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

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The $2s^2\ ^1S_0 - 2s2p\ ^3P_1$ 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 $R = I(2s^2\ ^1S_0 - 2s2p\ ^3P_2)/(2s^2\ ^1S_0 - 2s2p\ ^3P_1) = I(1213\ Å)/I(1218\ Å)$, 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 $N_e \geq 10^{4.5}$ cm^{-3}.

The gaseous nebula RR Tel has been observed using the GHRS 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 $\log N_e = 5.2 \pm 0.2$ (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 $\log N_e = 5.0 \pm 0.5$ 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

Doschek, G. A. & Feibelman, W. A. 1993 ApJ Supp. Series, 87, 331

Edlén, B. 1983, Phys. Scr., 28, 51

Espey, B., Keenan, F. P., McKenna, F. C., Feibelman, W. A., & Aggarwal, K. M. 1996, ApJ, 465, 965

McKenna, F.C., Keenan, F.P., Aller, L.H., Hyung, S. Feibelman, W.A., Berrington, K.A., Fleming, J., & Hibbert, A. 1996 ApJ Lett., *submitted*

Sandlin, G.D., Bruekner, G.E., Tousey, R. 1977, ApJ, 214, 898

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