# THE AGB NEWSLETTER

*An electronic publication dedicated to stellar evolution on the asymptotic giant branch and beyond*

No. 15 — 01 June 1995

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## *Abstracts of recently accepted papers*

### Diffuse X-ray Emission from the Hydrogen-Deficient Planetary Nebula Abell 30

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We have detected diffuse X-ray emission within the planetary nebula shell of Abell 30, using a 21.8-ks *ROSAT* Position Sensitive Proportional Counter observation. The spectrum is very soft, with almost all source counts at energies below 0.4 keV. The extended emission is real because most of the detected counts are within the 0.2–0.4 keV band, which is not seriously plagued by the electronic-ghost-image problem. The best-fit Raymond & Smith plasma emission models give plasma temperatures of $2–4.5\times10^5$ K. The X-ray emission could arise from the hot shocked stellar wind or the central H-poor nebula shocking the ambient H-rich material. Low plasma temperatures are expected in shocked stellar wind, if there is a strong heat conduction at the interface between the hot shocked wind and the surrounding cool nebular shell, or if the fast stellar wind is mass-loaded by the ejecta clumps. Low plasma temperatures are also expected behind the moderate shock of the H-poor shell advancing into the H-rich envelope. High-resolution X-ray images of A 30 are needed to determine more accurately the relationship between the X-ray emission and the nebular shells.

**Accepted by Astrophysical Journal Letters** *For preprints, contact chu@astro.uiuc.edu*

### Infrared and Optical Velocities of Carbon Stars

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We present radial velocities of 2$\mu$m infrared photospheric lines observed in 46 bright carbon stars. The velocities were measured by cross-correlation from FTS observations of a spectral region dominated by the $\Delta$v=–2 bands of the CN red system. In addition, for 37 of these stars we have measured velocities of 9 infrared Ti I lines. We also present velocities of CO second overtone ($\Delta$v=3) lines in 28 of these stars and of high excitation first overtone of CO ($\Delta$v=2) lines in 27 stars. These velocities are compared with optical velocities from both cross-correlation measurements of the optical bands of the CN red system and individual atomic absorption lines. We find the following: 1) In Miras (large pulsational amplitude variables), velocities of the same molecule at different wavelengths can be different by tens of kilometers per second. However, optical and infrared velocities are in relatively good agreement for the lower amplitude variables (SR and Lb) and are within a few kilometers

per second of the center-of-mass velocity. 2) Velocities in SR and Lb variables show no systematic red- or blueshift. 3) The resonance line of K I is the exception with a systematic blueshift that is consistent with the outflow velocity of the circumstellar shell in the SR variables, yet there is no such correlation in the Lb variables. 4) As found previously, the *mean* optical velocity of carbon star Miras over a pulsational period is systematically redshifted from the center-of-mass velocity. However, we find that the infrared cross-correlation velocities do not show a redshift bias when observed throughout a photometric period, but rather are equally distributed about center-of-mass motion. We suggest that infrared spectroscopy would be a better way to measure center-of-mass motion in carbon stars than optical spectra, if the photometric period is well sampled.

**Accepted by AJ for the September issue** *For preprints, contact cbarnbau@nrao.edu*

## Organic molecules in oxygen-rich circumstellar envelopes: methanol and hydrocarbons

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The existence of anomalously high abundances of gaseous $CH_4$ has been invoked to explain the unexpectedly high abundances of the carbon-bearing molecules, HCN and $H_2CO$, in the outflows from O-rich red giants. We have modelled the chemistry that proceeds in the outer envelope when $CH_4$ is injected from the inner envelope. We find that photolysis by the interstellar radiation field drives an ion-neutral chemistry which produces several organic molecules. The calculated abundances of $CH_3OH$, $C_2H$, and $C_2$ can be comparable to those calculated for $H_2CO$ and HCN. Species such as $C_2H_4$, $C_2H_2$, and $CH_3CN$ can also be quite abundant. A search for $CH_3OH$ and $C_2H$ in several O-rich outflows known to exhibit strong HCN emission is needed. As it derives entirely from the $CH_4$ photochain, is insensitive to the envelope temperature distribution, and has accessible transitions at millimetre wavelengths, the detection of the $C_2H$ radical would provide further indirect support for the presence of the hypothesised methane.

**Accepted by M.N.R.A.S.**

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## A long-lived disk around the Red Rectangle ?

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We report high signal to noise radio CO emission from the circumstellar envelope around the Red Rectangle. The CO (2−1) line displays a narrow central spike with a FWHM $\sim$ 2 km s$^{-1}$, which is much narrower than the circumstellar CO lines typically found around most mass-losing red giants. In addition, instead of the sharp edges expected for a spherical envelope, the lines show extended blue shifted and red shifted wings, with a full width at zero intensity of 12 km s$^{-1}$, consistent with a bipolar distribution. The circumstellar CO traces the center of mass of the system rather than the binary motion of HD 44179, the optically visible star in the Red Rectangle. There appears to have been significant de-acceleration of the gas ejected from the mass-losing star; the observed CO emission may result from a bipolar outflow from a disk that is viewed edge-on. We suggest that much of the material around the Red Rectangle resides in a long-lived configuration, such as a gravitationally bound disk.

Because the material may dwell for a long time near the binary system, the resulting substantial processing and evolution may explain why the circumstellar matter is so different around the Red Rectangle compared to that around AFGL 2688, another post main sequence bipolar nebula. We speculate that large carbon particles similar to the grains up to 20 $\mu$m in diameter found in the solar system might grow around the Red Rectangle.

**Accepted by Astrophysical Journal** *For preprints, contact jura@bonnie.astro.ucla.edu*

## On the nature of AFGL 2477

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Because of its bimodal spectral energy distribution and featureless LRS spectrum, AFGL 2477 has been suggested to be a carbon-rich post-AGB star. In this paper we argue against this hypothesis (based on our finding that the alleged optical counterpart is *oxygen*-rich) and propose that there are two stars close together on the sky (within 5" of each other) which probably are not physically related. A more exotic scenario is also discussed.

**Accepted for publication in Astronomy & Astrophysics** *For preprints, contact groen@iap.fr*

## Search for new pulsating O VI central stars of planetary nebulae

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A photoelectric monitoring program has been applied, during the last four years, to five central stars of planetary nebulae (PNNs) with strong O VI $\lambda$3811–34 Å emission. NGC 6905 and, marginally, NGC 2452, show intrinsic luminosity variations, while NGC 7026, IC 2003 and NGC 1501 have constant luminosity within a few mmag. Photometric data have been analyzed with the best available packages for power–spectra reductions. Both pulsators have periods and physical characteristics well encompassed by the theoretical pulsational models relative to these stars.

**Accepted by Astronomy and Astrophysics** *For preprints, contact silvotti@astbo3.bo.astro.it*