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The Temperature Structure of Dusty Planetary Nebulae

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Abstract. We have computed photoionization models of planetary nebulae containing dust. Photoelectric heating by small grains has an important effects on the temperature structure of the nebulae and could solve a number of problems that have found no satisfactory solution so far.

Dopita & Sutherland (2000) showed that photoelectric heating by *small* grains in planetary nebulae (PNe) is important. Developing on this, we found that such grains could explain: i) the thermal energy deficit inferred in some objects from tailored photoionization modelling; ii) the large negative temperature gradients inferred directly from spatially resolved observations and indirectly from integrated spectra in some PNe; iii) the Balmer jump temperatures being smaller than temperatures derived from forbidden lines; iv) the observed intensities of [O I] λ6300 often larger than predicted by photoionization models; v) the temperature fluctuations advocated by Peimbert (1967) but not explained so far: in presence of *moderate* density inhomogeneities (such as inferred from high resolution images of PNe) photoelectric heating would boost the temperature of the tenuous component and produce important small-scale temperature variations in the nebula (the hot tenuous component would also better confine the clumps); vi) the large discrepancies between abundances derived from forbidden and collisionally excited lines of the same ions (Liu et al. 2000) (if dielectronic recombinations for high level states, not yet included in the atomic physics calculations, strongly enhance the emissivities of the recombination lines as expected).

A full description of our results is given in Stasińska & Szczerba (2001).

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