

## NEBULAR DENSITY DISTRIBUTIONS; A CRITICAL LOOK

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**ABSTRACT.** The symmetry of planetary nebulae demands an explanation. Underlying previous attempts to explain these objects is the inferred density distribution based on spatio-kinematic models such as those of Weedman (1968), Reay *et al.* (1983) and others. Although some observations suggest a linear velocity-radius relationship for planetaries, plausible hypothetical examples may be constructed which greatly violate a linear relationship, and hydrodynamic theory (Schmalz 1986) suggests it may not hold even when observations may be most easily interpreted as supporting a linear relationship. Therefore, an independent assessment of the nebular density distribution is needed.

For a few special cases, an independent method is readily available -that of tomographic reconstruction. The axis of symmetry for NGC 7009 and a few other objects appears to lie almost in the plane of the sky. By assuming it does and that they are truly axi-symmetric; its brightness distribution may be "peeled" to yield a density distribution. This is done by assuming the distribution consists of cylindrical layers in discs stacked along the axis of symmetry. Then one disc at a time, the outermost layer's emission measure may be deduced by dividing its brightness by the chord through the outermost layer and the contribution of that layer to brightness from all layers inside it removed mathematically, leaving a new brightness distribution for which the next to outer layer of the old brightness distribution is now the new outer layer for a partially "peeled" brightness distribution. Repeating this process until the very inside of the object is reached yields an emission measure distribution, the square root of which is a relative density distribution.

### REFERENCES

- Reay, N.K., Atherton, P.D., and Taylor, K. 1983, *M.N.R.A.S.*, 203, 1079.  
Schmalz, R.F. 1986, *Physics and Fluids*, 29, 1389.  
Weedman, D.W. 1968, *Ap. J.*, 153, 49.