THE AGB NEWSLETTER

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

No. 11 — 01 February 1995

Editors: Thierry Forveille and Claudine Kahane (agbnews@gag.observ-gr.fr)

Abstracts of recently accepted papers

A Direct Image of Wind Interaction in the Post-AGB Evolution : CO Observations of M1-92

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We present high-resolution CO $J = 1--0$ maps of the protoplanetary nebula M1-92, the Minkowski's Footprint, obtained with the IRAM interferometer at Plateau de Bure. The cartography is particularly revealing. Three components are distinguished in the maps: a bipolar outflow, with a (deprojected) velocity of about 65 kms^{-1}, a hollow prolate structure, with an axial velocity increasing with the distance to the star up to about 60 kms^{-1}, and a central condensation with velocities smaller than 10 kms^{-1}. A remarkable continuity in position and velocity is found between the hollow component and the bipolar flow. We argue that these properties indicate that an important dynamical interaction between both features is active at the present moment and affects most of the nebular material. Such an interaction would consist in a significant momentum transport from the bipolar fast flow to the rest of the nebula.

Accepted by Astrophys. J. Letters *For preprints, contact bujarrabal@cay.es*

Infrared Emission and Dynamics of Outflows in Late-Type Stars

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The dynamical structure and infrared emission of winds around late-type stars are studied in a self-consistent model that couples the equations of motion and radiative transfer. Thanks to its scaling properties, both the dynamics and IR spectrum of the solution are fully characterized by τ_F, the flux averaged optical depth of the wind. Five types of dust grains are considered: astronomical silicate, crystalline olivine, graphite, amorphous carbon and SiC, as well as mixtures. Analysis of infrared signatures provides constraints on the grain chemical composition and indications for the simultaneous existence of silicate and carbon grains. The abundances of crystalline olivine in Si-dominated grains and of SiC in C-dominated grains are found to be limited to $\leq$ 20–30%. Furthermore, in carbonaceous grains carbon is predominantly in amorphous form, rather than graphite. In mixtures, carbonaceous grains tend to dominate the dynamic behavior while silicate and SiC grains dominate the IR signature. The region of parameter space where radiation pressure can support a given mass-loss rate is identified, replacing the common misconception $\dot{M}v \leq L_*/c$, and it shows that radiatively driven winds can explain the highest mass loss rates observed to date. A new method to derive mass loss rates from IR data is presented, and its results agree with other determinations.

Theoretical spectra and colors are in good agreement with observations. IRAS LRS classes are associated with τ_F for various grain materials and the regions of color-color diagrams expected to be populated by late-type stars are identified. For a given grain composition, location in the color-color diagram follows a track with position along the track determined by τ_F. We show that cirrus emission can severely affect point source measurements to the extent that their listed IRAS long wavelength fluxes are unreliable. Whenever the listed IRAS flag *cirr*3 exceeds the listed 60 μm flux by more than a factor of 2, the 60 and 100 μm fluxes are no longer indicative of the underlying point source. After accounting for cirrus contamination, essentially all IRAS point sources (95%) located in the relevant regions of the color-color diagrams can be explained as late-type stars. There is no need to invoke time dependent effects, such as detached shells, for example, to explain either the colors or mass loss rates of these sources. Although various indications of time varying mass-loss rates exist in numerous sources, the infrared properties of this class of stars are well explained as a whole with steady state outflows.

Accepted by Astrophysical Journal. *For preprints, contact ivezic@asta.pa.uky.edu*

Semiregular Variables of types SRa and SRb. Variability classification in the GCVS

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We studied the shape and the quality of light curves of oxygen-rich Semiregular Variables and the occurrence of multiple and variable periods among this group of variables to investigate whether there is any correlation between the subgroups of SRVs described by Kerschbaum & Hron (A&A 263, 97) and these parameters. For this purpose we used the data and the light curve references given in the General Catalogue of Variable Stars (4th edition, GCVS4).

To judge the quality of the light curves we introduced a new quality classification based on the number of observed cycles and the mean number of observations per cycle. We also compared our system with a system based on the subjective impression of the light curve similar to the one used in the GCVS4.

It was found that for more than 40% of the objects investigated, the data given in the GCVS4 seem to be based on badly known and insufficient light curves. No correlation between the shape of the light curves and the classification of Kerschbaum & Hron could be found. More objects with multiple or variable periods were found among the objects with very long periods than among the objects with short periods.

Accepted by Astronomy & Astrophysics *For preprints, contact lebzelter@astro.ast.univie.ac.at*

A Survey of Planetary Nebulae at Na D: Evidence for Neutral Envelopes

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We present high-dispersion spectra of 21 planetary nebulae in the region of the Na I D lines at $\lambda\lambda$ 5889.95. These resonance lines, long used to study neutral interstellar clouds, act as tracers of cool, neutral material associated with the ionized nebulae. Over half the observed objects show nebular components in the Na D lines, either in absorption or emission, or both; some of these were not previously suspected to contain neutral material. For objects in which well-resolved absorption components are seen in the Na I lines, we estimate column densities using the doublet-ratio method, finding $N(\mathrm{Na\,I}) \approx 10^{11-13}$ cm^{-2}. For five objects previously detected at 21 cm, we estimate the ratios $N(\mathrm{Na\,I})/N(\mathrm{H\,I})$. The values for the planetary nebulae are somewhat higher than for typical interstellar clouds, indicating that, integrated through the absorbing column, a larger fraction of the sodium is neutral. The layers where the Na I lines are formed generally appear to be expanding at similar velocities as the ionized gas, a result previously found for H I. A couple of objects show blue wings in the nebular Na absorptions, possibly indicating acceleration, non-spherical ejection, or the presence of clumps of low-ionization, fast-moving material.

Our results imply that the outer portions of many planetary nebulae are neutral. Therefore, the nebulae are radiation-bounded rather than mass-bounded, and the total masses are larger than the ionized masses. Resonance lines such as the Na I lines offer a means of detecting circumnebular neutral material whether or not molecules are present, and of investigating properties of the neutral envelopes such as ionization balance, column densities, and kinematics.

Accepted by The Astrophysical Journal

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