Circumstellar Envelopes of OH/IR stars

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We present near-infrared interferometric observations of three tip-AGB stars carried out with the VLT/AMBER instrument in April 2008. These stars are evolved oxygen-rich single stars belonging to the OH/IR type. The data were taken in low resolution mode in $H$ and $K$ bands, using the 1.8-m Auxiliary Telescopes (ATs) with three different baseline lengths of 15.92, 31.83 and 47.76 meters. We fit the resulting visibilities with a model consisting of a Gaussian component plus a central uniform disk obtaining apparent diameters of the dust shell and the central star and their flux ratios.
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Abstract

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Introduction:

The final phase of the evolution of low to intermediate mass stars is crucial for the chemical enrichment of the interstellar medium. While a star ascends the Asymptotic Giant Branch (AGB), its luminosity rises several thousand times. Furthermore, pulsations and radiation pressure on dust grains cause a dense stellar wind, obscuring the object at short wavelengths. At the tip of the AGB, mass-loss increases reaching rates of up to several $10^{-6}$ M$_\odot$ yr$^{-1}$ and leaving the star surrounded by a dense circumstellar envelope. Stellar pulsations create a transient "super wind" phase, while layers close to the photosphere begin to cool and become exposed. The ejected envelope slowly expands and cools, revealing the central star and forming a planetary nebula (PN).

Data analysis:

The data were downloaded from the ESO archive and reduced with the standard procedure of the amdlib 2.2 package and the yorick interface provided by the AMBER consortium and the Jean-Marie Mariotti Center. We modelled the visibilities as a Gaussian circumstellar shell plus a central uniform disk for the star (a cartoon representing this is shown as background).

The plots show the best fit model for each star. Since the optical depth of the dust shell in each star is different, we can observe different stages of evolution. In the case of IRAS 17020-5254, there is a more diluted dust component and a molecular shell, whereas IRAS 14086-6907 has a stronger contribution from the star and the shell, and IRAS 13479-5436 shows a point source in the center with most of the emission coming from the dust envelope.

Conclusions and future work:

We determined apparent diameters of three OH/IR stars and their circumstellar envelopes. For one star we resolved the molecular features around the photosphere. In future investigations we will additionally use mid-infrared observations taken with the VLTI/MIDI instrument available in the archive and compare them to theoretical data based on density profiles of hydrodynamical wind models in order to constrain the models.

*Based on observations made with the Very Large Telescope Interferometer (VLTI) at the Paranal Observatory under program ID 081.D-0325(H).