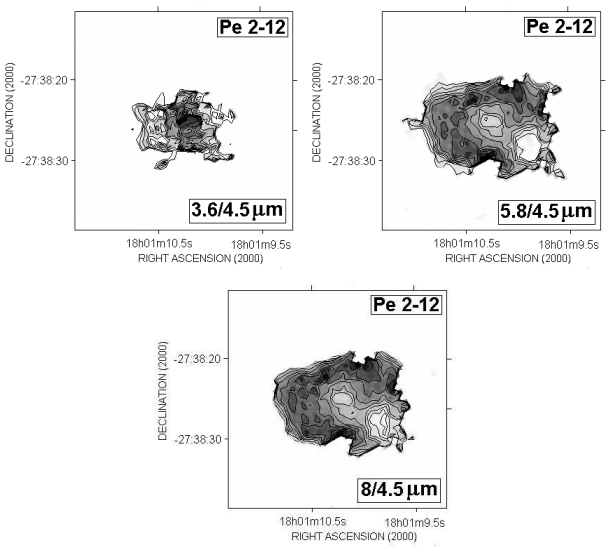

Fig. 4. Mapping of IRAC flux ratios over the projected envelope of Pe 2-12, where the contour parameters [D, E] are given by [0.5, 0.0618] for 3.6 μm/4.5 μm, [1.6, 0.0972] for 5.8 μm/4.5 μm, and [2.0, 0.1307] for 8.0 μm/4.5 μm. Notice how ratios are lowest (lighter grey colouration) at the centre of the source, and increase outwards towards the perimeter. The region of lower ratios to the south-west (lower right-hand side) results from contamination by an unrelated field star.

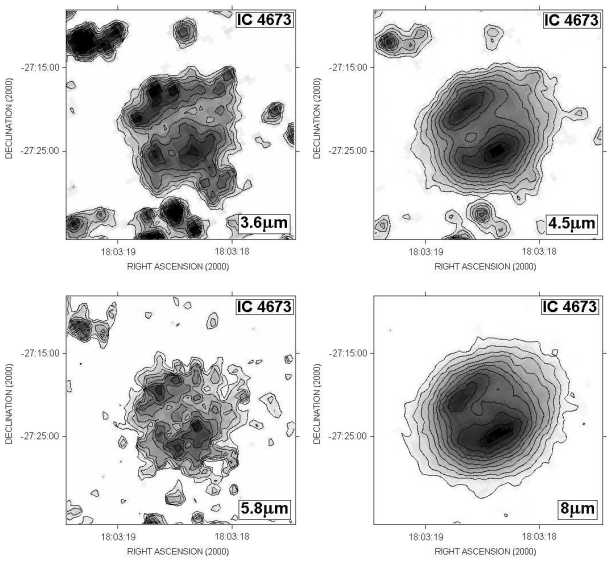

Fig. 5. Contour mapping of IC 4673 in the MIR, where the contour parameters [A, B, C] are given by [3.9, 2.48, 0.0478] at 3.6 μm, [3.2, 1.50, 0.0972] at 4.5 μm, [5.7, 3.57, 0.0450] at 5.8 μm, and [17, 13.04, 0.0521] at 8.0 μm. The shell is seen to have an elliptical morphology, with higher levels of surface brightness along the minor axis of the source. The fragmentary appearance of the envelope at 3.6 and 5.8 μm is due to lower levels of S/N.

There appears to be an increase in ratios 5.8 μm/4.5 μm and 8.0 μm/4.5 μm over the central portions of the source (Figure 3); a trend which is also confirmed through the IRAC band ratio mapping illustrated in Figure 4, whence it would seem that nuclear 5.8 μm/4.5 μm and 8.0 μm/4.5 μm ratios are low, and surrounded by a collar of higher ratio material. This may arise, yet again, as a result of more extended PAH band emission.

We finally note evidence for a dip in the profiles at the centre of the source, suggesting the possible presence of a central cavity in the longer wave (5.8 and 8.0 μm) emission (see Figure 3), or a narrowing of the structure associated with a nebular waist. On the other hand, the high ellipticity of the central 8.0 μm contours (see Figure 2) suggests aspect ratios which are relatively large (and of order $\sim$2). Both of these results may imply that the nebula is a barely resolved bipolar source.

3.2. *IC 4673*

Early optical observations of this source quoted by Cahn & Kaler (1971) and Chu, Jacoby, & Arendt (1987) showed it to have a diameter of 14.8 arcsec, compared to radio dimensions of 17 arcsec (Zijlstra, Pottasch, & Bignell 1989) Patriarchi & Perinotto (1994) used an ESO B survey plate to determine a size of 18×15 arcsec^2, whilst imaging by Schwarz, Corradi, & Melnick (1992) appeared to show a halo extending to 25×16 arcsec^2. The results of the latter authors have been combined in the Planetary Nebula Image Catalogue (Bruce Balick & collaborators[2]) to make an excellent false-colour image of the source which is similar to that in Figure 1. Patriarchi & Perinotto (1994) suggest that IC 4673 is a Type I source, and their abundances He/H $\cong$ 0.15 and N/O $\cong$ 5.57 are certainly consistent with this presumption. However, we note that values [He/H, N/O] of [0.0869, 0.565], [0.132, 0.424] and [0.146, 0.281] have been quoted by Chiappini et al. (2009), Exter, Barlow, & Walton (2004) and Kingsburgh & Barlow (1994), and it is possible that the Type I designation may have to be revised.

Phillips (2003) points out that the mean HeII Zanstra is 113.3 kK, whilst the corresponding H Zanstra value is 63.5 kK, perhaps implying a significant loss of H ionising photons by the nebular shell. This may suggest that the nebula is density bound, and that there is little neutral material outside of the ionised regime. Such an analysis would

[2]Available at `http://www.astro.washington.edu/users/balick/PNIC/`.