# Structure of Selected Planetary Nebulae Surrounding WR-type Central Stars

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The main aim of this work was to confirm that expansion of planetary nebulae surrounding Wolf-Rayet type central stars is characterized by turbulent motions or strong variations of velocity in the radial direction relative to the nucleus. Such properties have already been found in M1-25, M3-15 and Pe1-1 by Gęsicki & Acker (1995). We have analyzed the photoionization structure and velocity field of the NGC 40 - a planetary nebula with late type ([WC 8]) Wolf-Rayet nucleus. The spectra of H$\alpha$ and [NII] lines have been obtained with the 1.5m telescope at the Observatoire de Haute-Provence. The spectrograph Aurelie with dispersion of 5Å/mm and a 3" circular entrance was used. The method and the details of the applied computer codes are published in Gęsicki et al. (1996).

Our models have shown that 33000 K central star is a best explanation to the apparent low ionization state of this nebula. The nebular chemical composition have been adopted from the literature. Despite a simplified spherical symmetry of the models we have found satisfactory fits to individual line ratios and to the ionization structure of NGC 40 published in the literature. Two types of the velocity field within the nebulae give comparable, equally good fits to observed line profiles. In the first model we have assumed a constant velocity of 25 km/s and existence of turbulent motions at the level of 10 km/s. In the second model an almost linearly increasing velocity field from 15 km/s at the inner edge to 45 km/s at the outer edge of the nebula has been adopted.

It has been found by Bianchi & Grewing (1987) that there exists a "carbon curtain" at the inner edge of the NGC 40 nebulosity and its expansion velocity is 30 km/s. Dinerstein et al. (1995) have measured positions of NaI absorption lines and found a neutral nebular halo of NGC 40 to expand with the velocity of 36 km/s, comparable to 35 km/s derived from HeI lines formed in outermost ionized parts of the nebula. This suggests that the velocity does not increase significantly outward in the nebula and favors our model of constant velocity with substantial turbulent motions present. Therefore, the dynamical properties of NGC 40 seem to be similar to those of other planetary nebulae with [WR] nuclei studied so far.

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