whilst the volume density of particles increased as $\propto R^{4.19}$; tendencies which were attributed to grain-grain collisions, sputtering by stellar winds, or the selective destruction of larger grains. A further analysis by Stasinska & Szczerba (1999), however, found no change in either of the latter two parameters.

A subsequent survey of PNe has been undertaken in the near infrared (NIR) using the 2MASS all-sky survey (Ramos-Larios & Phillips 2005), whilst a more restrictive survey, taken with the *Spitzer Space Telescope* (*Spitzer*; Werner et al. 2004), has enabled mid-infrared (MIR) observations of PNe close to the Galactic plane (see e.g., Cohen et al. 2005; Phillips & Ramos-Larios 2008; Ramos-Larios & Phillips 2008; Zhang & Kwok 2009; Phillips & Márquez-Lugo 2011). These latter results have shown the importance of polycyclic aromatic hydrocarbons (PAHs) in enhancing MIR emission at 5.8 and 8.0 μm, and revealed the presence of extensive emission outside of the ionized regimes, likely arising from photo-dissociation regimes (PDRs).

A more recent AKARI infrared survey has now completed the major phase of its observational program, and the point source catalogue (PSC) was made available in March 2010. This represents an updated version of the IRAS project, containing as it does more photometric channels, higher levels of spatial resolution, and higher sensitivity detectors. We present photometry for 857 Galactic PNe taken with the infrared camera (IRC) and far-infrared surveyor (FIS), and use this to analyse the evolution in grain temperatures and FIR luminosities.

2. OBSERVATIONS

The AKARI space mission (Murakami et al. 2007) was launched in 2006, and contains the IRC (Onaka et al. 2007) for observations in the range 2–26 μm, and the FIS (Kawada et al. 2007) for the 50–200 μm regime. The Ritchey-Chretien type telescope has a 0.685 m primary mirror, cooled to 6 K by liquid helium and mechanical coolers. One of the primary objectives of this mission was an all sky IRC/FIS survey, undertaken between 2006 May and 2007 August. The resulting PSCs [Kataza et al. 2010 (IRC); Yamamura et al. 2010 (FIS)] were published in 2010 March.

The IRC filter profiles extend between 6.76 and 11.6 μm (in the case of MIR-S), with an effective wavelength of 9 μm, and between 13.9 and 25.6 μm (MIR-L) with an effective wavelength of 18 μm. The camera field of view (FOV) was 10×9.6 arcmin^2 for MIR-S, and 10.7×10.2 arcmin^2 for MIR-L, whilst the pixel scales were 2.34×2.34 arcsec^2 (MIR-S) and 2.31×2.39 arcsec^2 (MIR-L). Each of four adjacent pixels were subsequently binned to create so-called "virtual" pixels, with areas 4×4 times greater than those of the original pixels. However, subsequent processing of two independent survey grids resulted in an improvement in spatial resolution, and point spread functions (PSFs) with FWHM ∼5.5 arcsec at 9 μm, and 5.7 arcsec for the 18 μm channel.

The FIS survey, by contrast, permitted observations at effective wavelengths of 65 μm (filter N60, bandwidth $\Delta\lambda = 21.7$ μm), 90 μm (Wide-S, $\Delta\lambda = 37.9$ μm), 140 μm (Wide-L, $\Delta\lambda = 52.4$ μm) and 160 μm ($\Delta\lambda = 34.1$ μm). The 65 and 90 μm results were taken with a monolithic Ge:Ga detector having a pixel size 26.8 arcsec, whilst the longer wave (140 and 160 μm) data were acquired using a stressed Ge:Ga detector, and pixel scale of 44.2 arcsec. The FOVs were in all cases ∼1 arcmin, whilst the FWHM of the PSFs were 37 arcsec (at 65 μm), 39 arcsec (90 μm), 58 arcsec (140 μm) and 61 arcsec (160 μm). Detector sensitivities are important in determining the rates of source detection, and quoted values range between 0.55 Jy at 90 μm to as high as 25 Jy for the 160 μm results. This question is further examined in § 3.4, where we consider its importance in determining nebular emission trends.

Details of the source selection procedure are provided in the following sections, together with a description of the catalogue results, the infrared dimensions of the PNe, and a comparison of the AKARI and IRAS photometry.

2.1. *Planetary Nebula Data Base and Search Radius*

The positions of the PNe investigated in this present study are taken from the listing of coordinates by Kerber et al. (2003). This provides positions for 1086 sources based on the 2$^{\rm nd}$ generation General Star Catalogue. The coordinates for sources which are compact (or have central stars) are quoted as being accurate to 0.35 arcsec, whilst the positions for 226 more extended PNe are accurate to ∼5 arcsec.

By contrast, the AKARI/IRC All-Sky Survey Release Point Source Catalogue - Release Note (Rev. 1) (Kataza et al. 2010) suggests that the mean angular separation of the AKARI and 2MASS sources is of order ≅0.77 arcsec, with 95% of the sources having angular separations of <2 arcsec. Similarly, the positional errors of the longer wave FIS sources (Yamamura et al. 2010) are determined through a comparison with the SIMBAD database, yielding flux independent uncertainties of order ∼6 arcsec.