STARK WIDTHS OF ASTROPHYSICALLY IMPORTANT FOUR- AND FIVE-TIMES CHARGED ION LINES

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Important astrophysical applications of Stark broadening of spectral lines of multiply charged ions are in the physics of stellar interiors (Seaton 1987). In subphotospheric layers, the modelling of energy transport requires radiative opacities and thus, certain atomic processes must be known accurately. At these high temperatures (10^5 K or more) and densities ($10^{17} - 10^{22}\mathrm{cm}^{-3}$) Stark broadening of strong multicharged ionic lines plays a non-negligible role in the calculation of the opacities, especially in the UV. Moreover, with the development of spectroscopic investigations from space, UV and extreme UV spectral line research has been further stimulated.

In order to provide such data for four- and five-times charged ions, comprehensive studies of electron-, proton- and ionized helium-impact broadening parameters for 30 N V (Dimitrijević and Sahal-Bréchot 1992a), 30 O VI (Dimitrijević and Sahal-Bréchot 1992b) and 21 S VI (Dimitrijević and Sahal-Bréchot 1993) multiplets have been made recently, by using the semiclassical perturbation approach (Sahal-Bréchot 1969ab). In the case of C V, O V and P V lines, there exist sufficient atomic data for sophisticated semiclassical calculations for some or all astrophysically interesting lines. But, for other four- and five-times charged ions, the atomic data set is not sufficiently complete.

In order to complete the Stark broadening data for four- and five-time charged ions, Stark widths of astrophysically important spectral lines within 3 C V, 50 O V, 12 F V, 9 Ne V, 3 Al V, 6 Si V, 11 N VI, 28 F VI, 8 Ne VI, 7 Na VI, 15 Si VI, 6 P VI and 1 Cl VI multiplets, have been calculated by using the modified semi-empirical approach (Dimitrijević, Konjević, 1980). Results for 159 Stark line widths (FWHM) calculated using the modified semi-empirical approach (Dimitrijević and Konjević 1980) - (WMSE) will be published in Dimitrijević (1993a). Moreover, in order to compare the different theoretical methods, for 88 of the above mentioned multiplets calculations were performed by using the symplified semiclassical approach (Griem, 1974) as well (Dimitrijević, 1993b).

Comparison of the present values with values calculated by using Eq. (526) in Griem (1974) have been performed, and the obtained agreement is satisfactory. As an example, a comparison for the C V $3s^1S - 3p^1P$, N VI $2s^1S - 2p^1P$ and O V $4p^1P - 4d^1D$ cases is presented in Table 1. In comparison with the experiment of Purić et al. (1988) for two O V lines, both approaches give about two times smaller values.

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TABLE 1

Comparison of present results for Stark broadening full half width (WMSE) with values obtained by using Eq. (526) in Griem (1974) (WG). The electron density is 10^{17} cm^{-3}.

Transition	λ(Å)	χ(eV)	T(K)	WMSE(Å)	WG(Å)
C V $3s^1S - 3p^1P$	12202.6	56.6	50000	1.79	1.63
			100000	1.57	1.36
			200000	1.46	1.18
			400000	1.22	1.05
			800000	1.21	0.949
N VI $2s^1S - 2p^1P$	2833.7	2.95	50000	0.700E-02	0.812E-02
			100000	0.516E-02	0.607E-02
			200000	0.420E-02	0.475E-02
			400000	0.357E-02	0.395E-02
			800000	0.305E-02	0.349E-02
O V $4p^1P - 4d^1D$	11913.1	29.2	50000	4.35	4.16
			100000	3.79	3.43
			200000	3.30	2.96
			400000	2.98	2.64
			800000	2.81	2.41

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