10μm IMAGES OF AGB STARS & SUPERGIANTS

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We present mid-IR and far-IR images of a variety of AGB stars and red supergiants. The mid-IR images were all taken with the Berkeley/Livermore mid-IR array camera, which employs a 10×64 pixel Hughes photoconductor. All the images reported here were taken using a 10% bandpass CVF, at various wavelengths in the 10μm atmospheric window. These were supplemented by *IRAS* images, some constructed from survey scans, others made as Additional Observations during the pointed phase of the *IRAS* mission. We have so far observed 11 such sources with our mid-IR camera, and report here that only two of them (R Aql and V Hya) appear to be unresolved.

The red supergiants α Ori and μ Cep were both pointlike at 8.2μm and 8.5μm , but extended at longer wavelengths due to emission in the silicate bands (which peak around 9.7μm and 18μm). Neither source is spherically symetric. α Ori shows general extension, but this is accentuated to the NE at wavelengths of 9.7μm , 12.5μm , 60μm and 100μm . μ Cep shows a remarkable elongation in the E-W direction, both in our mid-IR images at wavelengths of 9.7μm , 11.3μm and 12.5μm , and in KAO observations we have made at 50μm and 100μm . On the other hand, NML Cyg, another red supergiant, which has an optically thick dust shell (unlike the previous two sources), appears to exhibit symmetry in its dustshell, which is elliptical at 9.7μm , the major axis being roughly in the EW direction.

The oxygen-rich Mira R Cas is marginally extended in the ESE direction in our images at 10.0μm , and pointlike at 8.5μm . The *IRAS* AOs reveal an extraordinary elongated image, with the elongation in the ESE direction, almost aligned with our mid-IR images.

The carbon star IRC+10216 shows similar asymmetries at wavelengths of 10.0μm 60μm and 100μm . However, the asymmetries are in different directions at different wavelengths. The more extreme C-star AFGL3068 is also extended, but somewhat smaller; in this case we find no evidence for anything other than spehrical symmetry.

Thus, in the majority of our sources, mass-loss appears to occur in a preferred direction, which does not alter on the timescale reflected in the 100μm observations (a few millenia). IRC+10216 also appears to lose mass preferentially in certain directions, but the direction appears to vary on a timescale of a few hundred years. We have no explanation for why mass should be lost preferentially in a singular direction. Neither do these observations help to clarify the appearance of bipolar symmetry in some PN.