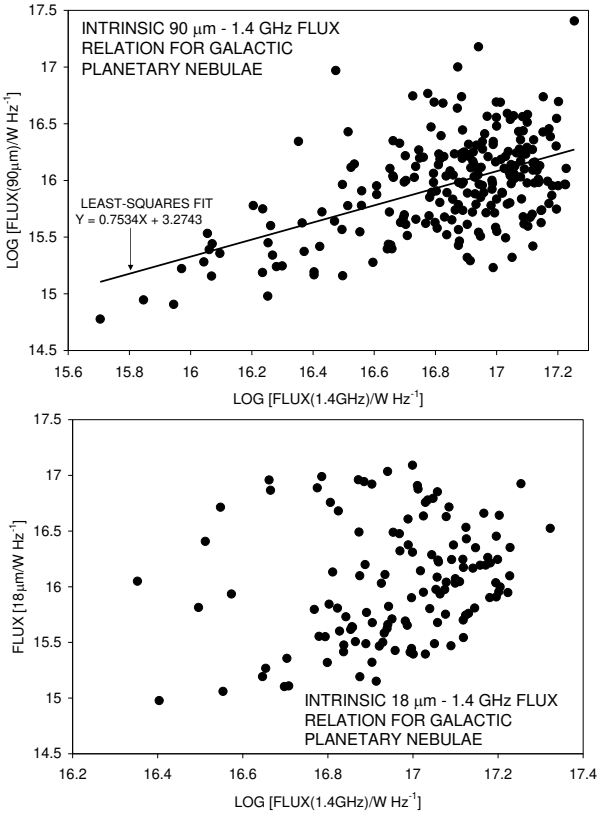

Fig. 13. The variation of intrinsic 18 and 90 μm emission with 1.4 GHz flux. There is still evidence for linearity in the 90 μm trends, although the 18 μm results appear to be random. We have indicated the equation and trend for the least-squares fit in the upper panel.

as before. There is still evidence for linearity between the 90 μm and 1.4 GHz results, although this is consistent with an approximate constancy of IR/radio flux ratios.

It would appear, apart from this, that there is little evidence for evolution or correlation – and certainly nothing like the invariance in q noted for extragalactic systems. The scatter in these planes is huge, and indicates variations of an order of magnitude or more. Most of this scatter likely to be intrinsic to the sources. The combined errors resulting from photometric errors (∼20%) and uncertainties in the distance (∼30%) are likely to be ∼60% for the 90 μm results, for instance – and probably somewhat less than that for the 18 μm trends. This is a factor ∼15 less than is observed in Figure 13.

Whilst it is therefore possible to obtain reasonable values of q for large ensembles of PNe, as has previously been undertaken by the authors cited above, there is little evidence that this parameter is invariant between PNe, or indicates any close relation between the mechanisms responsible for radio and IR emission. Whilst it is undoubtedly the case that UV radiation is stimulating the radio and infrared emission, there is little evidence for the levels of correlation noted in extragalactic systems.

4. CONCLUSIONS

The AKARI all-sky survey has resulted in photometry for 8.77×10^5 sources in the MIR, using the IRC at 9 and 18 μm, and 4.27×10^5 sources in the FIR using the FIS at 65–160 μm. We have interrogated this database to identify the counterparts of Galactic PNe, and undertaken an analysis of the resulting photometry.

Approximately 80% of the Kerber et al. (2003) sources were detected to quality levels FQUAL = 3, of which ∼ half were observed in both the FIR and MIR regimes. A comparison with photometry deriving from the IRAS survey shows that there are systematic differences between the two sets of flux, although much of the variation is attributable to differences in the wavelengths employed. We also note that the mean AKARI dimensions of the sources are similar to those at radio and optical wavelengths, although the distributions of diameters appear to be radically different. This may arise because of centrally concentrated fluxes due to [OIV] and [NeV], and/or high levels of dust emission in extended PDRs. It is also possible that limiting sensitivities and errors are biasing the distribution of AKARI results.

Analysis of the nebulae in the colour-colour planes suggests that many of the SEDs are consistent with dust continuum emission, although emission bands and ionic transitions also contribute to the results. We find evolutionary trends in grain temperatures similar to those measured in previous studies, with values approaching ∼160 K where nebulae are young ($D < 0.08$ pc), and $T_{\rm GR}$ ∼60–120 K where nebulae are more evolved.

Fluxes in the individual channels also show an evolution with nebular diameter, much of which may be attributed to cooling of the grains. However, we also note that total FIR emission declines with increasing nebular diameter, from a peak of $\approx 1.5 \times 10^4\ L_\odot$ where $D < 0.05$ pc, to values ∼600 $L_\odot$ in more evolved PNe. The high luminosities of less evolved sources suggest that dust opacities are appreciable. Although up to ∼0.5 of the grain heating may arise from absorption of Lyα photons, it seems likely that most of the energy budget depends upon absorption of the stellar radiation field. There is ev-