MID-IR (8-13μm) IMAGES OF PROTO-PLANETARY NEBULAE

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We present mid-IR (8-13μm) images of dust in seven proto-planetary nebulae (PPN), GL2343, HD 161796, 89 Her, OH 0739-1435, CRL2688, IRAS 22272+5435, and CRL618. The images were taken at UKIRT and the IRTF with the Berkeley mid-IR camera which was developed at the Space Sci. Lab. in UC Berkeley and is supported by IGPP and LEA, LLNL. The results presented here are part of an on-going mid-IR imaging project to study the morphological development of a star as it evolves from the Asymptotic Giant Branch (AGB) to the planetary nebula (PN) stage. In particular, we aim to establish when non-spherical symmetry which is evident in so many PN arises. Four of the objects are oxygen rich. Of these, GL2343 (Fig. 1) and HD161796 are found to have spherical dust shells in the mid-IR with diameters of 6.″ 7 and 3″ , respectively. OH 0739 is marginally resolved, but has a hint of elongation that is aligned with the bipolar nebula evident in the near-IR. 89 Her is unresolved at 1.″ 1 resolution. 89 Her, HD 161796 and GL2343, all high latitude supergiants, appear to form an evolutionary sequence as evidenced by the size of their circumstellar dust shells. Three of the objects are carbon rich. CRL2688 and IRAS 22272 +5435 are found to have elongated structures which suggest a bipolar morphology. CRL 618 is unresolved at 1.″ 7, but is known to be bipolar from optical studies. Hence, with the exception of OH 0739, a known binary, the oxygen rich PPN have spherical dust shells while the carbon rich have bipolar dust shells. Our small number of observations do not provide solid statistics; however, this trend suggests that nebula bipolarity is linked to carbon-rich chemistry.

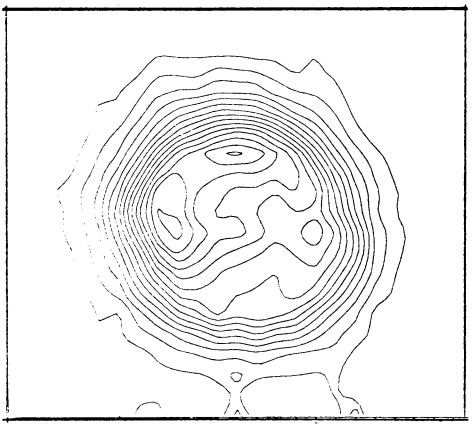

Fig. 1. GL 2343 at 12.5μm