

# A New Distance Indicator To The Galactic Planetary Nebulae Based Upon IRAS Fluxes

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The distance to Planetary Nebulae (PNe) is a most important parameter to study their evolution and the distribution among our Galaxy, but it has been very difficult to determine it precisely. On the other hand, it is well-known that the *IRAS* colors of PNe are very similar to the blackbody colors. Taking into account of this characteristic, we define a new method to get some information about the distance to PNe by the blackbody fitting of *IRAS* 4-band fluxes, assuming these fluxes are due to the thermal emission from the nebular dust envelope.

The fitting should have two free parameters — the dust temperature  $T_D$  and the distance depended “scaling factor”  $A$ . The fitting equation should be written by

$$F_{\nu,IRAS}(\lambda) = A \times B_{\nu}(\lambda, T_D)$$

where  $F_{\nu,IRAS}$  is observed flux and  $B_{\nu}$  is the Planckian function. Here, if we assume these *IRAS* fluxes caused by a spherical dust cloud with uniform size, temperature and composition of the grains, the scaling factor  $A$  can be expressed,

$$A = \frac{3}{4} \frac{M_D Q_{25\mu m}}{a\rho} \frac{1}{D^2}$$

where  $M_D$  is the mass of all dust,  $\rho$  is specific mass density of the grain material,  $a$  is the radius of a dust grain,  $Q_{25\mu m}$  is the emissivity efficiency of the dust at  $25\mu m$  and  $D$  is the distance to the PNe.

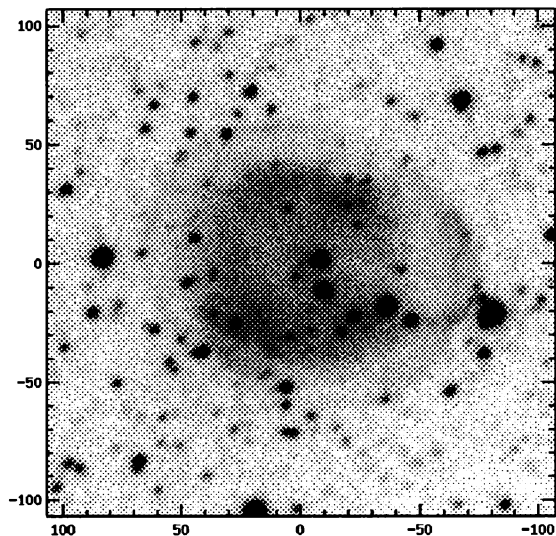
We have execute this blackbody fitting for 660PNe identified as *IRAS* source in Strasbourg-ESO Catalogue(1992) and found that  $A$ -values have good correlation with both statistical (Cahn *et al.* 1992, Maciel 1984) and individual (Acker 1978) distances already existing. And we also found  $T_D$  are concentrated between 100K and 200K, and its typical value is about 150K.

The scaling factor  $A$  could be a more effective distance scale than others, because many PNe have been detected as *IRAS* sources and the extinction of *IRAS* fluxes is not so severe compared with  $H\beta$  fluxes used by other distance estimations in usual. But some problem could be thought. The most serious problem is uncertainty of variation of the total dust mass in each nebula.

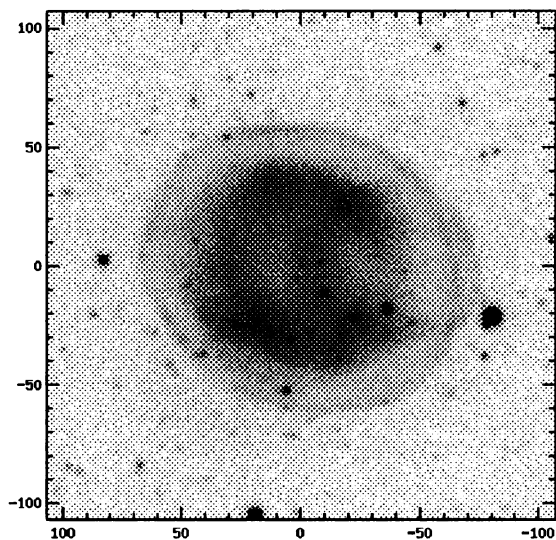
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H $\alpha$



[OIII]



IC 1295 025.4-04.7

From: "The IAC Morphological Catalog of Northern Galactic Planetary Nebulae",  
A. Manchado, M.A. Guerrero, L. Stanghellini, M. Serre-Ricart.  
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