THE SPATIAL STRUCTURE OF PLANETARY NEBULAE WITH BINARY CENTRAL STARS

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ABSTRACT. The planetary nebulae formation in the detached binaries is considered.

We assumed that the process of the planetary nebula formation (or the envelope ejection) is the process of the unlimited expansion of the red giant envelope. The expansion velocity is invariant with distance from the star. The envelope ejection by the single star leads to the spherical planetary nebula formation.

When the envelope ejection takes place in the detached binaries then a few factors determine the spatial structure of the ejected shell. The main of them is that the shell ejected by one of the stars flow past a gravitating body (binary companion). If a gravitating body moves through the medium of the non-interacting particles then the density is maximal on the downstream axis. Conversely, if a gravitating body moves supersonically through the gas then the density on this axis is lower than the one away from the axis (R. Hunt, *M.N.*, 1971, 154, 141; 1979, 188, 83). The planetary nebulae is a gas but not a medium of the non-interacting particles. Hence, the density minimum can be expected in the orbital plane.

It is known that the star rotation results in the increase of the density of the ejected shell in the equatorial plane.

Thus, two factors (a. the flow past of the binary companion, b. the rotation of the ejecting star) mainly determine the spatial structure of envelope. If the first factor is dominant, then the main structure (the enhanced density area) has the form of an hour-glass. If the second factor is dominant then the main structure has the toroidal form.

The peripherical structure (a relative fainter shell around main structure) has the form of an oblate ellipsoide. The observed form of the peripherical structure of the ionization-bounded nebula can differ from the real one.

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S. Torres-Peimbert (ed.), Planetary Nebulae, 460.