IV. Envelopes

The Identification of the O V Forbidden Line in the Ultraviolet Spectrum of Gaseous Nebulae

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The 2s2 1S0 – 2s2p 3P1 intercombination line at 1218.34 Å of Be-like O V has been observed in IUE spectra of gaseous nebulae such as RR Tel (Doschek & Feibelman 1993). However, the forbidden line at 1213 Å has not been detected to date in any astrophysical object, with the possible exception of the Sun, where Sandlin, Brueckner & Tousey (1977) very tentatively identify the line at 1213.90 Å in an off-limb spectrum.

In order to calculate reliable forbidden-to-intercombination line ratios in O V, accurate atomic data was employed (McKenna et al. 1996). Thus, it was possible to obtain R = I(2s2 1S0 – 2s2p 3P2)/(2s2 1S0 – 2s2p 3P1) = I(1213 Å)/I(1218 Å), in the electron density range 10^4 – 10^10 cm^-3, for electron temperatures of T_e = 10000 K and 20000 K. The usefulness of this ratio as an electron density diagnostic is evident as it varies greatly with density for N_e = 10^4.5 cm^-3.

The gaseous nebula RR Tel has been observed using the GHRIS on the HST, on July 16 1995, and along with the O V intercombination line at 1218.34 Å, the [O V] line is clearly identified in these data. Close examination of this data shows that the wavelength separation between the O V lines is 4.62 ± 0.12 Å, in good agreement with the value of 4.54 ± 0.01 Å predicted by Edlén (1983). Employing our derived theoretical line ratio, the value of R measured from this spectrum implied a logarithmic electron density of log N_e = 5.2 ± 0.2 (N_e in cm^-3). This is very similar to those deduced from the line ratios of other high temperature species. For example, Espey et al. (1996) found log N_e = 5.0 ± 0.5 from the I(1010.6 Å)/I(999.6 Å) Ne VI ratio, providing additional support for the identification of the [O V] line.

REFERENCES

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