THE AGB NEWSLETTER

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From the editors

Please note that the e-mail address of the AGB newsletter has changed from agbnews@gag.observ-gr.fr to agbnews@obs.ujf-grenoble.fr. The internet address of the computer which hosts the newsletter (to be used for ftp and WWW access) is laog.obs.ujf-grenoble.fr. The announcement we published last month unfortunately had a confusion between our e-mail adress and the internet address of the computer.

Abstracts of recently accepted papers

The formation of bipolar planetary nebulae

Garrelt Mellema

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Using a radiation-hydrodynamics code I follow the formation of planetary nebulae around stars of different mass. Because a more massive central star evolves much faster than a lower mass one, it is to be expected that this will affect the formation of the PN. For the stars I use the evolutionary tracks for remnants with masses of 0.605 $M_\odot$ and 0.836 $M_\odot$, taken from Blöcker (1995). The AGB wind is assumed to be concentrated in a thin disk, which in models without evolving stars leads to the formation of a bipolar nebula. I find that in the case of the 0.836 $M_\odot$ remnant the nebula indeed acquires a bipolar shape, whereas for the 0.605 $M_\odot$ remnant the shape is more elliptical. The reason for this is the time it takes to ionize the AGB material; if this happens sufficiently slowly the density distribution in the AGB wind will be smoothed out, leading to more elliptical shapes. If it happens quickly, the original density distribution (in this case a thin disk) is hardly affected. This result suggests that lower mass central stars will less easily produce bipolar nebulae, which is supported by observations.

Accepted by A&A (letters)

Preprints can be obtained by contacting garrelt@astro.su.se *or via WWW on* http://www.astro.su.se/preprints.html *or via anonnymous ftp on* ftp://hp3.astro.su.se/pub/preprints/aa_stevol.ps.gz *It appeared in the astrophysics preprint server as* astro-ph/9704172

Near infrared photometry of IRAS sources with colours like planetary nebulae. III

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We present the near infrared photometry of a new sample of 225 IRAS sources, many of them previously unidentified in the literature, selected because their far infrared colours are similar to those shown by known planetary nebulae. The results obtained are used to establish the main source of near infrared emission. Combining this information with the far infrared IRAS data and a few additional criteria we determine the nature and evolutionary stage of all the sources observed so far, including those for which near infrared photometry was previously reported in Papers I and II.

Among the unidentified IRAS sources in our sample we find only a small percentage of planetary nebulae, many of them very young and dusty, showing peculiar near infrared colours. Most of the new objects observed in the near infrared are identified as transition objects in the previous stages of the stellar evolution. Among them, we find heavily obscured late-AGB stars, early post-AGB stars still obscured by thick circumstellar envelopes which are probably the true progenitors of planetary nebulae, and a significant fraction of stars with bright optical counterparts showing little or no near infrared excess, which we associate with highly evolved post-AGB stars with low mass progenitors, which may never become planetary nebulae. In addition, we also find a small percentage of young stellar objects, as well as a few Seyfert galaxies.

We conclude that, in most cases, based on near infrared data alone, it is not possible to give a confident classification of the unidentified IRAS source. However, the near infrared is shown to be a powerful tool, specially when dealing with objects which are heavily obscured in the optical. In this case, the detection of the near infrared counterpart is the only way in which we can extend the study of these sources to other spectral ranges and may be crucial to understand the short-lived phase which precedes the formation of a new planetary nebula.

Accepted by Astronomy and Astrophysics Supplement Series

Preprints can be obtained by contacting pgl@mach.laeff.esa.es

Nebular Abundance Errors

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The errors inherent to the use of the standard "ionization correction factor" ("i_{CF}") method of calculating nebular conditions and relative abundances of H, He, N, O, Ne, S, and Ar in emission line nebulae have been investigated under conditions typical for planetary nebulae. The photoionization code CLOUDY was used to construct a series of model nebulae with properties spanning the range typical of PNe. Its radial "profiles" of bright, frequently observed optical emission lines were then summed over a variety of "apertures" to generate sets of emission line measurements. These resulting line ratios were processed using the i_{CF} method to "derive" nebular conditions and abundances. We find that for lines which are summed over the entire nebula the i_{CF}–derived abundances differ from the input abundances by $\leq 5\%$ for He and O up to $\leq 25\%$ or more for Ne, S, and Ar. For resolved observations, however, the discrepancies are often much larger and are systematically variable with radius. This effect is especially pronounced in low–ionization zones where nitrogen and oxygen are neutral or once–ionized such as in FLIERs, ansae and ionization fronts. We argue that the reports of stellar–enriched N in the FLIERs of several PNe are probably specious.

Accepted by The Astronomical Journal

Preprints can be obtained by contacting jalex@astro.washington.edu *or as* LANL preprint 9704298 *at* http://xxx.lanl.gov/archive/astro-ph.

Obscured Asymptotic Giant Branch stars in the Magellanic Clouds III. New IRAS counterparts

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We have searched for near-infrared stellar counterparts of IRAS point sources in the Large Magellanic Cloud (LMC), in J and K-bands. This resulted in the detection of 21 counterparts, of which 19 are new discoveries. Using colour–magnitude and colour–colour diagrams, we identify 13 Asymptotic Giant Branch (AGB) stars with thick circumstellar dust envelopes, 7 possible early post-AGB stars or stars recovering from a thermal pulse, and 1 red supergiant or foreground star. For 10 of the IRAS targets we do not succeed in detecting and/or identifying a near-infrared counterpart. We serendipitously detect 14 other red sources, of which 2 are known Long Period Variables, and a few galaxies. The near-infrared and optical colours of the galaxies may indicate considerable interstellar extinction through the LMC, as much as $A_V \sim 2$–4 mag. The relative number of AGB carbon stars over oxygen stars is shown to decrease as the luminosity increases. Yet amongst the faintest mass-losing AGB stars oxygen-rich stars still exist, which puts constraints on current convection theories that predict the occurrence of third dredge-up and Hot Bottom Burning. We investigate the nature of some LMC stars that have infrared properties very similar to suspected Galactic post-AGB stars.

Accepted by Astron. and Astrophys.

Preprints can be obtained by contacting jacco@astro.uva.nl

A Molecular Disk around the Episodic Jets in KjPn 8

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We report the detection of millimeter CO emission from a dense, expanding disk of molecular gas, $\approx 20''$ in diameter, at the center of the remarkable $14' \times 4'$, bipolar, episodic jet system of the planetary nebula KjPn 8. The disk surrounds the compact photo-ionized core and exceeds it in mass by at least an order of magnitude. The disk axis lies at a position angle of $\approx 115°$ and appears to be aligned with the most prominent and youngest of the bipolar jets. The disk axis is not, however, aligned with the older, more extensive bipolar structure of the nebula at a position angle of $\approx 71°$, indicating that major changes have taken place in the escape of matter from the central star system over the last ≈ 5000 yr.

Accepted by ApJ Letters

Preprints can be obtained by contacting patrick.huggins@nyu.edu

First HST Observations of Mira AB Wind Accreting Binary System

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The Mira AB system belongs to a class of detached binaries in which a compact object accretes mass from the wind of a cool giant or supergiant. This system provides a unique laboratory for detailed study of the characteristics of the wind accretion processes because it can be spatially resolved with the HST and the components can be studied individually at UV and optical wavelengths.

We resolved the components of this binary using the HST Faint Object Camera (FOC) images and obtained spectra of each component separated for the first time. The multiwavelength FOC images combined with the spectra provide a unique perspective of this accreting system and its components at wavelengths ranging from 150 nm to 550 nm. We determined the spectral energy distribution of each component unambiguously at UV and optical wavelengths and obtained the first high spatial resolution images of Mira A and Mira B at UV wavelengths. We detected significant asymmetries in the giant's atmosphere and found evidence for possible interaction with its companion.

Accepted by ApJ. Letters.

Preprints can be obtained by contacting karovska@cfa.harvard.edu

Thesis Abstract

Title of Thesis

Anita M. S. Richards

Thesis work conducted at: NRAL Jodrell Bank University of Manchester, Macclesfield, Cheshire, SK11 9DL, UK.

Ph.D dissertation directed by: R. J. Cohen

Ph.D degree awarded: April 1997

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Four late-type red supergiant stars, S Per, VX Sgr, VY CMa and NML Cyg, have been observed at 1.6 and 22 GHz using MERLIN in spectral line mode. In broad outline the traditional picture is seen, in which the 22 GHz water masers are found closer to the star in a thick ring. OH mainline masers (at 1665 and 1667 MHz) are patchily distributed from the middle of the water maser region outwards, and OH 1612 MHz emission is found at larger radii with a twin peaked velocity profile. Much interesting detail is revealed by the high resolution and sensitivity of MERLIN. The water masers form a shell of radius 10^{13} to 10^{14} m, over which the velocity typically doubles from 10 to 20 km s^{-1}. The stellar wind is gravitationally bound to the star at the inner edge and unbound at the outer.

The 22 GHz maser brightness temperatures are 10^5 - 10^{13} K. Maser components are found in groups of 5 - 10 separated by ~ 1 mas in successive channels over a $V_{\rm LSR}$ of ~ 1 km s^{-1}. In S Per, the first direct measurements of the unbeamed masing blob radius were made, 10^{12} m at $\sim 1.5 \times 10^{13}$ m from the star. This was used to derive the beaming angle which showed that the brightest masers are on the verge of saturation. The inner radius of 22 GHz emission is determined by the maser quenching density. This is 10 - 100 times higher than the density estimated from CO and dust observations, and predicts an inner limit for OH 1612 MHz masers ten times larger than the observed radius. This shows that mass loss from these stars is clumpy and the 22 GHz H_2O masering

blobs are about 20 times denser than their surroundings. The outflow is driven by radiation pressure on dust and the water masers show tangential beaming indicative of greater acceleration; the OH masers are radially beamed, consistent with the origins of the latter in less dusty inter-clump regions. The method derived by Chapman & Cohen (MNRAS, 220, 513) was used to find the dust absorption coefficient which increases with radius from ≤ 0.1 - ≤ 1.0 m^2 kg^{-1}. The low values near the star are similar to those found from laboratory studies of small grains of crystalline silicates or metal oxides in hot conditions, while astronomical silicates are more efficient absorbers. This suggests that grain growth and annealing takes place out to large distances from the star.

Water maser emission from S Per is elongated E-W while the OH emission is extended N-S. In VX Sgr the 22 GHz masers show a velocity axisymmetry in line with the direction of the magnetic field axis found from Zeeman splitting of OH emission. The 22 GHz shell in VY CMa has a radius of 300 - 400 mas elongated E-W, but the OH emission is extended N-S, 1667 MHz and 1612 MHz masers occuring up to 5 arcsec from the star. In VY CMa almost all H_2O maser features observed by MERLIN in 1994 could be matched with features mapped in 1985 using the VLA (Bowers et al. AJ, 105, 284). Expansion proper motions of 8.8 - 31.2 km s^{-1} were found. In NML Cyg two features separated by 600 mas, symmetrical in position and velocity about the assumed stellar location were matched with features observed by Yates & Cohen (MNRAS, 270, 958) in 1985 and their increase in separation corresponds to an expansion velocity of 19 ± 4 km s^{-1}. OH 1612 MHz masers and dust emission are elongated along the same position angle. This could the the onset of bipolar outflow as the star evolves towards its eventual fate as a supernova.

This thesis (amsrthesis.dvi-ps.Z) can be obtained by anonymous ftp from `ftp.jb.man.ac.uk` then cd `pub/amsr` - email me if you encounter any difficulties, or just to let me know you have got it. Thank-you.

Jobs

Research Assistantship in Modelling of Circumstellar Environments beginning September 1997 at ARMAGH OBSERVATORY

Applications are invited for a 13 month research assistantship in the modelling of circumstellar environments, funded by the UK PPARC, with the possibility of an extension. The candidate should have obtained their PhD prior to appointment, preferably with experience in modelling of dust environments and/or stellar atmospheres.

Current research interests of staff members at Armagh Observatory include the following areas:

- **Solar physics**
- **Stellar atmospheres**
- **Solar-terrestrial physics**
- **Circumstellar environments**

The Observatory has a staff of seven astronomers, six post docs, seven research students, plus additional support staff. Extensive use is made of the local STARLINK computers (Alpha workstations), which are part of the N. Ireland STARLINK node. Applications, including a CV and the names of three referees should be forwarded before 15 June 1997 to **The Administrator, Armagh Observatory, College Hill, Armagh BT61 9DG, N. Ireland**. Any requests for further information should be addressed to the same point, or to **Dr J.G. Doyle (email — jgd@star.arm.ac.uk)**. For further details on the Observatory and our research interests one should check the WWW at: **http://star.arm.ac.uk/research.html** . Additional information on the research interests of the PI may be found on the WWW at: **http://star.arm.ac.uk/~jgd/gerry.html**.

Annoucements

Dear Colleague,

We wish to draw your attention to the

International Colloquium on

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ASYMPTOTIC GIANT BRANCH STARS

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to be held in Montpellier, France,
on AUGUST 28 - SEPTEMBER 1rst, 1998,

Chair : C. Waelkens (christoffel@ster.kuleuven.ac.be)
Co-Chair : T. Lebertre (lebertre@obspm.fr)

Purpose :

Asymptotic Giant Branch (AGB) stars occupy the evolutionary stage which is decisive for the final fate of low- and intermediate-mass stars. Once a star has left the AGB, nuclear burning soon stops and, after the short but spectacular planetary-nebula phase, the stellar remnant cools to become a white dwarf.

The study of AGB stars is important for stellar structure and evolution, for the understanding of the interstellar and circumstellar media and for the dynamical and chemical evolution of galaxies.
The observational study of AGB stars has been triggered enormously by the recent advances in optical-detector technology, which enable high-resolution spectroscopic studies of faint stars, and maybe more even by the advances in infrared, submm and mm astronomy, which now enable detailed scrutiny of the circumstellar environment and can probe AGB stars in remote and obscured places.

Current work on AGB stars is relevant for stellar evolution, stellar populations, stellar pulsation, stellar mass loss, circumstellar matter, galactic evolution, but also for understanding meteorites and solar-system dust. Clearly, the subject of AGB stars has now become sufficiently mature so as to warrant a dedicated conference which will attract researchers from different disciplines all over the world.

More information about that colloquium can be found on our Web pages :

http://www.dstu.univ-montp2.fr/GRAAL/agb98-1.html

We strongly recommend you to fill in a pre-registration form available
on our web site (http://www.dstu.univ-montp2.fr/GRAAL/agb98/regist.html)
or upon request at agb98@graal.univ-montp2.fr (only if you can not have any
access to the Web) and return it by June 15th.

Please, forward this message to any of your colleague who may be interested.

Sincerely yours,

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