A NEW METHOD FOR OBSERVATIONAL TESTING OF THE PLANETARY NEBULAE NUCLEI EVOLUTION

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Planetary nebulae (PNe) are very useful as a tool for testing the theory of stellar evolution. The most widely applied method in this respect is the Hertzsprung-Russell (H-R) diagram. However, the observed positions of planetary nebulae nuclei (PNNi) on the H-R diagram are subject to large uncertainties, mostly due to inaccurate distances to them. On the other hand, the (absolute visual magnitude, age)-diagram also is not free of this problem. Therefore, an attempt has been done to develop a new method which is distance-independent. For comparison between theory and observations we propose the I(HeII λ 4686)/I(H β) versus log [I(H β,PN)/I_c(H β,PNN)] diagram. Both ratios reflect the evolutionary status of the central star and the surrounding nebula. Consequently, such diagram is a valuable tool for studying common evolution of the PNN-PN system.

The appropriate observational data have been collected from the literature for about 120 objects. The dereddened PNN continuum at Hβ was calculated from the corrected B and/or V magnitudes in the Rayleigh-Jeans approximation. In our sample are not included these PNe the nuclei of which are close binaries and nebulae with uncertain central stars.

The evolutionary tracks of post-AGB models (Schönberner 1979, 1983; Wood and Faulkner 1986) and the simplified model of PN structure and evolution (Szczerba 1987) has been adopted for the numerical experiments. Results of comparison between theory and observation show that:

1. Our diagram yields some information on the phase of the flash cycle at which PN ejection occurs. Namely, only Schönberner H-burning models can explain a gap around 80 in the I(HeII λ 4686)/I(H β).
2. The evolution along the brightest portion of tracks is too slow if mass loss by fast wind is not taken into account.
3. The PNNi studied seem to have masses below 0.7 $M_\odot$.

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