

An Analysis of Ultraviolet (IUE) and Optical Spectra of High Latitude Planetary Nebulae Hb 7 and Sp 3

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Hb 7 (003.9 - 14.9) and Sp 3 (342.5 - 14.3) are high galactic latitude planetary nebulae. Ultraviolet spectra obtained with the IUE reveal UV stellar continuum and P - Cygni stellar wind profiles of NV and CIV indicating post-AGB mass loss from the central stars of these two PN. From an analysis of optical and ultraviolet spectra we have derived the parameters of the central stars and nebulae. The IUE ultraviolet continuum shows that the central stars of Hb 7 and Sp 3 are O8 stars. The Si IV 1400Å doublet in the spectra of both these stars is very weak or absent most likely due to underabundance of Si and due to also due to earlier spectral type (O 8). The Si IV lines in hot stars are sensitive to surface gravity, their weakness suggests that surface gravity the central stars of Hb7 and Sp3 is relatively higher. The terminal velocity of the stellar wind in Hb7 and Sp 3 are found to be -2460 km/sec and -3630 km/sec respectively.

The optical spectra of these two PN were obtained with Boller and Chivens spectrograph with CCD on the 152cm telescope at ESO. Spectra are analysed using the computer programme HOPPLA (Koeppen 1989, Koeppen et al. 1991 A and A 248, 197). HOPPLA allows the automatic derivation of the physical and chemical properties of the nebulae. For Hb7 we find the interstellar extinction $c = 0.2806$, electron temperature $T_e = 9288$ K and electron density $n_e = 4.390E+09 \text{ m}^{-3}$. And for Sp3 we find : $c = 0.2582$, $T_e = 10000$ K, $n_e = 2.397E+09 \text{ m}^{-3}$. The absolute H-beta flux for both the nebulae is $\log F(\text{H-beta}) = -14.00$ (in mW m^{-2}). The temperatures ($T_{\text{ambartz.}}$) of the central stars of Hb7 and Sp3 are found to be 53244 K and 44048 K respectively.

From an analysis of the optical spectra of the nebulae we find that Hb 7 and Sp 3 have abundances similar to that of halo planetary nebulae. Both these nebulae are found to be metal poor. In Hb 7 the helium abundance is close to solar. Sp 3 may be slightly He-rich. The abundances of elements in Hb 7 are : [N] = -0.37, [O] = -0.22, [Ne] = -0.91, [S] = -0.64, [Cl] = -0.64, and [Ar] = -0.51. And in Sp 3 the abundances are : [N] = -0.58, [O] = -1.48, [S] = -1.9, and [Ar] = -0.62.

The nebular abundances of Hb 7 and Sp 3 indicates that these two high galactic latitude PN mostly likely belong to halo or old-disk population. They originated from low mass old metal-poor (population II) stars.