CONTINOUS INFRARED EMISSION OF PROTO- AND YOUNG-PLANETARY NEBULAE

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Interstellar dust is the component of interstellar medium (ISM) which determines its physical properties. An important source of new grains seem to be the outflows from the cool stars outer athmospheres. A very high rate of mass loss up to some 10^{-4} $M_\odot$/yr is common for red giants on the asymptotic giant branch which, as it is now generally accepted, are precursors of planetary nebulae (PNe). Infrared (IR) observations of PNe have established the presence of dust in these objects. As the candidates for grain materials, silicate minerals are proposed from the features at 10 μm and/or 20 μm for O- rich stars and carbon and SiC grains from the 11.5 μm feature for C- stars. While the dust in PNe may be different from that present in the ISM, it is in a better defined environment than that in a diffuse cloud, for example and so its properties and significance may be better established.

Evolutionary sequences of PNe were calculated beginning from the moment of shell ejection to its dissipation and IR spectra of the outgoing radiation were obtained for different stages of the evolution. To solve the coupled hydrodynamical and radiation transfer problem we have used computer code described and used by Yorke (1979) and Okorokov et al. (1985) in which gas and dust are treated as two separate hydrodynamical components. The models, which are calculated for two grain materials - graphite and silicate, have a size distribution of particles based on that found for the ISM by Mathis et al. (1977). In our computations we have employed the recent optical properties of graphite and "astronomical silicate" grains tabulated by Draine (1987). The details of the dust formation and growth process were neglected. We have simply assumed that silicate or graphite grains exist below some critical temperature equal to 1300 or to 1700 °K, respectively.

Infrared model spectra are compared with the IR radiation emitted by some proto- and some young-planetary nebulae. The observed IR continua can be quite well matched with our models with grains having a reasonable size range.

REFERENCES:

Draine, B.T.: 1987, Princeton Observatory Preprint,No. 213

Mathis, J.S., Rumpl, W., Nordsieck, K.H.: 1977,
Astrophys. J., 217, 425

Okorokov, V.A., Shustov, B.M., Tutukov, A.V., Yorke, H.W.: 1985,
Astron. Astrophys., 142, 441

Yorke, H.W.: 1979, Astron. Astrophys. 80, 308