P Cygni Profiles Variability in Central Stars of Planetary Nebulae

P. Patriarchi[1] and M. Perinotto[2]

[1]Gruppo Nazionale di Astronomia del CNR, UdR di Arcetri;

[2]Dipartimento di Astronomia e Scienza dello Spazio, Univ. di Firenze

The variability of P Cygni profiles is important because of its connection with the mechanism of wind production and with the behaviour of the associated mass loss rates.

Studies of population I OB stars, using IUE high resolution spectra show that all the examined stars vary on timescales from minutes to years (cf. Baade, 1988, NASA SP-497, 137; Kaper et al. 1996, A&AS, 116, 257). Less attention has been given to other categories of hot stars, as the central stars of planetary nebulae (CSPN), in spite of their importance also for the role of the fast winds in the structure and evolution of the nebulae according to the multiple wind theory (Kwok et al., 1978, ApJ 219, L125)

We did examined all the high resolution SWP spectra of CSPN taken by IUE for which at least two good quality SWP spectra exist of the same object. This occurs for 14 CSPN belonging to the list of 47 CSPN known to have wind (Patriarchi & Perinotto, 1991, A&AS 91, 325).

The spectral intervals considered were of ± 20 Å around the mean wavelength of the UV P Cygni profiles: $\lambda\lambda$ N V 1238.82, 1242.80; O IV 1338.60, 1342.98, 1343.51; O V 1371.29; Si IV 1393.73, 1402.73; C IV 1548.20, 1550.77; N IV 1718.55 Å.

The original spectral resolution is 0.10 Å. The minimum detectable variation in the edge velocity is ± 30 km/s. The flux calibration procedures by Cassatella et al. (1981, ESA IUE Newsl. 10, 31; 1994, A&A 281, 594) have been used. We estimate that variations above a 10% level can be considered significant.

Seven out of the 14 objects did show changes in the shapes of all or some of their P Cygni profiles at levels of 10-50 % over timescales of years. In two CSPN (NGC 6543, NGC 6826) there is moreover an indication of photometric changes. We conclude that the variability of P Cygni profiles is a common property of CSPN with a detected wind.

It is interesting to examine how much the found variations can affect the mass loss rates. As an example we have considered NGC 1535, which presents P Cygni profiles in the lines of NV and OV. The OV profile did not vary between December 1980 and March 1981, while the absoption component of NV did change markedly. Using the SEI method (Lamers et al., 1987, ApJ 314, 729) we have estimated $\dot{M} q_{NV}$, where q_{NV} is the mean ionization fraction across the wind. This quantity did increase in the mentioned time interval by a factor of 3 ± 1. To evaluate how much this factor reflects into the corresponding mass loss rate an accurate knowledge of the ionization structure in the wind is needed, whose determination is difficult.

https://doi.org/10.1017/S0074180900130098 Published online by Cambridge University Press