

Cold dust envelopes of evolved stars and their mass-loss

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Low- to intermediate-mass stars lose a significant fraction of their mass when they become cool evolved stars, in particular, at the asymptotic giant branch (AGB) phase. The AGB mass-loss is considered to dominate the final stages of the stellar evolution. However, the mechanism of AGB mass-loss is not well understood yet. Extended circumstellar dust envelopes around AGB stars, which are the direct products of their mass-loss, may provide us with the history of mass-loss as recorded in their circumstellar structure, which would be a clue to understanding the mass-loss mechanism.

We present the results of our far-infrared imaging survey of cool evolved stars for their cold circumstellar dust envelopes using the first Japanese astronomical satellite dedicated to infrared astronomy, AKARI. We aim to investigate the time dependence and geometry of their mass-loss in their circumstellar dust envelopes. We have observed 144 evolved stars with the Far-Infrared Surveyor (FIS) onboard AKARI as one of the AKARI mission programs. We have obtained maps of 10'x 40' size in the four FIS bands at 65, 90, 140, and 160 microns for most of the objects. Maps of 10'x 20' area have been taken for the remaining 17 fainter objects. Extended dust shells, most of which show departure from circular symmetry or offset with respect to the star, have been found in both dozen oxygen-rich and dozen carbon-rich evolved objects. In the carbon star U Hya, a circular dust shell centered at the star with a radius of about 130" (3.2E17cm, 0.1pc) is revealed in the four FIS bands, for the first time by direct imaging in the far-infrared. The FIS images of U Hya are analysed by a simple detached dust shell model. The best fit models give the inner radius of 2.5E17cm, thickness of (0.8-2)E17cm, and power-law index of the dust opacity of 1.1. Dust mass of 1E-4 M_{solar} is obtained for the case of a dust opacity of 25cm² g⁻¹ at 100 micron. Possible origin of the extended dust shells of the target evolved stars will be discussed on the basis of the results on U Hya.

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