm 0.06(\mathrm{stat}) \pm 0.15(\mathrm{sys})$, in excellent agreement with a measurement from RR Lyrae stars. The peak of the $(\mathrm{J}-\mathrm{K_s})_0$ histogram at different M_{Ks} suggests that Draco has a mean [Fe/H]$=-1.95 \pm 1.26$ while fiducial RGB tracks of Galactic globular clusters indicate a mean [Fe/H]$=-1.33 \pm 0.72$ where the error corresponds to the spread around the mean value. There are significant differences between the colour-magnitude diagrams of stars in the inner, medium and outer areas of the galaxy. A metal poor (Z=0.0004) intermediate-age population (about 1.6 Gyr old) is clearly present and emerges in particular between $6'$ and $12'$ from the centre of the galaxy. A few additional carbon star candidates have been identified from both their location in the colour-magnitude diagram and from an indication of variability. The large scale distribution of late-type stars is smooth but irregular in shape; this points at a variation of inclination with radius.

Published in Astronomy & Astrophysics, 442, 165
Available from astro-ph/0507329

Near-IR observations of NGC 6822: AGB stars, distance, metallicity and structure

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Observations in the IJK_s wave bands covering the central $20' \times 20'$ of the Local Group galaxy NGC 6822 have been made with the William Herschel Telescope in La Palma. They have allowed us to characterize, for the first time in the near-infrared across the whole galaxy, its late-type stellar population (i.e. red giant and asymptotic giant branch stars) and to derive from the ratio between carbon-rich and oxygen-rich asymptotic giant branch stars an indication about spatial variations in metallicity. These amount to about 1.56 dex, twice of what has been previously found within each Magellanic Cloud using the same technique. We have calibrated our photometry on the DENIS (I-band) and 2MASS (J and $\mathrm{K_s}$ bands) data and obtained a distance modulus of $(m-M)_0 = 23.34 \pm 0.12$ from the position of the tip of the RGB. The large scale distribution of late-type stars suggests that either the galaxy is viewed under a high inclination angle or it has a non–negligible thickness.

Published in Astronomy & Astrophysics, 429, 837
Available from astro-ph/0409294

The shaping of planetary nebula Sh 2-188 through interaction with the interstellar medium

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Sh 2-188 is an example of strong interaction between a planetary nebula (PN) and the interstellar medium (ISM). It shows a single arc-like structure, consisting of several filaments, which is postulated to be the result of motion through the ISM. We present new Hα images from the Isaac Newton Telescope Photometric Hα Survey of the Northern Galactic Plane (IPHAS) which reveal structure behind the filamentary limb. A faint, thin arc is seen opposite the bright limb, in combination forming a closed ring. Behind the faint arc a long wide tail is detected, doubling the size of the nebula. The nebula extends 15 arcmin on the sky in total. We have developed a 'triple-wind' hydrodynamical model, comprising of the initial 'slow' asymptotic giant branch (AGB) wind and the later 'fast' stellar wind (the interacting stellar wind model), plus a third wind reflecting the motion through the ISM. Simulations at various velocities of the central star relative to the ISM indicate that a high velocity of 125 kms is required to reproduce the observed structure. We find that the bright limb and the tail already formed during the AGB phase, prior to the formation of the PN. The closure of the ring arises from the slow–fast wind interaction. Most of the mass lost on the AGB has been swept downstream, providing a potential explanation of the missing mass problem in PNe. We report a proper motion for the central star of 30 ± 10 mas yr^{-1} in the direction of the bright limb. Assuming the central star is moving at 125 ± 25 kms, the distance to the nebula is estimated to be 850^{+500}_{-420} pc, consistent with a spectroscopic distance to the star. Expansion velocities measured from spectroscopic data of the bright filaments are consistent with velocities measured from the simulation. Sh 2-188 is one of the largest PNe known, with an extent of 2.8 pc. The model shows that this size was already set during the AGB phase.

Accepted for publication in MNRAS
Available from astro-ph/0512028

New insights on the complex planetary nebula Hen 2-113

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We report infrared observations of the planetary nebula Hen 2-113 obtained with VLT/NACO, VLTI/MIDI, VLT/ISAAC and TIMMI at the ESO 3.6m. Hen 2-113 exhibits a clear ring-like structure superimposed to a more diffuse environment visible in the L' (3.8μm), M' (4.78μm) and 8.7μm bands. No clear core at 8.7μm and no fringes through the N band could be detected for this object with MIDI. A qualitative interpretation of the object structure is proposed using a diabolo-like geometrical model. The PAH content of the nebula was also studied with ISAAC and TIMMI observations. This indicates that the PAHs are mostly concentrated towards the lobes of the diabolo and the bipolar lobes of the nebula. In L' band, a void 0.3" in diameter was discovered with NACO around the central source. The L' and M' fluxes from the central source were derived from NACO data indicating an important infrared excess with respect to the expected stellar emission based on stellar models and short wavelength data. The observed flux from this source in the L' and M' is about 300 and 800 times respectively than those expected from a model including only the central star. Moreover, the central object appears resolved in L' band with measured FWHM about 155 mas. This

infrared excess can be explained by emission from a cocoon of hot dust (T∼1000K) with a total mass $\sim 10^{-9} M_{\odot}$.

Accepted for publication in Astronomy and Astrophysics
Available from astro-ph/0509014

Full polarization study of SiO masers at 86 GHz

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We study the polarization of the SiO maser emission in a representative sample of evolved stars in order to derive an estimate of the strength of the magnetic field, and thus determine the influence of this magnetic field on evolved stars. We made simultaneous spectroscopic measurements of the 4 Stokes parameters, from which we derived the circular and linear polarization levels. The observations were made with the IF polarimeter installed at the IRAM 30m telescope. A discussion of the existing SiO maser models is developed in the light of our observations. Under the Zeeman splitting hypothesis, we derive an estimate of the strength of the magnetic field. The averaged magnetic field varies between 0 and 20 Gauss, with a mean value of 3.5 Gauss, and follows a 1/r law throughout the circumstellar envelope. As a consequence, the magnetic field may play the role of a shaping, or perhaps collimating agent of the circumstellar envelopes in evolved objects.

Accepted for publication in A&A, accepted on 29/12/05
Available from astro-ph/0601098

The 10 μm Feature of M-Type Stars in the Large Magellanic Cloud and the Dust Condensation Sequence

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We present 7-14 μm Infrared Space Observatory (ISO) spectroscopy of 12 M-type evolved stars in the Large Magellanic Cloud (LMC), in order to study the dust mineralogy and condensation process around these stars. The sample stars show a broad dust feature in the 7-14 μm region, which is seen in either emission or (self-) absorption. The shape of the feature changes with increasing mass-loss rate, $\dot{M}$, suggesting a change in dust mineralogy as the central star evolves. At low mass-loss rates amorphous alumina and amorphous silicates are observed, while at high mass-loss rates only amorphous silicates are seen, in agreement with the classical condensation sequence expected for these materials. We find a clear correlation between $\dot{M}$ and the peak wavelength position of the broad dust feature. Our data suggest a strong dependence of the dust mineralogy on the temperature at the dust condensation radius.

Published in The Astrophysical Journal, Volume 633, Issue 2, pp. L133-L136

Water ice growth around evolved stars II : Modeling infrared spectra

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We present combined radiative transfer and H_2O ice formation calculations for the dusty envelopes of oxygen-rich evolved stars. We study the effects of various (circum-)stellar parameters on the spectral energy distribution of these stars, their infrared spectral water ice features at $3\,\mu$m and in the $30-100\,\mu$m region, and the properties of (water ice on) the grains in their envelopes. We also study the ice formation process as a function of stellar evolution for a star with an initial mass of $5\,M_\odot$, which is followed during the AGB, post-AGB and planetary nebula (PN) phase. We find that its water ice features probe its evolution. Both crystalline and amorphous water ice form in our models. The 43 and $62\,\mu$m crystalline water ice features are most prominent during the post-AGB phase, and only modestly or not present during the AGB and PN phase, in agreement with observations. The strength of the 3, 43 and $62\,\mu$m water ice features decreases with decreasing initial mass of the star. The total amount of ice predicted (a few percent of the total dust mass) also agrees with observations, but the crystalline ice mass fraction is consistently about two orders of magnitude lower. This is mainly due to efficient amorphization by interstellar UV photons, and leads to weaker 43 and 62 μm crystalline water ice features than observed. The intensity of the interstellar UV radiation field strongly influences the strength of these features. We discuss several means to increase the crystalline water ice mass, and hence their strength. The strength of the features increases dramatically when the mass-loss rate over luminosity ratio of the star, $\dot{M}/L$, is large in the AGB phase. In case of the post-AGB star HD 161796 we demonstrate that this indeed leads to the correct crystalline ice mass fraction and feature strengths. Also, the formation of clumps in the AGB wind provides high densities to stimulate the formation of (crystalline) ice. For stars with high initial masses, it additionally provides sufficient shielding from interstellar UV radiation to keep ice crystalline during the post-AGB and PN phase. Axisymmetric mass loss on the AGB provides favorable conditions for the formation and preservation of water ice, and crystalline water ice in particular, as well. In contrast we find that post-AGB crystallization of AGB produced amorphous ice is unimportant for increasing the crystalline water ice mass around $5\,M_\odot$ stars.

Accepted for publication in Astronomy and Astrophysics

Disk-Like Structure in the Semi-Regular Pulsating Star, X Her

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The author reports a result of an interferometric observation of the semiragular pulsating star with an unusual narrow molecular line profile, X Her, in the CO J=1-0 line with the Berkeley-Illinois-Maryland array. In the CO spectrum, a double-component profile (including narrow and broad components) is seen as reported by previous observations. The narrow component consists of two spiky peaks. The spatial structure of the board component shows bipolar shape, and that of the narrow component shows an elliptical/spherical shape. The two peaks in the narrow component show a systematic difference in the integrated intensity map. The kinematical and geometrical properties of the narrow component are reminiscent of a Keplerian rotating disk with the central mass of 0.9 $M_\odot$, though an interpretation by an expansion disk seems to be more natural. A secondary bipolar flow instead of the disk cannot be fully excluded as an interpretation of the narrow line.

Published in 2005, ApJ, 620, 943
Available from astro-ph/0411021

BIMA Array Observations of the Highly Unusual SiO Maser Source with a Bipolar Nebulosity, IRAS 19312+1950

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We report the results of mapping observations of the bipolar nebula with SiO maser emission, IRAS 19312+1950,

in the CO (J=1-0 and J=2-1), 13CO (J=1-0 and J=2-1), C18O (J=1-0), CS (J=2-1), SO (J_K=3_2-2_1) and HCO+ (J=3-2) lines with the Berkeley-Illinois-Maryland Association array. Evolutional status of this source has been evoking a controversy since its discovery, though SiO maser sources are usually identified as late-type stars with active mass loss. In line profiles, two kinematical components are found as reported in previous single-dish observations: a broad pedestal component and a narrow component. Spatio-kinetic properties of a broad component region traced by ^{12}CO lines are roughly explained by a simple spherical outflow model with a typical expanding velocity of an AGB star, though some properties of the broad component region still conflict with properties of a typical AGB spherical outflow. A narrow component region apparently exhibits a bipolar flow. The angular size of the narrow component region is spatially larger than that of a broad component region. Intensity distribution of the CS emission avoids the central region of the source, and that of an SO broad component emission exhibits a small feature peaked exactly at the mapping center. According to the present results, if a broad component really originates in a spherical outflow, an oxygen-rich evolved stellar object seems to be a natural interpretation for the central star of IRAS 19312+1950.

Published in 2005,ApJ, 633, 282
Available from astro-ph/0507191

BIMA CO Observation of EP Aqr the Semiregular Pulsating Star with a Double Component Line Profile

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This paper reports the results of a Berkeley-Illinois-Maryland array interferometric observation of EP Aqr, a semiregular pulsating star with a double component line profile in the CO J=1-0 line. The broad component shows a flat-top profile, and the narrow component shows a spiky strong peak. Though the previous single dish observations suggested that the CO J=2-1 line exhibits a Gaussian-like profile, the CO J=1-0 line does not. The spatial distributions of both the narrow and broad components appears to be roughly round with the same peak positions. No significant velocity gradient is seen. The spatial-kinetic properties of the molecular envelope of EP Aqr are reminiscent of a multiple shell structure model rather than a bipolar flow and disk model. A problem of this interpretation is that no evidence of interaction between the narrow and broad component regions is seen. A Gaussian-like feature seen in the CO J=2-1 line might play a key role to understand the spatio-kinetic properties of the molecular envelope of EP Aqr.

Accepted for publication in accepted for publication in ApJ
Available from astro-ph/0510543

Near-Infrared echelle spectroscopy of Proto-Planetary Nebulae: probing the fast wind in H_2

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Echelle spectroscopy of H_2 1-0S(1), [FeII] 1.64μm and Brγ line emission from a very young planetary nebula, IRAS 21282+5050, and from four proto-planetary nebulae, IRAS 19343+2926 (M 1-92), IRAS 17150-3224 (AFGL 6815), IRAS 17423-1755 (Hen 3-1475), and IRAS 17441-2411 is presented. H_2 line emission is detected in discrete shock fronts in the lobes of each nebula, regardless of source spectral type (although non-detections in IRAS 09371+1212 (Frosty Leo) support claims that late spectral types do not produce bright H_2 line emission). In IRAS 17150-3224 we also uncover possible signs of rotation, as would be expected if the H_2 features were excited in a magneto-centrifugal disk wind. [FeII] emission was detected in only one source, M 1-92 (notably, the source with the brightest H_2 features).

Again, the emission is predominantly excited in high-velocity shocks in the bipolar lobes of the PPN. The H_2 and [FeII] observations of M 1-92, and the complex H_2 profiles in IRAS 21282+5050, are explained using the shock models of Smith and collaborators. We show that bow shock models are generally able to account for the observed line profiles, peak velocities, the double-peaked profiles in IRAS 21282+5050 and the spatial distribution of H_2 and [FeII] in M 1-92. J-type bow models are adequate in each case, i.e. a strongly-magnetised wind is not required.

Finally, Brγ is detected in each of the five targets; in absorption in the G-type PPN though in emission in the O and B-type sources. Brγ emission is detected predominantly toward the near-IR continuum peak in each PPN, with only very weak emission detected in the extended lobes of the O- and B-type sources. In Brγ, low peak velocities, though very broad profile widths, are measured in each target, regardless of nebula inclination angle. The emission must therefore derive from ionised regions in a fast wind very close to the central star (rather than from shocks in the bipolar lobes), or, in the late-type sources, from absorption in an equatorial torus.

Published in MNRAS, 2005, 360, 104
Available from astro-ph/0503327
and from http://www.jach.hawaii.edu/∼cdavis/

Atlas of Hα emission lines and *V* light curves of 30 carbon Miras

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This paper presents an atlas of V light curves and Hα emission lines of 30 carbon Miras observed in various photometrical phases. The visualization of both photometric and spectral variations allowed us to reveal a strong correlation between the equivalent widths of the Hα emission of carbon Miras and their V brightnesses as a function of the photometric phase.

Published in Contributions of the Astronomical Observatory Skalnate Pleso
Available from http://www.ta3.sk/caosp/Eedition/Abstracts/2005/Vol_35/No_2/pp83-106_abstract.html

Preliminary Analysis of *V* and *Hp* Light Curves of 26 Carbon Miras

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Light variations of a representative sample of 26 more or less periodically variable carbon stars were analyzed on the basis of 2220 individual observations made by the Hipparcos satellite and 33 544 visual observations listed in AFOEV and VSOLJ databases within the interval JD = 2 448 000 (1988) 6 cycles. We found the osculating linear ephemerides of all stars and their mean light curves, as well. We found that the light curves of the carbon Miras in our set can be satisfactorily expressed as a linear combination of only two basic light curves. The analysis was done by an own method combining robust regression and principal component analysis.

Published in Astrophysics and Space Science, Volume 296, Issue 1-4, pp. 157-160
Available from http://www.springer.com/sgw/cda/frontpage/0,11855,5-0-70-35683926-0,00.html?referer=www.wkap.nl

Spectral Index of the H_2O-Maser Emitting Planetary Nebula IRAS 17347-3139

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We present radio continuum observations of the planetary nebula (PN) IRAS 17347-3139 (one of the only two known to harbour water maser emission), made to derive its spectral index and the turnover frequency of the emission. The spectrum of the source rises in the whole frequency range sampled, from 2.4 to 24.9 GHz, although the spectral index seems to decrease at the highest frequencies (0.79 ± 0.04 between 4.3 and 8.9 GHz, and 0.64 ± 0.06 between 16.1 and 24.9 GHz). This suggests a turnover frequency around 20 GHz (which is unusual among PNe, whose radio emission usually becomes optically thin at frequencies < 10 GHz), and a relatively high emission measure (1.5×10^9 cm^{-6} pc). The radio continuum emission has increased by a factor of $\simeq 1.26$ at 8.4 GHz in 13 years, which can be explained as expansion of the ionized region by a factor of $\simeq 1.12$ in radius with a dynamical age of $\simeq 120$ yr and at an expansion velocity of $\simeq 5-40$ km s^{-1}. These radio continuum characteristics, together with the presence of water maser emission and a strong optical extinction suggest that IRAS 17347-3139 is one of the youngest PNe known, with a relatively massive progenitor star.

Published in Monthly Notices of the Royal Astronomical Society, 364, 738
Available from astro-ph/0509246

Long-Period Variables in the Large Magellanic Cloud: Results from MACHO and 2MASS

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We use the 8 year light-curve database from the MAssive Compact Halo Objects project together with infrared colors and magnitudes from the Two Micron All Sky Survey to identify a sample of 22,000 long-period variables in the Large Magellanic Cloud (referred to hereafter as LMC LPVs). A period-luminosity diagram of these stars reveals six well-defined sequences, in substantial agreement with previous analyses of samples from the Optical Gravitational Lensing Experiment. In our analysis we identify analogues to Galactic LPVs in the LMC LPV sample. We find that carbon-dominated asymptotic giant branch (AGB) stars populate only two of the sequences, one of which includes the Mira variables. The high-luminosity end of the same two sequences are also the location of the only stars with J-Ks¿2, indicating that they are enshrouded in dust. The unknown mechanism that drives the variability of stars in the longest period produces different morphology in the period-luminosity diagram as compared with the shortest period sequences, which are thought to be caused by pulsation. In particular, the longest period sequence extends to lower luminosity red giant branch stars, and the luminosity function does not peak among the AGB stars. We point out several features that will constrain new models of the period-luminosity sequences.

Published in Astronomical Journal
Available from astro-ph/0410398

Inward motions of the compact SiO masers around VX Sagitarii

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We report Very Long Baseline Array (VLBA) observations of 43 GHz v=1, J=1-0 SiO masers in the circumstellar envelope of the M-type semi-regular variable star VX Sgr at 3 epochs during 1999 April-May. These high-resolution VLBA images reveal a persistent ringlike distribution of SiO masers with a projected radius of 3 stellar radii. The typical angular size of 0.5 mas for individual maser feature was estimated from two-point correlation function analysis for maser spots. We found that the apparent size scale of maser features was distinctly smaller than that observed in the previous observations by comparing their fractions of total power imaged. This change in the size scale of maser emission may be related to stellar activity that caused a large SiO flare during our observations. Our observations confirmed the asymmetric distribution of maser emission, but the overall morphology has changed significantly with the majority of masers clustering to the north-east of the star compared to that lying to the south-west direction in 1992. By identifying 42 matched maser features appearing in all the three epochs, we determined the contraction of an SiO maser shell toward VX Sgr at a proper motion of -0.507 ± 0.069 mas/yr, corresponding to a velocity of about 4 km/s at a distance of 1.7 kpc to VX Sgr. Such a velocity is on the order of the sound speed, and can be easily explained by the gravitational infall of material from the circumstellar dust shell.

Accepted for publication in ApJ
Available from astro-ph/0512011

3D Numerical Experimentation on the Core Helium Flash of low-mass Red Giants

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We model the core helium flash in a low-mass red giant using Djehuty, a fully three-dimensional (3D) code. The 3D structures were generated from converged models obtained during the 1D evolutionary calculation of a 1 $M_\odot$ star. Independently of which starting point we adopted, we found that after some transient relaxation the 3D model settled down with a briskly convecting He-burning shell that was not very different from what the 1D model predicted.

Accepted for publication in Astrophys J
Available from astro-ph/0512049

Spectroscopic observations of the rapid rotating post-AGB star IRAS 05381+1012

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This work reports high-resolution stellar parameters and abundance analysis of the rapid rotating post-AGB star IRAS 05381+1012. Analysis of high resolution spectrum shows that IRAS 05381+1012 has an effective temperature of $T_{\rm eff} = 5\,200 \pm 100$ K and a surface gravity of $\log g = 1.0 \pm 0.5$ corresponding to a spectral type G(2-3)I. These parameters result into an estimated luminosity of $970\,L_\odot$ and a distance of 2700 pc. We also show that IRAS 05381+1012 has a projected rotational velocity $v \sin i = 40 \pm 10\,{\rm km\,s^{-1}}$. The abundance analysis based on a few available lines reveals

that this star is an iron deficient object having [Fe/H] = −0.8. We also analyze the abundance pattern and compare it to other classes of stars with similar stellar parameters

Accepted for publication in Astronomy & Astrophysics

Resolving the compact dusty discs around binary post-AGB stars using N-band interferometry

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We present the first mid-IR long baseline interferometric observations of the circumstellar matter around binary post-AGB stars. Two objects, SX Cen and HD 52961, were observed using the VLTI/MIDI instrument during Science Demonstration Time. Both objects are known binaries for which a stable circumbinary disc is proposed to explain the SED characteristics. This is corroborated by our N-band spectrum showing a crystallinity fraction of more than 50 % for both objects, pointing to a stable environment where dust processing can occur. Surprisingly, the dust surrounding SX Cen is not resolved in the interferometric observations providing an upper limit of 11 mas (or 18 AU at the distance of this object) on the diameter of the dust emission. This confirms the very compact nature of its circumstellar environment. The dust emission around HD 52961 originates from a very small but resolved region, estimated to be ∼35 mas at 8 μm and ∼55 mas at 13 μm. These results confirm the disc interpretation of the SED of both stars. In HD 52961, the dust is not homogeneous in its chemical composition: the crystallinity is clearly concentrated in the hotter inner region. Whether this is a result of the formation process of the disc, or due to annealing during the long storage time in the disc is not clear.

Accepted for publication in Astronomy & Astrophysics
Available from astro-ph/0601169

Relics of metal-free low mass stars exploding as thermonuclear supernovae

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Renewed interest in the first stars that were formed in the universe has led to the discovery of extremely iron-poor stars. Since several competing scenarios exist, our understanding of the mass range that determines the observed elemental abundances remains unclear. In this study, we consider three well-studied metal-poor stars in terms of the theoretical supernovae (SNe) model. Our results suggest that the observed abundance patterns in the metal-poor star BD +80°245 and the pair of stars HD 134439/40 agree strongly with the theoretical possibility that these stars inherited their heavy element abundance patterns from SNe initiated by thermonuclear runaways whose progenitors were primordial asymptotic giant branch stars with masses of $\sim 3.5 - 5$ M$_\odot$. Recent theoretical calculations have predicted that such SNe could be originated from metal-free stars in the intermediate mass range. On the other hand, intermediate mass stars containing some metals would end their lives as white dwarfs after expelling their envelopes in the wind due to intense momentum transport from outgoing photons to heavy elements. This new pathway for the formation of SNe requires that stars are formed from the primordial gas. Thus, we suggest that stars of a few solar

masses were formed from the primordial gas and that some of them caused thermonuclear explosions when the mass of their degenerate carbon-oxygen cores increased to the Chandrasekhar limit without experiencing efficient mass loss.

Accepted for publication in The Astrophysical Journal Letters
Available from astro-ph/0601324

Polarimetry of Li-rich giants

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Protoplanetary nebulae typically present non-spherical envelopes. The origin of such geometry is still controversial. There are indications that it may be carried over from an earlier phase of stellar evolution, such as the AGB phase. But how early in the star's evolution does the non-spherical envelope appear? Li-rich giants show dusty circumstellar envelopes that can help answer that question. We study a sample of fourteen Li-rich giants using optical polarimetry in order to detect non-spherical envelopes around them. We used the IAGPOL imaging polarimeter to obtain optical linear polarization measurements in V band. Foreground polarization was estimated using the field stars in each CCD frame. After foreground polarization was removed, seven objects presented low intrinsic polarization $(0.19 - 0.34)\%$ and two (V859 Aql and GCSS 557) showed high intrinsic polarization values $(0.87 - 1.16)\%$. This intrinsic polarization suggests that Li-rich giants present a non-spherical distribution of circumstellar dust. The intrinsic polarization level is probably related to the viewing angle of the envelope, with higher levels indicating objects viewed closer to edge-on. The correlation of the observed polarization with optical color excess gives additional support to the circumstellar origin of the intrinsic polarization in Li-rich giants. The intrinsic polarization correlates even better with the IRAS 25 μm far infrared emission. Analysis of spectral energy distributions for the sample show dust temperatures for the envelopes tend to be between 190 and 260 K. We suggest that dust scattering is indeed responsible for the optical intrinsic polarization in Li-rich giants. Our findings indicate that non-spherical envelopes may appear as early as the red giant phase of stellar evolution.

Accepted for publication in Astronomy and Astrophysics
Available from astro-ph/0512237

The origin and chemical evolution of carbon in the Galactic thin and thick disks

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In order to trace the origin and evolution of carbon in the Galactic disk we have determined carbon abundances in 51 nearby F and G dwarf stars. The sample is divided into two kinematically distinct subsamples with 35 and 16 stars that are representative of the Galactic thin and thick disks, respectively. The analysis is based on spectral synthesis of the forbidden [C I] line at 872.7 nm using spectra of very high resolution ($R \approx 220\,000$) and high signal-to-noise ($S/N \gtrsim 300$) that were obtained with the CES spectrograph on the ESO 3.6-m telescope on La Silla in Chile. We find that [C/Fe] versus [Fe/H] trends for the thin and thick disks are totally merged and flat for sub-solar metallicities. The thin disk that extends to higher metallicities than the thick disk, shows a shallow decline in [C/Fe] from [Fe/H] ≈ 0 and up to [Fe/H] $\approx +0.4$. The [C/O] versus [O/H] trends are well separated between the two disks (due to differences in the oxygen abundances) and bear a great resemblance to the [Fe/O] versus [O/H] trends. Our interpretation of our abundance trends is that the sources that are responsible for the carbon enrichment in the Galactic thin and thick disks have operated on a time-scale very similar to those that are responsible for the Fe and Y enrichment (i.e., SN Ia

and AGB stars, respectively). We further note that there exist other observational data in the literature that favour massive stars as the main sources for carbon. In order to match our carbon trends, we believe that the carbon yields from massive stars then must be very dependent on metallicity for the C, Fe, and Y trends to be so finely tuned in the two disk populations. Such metallicity dependent yields are no longer supported by the new stellar models in the recent literature. For the Galaxy we hence conclude that the carbon enrichment at metallicities typical of the disk is mainly due to low and intermediate mass stars, while massive stars are still the main carbon contributor at low metallicities (halo and metal-poor thick disk).

Accepted for publication in MNRAS, in press
Available from astro-ph/0601130

The mass loss of C-rich giants

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The mass loss rates, expansion velocities and dust-to-gas density ratios from millimetric observations of 119 carbon-rich giants are compared, as functions of stellar parameters, to the predictions of recent hydrodynamical models. Distances and luminosities previously estimated from HIPPARCOS data, masses from pulsations and C/O abundance ratios from spectroscopy, and effective temperatures from a new homogeneous scale, are used. Predicted and observed mass loss rates agree fairly well, as functions of effective temperature. The signature of the mass range $M \leq 4\,M_{\odot}$ of most carbon-rich AGB stars is seen as a flat portion in the diagram of mass loss rate *vs.* effective temperature. It is flanked by two regions of mass loss rates increasing with decreasing effective temperature at nearly constant stellar mass. Four stars with detached shells, i.e. episodic strong mass loss, and five cool infrared carbon-rich stars with optically-thick dust shells, have mass loss rates much larger than predicted values. The latter (including CW Leo) could be stars of smaller masses ($M \simeq 1.5 - 2.5\,M_{\odot}$) while $M \simeq 4\,M_{\odot}$ is indicated for most of the coolest objects. Among the carbon stars with detached shells, R Scl returned to a predicted level (16 times lower) according to recent measurements of the central source. The observed expansion velocities are in agreement with the predicted velocities at infinity in a diagram of velocities *vs.* effective temperature, provided the carbon to oxygen abundance ratio is $1 \leq \epsilon_C/\epsilon_O \leq 2$, i.e. the range deduced from spectra and model atmospheres of those cool variables. Five stars with detached shells display expansion velocities about twice that predicted at their effective temperature. Miras and non-Miras do populate the same locus in both diagrams at the present accuracy. The predicted dust-to-gas density ratios are however about 2.2 times smaller than the values estimated from observations. Recent drift models can contribute to minimize the discrepancy since they include more dust. Simple approximate formulae are proposed.

Published in A&A
Available from astro-ph/0601366
and from http://dx.doi.org/10.1051/0004-6361:20041280

Proper-Motion Measurements of the Cygnus Egg Nebula

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We present the results of proper-motion measurements of the dust shell structure in the Egg Nebula (AFGL 2688, CRL 2688, V1610 Cyg), based on the archived two-epoch imaging-polarimetry data in the 2-micron band taken with

NICMOS on-board the Hubble Space Telescope. We measured the amount of motions of local structures in the nebula by determining their relative shifts over an interval of 5.5 years. The dynamical age of the nebula is found to be roughly 350 years based on the overall motion of the nebula that exhibits a Hubble-law-esque linear relation between the measured proper motion and the projected radial distance from the origin of the expansion. By adopting the de-projected velocity of 45 km/s at the tips of the bipolar lobes, our proper-motion measurements indicate that the distance to the Egg Nebula is about 420 pc and that the lobes are inclined at 7.7 deg with respect to the plane of the sky. The refined distance estimate yields the luminosity of the central star of 3.3×10^3 $L_\odot$, the total shell mass of 1.2 $M_\odot$, and the mass loss rate (the upper limit) of 3.6×10^{-3} $M_\odot$/yr. Assuming 0.6 $M_\odot$ central post-AGB stellar mass, the initial mass of the Egg is 1.8 $M_\odot$. Given the adopted distance to the nebula and the tip velocity, the lobe tips would need only 270 years to reach their epoch 2 positions. This is about 80 years shorter than the dynamical age of the nebula. This discrepancy, together with the fact that the lobe tips do not follow the linear relation as the rest of the nebula, suggests that the tips increased their velocity due to shock acceleration. Upon analysis, we also discovered that the central star of the Egg Nebula has proper motion of its own at the rate of (14, −10) mas/yr and that the apparent bipolar lobes consist of multiple outflows at distinct inclination angles projected onto each other.

Accepted for publication in To appear in the ApJ 20 April 2006, v641 2 issue
Available from astro-ph/0512601

Revealing the mid-infrared emission structure of IRAS 16594-4656 and IRAS 07027-7934

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TIMMI2 diffraction-limited mid-infrared images of a multipolar proto-planetary nebula IRAS 16594-4656 and a young [WC] elliptical planetary nebula IRAS 07027-7934 are presented. Their dust shells are for the first time resolved (only marginally in the case of IRAS 07027-7934) by applying the Lucy-Richardson deconvolution algorithm to the data, taken under exceptionally good seeing conditions ($< 0.5''$). IRAS 16594-4656 exhibits a two-peaked morphology at 8.6, 11.5 and 11.7 microns which is mainly attributed to emission from PAHs. Our observations suggest that the central star is surrounded by a toroidal structure observed edge-on with a radius of $0.4''$ ($\sim$ 640 AU at an assumed distance of 1.6 kpc) with its polar axis at P.A.$\sim$ 80 degrees, coincident with the orientation defined by only one of the bipolar outflows identified in the HST optical images. We suggest that the material expelled from the central source is currently being collimated in this direction and that the multiple outflow formation has not been coeval. IRAS 07027-7934 shows a bright, marginally extended emission (FWHM= $0.3''$) in the mid-infrared with a slightly elongated shape along the N-S direction, consistent with the morphology detected by HST in the near-infrared. The mid-infrared emission is interpreted as the result of the combined contribution of small, highly ionized PAHs and relatively hot dust continuum. We propose that IRAS 07027-7934 may have recently experienced a thermal pulse (likely at the end of the AGB) which has produced a radical change in the chemistry of its central star.

Accepted for publication in The Astrophysical Journal
Available from astro-ph/0512064

The Optical Gravitational Lensing Experiment. Miras and Semiregular Variables in the Large Magellanic Cloud

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We use the OGLE-II and OGLE-III data in conjunction with the 2MASS near-infrared (NIR) photometry to identify and study Miras and Semiregular Variables (SRV) in the Large Magellanic Cloud. We found in total 3221 variables of both types, populating two of the series of NIR period–luminosity (PL) sequences. The majority of these objects are double periodic pulsators, with periods belonging to both PL ridges. We indicate that in the period – Wesenheit index plane the oxygen-rich and carbon-rich AGB stars from the NIR PL sequences C, C$'$ and D split into well separated ridges. Thus, we discover an effective method of distinguishing between O-rich and C-rich Miras, SRV and stars with Long Secondary Periods using their V and I band photometry. We present an empirical method of estimating the mean K_s magnitudes of the Long Period Variables using single-epoch K_s measurements and complete light curves in the I band. We utilize these corrected magnitudes to show that the O-rich and C-rich Miras and SRV follow somewhat different K_s band PL relations.

Published in Acta Astronomica
Available from astro-ph/0512578
and from http://ogle.astrouw.edu.pl/ogle2/lpv_lmc.html

Polycyclic Aromatic Hydrocarbons orbiting HD 233517, an evolved oxygen-rich red giant

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We report spectra obtained with the *Spitzer Space Telescope* in the $\lambda = 5 - 35$ μm range of HD 233517, an evolved K2 III giant with circumstellar dust. For $\lambda > 13$ μm, the flux is a smooth continuum that varies approximately as $\nu^{-5/3}$. For $\lambda < 13$ μm, although the star is oxygen-rich, PAH features produced by carbon-rich species at 6.3 μm, 8.2 μm, 11.3 μm and 12.7 μm are detected along with likely broad silicate emission near 20 μm. These results can be explained if there is a passive, flared disk orbiting HD 233517. Our data support the hypothesis that organic molecules in orbiting disks may be synthesized *in situ* as well as being incorporated from the interstellar medium.

Accepted for publication in ApJ Letters
Available from astro-ph/0512371

The structure of Planetary Nebulae: theory vs. practice

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This paper - the first of a short series dedicated to the long-stan ding astronomical problem of de-projecting the bi-dimensional apparent morpholog y of a three-dimensional mass of gas - focuses on the density distribution in real Planetary Nebulae (and all types of expanding nebulae). We introduce some basic theoretical notions, discuss the observational methodology and develope the accurate procedure for the determination of the matter radial profile

within the sharp portion of nebula in the plane of the sky identified by the zero-velocity-pixel-column (zvpc) of high-resolution spectral images. Moreover, a series of evolutive snapshots is presented, combining illustrative examples of model- and true-Planetary Nebulae. Last, the general and specific applications of the method (and some caveats) are discussed.

Accepted for publication in A&A
Available from astro-ph/0601283

New Planetary Nebulae in the Galactic Bulge region with $l > 0^o$ - II

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The presentation of new results from an [O III] 5007 A survey in a search for planetary nebulae (PNe) in the galactic bulge is continued. A total of 60 objects, including 19 new PNe, have been detected in the remaining 34 per cent of the survey area, while 41 objects are already known. Deep Halpha+[N II] CCD images as well as low resolution spectra have been acquired for these objects. Their spectral signatures suggest that the detected emission originates from photoionized nebulae. In addition, absolute line fluxes have been measured and the electron densities are given. Accurate optical positions and optical diameters are also determined.

Accepted for publication in Monthly Notices of the Royal Astronomical Society
Available from astro-ph/0601178

Improved HCN/HNC linelist, model atmospheres and synthetic spectra for WZ Cas

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We build an accurate database of 5200 HCN and HNC rotation-vibration energy levels, determined from existing laboratory data. 20000 energy levels in the Harris et al. (2002) linelist are assigned approximate quantum numbers. These assignments, lab determined energy levels and Harris et al. (2002) energy levels are incorporated in to a new energy level list. A new linelist is presented, in which frequencies are computed using the lab determined energy levels where available, and the ab initio energy levels otherwise.

The new linelist is then used to compute new model atmospheres and synthetic spectra for the carbon star WZ Cas. This results in better fit to the spectrum of WZ Cas in which the absorption feature at 3.56 micron is reproduced to a higher degree of accuracy than has previously been possible. We improve the reproduction of HCN absorption features by reducing the abundance of Si to [Si/H] = –0.5 dex, however, the strengths of the $\Delta v = 2$ CS band heads are over-predicted.

Accepted for publication in MNRAS
Available from astro-ph/0512363
and from www.tampa.phys.ucl.ac.uk/∼greg/public_html/HCN/

First VLBI mapping of circumstellar ^{29}SiO maser emission

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We report the first VLBI map of the v =0 J =1-0 maser line of ^{29}SiO in the long-period variable star IRC +10011. We have found that this maser emission is composed of multiple spots distributed in an incomplete ring, suggesting that this maser is also amplified tangentially, as already proposed in other SiO circumstellar masers. We present also VLBI maps for the 7 mm ^{28}SiO v =1 and 2 J =1-0 and the 3 mm v =1 J =2-1 lines. The ^{29}SiO masing region appears to be located in a layer in between the ^{28}SiO v =1 J =1-0 and ^{28}SiO v =1 J =2-1 lines. In addition, we confirm that the 86 GHz maser v =1 J =2-1 forms in an outer region of the circumstellar envelope compared to the other ^{28}SiO masers studied. Finally, we discuss the possible implications of the observational results on the SiO maser pumping theory.

Published in Astronomy and Astrophysics, Volume 432, Issue 2, March III 2005, pp.L39-L42
Available from astro-ph/0502016
and from http://adsabs.harvard.edu/cgi-bin/nph-data_query?bibcode=2005A

First Resolved Images of the Mira AB Symbiotic Binary at Centimeter Wavelengths

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We report the first spatially resolved radio continuum measurements of the Mira AB symbiotic binary system, based on observations obtained with the Very Large Array (VLA). This is the first time that a symbiotic binary has been resolved unambiguously at centimeter wavelengths. We describe the results of VLA monitoring of both stars over a ten month period, together with constraints on their individual spectral energy distributions, variability, and radio emission mechanisms. The emission from Mira A is consistent with originating from a radio photosphere, while the emission from Mira B appears best explained as free-free emission from an ionized circumstellar region $\sim$(1-10)$\times10^{13}$ cm in radius.

Accepted for publication in ApJ Letters
Available from astro-ph/0512205

Planetary nebulae with emission-line central stars

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The kinematic structure of a sample of planetary nebulae, consisting of 23 WR] central stars, 21 weak emission line stars (wels) and 57 non-emission line central stars, is studied. The [WR] stars are shown to be surrounded by turbulent nebulae, a characteristic shared by some wels but almost completely absent from the non-emission line

stars. The fraction of objects showing turbulence for non-emission-line stars, wels and [WR] stars is 7%, 24% and 1%, respectively. The [WR] stars show a distinct IRAS 12-micron excess, indicative of small dust grains, which is not found for wels. The [WR]-star nebulae are on average more centrally condensed than those of other stars. On the age-temperature diagram, the wels are located on tracks of both high and low stellar mass, while [WR] stars trace a narrow range of intermediate masses. Emission-line stars are not found on the cooling track. One group of wels may form a sequence wels-[WO] stars with increasing temperature. For the other groups both the wels and the [WR] stars appear to represent several, independent evolutionary tracks. We find a discontinuity in the [WR] stellar temperature distribution and suggest different evolutionary sequences above and below the temperature gap. One group of cool [WR] stars has no counterpart among any other group of PNe and may represent binary evolution. A prime factor distinguishing wels and [WR] stars appears to be stellar luminosity. We find no evidence for an increase of nebular expansion velocity with time.

Accepted for publication in A&A
Available from astro-ph/0601439

The C-flash and the ignition conditions of type Ia supernovae

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Thanks to a stellar evolution code able to compute through the C-flash we link the binary population synthesis of single degenerate progenitors of type Ia supernovae (SNe Ia) to their physical condition at the time of ignition. We show that there is a large range of possible ignition densities and we detail how their probability distribution depends on the accretion properties. The low density peak of this distribution qualitatively reminds of the clustering of the luminosities of Branch-normal SNe Ia. We tighten the possible range of initial physical conditions for explosion models: they form a one-parameter family, independent of the metallicity. We discuss how these results may be modified if we were to relax our hypothesis of a permanent Hachisu wind or if we were to include electron captures.

Accepted for publication in MNRAS
Available from astro-ph/0601443

An infrared study of galactic OH/IR stars. I. An optical/near-IR atlas of the Arecibo sample.

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In this paper we present optical and near-infrared finding charts, accurate astrometry ($\approx 1''$) and single-epoch near-infrared photometry for 371 IRAS sources, 96% of those included in the so-called 'Arecibo sample of OH/IR stars' (Eder et al. 1988; Lewis et al. 1990; Chengalur et al. 1993). The main photometric properties of the stars in the sample are presented and discussed as well as the problems found during the process of identification of the optical/near-infrared counterparts. In addition, we also identify suitable reference stars in each field to be used for differential photometry purposes in the future.

We find that 39% of the sources (144 in number) have no optical counterpart, 8 of them being invisible even at near infrared wavelengths. The relative distribution of sources with and without optical counterpart in the IRAS two-colour

diagram and their characteristic near infrared colours are interpreted as the consequence of the increasing thickness of their circumstellar shells. Among the objects not detected at near infrared wavelengths four non-variable sources are proposed to be heavily obscured post-AGB stars which have just very recently left the AGB. Eight additional objects with unusually bright and/or blue near-infrared colours are identified as candidate post-AGB stars and/or proto-planetary nebulae.

Published in Astronoy and Astrophysics, v.431, p.779-791 (2005)
Available from astro-ph/0411194

An infrared study of galactic OH/IR stars. II. The 'GLMP sample' of red oxygen-rich AGB stars

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We present optical and near-infrared finding charts taken from the DSS and 2MASS surveys of 94 IRAS sources selected from the GLMP catalogue, and accurate astrometry ($\approx 0.2''$) for most of them. Selection criteria were very red IRAS colours representative for OH/IR stars with optically thick circumstellar shells and the presence of variability according to the IRAS variability index (VAR>50). The main photometric properties of the stars in this 'GLMP sample' are presented, discussed and compared with the correspondent properties of the 'Arecibo sample' of OH/IR stars studied nearlier. We find that 37% of the sample (N = 34) has no counterpart in the 2MASS, implying extremely high optical depths of their shells. Most of the sources identified in the 2MASS are faint (K$\gtrsim$8) and are of very red colour in the near-infrared, as expected. The brightest 2MASS counterpart (K=5.3 mag) was found for IRAS 18299–1705. Its blue colour H–K=1.3 suggests that IRAS 18299–1705 is a post-AGB star. Few GLMP sources have faint but relatively blue counterparts. They might be misidentifed field stars or stars that recently experienced a drop of their mass loss rates. The 'GLMP sample' in general is made of oxygen-rich AGB stars, which are highly obscured by their circumstellar shells. They belong to the same population as the reddest OH/IR stars in the 'Arecibo sample'.

Published in Astronomy and Astrophysics, v.446, p.773-783 (2006)
Available from astro-ph/0508113

Multi-periodic variations in the last 104 years light curve of the symbiotic star BF Cyg

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We analyze a light curve of the symbiotic star BF Cyg, covering 114 years of its photometric history. The star had a major outburst around the year 1894. Since then the mean optical brightness of the system is in steady decline, reaching only in the last few years its pre-outburst value. Superposed on this general decline are some 6 less intense outbursts of 1-2 magnitude and duration of 2000-5000 days. We find a cycle of ∼6376 days, or possibly twice this period, in the occurrence of these outbursts. We suggest that the origin of the system outbursts is in some magnetic cycle in the outer layers of the giant star of the system, akin to the less intense ∼8000 days magnetic cycle of our Sun. We further find, that in addition to its well known binary period of 757.3 days, BF Cyg possesses also another photometric period of 798.8 days. This could be the rotation period of the giant star of the system. If it is, the beat period of these two periodicities, 14580 days, is the rotation period of a tidal wave on the surface of the giant. A 4th

period of 4436 days, the beat period of the 14580 and the 6376 cycles is possibly also present in the LC. We predict that BF Cyg will be at the peak of its next outburst around the month of May in the year 2007. The newly discovered 798.8 days period explains the disappearance of the orbital modulation at some epochs in the light curve. The 757.3 oscillations will be damped again around the year 2013.

Accepted for publication in MNRAS
Available from astro-ph/0512284

Low and intermediate mass stars yields. II: The evolution of nitrogen abundances

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We analyze the impact on the Galactic nitrogen abundances of using a new set of low and intermediate mass star yields. These yields have a significant yield of primary nitrogen from intermediate mass stars. We use these yields as an input to a Galactic Chemical Evolution model and study the nitrogen abundances in the halo and in the disc, and compare them with models obtained using other yield sets and with a large amount of observational data. We find that, using these new yields, our model adequately reproduce the observed trends. In particular, these yields solve the historical problem of the evolution of nitrogen, giving the right level of relative abundance N/O by the production of a primary component in intermediate mass stars. Moreover, using different evolutionary rates in each radial region of the Galaxy, we may explain the observed N dispersion.

Accepted for publication in Astronomy & Astrophysics
Available from astro-ph/0601326

Observable Effects of Dust Formation in Dynamic Atmospheres of M-type Mira Variables

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The formation of dust with temperature-dependent non-grey opacity is considered in a series of self-consistent model atmospheres at different phases of an O-rich Mira variable of mass 1.2 $M_{\odot}$. Photometric and interferometric properties of these models are predicted under different physical assumptions regarding the dust formation. The iron content of the initial silicate that forms and the availability of grain nuclei are found to be critical parameters that affect the observable properties. In particular, parameters were found where dust would form at 2-3 times the average continuum photospheric radius. This work provides a consistent physical explanation for the larger apparent size of Mira variables at wavelengths shorter than 1 μm than that predicted by dust-free fundamental-mode pulsation models.

Accepted for publication in MNRAS
Available from astro-ph/0601383

Amorphous alumina in the extended atmosphere of α Orionis

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In this paper we study the extended atmosphere of the late-type supergiant α Orionis. Infrared spectroscopy of red supergiants reveals strong molecular bands, some of which do not originate in the photosphere but in a cooler layer of molecular material above it. Lately, these layers have been spatially resolved by near and mid-IR interferometry. In this paper, we try to reconcile the IR interferometric and ISO-SWS spectroscopic results on α Ori with a thorough modelling of the photosphere, molecular layer(s) and dust shell. From the ISO and near-IR interferometric observations, we find that α Ori has only a very low density water layer close above the photosphere. However, mid-IR interferometric observations and a narrow-slit N-band spectrum suggest much larger extra-photospheric opacity close to the photosphere at those wavelengths, even when taking into account the detached dust shell. We argue that this cannot be due to the water layer, and that another source of mid-IR opacity must be present. We show that this opacity source is probably neither molecular nor chromospheric. Rather, we present amorphous alumina (Al_2O_3) as the best candidate and discuss this hypothesis in the framework of dust-condensation scenarios.

Accepted for publication in Astronomy & Astrophysics
Available from astro-ph/0510486

Post-AGB stars as testbeds of nucleosynthesis in AGB stars

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We construct a data base of 125 post-AGB objects (including R CrB and extreme helium stars) with published photospheric parameters (effective temperature and gravity) and chemical composition. We estimate the masses of the post-AGB stars by comparing their position in the (log Teff, log g) plane with theoretical evolutionary tracks of different masses. We construct various diagrams, with the aim of finding clues to AGB nucleosynthesis. This is the first time that a large sample of post-AGB stars has been used in a systematic way for such a purpose and we argue that, in several respects, post-AGB stars should be more powerful than planetary nebulae to test AGB nucleosynthesis. Our main findings are that: the vast majority of objects which do not show evidence of N production from primary C have a low stellar mass ($M_\star < 0.56$ M$_\odot$); there is no evidence that objects which did not experience 3rd dredge-up have a different stellar mass distribution than objects that did; there is clear evidence that 3rd dredge-up is more efficient at low metallicity. The sample of known post-AGB stars is likely to increase significantly in the near future thanks to the ASTRO-F and follow-up observations, making these objects even more promising as testbeds for AGB nucleosynthesis.

Accepted for publication in Astronomy & Astrophysics
Available from astro-ph/0601504

Near-infrared observations of water-ice in OH/IR stars

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A search for the near-infrared water-ice absorption band was made in a number of very red OH/IR stars which are known to exhibit the 10μm silicate absorption. As a by-product, accurate positions of these highly reddened objects are obtained. We derived a dust mass loss rate for each object by modelling the spectral energy distribution and the gas mass loss rate by solving the equation of motion for the dust drag wind. The derived mass loss rates show a strong correlation with the silicate optical depth as well as that of the water-ice. The stars have a high mass loss rate ($> 10^{-4}$ $M_\odot$ yr^{-1}) with an average gas-to-dust mass ratio of 110. In objects which show the 3.1μm water-ice absorption, the near-IR slope is much steeper than those with no water-ice. Comparison between our calculated mass loss rates and those derived from OH and CO observations indicates that these stars have recently increased their mass loss rates.

Accepted for publication in A&A
Available from astro-ph/0601649

The Uncertainties in the ^{22}Ne + α-capture Reaction Rates and the Production of the Heavy Magnesium Isotopes in Asymptotic Giant Branch Stars of Intermediate Mass

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We present new rates for the ^{22}Ne$(\alpha,n)^{25}$Mg and ^{22}Ne$(\alpha,\gamma)^{26}$Mg reactions, with uncertainties that have been considerably reduced compared to previous estimates, and we study how these new rates affect the production of the heavy magnesium isotopes in models of intermediate mass Asymptotic Giant Branch (AGB) stars of different initial compositions. All the models have deep third dredge-up, hot bottom burning and mass loss. Calculations have been performed using the two most commonly used estimates of the ^{22}Ne + α rates as well as the new recommended rates, and with combinations of their upper and lower limits. The main result of the present study is that with the new rates, uncertainties on the production of isotopes from Mg to P coming from the ^{22}Ne +α-capture rates have been considerably reduced. We have therefore removed one of the important sources of uncertainty to effect models of AGB stars. We have studied the effects of varying the mass-loss rate on nucleosynthesis and discuss other uncertainties related to the physics employed in the computation of stellar structure, such as the modeling of convection, the inclusion of a partial mixing zone and the definition of convective borders. These uncertainties are found to be much larger than those coming from ^{22}Ne + α-capture rates, when using our new estimates. Much effort is needed to improve the situation for AGB models.

Accepted for publication in The Astrophysical Journal
Available from astro-ph/0601645

Optical Spectropolarimetry of AGB and post-AGB stars

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Spectropolarimetric observations are presented for 21 AGB stars, 13 protoplanetary nebulae, and 2 R CrB-type stars. The spectra cover the wavelength range from ∼4200 to 8400 Å with 16 Å resolution. Among the AGB stars, 8 of 14 M giants, 5 of 6 carbon stars, and 0 of 1 S star showed intrinsic polarization. At least 9 of 13 PPNs exhibited intrinsic polarization, while the R CrB type stars show intrinsic polarization during fading episodes. There is a statistical

correlation between mean polarization, $\langle P \rangle$, and IR color, K−[12] among the AGB stars such that redder stars tend to be more polarized. The PPN sample is significantly redder and more polarized, on average, than the AGB stars. This increase in $\langle P \rangle$ with increased reddening is consistent with an evolutionary sequence in which AGB stars undergo increasing mass loss, with growing asymmetries in the dust distribution as they evolve up and then off the AGB into the short-lived PPN phase. A related trend is found between polarization and mass loss rate in gas, $\dot{M}_g$. The detectability of polarization increases with mass loss rate, and probably all AGB stars losing mass at $> 10^{-6}$ $M_\odot\,y^{-1}$ have detectable polarization.

Multiple observations of 3 polarized AGB stars show that in some cases $\langle P \rangle$ increases with m_V, and in others it decreases. If polarization arises from scattering of starlight off an aysmmetric distribution of grains, then the distribution varies with time.

Polarized features are detected in the TiO bands of 3 M-type Miras, in the CN bands of the carbon stars R Lep and V384 Per, and in the Swan bands of C_2 in R CrB and 2 PPNs. Polarization effects in the molecular bands appear to be more common and the effects are larger in O-rich than C-rich objects.

Accepted for publication in The Astrophysical Journal

CO J=2-1 and 4-3 observations of Proto-Planetary Nebulae: time-variable mass loss

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Observations made with the Heinrich Hertz Telescope of CO millimeter and submillimeter emission toward a sample of 22 proto-planetary nebulae (PPNe) candidates resulted in detections of 12 sources in the CO J=2-1 line. Of these 12, 7 sources were also detected in the J=4-3 line. These 4-3 transitions are the highest yet observed in all but one of these PPNe. Statistical equilibrium/radiative transfer models were calculated for the CO emission in the circumstellar envelopes (CSEs), assuming various power-law density distributions. These models were compared with the intensity and profile shape of the observed spectra. For the region of the CSE probed by CO emission, the density laws must be steeper than inverse-squared, and are consistent with power laws between $\rho \propto r^{-3}$ and $\rho \propto r^{-4}$. These radial density distributions imply that the mass loss was not constant but increased during the last part of the AGB phase. Mass loss rates at the end of the AGB for the three best-constrained sources are found to be 7.7×10^{-5} $M_\odot$ yr^{-1} (IRAS 22272+5435), 2.3×10^{-5} $M_\odot$ yr^{-1} (IRAS 07134+1005), and 1.3×10^{-5} $M_\odot$ yr^{-1} (IRAS 17436+5003), for the case of $\rho \propto r^{-3}$. These time-varying mass-loss rates can be integrated to calculate the enclosed envelope masses ejected in the past ∼10,000 yr. The ejected envelope masses close to the star lie in the range 0.02−0.30 $M_\odot$; these values are consistent with theoretical models which indicate that <20% of the stellar mass loss occurs in the last 10,000 years of the AGB. These results are in contrast to some recent dust studies based on infrared emission, however, in which much higher envelope masses are determined. The density laws, mass loss rates, and enclosed envelope masses which we derive furnish important constraints for evolutionary models of stars in the late AGB and during the transition to the planetary nebula phase.

Published in The Astrophysical Journal

Keplerian Discs around Post-AGB stars: a common phenomenon ?

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Aims: We aim at showing that the broad-band SED characteristics of our sample of post-AGB stars are best interpreted, assuming the circumstellar dust is stored in Keplerian rotating passive discs.

Methods: We present a homogeneous and systematic study of the Spectral Energy Distributions (SEDs) of a sample of 51 post-AGB objects. The selection criteria to define the whole sample were tuned to cover the broad-band characteristics of known binary post-AGB stars. The whole sample includes 20 dusty RV Tauri stars from the General Catalogue of Variable Stars (GCVS). We supplemented our own Geneva optical photometry with literature data to cover a broad range of fluxes from the UV to the far-IR.

Results: All the SEDs display very similar characteristics: a large IR excess with a dust excess starting near the sublimation temperature, irrespective of the effective temperature of the central star. Moreover, when available, the long wavelength fluxes show a black-body slope indicative of the presence of a component of large mm sized grains.

Conclusions: We argue that in all systems, gravitationally bound dusty discs are present. The discs must be puffed-up to cover a large opening angle for the central star and we argue that the discs have some similarity with the passive discs detected around young stellar objects. We interpret the presence of a disc to be a signature for binarity of the central object, but this will need confirmation by long-term monitoring of the radial velocities. We argue that dusty RV Tauri stars are those binaries which happen to be in the Population II instability strip.

Accepted for publication in A&A
Available from astro-ph/0601578

An empirical formula for the mass-loss rates of dust-enshrouded red supergiants and oxygen-rich Asymptotic Giant Branch stars

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We present an empirical determination of the mass-loss rate as a function of stellar luminosity and effective temperature, for oxygen-rich dust-enshrouded Asymptotic Giant Branch stars and red supergiants. To this aim we obtained optical spectra of a sample of dust-enshrouded red giants in the Large Magellanic Cloud, which we complemented with spectroscopic and infrared photometric data from the literature. Two of these turned out to be hot emission-line stars, of which one is a definite B[e] star. The mass-loss rates were measured through modelling of the spectral energy distributions. We thus obtain the mass-loss rate formula $\log \dot{M} = -5.65 + 1.05 \log(L/10,000\,\mathrm{L}_\odot) - 6.3 \log(T_\mathrm{eff}/3500\,\mathrm{K})$, valid for dust-enshrouded red supergiants and oxygen-rich AGB stars. Despite the low metallicity of the LMC, both AGB stars and red supergiants are found at late spectral types. A comparison with galactic AGB stars and red supergiants shows excellent agreement between the mass-loss rate as predicted by our formula and that derived from the $60\,\mu$m flux density for dust-enshrouded objects, but not for optically bright objects. We discuss the possible implications of this for the mass-loss mechanism.

Published in 2005, A&A 438, 273
Available from astro-ph/0504379

Dust-enshrouded giants in clusters in the Magellanic Clouds

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We present the results of an investigation of post-Main Sequence mass loss from stars in clusters in the Magellanic Clouds, based around an imaging survey in the L′-band (3.8 μm) performed with the VLT at ESO. The data are complemented with JHK_s (ESO and 2MASS) and mid-IR photometry (TIMMI2 at ESO, ISOCAM on-board ISO, and data from IRAS and MSX). The goal is to determine the influence of initial metallicity and initial mass on the mass loss and evolution during the latest stages of stellar evolution. Dust-enshrouded giants are identified by their reddened near-IR colours and thermal-IR dust excess emission. Most of these objects are Asymptotic Giant Branch (AGB) carbon stars in intermediate-age clusters, with progenitor masses between 1.3 and $\sim$5 $M_\odot$. Red supergiants with circumstellar dust envelopes are found in young clusters, and have progenitor masses between 13 and 20 $M_\odot$. Post-AGB objects (e.g., Planetary Nebulae) and massive stars with detached envelopes and/or hot central stars are found in several clusters. We model the spectral energy distributions of the cluster IR objects, in order to estimate their bolometric luminosities and mass-loss rates. The IR objects are the most luminous cluster objects, and have luminosities as expected for their initial mass and metallicity. They experience mass-loss rates in the range from a few 10^{-6} up to 10^{-4} $M_\odot$ yr^{-1} (or more), with most of the spread being due to evolutionary effects and only a weak dependence on progenitor mass and/or initial metallicity. About half of the mass lost by 1.3–3 $M_\odot$ stars is shed during the superwind phase, which lasts of order 10^5 yr. Objects with detached shells are found to have experienced the highest mass-loss rates, and are therefore interpreted as post-superwind objects. We also propose a simple method to measure the cluster mass from L′-band images.

Published in 2005, A&A 442, 597
Available from astro-ph/0507571

Very Large Telescope three micron spectra of dust-enshrouded red giants in the Large Magellanic Cloud

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We present ESO/VLT spectra in the 2.9–4.1 μm range for a large sample of infrared stars in the Large Magellanic Cloud (LMC), selected on the basis of MSX and 2MASS colours to be extremely dust-enshrouded AGB star candidates. Out of 30 targets, 28 are positively identified as carbon stars, significantly adding to the known population of optically invisible carbon stars in the LMC. We also present spectra for six IR-bright stars in or near three clusters in the LMC, identifying four of them as carbon stars and two as oxygen-rich supergiants. We analyse the molecular bands of C_2H_2 at 3.1 and 3.8 μm, HCN at 3.57 μm, and sharp absorption features in the 3.70–3.78 μm region that we attribute to C_2H_2. There is evidence for a generally high abundance of C_2H_2 in LMC carbon stars, suggestive of high carbon-to-oxygen abundance ratios at the low metallicity in the LMC. The low initial metallicity is also likely to have resulted in less abundant HCN and CS. The sample of IR carbon stars exhibits a range in C_2H_2:HCN abundance ratio. We do not find strong correlations between the properties of the molecular atmosphere and circumstellar dust envelope, but the observed differences in the strengths and shapes of the absorption bands can be explained by differences in excitation temperature. High mass-loss rates and strong pulsation would then be seen to be associated with a large scale height of the molecular atmosphere.

Accepted for publication in A&A
Available from astro-ph/0510510

Stellar mass loss and the Intra-Cluster Medium in Galactic globular

clusters: a deep radio survey for H I and OH

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We present the results of a survey, the deepest to date, for H I emission at 21 cm and OH emission at 18 cm (lines at 1612, 1665, 1667 and 1720 MHz) in the direction towards the Galactic globular clusters M 15, M 2, NGC 6934, NGC 7006 and Pal 13. The aim is to measure the amount of hydrogen in the intra-cluster medium (ICM), and to find OH masers in the circumstellar envelopes of globular cluster red giants. We present a tentative detection of 0.3 $M_\odot$ of neutral hydrogen in M 15 and possible detections of neutral hydrogen in M 2 and Pal 13. We derive upper limits to the neutral hydrogen content of NGC 6934 and NGC 7006. No OH emission is detected. We also present deep H I data of the northern tip of the Magellanic Stream behind Pal 13.

Published in 2006, MNRAS 365, 1277
Available from astro-ph/0511118

The first 8–13 μm spectra of globular cluster red giants: circumstellar silicate dust grains in 47 Tucanae (NGC 104)

Jacco Th. van Loon[1], *Iain McDonald*[1], *Joana M. Oliveira*[1], *A. Evans*[1], *Martha L. Boyer*[2], *Robert D. Gehrz*[2], *Elisha Polomski*[2] *and Charles E. Woodward*[2]

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We present 8–13 μm spectra of eight red giants in the globular cluster 47 Tucanae (NGC 104), obtained at the European Southern Observatory 3.6m telescope. These are the first mid-infrared spectra of metal-poor, low-mass stars. The spectrum of at least one of these, namely the extremely red, large-amplitude variable V1, shows direct evidence of circumstellar grains made of amorphous silicate.

Accepted for publication in A&A
Available from astro-ph/0601074

Conference Papers

Proposal of observational program of CCD monitoring of 30 carbon Miras in V, R_c and I

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We present a new long-term observational program of CCD monitoring of 30 selected carbon Miras (V 374 Aql, S Aur, UV Aur, AU Aur, AZ Aur, S Cam, R CMi, W Cas, X Cas, HV Cas, S Cep, V CrB, U Cyg, V Cyg, RS Cyg, WX

Cyg, T Dra, R For, VX Gem, ZZ Gem, V Hya, CZ Hya, R Lep, U Lyr, CL Mon, V Oph, RZ Peg, SY Per, RU Vir, SS Vir) in the standard $\boldsymbol{V}$, R_c and $\boldsymbol{I}$ Johnsonian filters. The aim of the program is to reveal and describe photometric behavior of above mentioned objects and to ascertain the reliability of visual observations of these variable stars. The authors will send interested persons the pertinent finding charts and they will see to process rough CCD exposures taken in desired colors themselves.

Oral contribution, published in http://var.astro.cz/oejv/
Available from http://www.astro.sk/caosp/Eedition/Abstracts/2005/Vol_35/No_2/pp83-106_abstract.html

Why are massive O-rich AGB stars in our Galaxy not S-stars?

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We present the main results derived from a chemical analysis carried out on a large sample of galactic O-rich AGB stars using high resolution optical spectroscopy (R 40,000-50,000) with the intention of studying their lithium abundances and/or possible s-process element enrichment. Our chemical analysis shows that some stars are lithium overabundant while others are not. The observed lithium overabundances are interpreted as a clear signature of the activation of the so-called "Hot Bottom Burning" (HBB) process in massive galactic O-rich AGB stars, as predicted by the models. However, these stars do not show the zirconium enhancement (taken as a representative for the s-process element enrichment) associated to the third dredge-up phase following thermal pulses. Our results suggest that the more massive O-rich AGB stars in our Galaxy behave differently from those in the Magellanic Clouds, which are both Li- and s-process-rich (S-type stars). Reasons for this unexpected result are discussed. We conclude that metallicity is probably the main responsible for the differences observed and suggest that it may play a more important role than generally assumed in the chemical evolution of AGB stars.

Oral contribution, published in 'Planetary Nebulae as astronomical tools', held in Gdańsk, Poland, jun 28/jul 02, 2005. Eds. R. Szczerba, G. Stasińska & S.K. Górny
Available from astro-ph/0509051

Photometric colors of late-type giants: theory versus observations

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To assess the current status in the theoretical modeling of the spectral properties of late-type giants, we provide a comparison of synthetic photometric colors of late-type giants (calculated with PHOENIX, MARCS and ATLAS model atmospheres) with observations, at [M/H]=0.0 and −2.0. Overall, there is a good agreement between observed

and synthetic colors, and synthetic colors and published Teff-color relations, both at [M/H]=0.0 and −2.0. Deviations from the observed trends in $T_{\rm eff}$-color planes are generally within ±150 K (or less) in the effective temperature range $T_{\rm eff}$ =3500-4800 K. Synthetic colors calculated with different stellar atmosphere models typically agree to ∼100 K, within a large range of effective temperatures and gravities. Some discrepancies are seen in the $T_{\rm eff}$-(B−V) plane below $T_{\rm eff} \sim 3800$ K at [M/H]=0.0, due to difficulties in reproducing the 'turn-off' to the bluer colors which is seen in the observed data at $T_{\rm eff} \sim 3600$ K. Note that at [M/H]=−2.0 effective temperatures given by the scale of Alonso et al. (1999) are generally lower than those resulting from other $T_{\rm eff}$-color relations based both on observed and synthetic colors.

Oral contribution, published in IAU Symposium 232
Available from astro-ph/0512354

Convection and observable properties of late-type giants

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[2]Observatoire Paris-Meudon, Paris-Meudon, France
[3]Hamburger Sternwarte, Hamburg, Germany

We show that contrary to what is expected from 1D stationary model atmospheres, 3D hydrodynamical modeling predicts a considerable influence of convection on the spectral properties of late-type giants. This is due to the fact that convection overshoots into the formally stable outer atmospheric layers producing a notable granulation pattern in the 3D hydrodynamical models, which has a direct influence on the observable spectra and colors. Within the framework of standard 1D model atmospheres the average thermal stratification of the 3D hydro model can not be reproduced with any reasonable choice of the mixing length parameter and formulation of the turbulent pressure. The differences in individual photometric colors – in terms of 3D versus 1D – reach up to ∼0.2 mag, or $\Delta T_{\rm eff} \sim 70$ K. We discuss the impact of full 3D hydrodynamical models on the interpretation of observable properties of late-type giants, briefly mentioning problems and challenges which need to be solved for bringing these models to a routine use within the astronomical community in 5-10 years from now.

Oral contribution, published in IAU Symposium 232 "The Scientific Requirements for Extremely Large Telescopes", eds. P. Whitelock, B. Leibundgut, and M. Dennefeld
Available from astro-ph/0512353

Review Papers

The Element Abundances in Bare Planetary Nebula Central Stars and the Shell Burning in AGB Stars

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[2]LANL, U.S.A.

We review the observed properties of extremely hot hydrogen-deficient post-AGB stars of spectral type [WC] and PG1159. Their H-deficiency is probably caused by a (very) late helium-shell flash or a AGB final thermal pulse, laying bare interior stellar regions which are usually kept hidden below the hydrogen envelope. Thus, the photospheric element abundances of these stars allow to draw conclusions about details of nuclear burning and mixing processes in the precursor AGB stars. We summarize the state-of-the-art of stellar evolution models which simulate AGB evolution and the occurrence of a late He-shell flash. We compare predicted element abundances to those determined

by quantitative spectral analyses performed with advanced non-LTE model atmospheres. A good qualitative and quantitative agreement is found. Future work can contribute to an even more complete picture of the nuclear processes in AGB stars.

Published in PASP, in press (scheduled for February issue)
Available from astro-ph/0512320
and from http://astro.uni-tuebingen.de/publications/paper_05_05.shtml

On the metallicity dependence of the winds from red supergiants and Asymptotic Giant Branch stars

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Over much of the initial mass function, stars are destined to become luminous and cool red giants. They may then be able to produce dust in an atmosphere which has been elevated by strong radial pulsations, and hence drive a wind. The amount of mass that is lost in this way can be a very significant fraction of the stellar mass, and especially in the case of intermediate-mass stars it is highly enriched. The delay between a star's birth and its feedback into the environment varies from several million years for massive stars to almost the age of the Universe for the least massive red giants we see today. I here present a review on the metallicity dependence of red giant winds. I show that recent measurements not only confirm theoretical expectations, but also admonish of common misconceptions with implications for feedback at low initial metallicity.

Published in 2005 Tartu workshop: Stellar Evolution at Low Metallicity: Mass Loss, Explosions, Cosmology, eds. H.J.G.L.M. Lamers, N. Langer, T. Nugis and K. Annuk, ASP Conference Series
Available from astro-ph/0512326

Thesis

Evolved stars: a combined view from interferometry and spectroscopy

Tijl Verhoelst[1]

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In this thesis, we combine infrared spectroscopic and interferometric observations to study the atmospheres and dusty stellar winds of evolved (RGB, AGB and RSG) giant and super giant stars. We focus on (1) the exact mechanism driving the mass loss, e.g. the dust condensation sequence, and (2) the origin of the asymmetries seen later on in Planetary Nebulae. Extensive data sets are presented for the giant Arcturus, the supergiant Betelgeuse and the OH/IR star OH26.5+0.6 (a star heavily obscured by the thick dusty wind). While the spectroscopic data on Arcturus can be well modelled using a single star model, the interferometric data suggest emission far out from the star. We suggest this to be a subgiant companion at small (projected) separation. In Betelgeuse we find strong evidence for a thin layer of alumina dust grains only 0.5 stellar radii above the photosphere. This is the first time the dust condensation sequence is spatially resolved and confirms the crucial role of alumina. OH26.5+0.6 is found to have an asymmetric superwind, indicating that deviations from spherical symmetry already occur in the AGB phase. Moreover, the observed angular size throughout the N-band (8 to 13 micron) is not compatible with a spherical outflow model. Lastly, as a more practical contribution to the field of IR interferometry, we present a new network of mid-IR interferometric calibrators with new optical and near-IR photometry and accurate diameter estimates.

Defended on 24 May 2005; Please email for hardcopy: Tijl.Verhoelst@ster.kuleuven.be

Available from http://www.ster.kuleuven.be/pub/verhoelst_phd/

Announcements

Workshop on the Red Rectangle

In the three decades that have passed since the first detailed description of this post-AGB star, the Red Rectangle (HD 44179) has proven to be a Rosetta Stone for astrophysical processes. Not only is the object found in a short-lived evolutionary phase, it is also relatively nearby and seen almost edge-on, thus allowing detailed studies of the stellar properties (through scattered light), the shaping of the post-AGB nebula, the properties of the circumbinary disk, and the chemistry in the biconical nebula and the disk.

Many scientists have participated in the road to unravelling the mysteries of the Red Rectangle, by means a large variety of methods and techniques at many different wavelengths.

For this small-scale meeting with about 50 participants, we would like to bring together scientists working on the Red Rectangle from different backgrounds and perspectives. In an informal setting, with lots of room for discussion, we will investigate the current status of the Red Rectangle research, draw parallels to other objects and look forward to the future of this topic.

The pre-registration has closed on Jan 18, 2006, and new participants will only be admitted as long as the room capacity has not filled up. Contact us through the website, or write to Ciska Markwick-Kemper at fk2n@virginia.edu

See also www.theredrectangle.net

'The Nature of V838 Mon and its Light Echo" (La Palma, 16-19 May 2006)

FIRST ANNOUNCEMENT

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*                                                       *
*             International Conference on               *
*                                                       *
*       THE NATURE OF V838 MON AND ITS LIGHT ECHO       *
*                                                       *
*       La Palma, Canary Islands, 16-19 May 2006        *
*                                                       *
*       http://www.ing.iac.es/conferences/v838mon       *
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– BACKGROUND –

The 2002 outburst of V838 Monocerotis has been one of the major hits in stellar astrophysics in recent years. The object is the most studied member of an exciting class of rare objects undergoing tremendous stellar explosions, so powerful as to make V838 Mon at peak brightness one of the most luminous stars in the whole Local Group (at $M_V = -10$ mag). Other objects similar to V838 Mon are M31-RV, which exploded in 1988 in the Andromeda galaxy, and V4332 Sgr which erupted in 1994 in our Galaxy. V838 Mon progenitor must have been massive and young, given the presence of a normal B3V companion.

The eruption of V838 Mon was discovered on January 2002 (cf. IAUC 7785). V838 Mon has displayed a complex light curve characterized by multiple maxima of very different colors, a very red spectral energy distribution, a long phase during which the optical brightness was below the quiescence value while the star remained very bright in the near-IR, and a recent re-warming accompanied by a recovery of the optical luminosity.

The spectral evolution of V838 Mon was as peculiar as its light curve. In spite of large ejection velocities at the outburst onset ($\sim$ 500 km/sec), the expanding ejecta never reached optically thin conditions. It remained optically thick and got cooler and cooler with time, initially mimicking a K giant, then making a complete excursion along the whole sequence of M giant spectra down to M10, and finally entering the new realm of L-type supergiants, a spectral type never seen before anywhere in the Universe and characterized by temperatures so low that were previously measured only in brown dwarfs.

Besides this, V838 Mon became one of the major attractions in stellar astrophysics over the last few years by displaying a 2 arcmin wide bright circumstellar light-echo, the first one seen in our Galaxy in the last 70 years. At the peak of its development around 2003, it was so bright that it became a favourite object even for amateur-sized telescopes. HST soon started monitoring the light-echo evolution (with eye-catching images appearing even on the front cover of Nature 422, 405 - 2003). These are set to continue during the next observing season, starting in October 2005, when V838 Mon will emerge from its seasonal conjunction with the Sun.

Little consensus has been reached so far on the nature and causes of the outburst of V838 Mon. The interpretations published in the literature cover a wide range of possibilities such as the swallowing of giant planets, merging of the components of a binary star, surface helium flash in a highly evolved and very massive star and a highly degenerate hydrogen flash in a low mass, cool and very slowly accreting white dwarf.

Given the many important questions opened by the intensive study of V838 Mon in the last three years, a conference dedicated to the subject is planned for May 16-19, 2006, on the island of La Palma (Canary Islands, Spain). The Conference aims to bring together researchers interested in V838 Mon and related stars, in light-echos, in the atmospheres and chemistry of very cool giant stars, in circumstellar cocoons, in the latest evolutionary stages of very massive stars and in the various alternative scenarios proposed to account for the unique properties of V838 Mon and its associates. One main goal of the conference is to compare observational evidence and theoretical interpretations, so as to gain a better understanding of the V838 Mon phenomenon. Another objective is to foster cooperation and coordination of future observational and modelling efforts, both concerning its still active outburst phase and in view of the return to quiescence conditions in the years to come.

– TOPICS, SOC, LOC –

The conference topics include:

* Photometric evolution, optical and IR
* Spectroscopic evolution, optical and IR
* L-supergiant spectra, interpretation, molecular chemistry
* Structure and evolution of mass loss in early phases
* Polarimetry and spectropolarimetry
* Pre-Outburst properties and progenitor
* The B3V companion
* Young stars in the outskirts of the Galaxy
* The circumstellar cocoon
* The interstellar medium toward and around
* The light echo structure and evolution
* Distance from light-echo evolution
* Evolutionary status of the outbursting component
* Models of the outburst
* Similar or related objects (e.g. M31-RV, V4332 Sgr)

The SOC of the Conference is composed of

Nagarhalli Ashok	India
Howard Bond	USA
Romano Corradi (co-chair)	Spain
Silvano Desidera	Italy
Aneurin Evans	UK
Arne Henden	USA
Tonu Kipper	Estonia
Ulisse Munari (co-chair)	Italy
Noam Soker	Israel
Sumner Starrfield	USA
Oscar Straniero	Italy
Jacco van Loon	UK
Patricia Whitelock	South Africa

and the Conference LOC is composed of

Romano Corradi
Javier Mendez
Ulisse Munari
Pierre Leisy
Marguerite Lennon
Miguel Santander
Alessandro Siviero

– PROCEEDINGS, VENUE, REGISTRATION –

The Conference Proceedings will be edited by R.L.M.Corradi and U.Munari and published on the ASP (Astronomical Society of the Pacific).

The conference, organized by the Isaac Newton Group of Telescopes, will be held in the Hotel H10 Taburiente Playa in Los Cancajos, a quiet beach resort located between the airport and the capital Santa Cruz de La Palma. We expect most participants to be based in the hotel, which offers very attractive prices for participants (even cheaper accommodation is available in the attached H10 Costa Salinas Apartments that belong to the same hotel chain).

The registration fee has been fixed at 200 Euros and is payable upon arrival at the conference. It is expected to cover the Proceedings book, coffee breaks, and all social events (social dinner, excursions).

We are applying to various funding agencies. If these applications are successful, limited financial help might be available for applicants who are short of funding.

The scientific program will be finalized by SOC after the registration by the participants has been completed. Plenty of time for discussion will be allocated during the conference.

To register as a participant go to the Conference web-page

http://www.ing.iac.es/conferences/v838mon

and fill in the registration form.

– DEADLINES –

The most important dates and deadlines are:

* Nov 15 2005 for early registration
* Feb 15 2006 for late registration
* Mar 15 2006 closing of abstract book
* Apr 15 2006 block booking of hotel rooms expires
* Jun 20 2006 for submitting the contributions to the Proceedings

Contact: Romano Corradi & Ulisse Munari (Co-chairs, SOC & LOC): v838mon@ing.iac.es

See also http://www.ing.iac.es/conferences/v838mon/

Planetary Nebulae as Astronomical Tools

A conference on "Planetary Nebulae as Astronomical Tools" was held in Gdańsk, 28 June-2 July 2005. The proceedings are now available, edited by Ryszard Szczerba, Grażyna Stasińska and Sławomir K. Górny.

See also http://proceedings.aip.org/dbt/dbt.jsp?KEY=APCPCS&Volume=804&Issue=1

Workshop on Evolution and chemistry of symbiotic stars, binary post-AGB and related objects

WORKSHOP on:

Evolution and chemistry of symbiotic stars, binary post-AGB and related objects
28-30 August 2006, Wierzba (Mazury Lakes), Poland.

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The topics would be related to chemical composition determination; influence of chemical composition on evolution and evolution on chemical composition. In particular, the topics we would like to cover are:

- Effect of metallicity on mass loss and activity of symbiotic stars and related systems (includes hot component outbursts, jet formation, etc.)
- Relationship between symbiotic stars and other binaries involving post-AGB stars
- Effect of rotation (including binary interactions) on nucleosynthesis
- Formation of s-process elements in various chemical and physical (e.g. binary systems) environments
- Binary post-AGB evolution
- Mixed chemistry and binarity

SOC:

R. Corradi
A. Jorissen
J. Mikolajewska (co-chair)
J. Sokoloski
R. Szczerba (co-chair)
H. van Winckel
P. A. Whitelock
A. Zijlstra

The main reason(s) to organize the conference is the 25 aniversary of the first IAU colloquium on symbiotic stars (the infamous meeting in Haute Provance) and also to celebrate Michael Friedjung 65th birthday (note that Michael organized jointly with Roberto Viotti that meeting as well as co-organized - with Joanna Miklajewska - the second IAU Colloquium on symbiotic stars in Torun). The workshop will be held in a resort of the Polish Academy of Science in the Mazury Lakes region. The dates suggested (28-30 August) are just after the General Assembly of the IAU assembly in Prague.

The estimated cost of 1-day stay in single room with all meals included is about 70 euros but we will try to negotiate better prices.

For the moment we plan a 3 day meeting but it may expand up to 4 days if there will be enough interest.

Since the number of participants will be limited to about 50, please let us know as soon as possible if you are interested filling in the form below and email to:

mikolaj@camk.edu.pl

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Pre-registration (email: mikolaj@camk.edu.pl):

Evolution and chemistry of symbiotic stars, binary post-AGB and related objects
to be held 28-30 August 2006 in Wierzba (Mazury Lakes) Poland

Name(s):
Affilliation:

I will participate: yes/no
I will possibly participate: yes/no

I would like to present a contribution:

I prefer oral/poster presentation

I will come with acccompanying person(s) - how many?

Comments/special requirements:

Interstellar Dust Analogues Laboratory Spectra Online

The Department of Earth and Planetary Sciences at Washington University - St. Louis and the Department of Physics and Astronomy at the University of Missouri - Columbia are jointly launching an online database of mid- and far-IR laboratory spectra for over 100 interstellar and circumstellar dust proxy minerals. As of Dec. 2005, room temperature thin film absorption spectra are available upon user request; reflectivity spectra, optical constants, and low temperature data will be uploaded in 2006. For more information, please visit the Interstellar Dust Analogues Laboratory Spectral Database website or contact Karly Pitman (kpitman@levee.wustl.edu).

See also http://galena.wustl.edu/∼dustspec/idals.html