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## Stark broadening of spectral lines of multicharged ions of astrophysical interest. VI. C IV lines of large principal quantum number

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**Abstract.** — Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 69 C IV multiplets of large principal quantum number. This comprehensive set of data has been used for the investigation of Stark broadening parameter regularities within spectral series.

**Key words:** lines: profile — atomic and molecular data.

### 1. Introduction.

We have recently calculated Stark broadening data for 39 C IV multiplets (Dimitrijević & Sahal-Bréchet 1991ab), persuaded that we had provided data for practically all C IV lines important for stellar research. Our tables however are not sufficiently complete for the investigation of PG 1159 stars (Werner *et al.* 1991; Werner & Heber 1991). The PG 1159 stars are not hydrogen deficient pre-white dwarfs with effective temperature 100,000 - 140,000 K and peculiar chemical composition. Carbon and helium are the dominant constituents ( $C/He = 0.5$ ) (Werner *et al.* 1991). Due to the high surface gravity ( $\log g = 7$ ) Stark broadening is an important line broadening mechanism and Stark broadening data are needed for NLTE model atmosphere analysis (Werner *et al.* 1991) and other stellar plasma investigations (see e.g. Dimitrijević 1989 or Kršljanin & Dimitrijević 1992). In this class of stars a number of large principal quantum number C IV lines not included in our previous analysis were observed recently (Werner *et al.* 1991; Werner & Heber 1991). Moreover, Stark broadening data in the far and extreme ultraviolet, for lines originating from transitions between energy levels with large principal quantum number and low lying levels will become important for astrophysics in the near future. The Extreme Ultraviolet Explorer (EUVE) mission will provide the all sky survey in the  $\lambda = 70 - 700 \text{ \AA}$  range by four EUV telescopes in Earth orbit (Bowyer & Malina 1990). Moreover, the primary goal of the Far Ultraviolet Spectroscopy Explorer (FUSE) mission which is being developed by NASA is to obtain high resolution spectra

with unprecedented sensitivity in the wavelength range 912 - 1250  $\text{\AA}$  (Soneborn 1991). Consequently, one of the principal aims of this paper is to complement available C IV Stark broadening data with the lines of large principal quantum number.

This paper is the sixth of a series devoted to the calculation of Stark broadening parameters of spectral lines of multicharged ions. The first five were concerned with C IV, Si IV, O VI, N V Sc III and Ti IV lines (Dimitrijević *et al.* 1991a-d, Dimitrijević & Sahal-Bréchet 1992a-c). By using the semiclassical-perturbation formalism (Sahal-Bréchet 1969ab), we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 69 C IV multiplets of large principal quantum number. A summary of the formalism is given in Dimitrijević & Sahal-Bréchet (1991a). Here, we present and discuss the results for C IV multiplets of large principal quantum number, along with a discussion of the Stark broadening parameter regularities within spectral series.

### 2. Results and discussion.

Energy levels for C IV lines have been taken from Bashkin & Stoner (1975). Oscillator strengths have been calculated by using the method of Bates & Damgaard (1949) and the tables of Oertel & Shomo (1968). For higher levels, the method described by Van Regemorter *et al.* (1979) has been used.

In addition to electron-impact full halfwidths and shifts, Stark-broadening parameters due to proton-, and

ionized helium- impacts have been calculated. At high temperatures helium is ionized twice; yet the Stark broadening parameters due to doubly charged helium have not been provided, because they are smaller than previous one: the increase of the Coulomb repulsion entails a decrease of the line width. Besides, owing to the neutrality plasma condition, the electron density is twice larger than the corresponding doubly charged helium density due to the fact that helium is twice ionized and thus the relative contribution of the electron impact broadening is more important. Consequently, the influence of other multiply charged ions on the line broadening parameters is much smaller.

Our results for C IV multiplets of large principal quantum number are shown in Table 1, for perturber densities  $10^{13} - 10^{18} \text{ cm}^{-3}$  and temperatures  $T = 20,000 - 200,000 \text{ K}$ . In table 2 Stark broadening parameters are presented for far UV C IV multiplets for temperatures  $T = 20,000 - 200,000 \text{ K}$  and only for a perturber density of  $10^{15} \text{ cm}^{-3}$ , since these lines are not so important for model atmosphere analysis in comparison with previous ones. However, data for other densities may be provided by authors upon request. We also specify a parameter  $c$  (Dimitrijević & Sahal-Bréchet 1984), which gives an estimate for the maximum perturber density for which the line may be treated as isolated when it is divided by the corresponding electron-impact full width at half maximum. For each value given in Tables 1 and 2, the collision volume ( $V$ ) multiplied by the perturber density ( $N$ ) is much less than one and the impact approximation is valid (Sahal-Bréchet 1969ab). Values for  $NV > 0.5$  are not given and values for  $0.1 < NV < 0.5$  are denoted by an asterisk. When the impact approximation is not valid, the ion broadening contribution may be estimated by using quasistatic estimations (Sahal-Bréchet 1991 and Griem 1974). The accuracy of the results obtained decreases when broadening by ion interactions becomes important.

In Figures 1-4, the electron and proton full halfwidths and shifts within the  $2p^2P^\circ - ns^2S$  series are reported. By inspecting the energy separation between the upper level and the principal perturbing levels (see the Grotrian diagrams in Bashkin & Stoner 1975), we find that this separation decreases gradually within a spectral series. We obtain therefore, a gradual change of the Stark widths as in the case analysed in Dimitrijević *et al.* (1991a) when the upper level was a p level. In Figures 5 and 6 the case of C IV  $np^2P^\circ - 9s^2S$  transitions, i.e. the case when the upper level does not change is presented. We can see that particularly for shifts the changes of Stark broadening parameters are relatively small, permitting the interpolation of new data or critical evaluation of mutual consistency of existing data.

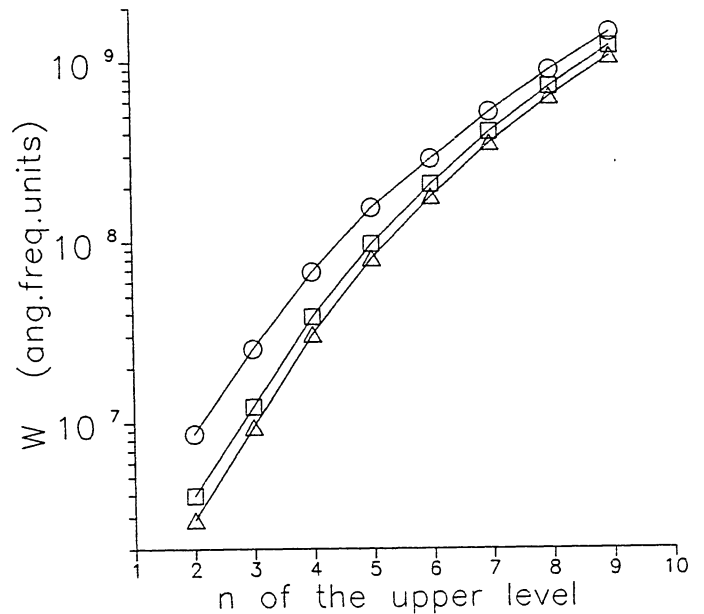


FIGURE 1. Electron-impact full half-widths (in angular frequency units) for the C IV  $2p^2P^\circ - ns^2S$  lines as a function of  $n$  for  $T = 20,000 \text{ K}$  (O);  $100,000 \text{ K}$  (□) and  $200,000 \text{ K}$  (Δ) at  $N_e = 10^{13} \text{ cm}^{-3}$ .

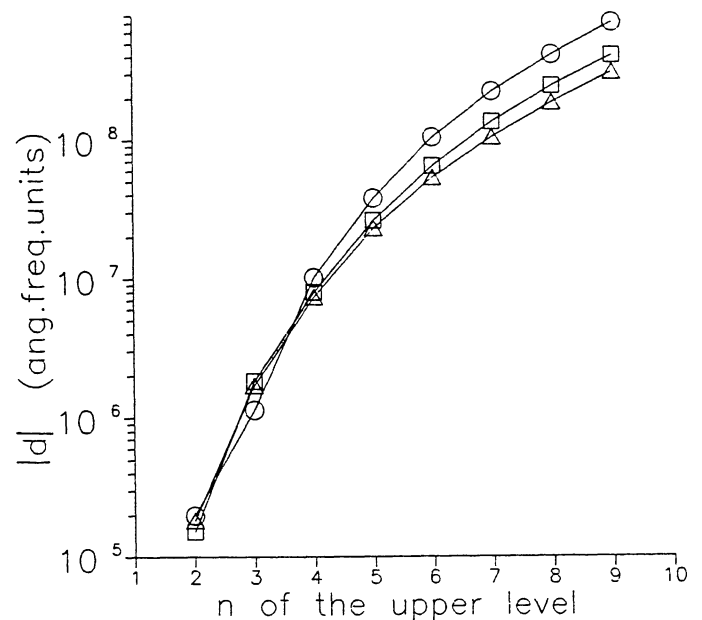


FIGURE 2. As in Fig. 1 but for the electron - impact shift.

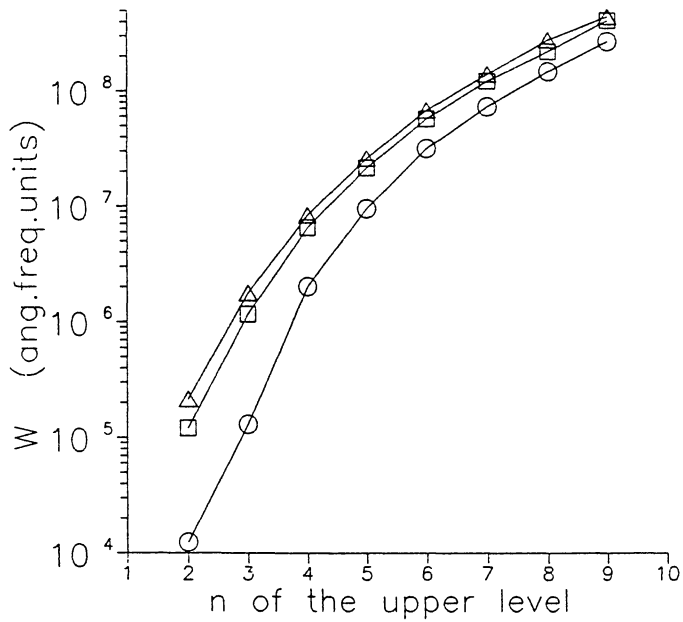


FIGURE 3. As in Fig. 1 but for the proton - impact full halfwidth.

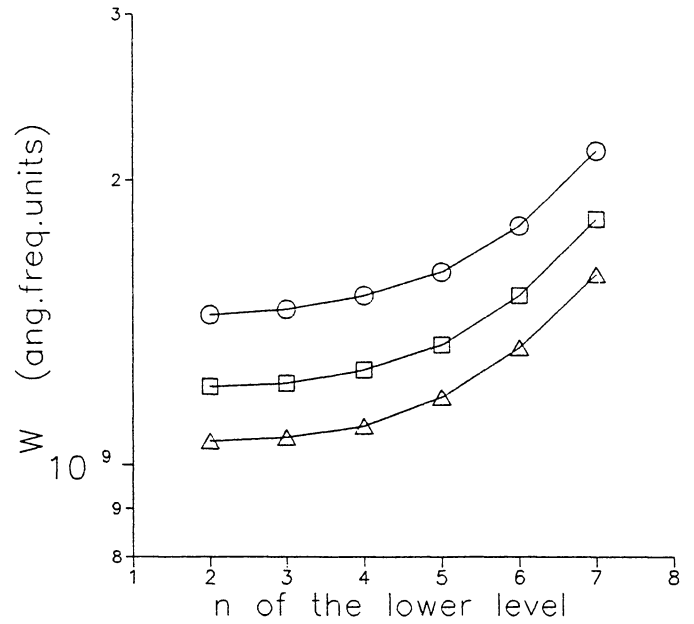


FIGURE 5. As in Fig. 1 but for the C IV  $np^2P^o - 9s^2S$  electron - impact width.

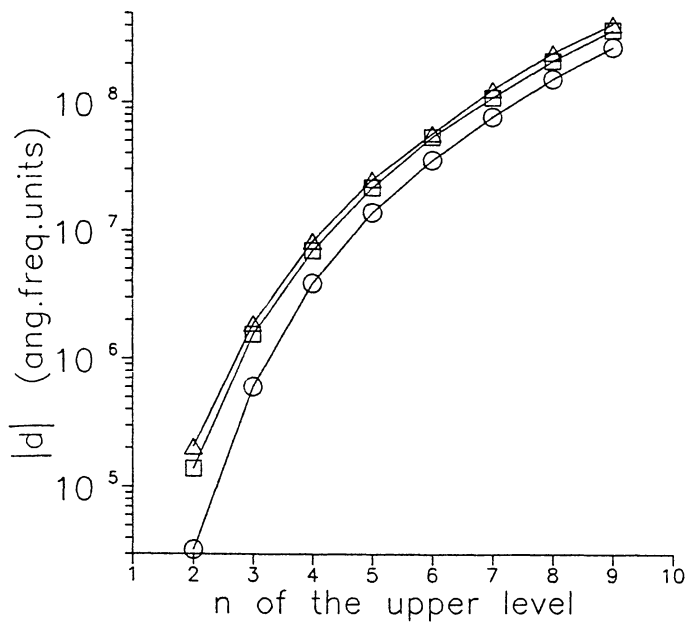


FIGURE 4. As in Fig. 1 but for the proton - impact shift.

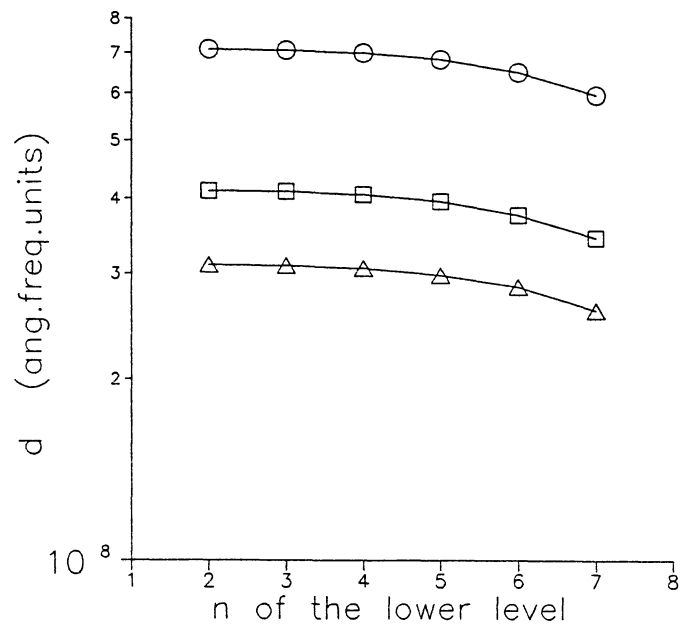


FIGURE 6. As in Fig. 1 but for the C IV  $np^2P^o - 9s^2S$  electron - impact shift.

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TABLE 1. This table shows electron-, proton-, and ionized-helium- impact broadening parameters for C IV lines of large principal quantum number, for perturber densities of  $10^{13} - 10^{18} \text{ cm}^{-3}$  and temperatures from 20,000 to 200,000 K. Transitions and averaged wavelengths for the multiplet (in Å) are also given. By using  $c$  [see Eq. (5) in Dimitrijević et al., 1991a], we obtain an estimate for the maximum perturber density for which the line may be treated as isolated and tabulated data may be used. The asterisk identifies cases for which the collision volume multiplied by the perturber density (the condition for validity of the impact approximation) lies between 0.1 and 0.5.

PERTURBER DENSITY = $0.1D+14(\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
CIV 4D-6F 1637.6 Å C= 0.79E+12	20000.	0.154E-03	0.153E-05	0.223E-03	0.209E-03	0.185E-03	0.170E-03
	50000.	0.116E-03	-0.421E-06	0.256E-03	0.255E-03	0.244E-03	0.190E-03
	100000.	0.922E-04	-0.154E-05	0.356E-03	0.275E-03	0.240E-03	0.209E-03
	200000.	0.720E-04	-0.118E-05	0.356E-03	0.324E-03	0.307E-03	0.232E-03
CIV 4D-7F 1351.3 Å C= 0.35E+12	20000.	0.215E-03	0.348E-05	0.385E-03	0.323E-03	0.320E-03	0.280E-03
	50000.	0.160E-03	-0.616E-06	0.386E-03	0.406E-03	0.424E-03	0.319E-03
	100000.	0.126E-03	-0.238E-05	0.516E-03	0.450E-03	0.462E-03	0.389E-03
	200000.	0.984E-04	-0.162E-05	0.521E-03	0.530E-03	0.489E-03	0.442E-03
CIV 4F-5G 2530.7 Å C= 0.55E+13	20000.	0.697E-04	-0.310E-05	0.973E-04	-0.966E-04	0.832E-04	-0.795E-04
	50000.	0.523E-04	-0.155E-05	0.124E-03	-0.115E-03	0.102E-03	-0.908E-04
	100000.	0.419E-04	-0.323E-06	0.144E-03	-0.130E-03	0.112E-03	-0.106E-03
	200000.	0.335E-04	0.453E-06	0.155E-03	-0.145E-03	0.158E-03	-0.128E-03
CIV 4F-6G 1640.1 Å C= 0.17E+12	20000.	0.128E-03	-0.168E-05	0.341E-03	0.315E-03	0.306E-03	0.257E-03
	50000.	0.950E-04	-0.160E-05	0.436E-03	0.357E-03	0.313E-03	0.312E-03
	100000.	0.744E-04	0.124E-06	0.445E-03	0.398E-03	0.414E-03	0.370E-03
	200000.	0.576E-04	0.189E-06	0.574E-03	0.431E-03	0.405E-03	0.397E-03
CIV 4F-7G 1353.0 Å C= 0.81E+11	20000.	0.213E-03	-0.201E-05	0.647E-03	0.605E-03	*0.620E-03	*0.497E-03
	50000.	0.156E-03	-0.155E-05	0.853E-03	0.664E-03	0.635E-03	0.619E-03
	100000.	0.121E-03	0.147E-06	0.117E-02	0.778E-03	0.663E-03	0.637E-03
	200000.	0.931E-04	-0.146E-06	0.956E-03	0.103E-02	0.107E-02	0.625E-03
CIV 5D-6F 4647.0 Å C= 0.64E+13	20000.	0.147E-02	-0.696E-05	0.177E-02	0.163E-02	0.143E-02	0.134E-02
	50000.	0.111E-02	-0.158E-04	0.198E-02	0.198E-02	0.196E-02	0.154E-02
	100000.	0.885E-03	-0.216E-04	0.282E-02	0.219E-02	0.196E-02	0.165E-02
	200000.	0.693E-03	-0.147E-04	0.286E-02	0.251E-02	0.252E-02	0.175E-02
CIV 5D-7F 2902.4 Å C= 0.16E+13	20000.	0.108E-02	0.883E-05	0.177E-02	0.149E-02	0.145E-02	0.129E-02
	50000.	0.807E-03	-0.739E-05	0.177E-02	0.185E-02	0.194E-02	0.147E-02
	100000.	0.638E-03	-0.142E-04	0.241E-02	0.209E-02	0.210E-02	0.180E-02
	200000.	0.498E-03	-0.914E-05	0.230E-02	0.241E-02	0.218E-02	0.203E-02
CIV 5F-6G 4658.5 Å C= 0.14E+13	20000.	0.131E-02	-0.200E-04	0.267E-02	0.248E-02	0.239E-02	0.200E-02
	50000.	0.983E-03	-0.152E-04	0.358E-02	0.277E-02	0.242E-02	0.240E-02
	100000.	0.774E-03	0.219E-06	0.350E-02	0.304E-02	0.290E-02	0.292E-02
	200000.	0.601E-03	0.274E-05	0.441E-02	0.331E-02	0.288E-02	0.312E-02
CIV 5F-7G 2906.5 Å C= 0.37E+12	20000.	0.109E-02	-0.119E-04	0.297E-02	0.275E-02	*0.287E-02	*0.228E-02
	50000.	0.802E-03	-0.812E-05	0.392E-02	0.304E-02	0.290E-02	0.284E-02
	100000.	0.626E-03	0.335E-06	0.538E-02	0.361E-02	0.296E-02	0.287E-02
	200000.	0.483E-03	-0.212E-06	0.429E-02	0.464E-02	0.497E-02	0.288E-02
CIV 5G-6F 4661.0 Å C= 0.64E+13	20000.	0.130E-02	0.337E-04	0.196E-02	0.180E-02	0.155E-02	0.147E-02
	50000.	0.979E-03	0.861E-05	0.242E-02	0.219E-02	0.203E-02	0.165E-02
	100000.	0.775E-03	-0.692E-05	0.310E-02	0.241E-02	0.202E-02	0.183E-02
	200000.	0.604E-03	-0.885E-05	0.320E-02	0.281E-02	0.269E-02	0.197E-02

TABLE 1. (continued)

PERTURBER DENSITY = 0.1D*14(CM-3)			PERTURBER DENSITY = 0.1D*15(CM-3)			IONIZED HELIUM			IONIZED HELIUM				
PERTURBERS ARE TRANSITION	ELECTRONS T(K)	SHIFT(A)	PERTURBERS ARE TRANSITION	ELECTRONS T(K)	SHIFT(A)	PROTONS WIDTH(A)	SHIFT(A)	WIDTH(A)	PROTONS WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	
CIV 5G-7F 2907.4 A C= 0.16E+13 200000.	20000. 50000. 100000. 200000.	0.101E-02 0.755E-03 0.596E-03 0.464E-03	CIV 4D-5G 2524.6 A C= 0.55E+14 200000.	20000. 50000. 100000. 200000.	0.825E-03 0.621E-03 0.500E-03 0.400E-03	0.174E-02 0.181E-02 0.233E-02 0.259E-02	-0.646E-04 -0.376E-04 -0.190E-04 -0.470E-05	0.106E-02 0.132E-02 0.154E-02 0.160E-02	0.102E-02 -0.122E-02 -0.137E-02 -0.153E-02	0.890E-03 0.107E-02 0.119E-02 0.166E-02	-0.846E-03 -0.998E-03 -0.119E-02 -0.128E-02		
CIV 5G-6H 4660.2 A C= 0.14E+13 200000.	20000. 50000. 100000. 200000.	0.561E-03 0.418E-03 0.332E-03 0.262E-03	CIV 4F-5G 2530.7 A C= 0.55E+14 200000.	20000. 50000. 100000. 200000.	0.690E-03 0.518E-03 0.416E-03 0.332E-03	0.290E-02 0.349E-02 0.377E-02 0.458E-02	-0.310E-04 -0.155E-04 -0.323E-05 0.453E-05	0.973E-03 0.124E-02 0.144E-02 0.155E-02	-0.966E-03 -0.115E-02 -0.130E-02 -0.145E-02	0.832E-03 0.102E-02 0.112E-02 0.158E-02	-0.795E-03 -0.908E-03 -0.106E-02 -0.128E-02		
CIV 6F-7F 7708.6 A C= 0.11E+14 200000.	20000. 50000. 100000. 200000.	0.866E-02 0.668E-02 0.530E-02 0.414E-02	CIV 4F-6G 1640.1 A C= 0.17E+13 200000.	20000. 50000. 100000. 200000.	0.117E-02 0.87E-03 0.692E-03 0.539E-03	0.122E-01 0.125E-01 0.166E-01 0.159E-01	-0.103E-01 0.127E-01 0.147E-01 0.164E-01	0.983E-02 0.134E-01 0.137E-01 0.148E-01	0.892E-02 0.103E-01 0.122E-01 0.138E-01	*0.341E-02 *0.357E-02 *0.445E-02 *0.574E-02	*0.306E-02 *0.313E-02 *0.414E-02 0.405E-02	*0.257E-02 *0.312E-02 *0.370E-02 0.397E-02	
CIV 6F-7D 7746.1 A C= 0.18E+14 200000.	20000. 50000. 100000. 200000.	0.762E-02 0.588E-02 0.474E-02 0.376E-02	CIV 4F-7G 1353.0 A C= 0.81E+12 200000.	20000. 50000. 100000. 200000.	0.187E-02 0.139E-02 0.109E-02 0.849E-03	0.422E-02 0.498E-02 0.536E-02 0.655E-02	-0.369E-02 -0.431E-02 -0.535E-02 -0.584E-02	0.360E-02 0.432E-02 0.519E-02 0.589E-02	-0.313E-02 -0.371E-02 -0.386E-02 -0.472E-02	*0.177E-02 *0.177E-01 *0.956E-02 *0.103E-01	*0.664E-02 *0.778E-02 *0.663E-02 *0.107E-01	*0.637E-02 *0.623E-02	
CIV 6F-7E 7729.7 A C= 0.38E+13 200000.	20000. 50000. 100000. 200000.	0.965E-02 0.713E-02 0.557E-02 0.428E-02	CIV 5D-6P 4786.8 A C= 0.12E+16 200000.	20000. 50000. 100000. 200000.	0.905E-02 0.734E-02 0.620E-02 0.513E-02	0.207E-01 0.261E-01 0.315E-01 0.296E-01	0.178E-01 0.201E-01 0.211E-01 0.321E-01	*0.183E-01 0.166E-01 0.211E-01 0.321E-01	*0.154E-01 0.183E-01 0.191E-01 0.212E-01	0.152E-02 0.203E-02 0.239E-02 0.261E-02	0.150E-02 -0.187E-02 -0.201E-02 0.235E-02	0.128E-02 0.171E-02 0.205E-02 0.247E-02	-0.125E-02 -0.153E-02 -0.178E-02 -0.196E-02
CIV 6F-7F 7729.6 A C= 0.38E+13 200000.	20000. 50000. 100000. 200000.	0.919E-02 0.684E-02 0.537E-02 0.416E-02	CIV 5D-7P 2935.9 A C= 0.44E+15 200000.	20000. 50000. 100000. 200000.	0.516E-02 0.434E-02 0.374E-02 0.314E-02	0.713E-02 0.974E-02 0.977E-02 0.127E-01	0.665E-02 0.767E-02 0.820E-02 0.872E-02	0.653E-02 0.665E-02 0.750E-02 0.757E-02	0.543E-02 0.638E-02 0.781E-02 0.816E-02	0.310E-03 0.394E-03 0.470E-03 0.542E-03	-0.247E-03 -0.310E-03 -0.358E-03 -0.416E-03	0.299E-03 0.368E-03 0.403E-03 0.449E-03	-0.208E-03 -0.254E-03 -0.294E-03 -0.335E-03
CIV 4P-6D 1586.0 A C= 0.81E+14 200000.	20000. 50000. 100000. 200000.	0.116E-02 0.895E-03 0.718E-03 0.574E-03	CIV 5D-6F 4647.0 A C= 0.64E+14 200000.	20000. 50000. 100000. 200000.	0.143E-01 0.109E-01 0.867E-02 0.680E-02	0.537E-03 0.720E-03 0.780E-03 0.903E-03	0.517E-03 0.612E-03 0.673E-03 0.849E-03	0.431E-03 0.516E-03 0.683E-03 0.757E-03	0.431E-03 0.573E-03 0.574E-03 0.589E-03	0.177E-01 0.198E-01 0.282E-01 0.286E-01	0.163E-01 0.198E-01 0.219E-01 0.251E-01	*0.143E-01 0.154E-01 0.196E-01 0.252E-01	*0.134E-01 0.154E-01 0.165E-01 0.175E-01
CIV 4P-7D 1315.9 A C= 0.53E+14 200000.	20000. 50000. 100000. 200000.	0.144E-02 0.112E-02 0.913E-03 0.734E-03	CIV 5D-7F 2902.4 A C= 0.16E+14 200000.	20000. 50000. 100000. 200000.	0.102E-01 0.772E-02 0.613E-02 0.480E-02	0.638E-03 0.793E-03 0.959E-03 0.999E-03	0.582E-03 0.694E-03 0.762E-03 0.799E-03	0.516E-03 0.642E-03 0.693E-03 0.789E-03	0.475E-03 0.573E-03 0.628E-03 0.747E-03	*0.177E-01 *0.177E-01 *0.241E-01 0.230E-01	*0.149E-01 *0.185E-01 *0.209E-01 0.241E-01	*0.145E-01 *0.194E-01 *0.210E-01 *0.203E-01	*0.129E-01 *0.147E-01 *0.180E-01 *0.203E-01
CIV 4D-6F 1637.6 A C= 0.79E+13 200000.	20000. 50000. 100000. 200000.	0.113E-02 0.900E-03 0.705E-03	CIV 5F-6D 4665.0 A C= 0.19E+15 200000.	20000. 50000. 100000. 200000.	0.124E-01 0.959E-02 0.776E-02 0.618E-02	0.223E-02 0.256E-02 0.356E-02 0.356E-02	0.209E-02 0.255E-02 0.240E-02 0.307E-02	*0.185E-02 0.244E-02 0.240E-02 0.307E-02	*0.170E-02 0.190E-02 0.209E-02 0.232E-02	0.207E-02 0.278E-02 0.331E-02 0.390E-02	0.205E-02 0.254E-02 0.293E-02 0.328E-02	0.175E-02 0.225E-02 0.265E-02 0.258E-02	0.172E-02 0.205E-02 0.235E-02 0.258E-02
CIV 4D-7F 1351.3 A C= 0.35E+13 200000.	20000. 50000. 100000. 200000.	0.203E-02 0.152E-02 0.121E-02 0.946E-03	CIV 5F-7D 2909.3 A C= 0.73E+14 200000.	20000. 50000. 100000. 200000.	0.798E-02 0.622E-02 0.507E-02 0.406E-02	*0.385E-02 *0.386E-02 *0.516E-02 *0.521E-02	*0.323E-02 *0.406E-02 *0.450E-02 0.530E-02	*0.320E-02 *0.424E-02 *0.462E-02 *0.489E-02	*0.280E-02 *0.319E-02 *0.309E-02 *0.442E-02	0.235E-02 0.273E-02 0.193E-02 0.110E-03	0.216E-02 0.256E-02 0.303E-02 0.331E-02	0.190E-02 0.244E-02 0.283E-02 0.275E-02	0.178E-02 0.206E-02 0.228E-02 0.256E-02



TABLE 1. (continued)

PERTURBER DENSITY = $0.10 \times 10^{16} \text{ (cm}^{-3}\text{)}$				PERTURBER DENSITY = $0.10 \times 10^{16} \text{ (cm}^{-3}\text{)}$			
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T (K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CIV 4D-7F	20000.	0.181E-01	-0.128E-04	0.106E-01	-0.102E-01	*0.890E-02	-0.840E-02
1351.3 A	50000.	0.139E-01	-0.616E-04	0.132E-01	-0.122E-01	0.107E-01	-0.998E-02
C = 0.35E+14	100000.	0.111E-01	-0.238E-03	0.154E-01	-0.137E-01	0.119E-01	-0.119E-01
	200000.	0.877E-02	-0.162E-03	0.160E-01	-0.153E-01	0.166E-01	-0.128E-01
CIV 4D-5G	20000.	0.793E-02	-0.585E-03	0.596E-02	0.560E-02	*0.492E-02	*0.448E-02
2524.6 A	50000.	0.601E-02	-0.376E-03	0.806E-02	0.656E-02	*0.632E-02	*0.568E-02
C = 0.55E+15	100000.	0.486E-02	-0.190E-03	0.830E-02	0.731E-02	0.745E-02	0.629E-02
	200000.	0.390E-02	-0.470E-04	0.100E-01	0.928E-02	0.828E-02	0.668E-02
CIV 4F-6D	20000.	0.119E-01	0.794E-03	0.596E-02	0.560E-02	*0.492E-02	*0.448E-02
1641.0 A	50000.	0.914E-02	0.521E-03	0.806E-02	0.656E-02	*0.632E-02	*0.568E-02
C = 0.87E+15	100000.	0.742E-02	0.337E-03	0.830E-02	0.731E-02	0.745E-02	0.629E-02
	200000.	0.594E-02	0.183E-03	0.100E-01	0.928E-02	0.828E-02	0.668E-02
CIV 4F-7D	20000.	0.149E-01	0.977E-03	*0.684E-02	*0.616E-02	*0.557E-02	*0.505E-02
1353.6 A	50000.	0.116E-01	0.655E-03	*0.849E-02	*0.745E-02	*0.692E-02	*0.606E-02
C = 0.56E+15	100000.	0.947E-02	0.420E-03	*0.102E-01	*0.813E-02	*0.749E-02	*0.663E-02
	200000.	0.762E-02	0.225E-03	0.106E-01	0.851E-02	*0.833E-02	*0.792E-02
CIV 4F-5G	20000.	0.658E-02	-0.255E-03	0.972E-02	-0.961E-02	0.832E-02	-0.790E-02
2530.7 A	50000.	0.498E-02	-0.155E-03	0.124E-01	-0.115E-01	0.102E-01	-0.908E-02
C = 0.55E+15	100000.	0.401E-02	-0.323E-04	0.144E-01	-0.130E-01	0.112E-01	-0.106E-01
	200000.	0.322E-02	0.453E-04	0.155E-01	-0.145E-01	0.158E-01	-0.128E-01
CIV 4F-6G	20000.	0.989E-02	-0.166E-03	0.439E-02	0.414E-02	0.400E-02	0.345E-02
1640.1 A	50000.	0.764E-02	-0.160E-03	0.585E-02	0.521E-02	0.526E-02	0.440E-02
C = 0.17E+14	100000.	0.612E-02	0.124E-04	0.705E-02	0.615E-02	0.606E-02	0.492E-02
	200000.	0.483E-02	0.189E-04	*0.574E-01	*0.431E-01	0.676E-02	0.563E-02
CIV 4F-7G	20000.	0.153E-01	-0.240E-03	0.469E-02	0.432E-02	0.415E-02	0.358E-02
1353.0 A	50000.	0.118E-01	-0.155E-03	0.618E-02	0.544E-02	0.535E-02	0.439E-02
C = 0.81E+13	100000.	0.943E-02	0.147E-04	0.725E-02	0.576E-02	0.562E-02	0.509E-02
	200000.	0.742E-02	-0.146E-04	0.769E-02	0.683E-02	0.735E-02	0.569E-02
CIV 5S-6P	20000.	0.484E-01	0.139E-02	0.469E-02	0.432E-02	0.415E-02	0.358E-02
3935.8 A	50000.	0.400E-01	0.106E-02	0.618E-02	0.544E-02	0.535E-02	0.439E-02
C = 0.92E+17	100000.	0.345E-01	0.637E-03	0.725E-02	0.576E-02	0.562E-02	0.509E-02
	200000.	0.292E-01	0.159E-03	0.822E-02	0.716E-02	0.683E-02	0.569E-02
CIV 5S-7P	20000.	0.348E-01	0.241E-02	0.469E-02	0.432E-02	0.415E-02	0.358E-02
2592.0 A	50000.	0.297E-01	0.206E-02	0.618E-02	0.544E-02	0.535E-02	0.439E-02
C = 0.24E+17	100000.	0.260E-01	0.139E-02	0.725E-02	0.576E-02	0.562E-02	0.509E-02
	200000.	0.221E-01	0.983E-03	0.769E-02	0.683E-02	0.735E-02	0.569E-02
CIV 5P-6S	20000.	0.633E-01	0.109E-01	0.288E-02	0.296E-02	0.272E-02	0.247E-02
5022.2 A	50000.	0.536E-01	0.816E-02	0.406E-02	0.375E-02	0.364E-02	0.315E-02
C = 0.26E+18	100000.	0.468E-01	0.653E-02	0.508E-02	0.452E-02	0.423E-02	0.370E-02
	200000.	0.401E-01	0.567E-02	0.597E-02	0.506E-02	0.543E-02	0.425E-02





TABLE 1. (continued)

PERTURBER DENSITY = 0.1D+17(CM-3)				PERTURBER DENSITY = 0.1D+17(CM-3)			
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
C IV 4P-6S	20000.	0.519E-01	0.140E-01	0.434E-02	0.470E-02	0.383E-02	0.397E-02
1653.9 A	50000.	0.433E-01	0.106E-01	0.614E-02	0.612E-02	0.532E-02	0.516E-02
C= 0.55E+18	100000.	0.376E-01	0.869E-02	0.738E-02	0.721E-02	0.656E-02	0.608E-02
	200000.	0.322E-01	0.721E-02	0.970E-02	0.828E-02	0.782E-02	0.704E-02
C IV 4P-7S	20000.	0.565E-01	0.204E-01	0.690E-02	0.703E-02	0.586E-02	0.586E-02
1344.3 A	50000.	0.488E-01	0.151E-01	0.957E-02	0.925E-02	0.775E-02	0.764E-02
C= 0.22E+18	100000.	0.436E-01	0.125E-01	0.115E-01	0.104E-01	0.104E-01	0.865E-02
	200000.	0.378E-01	0.971E-02	0.131E-01	0.119E-01	0.110E-01	0.946E-02
C IV 4P-8S	20000.	0.730E-01	0.301E-01	0.112E-01	0.110E-01	0.975E-02	0.894E-02
1200.0 A	50000.	0.650E-01	0.227E-01	0.148E-01	0.139E-01	0.125E-01	0.117E-01
C= 0.12E+18	100000.	0.589E-01	0.184E-01	0.168E-01	0.161E-01	0.150E-01	0.128E-01
	200000.	0.515E-01	0.139E-01	0.211E-01	0.187E-01	0.164E-01	0.139E-01
C IV 4P-9S	20000.	0.100	0.445E-01	0.181E-01	0.167E-01		
1118.4 A	50000.	0.911E-01	0.345E-01	0.234E-01	0.212E-01		
C= 0.72E+17	100000.	0.834E-01	0.268E-01	0.275E-01	0.244E-01	0.219E-01	0.200E-01
	200000.	0.733E-01	0.203E-01	0.296E-01	0.269E-01	0.289E-01	0.244E-01
C IV 4P-6D	20000.	0.109	0.229E-02				
1586.0 A	50000.	0.845E-01	0.318E-02				
C= 0.81E+16	100000.	0.689E-01	0.230E-02	0.780E-01	0.673E-01		
	200000.	0.555E-01	0.110E-02	0.903E-01	0.849E-01		
C IV 4D-6P	20000.	0.784E-01	0.527E-02	0.510E-02	0.419E-02	0.496E-02	0.350E-02
1654.5 A	50000.	0.647E-01	0.516E-02	0.665E-02	0.546E-02	0.621E-02	0.451E-02
C= 0.26E+17	100000.	0.555E-01	0.434E-02	0.790E-02	0.650E-02	0.702E-02	0.528E-02
	200000.	0.466E-01	0.332E-02	0.909E-02	0.756E-02	0.760E-02	0.603E-02
C IV 4D-7P	20000.	0.908E-01	0.793E-02	0.114E-01	0.101E-01	0.102E-01	0.834E-02
1358.5 A	50000.	0.775E-01	0.769E-02	0.148E-01	0.128E-01	0.126E-01	0.108E-01
C= 0.18E+17	100000.	0.676E-01	0.589E-02	0.179E-01	0.153E-01	0.144E-01	0.128E-01
	200000.	0.573E-01	0.469E-02	0.200E-01	0.166E-01	0.176E-01	0.143E-01
C IV 4D-5G	20000.	0.717E-01	-0.240E-02				
2524.6 A	50000.	0.554E-01	-0.283E-02	0.132	*-0.121		
C= 0.55E+16	100000.	0.452E-01	-0.190E-02	0.154	*-0.137	0.119	*-0.119
	200000.	0.367E-01	-0.670E-03	0.160	*-0.153	0.166	*-0.128
C IV 4F-6D	20000.	0.112	0.374E-02				
1641.0 A	50000.	0.874E-01	0.446E-02				
C= 0.87E+16	100000.	0.714E-01	0.337E-02	0.830E-01	0.731E-01		
	200000.	0.574E-01	0.183E-02	0.100	0.928E-01		
C IV 4F-7D	20000.	0.139	0.602E-02				
1353.6 A	50000.	0.110	0.548E-02				
C= 0.56E+16	100000.	0.906E-01	0.420E-02				
	200000.	0.732E-01	0.225E-02				

TABLE 1. (continued)

PERTURBER DENSITY = 0.1D+17(CM-3)			PERTURBER DENSITY = 0.1D+17(CM-3)			PERTURBER DENSITY = 0.1D+17(CM-3)														
PERTURBERS ARE ELECTRONS			PERTURBERS ARE ELECTRONS			PERTURBERS ARE ELECTRONS														
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	
CIV 50-7P	20000.	0.512	0.330E-01	0.310E-01	-0.239E-01	CIV 60-7F	20000.	6.61	-0.152			CIV 6F-7D	20000.	6.46	0.155					
2935.9 A	50000.	0.431	0.318E-01	0.394E-01	-0.308E-01	7708.6 A	50000.	5.26	-0.174			7746.1 A	50000.	5.14	0.203					
C= 0.44E+17	100000.	0.372	0.242E-01	0.470E-01	-0.358E-01	C= 0.11E+17	100000.	4.30	-0.138			C= 0.18E+17	100000.	4.22	0.161					
	200000.	0.313	0.202E-01	0.542E-01	-0.416E-01		200000.	3.43	-0.855E-01				200000.	3.39	0.947E-01					
CIV 50-6F	20000.	1.16	-0.269E-01																	
4647.0 A	50000.	0.916	-0.254E-01																	
C= 0.64E+16	100000.	0.746	-0.216E-01																	
	200000.	0.594	-0.147E-01																	
CIV 5F-6D	20000.	1.13	0.343E-01	0.206	0.193	CIV 7P-8S	20000.	14.6	2.72	0.651	0.481	C IV 7P-8S	20000.	14.6	2.72	0.651	0.481			
4665.0 A	50000.	0.890	0.370E-01	0.278	0.252	12985.7 A	50000.	13.2	1.92	0.833	0.628	12985.7 A	50000.	13.2	1.92	0.833	0.628			
C= 0.19E+17	100000.	0.728	0.268E-01	0.331	0.293	C= 0.61E+19	100000.	12.0	1.60	0.960	0.719	C= 0.61E+19	100000.	12.0	1.60	0.960	0.719			
	200000.	0.584	0.164E-01	0.390	0.328		200000.	10.4	1.21	1.12	0.837		200000.	10.4	1.21	1.12	0.837			
CIV 5F-7D	20000.	0.730	0.201E-01																	
2909.3 A	50000.	0.579	0.257E-01																	
C= 0.73E+16	100000.	0.477	0.193E-01																	
	200000.	0.385	0.110E-01																	
CIV 6S-7P	20000.	2.51	0.992E-02	*0.275	*0.261	CIV 4S-6P	20000.	0.567	0.260E-01	*0.629E-01	*0.485E-01	CIV 4S-6P	20000.	0.567	0.260E-01	*0.629E-01	*0.485E-01			
6593.7 A	50000.	2.18	0.288E-01	0.351	0.309	1440.3 A	50000.	0.467	0.302E-01	*0.847E-01	*0.724E-01	1440.3 A	50000.	0.467	0.302E-01	*0.847E-01	*0.724E-01			
C= 0.16E+19	100000.	1.93	0.690E-02	0.446	0.366	C= 0.12E+19	100000.	0.401	0.264E-01	*0.102	*0.866E-01	C= 0.12E+19	100000.	0.401	0.264E-01	*0.102	*0.866E-01			
	200000.	1.65	-0.576E-02	0.480	0.401		200000.	0.339	0.190E-01	*0.122	*0.102		200000.	0.339	0.190E-01	*0.122	*0.102			
C IV 6P-7S	20000.	3.40	0.635	0.160	0.139	C IV 4S-7P	20000.	0.698	0.342E-01			C IV 4S-7P	20000.	0.698	0.342E-01					
8385.0 A	50000.	2.99	0.453	0.213	0.183	1210.6 A	50000.	0.596	0.487E-01			1210.6 A	50000.	0.596	0.487E-01					
C= 0.42E+19	100000.	2.68	0.371	0.267	0.214	C= 0.53E+18	100000.	0.522	0.414E-01			C= 0.53E+18	100000.	0.522	0.414E-01					
	200000.	2.32	0.298	0.281	0.235		200000.	0.444	0.331E-01				200000.	0.444	0.331E-01					
C IV 6P-8S	20000.	1.53	0.427	*0.154	*0.144	C IV 4P-6S	20000.	0.519	0.133	*0.433E-01	*0.402E-01	C IV 4P-6S	20000.	0.519	0.133	*0.433E-01	*0.402E-01			
4791.4 A	50000.	1.38	0.316	*0.207	*0.188	1653.9 A	50000.	0.433	0.104	*0.615E-01	*0.585E-01	1653.9 A	50000.	0.433	0.104	*0.615E-01	*0.585E-01			
C= 0.14E+19	100000.	1.26	0.257	0.239	0.203	C= 0.55E+19	100000.	0.376	0.864E-01	*0.738E-01	*0.716E-01	C= 0.55E+19	100000.	0.376	0.864E-01	*0.738E-01	*0.716E-01			
	200000.	1.10	0.196	0.257	0.238		200000.	0.322	0.717E-01	0.970E-01	0.828E-01		200000.	0.322	0.717E-01	0.970E-01	0.828E-01			
C IV 6P-9S	20000.	1.30	0.455	*0.186	*0.173	C IV 4P-7S	20000.	0.565	0.190			C IV 4P-7S	20000.	0.565	0.190					
3709.7 A	50000.	1.20	0.352	*0.244	*0.217	1344.3 A	50000.	0.488	0.147			1344.3 A	50000.	0.488	0.147					
C= 0.80E+18	100000.	1.11	0.273	*0.280	*0.253	C= 0.22E+19	100000.	0.436	0.124	*0.115	*0.103	C= 0.22E+19	100000.	0.436	0.124	*0.115	*0.103			
	200000.	0.971	0.208	*0.314	*0.278		200000.	0.378	0.964E-01	*0.131	*0.119		200000.	0.378	0.964E-01	*0.131	*0.119			
CIV 6P-7D	20000.	5.07	-0.100E-01			C IV 4P-8S	20000.	0.730	0.274			C IV 4P-8S	20000.	0.730	0.274					
7389.4 A	50000.	4.07	0.424E-01			1200.0 A	50000.	0.650	0.216			1200.0 A	50000.	0.650	0.216					
C= 0.17E+18	100000.	3.40	0.254E-01			C= 0.12E+19	100000.	0.589	0.182			C= 0.12E+19	100000.	0.589	0.182					
	200000.	2.77	-0.658E-02				200000.	0.515	0.138				200000.	0.515	0.138					
CIV 6D-7P	20000.	5.02	0.210			C IV 4P-9S	20000.	0.998	0.388			C IV 4P-9S	20000.	0.998	0.388					
7949.8 A	50000.	4.16	0.179	*1.45	*1.31	1118.4 A	50000.	0.909	0.322			1118.4 A	50000.	0.909	0.322					
C= 0.20E+18	100000.	3.54	0.138	*1.66	*1.51	C= 0.72E+18	100000.	0.833	0.265			C= 0.72E+18	100000.	0.833	0.265					
	200000.	2.94	0.126	*1.68	*1.71		200000.	0.732	0.200				200000.	0.732	0.200					

TABLE 1. (continued)

PERTURBER DENSITY = $0.10 \times 10^{18} (\text{cm}^{-3})$				PERTURBER DENSITY = $0.10 \times 10^{18} (\text{cm}^{-3})$				PERTURBER DENSITY = $0.10 \times 10^{18} (\text{cm}^{-3})$							
PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM		PERTURBERS ARE		ELECTRONS		PROTONS		IONIZED HELIUM	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
CIV 5S-6P	20000.	4.84	0.538E-01	*0.437	*0.334	0.286	0.255	CIV 5G-6F	20000.	7.05	0.172E-02	13.0	3.99	13.0	3.99
3935.6 A	50000.	4.00	0.771E-01	*0.581	*0.496	0.407	0.361	4661.0 A	50000.	6.03	-0.106	12.0	3.29	12.0	3.29
C= 0.92E+19	100000.	3.45	0.585E-01	*0.705	*0.610	0.508	0.449	C= 0.64E+17	100000.	5.09	-0.132	11.0	2.70	11.0	2.70
200000.	200000.	2.92	0.159E-01	*0.822	*0.716	0.597	0.506	C= 0.885E-01	200000.	4.16	-0.885E-01	9.70	2.05	9.70	2.05
CIV 5S-7P	20000.	3.46	0.104					C IV 6P-9S	20000.	20000.					
2591.9 A	50000.	2.96	0.163					3709.7 A	50000.	12.0	3.29	12.0	3.29	12.0	3.29
C= 0.24E+19	100000.	2.59	0.132					C= 0.80E+19	100000.	11.0	2.70	11.0	2.70	11.0	2.70
200000.	200000.	2.21	0.983E-01						200000.	9.70	2.05	9.70	2.05	9.70	2.05
CIV 5P-6S	20000.	6.33	1.05	0.286	0.255	*0.268	*0.206	CIV 4S-6P	20000.	5.43	-0.575E-01	5.43	-0.575E-01	5.43	-0.575E-01
5022.2 A	50000.	5.36	0.805	0.407	0.361	*0.361	*0.300	1440.3 A	50000.	4.53	0.109	4.53	0.109	4.53	0.109
C= 0.26E+20	100000.	4.68	0.650	0.508	0.449	*0.423	*0.367	C= 0.12E+20	100000.	3.92	0.170	3.92	0.170	3.92	0.170
200000.	200000.	4.01	0.565	0.597	0.506	*0.543	*0.425	C= 0.12E+20	200000.	3.32	0.173	3.32	0.173	3.32	0.173
C IV 5P-7S	20000.	3.22	0.857					CIV 4S-7P	20000.	6.15	-0.209	6.15	-0.209	6.15	-0.209
2954.6 A	50000.	2.82	0.657	*0.403	*0.368			1210.6 A	50000.	5.48	0.109	5.48	0.109	5.48	0.109
C= 0.90E+19	100000.	2.52	0.550	*0.497	*0.460			C= 0.55E+19	100000.	4.89	0.209	4.89	0.209	4.89	0.209
200000.	200000.	2.18	0.432	*0.564	*0.499	*0.504	*0.431	C= 0.55E+19	200000.	4.21	0.290	4.21	0.290	4.21	0.290
C IV 5P-8S	20000.	3.05	0.998					C IV 4P-6S	20000.	5.18	1.12	5.18	1.12	5.18	1.12
2337.0 A	50000.	2.74	0.785					1653.9 A	50000.	4.32	0.913	4.32	0.913	4.32	0.913
C= 0.45E+19	100000.	2.49	0.661					C= 0.55E+20	100000.	3.76	0.807	3.76	0.807	3.76	0.807
200000.	200000.	2.18	0.502					C= 0.55E+20	200000.	3.21	0.711	3.21	0.711	3.21	0.711
C IV 5P-9S	20000.	3.55	1.26					C IV 4P-7S	20000.	5.59	1.43	5.59	1.43	5.59	1.43
2046.0 A	50000.	3.25	1.05					1344.3 A	50000.	4.85	1.19	4.85	1.19	4.85	1.19
C= 0.24E+19	100000.	2.98	0.865					C= 0.22E+20	100000.	4.33	1.12	4.33	1.12	4.33	1.12
200000.	200000.	2.62	0.653					C= 0.22E+20	200000.	3.76	0.948	3.76	0.948	3.76	0.948
CIV 5P-6D	20000.	8.34	-0.402					C IV 4P-8S	20000.	*6.95	*1.77	*6.95	*1.77	*6.95	*1.77
4442.4 A	50000.	6.75	-0.161					1200.0 A	50000.	6.30	1.60	6.30	1.60	6.30	1.60
C= 0.64E+18	100000.	5.65	-0.179E-01					C= 0.12E+20	100000.	5.75	1.56	5.75	1.56	5.75	1.56
200000.	200000.	4.63	0.122E-01					C= 0.12E+20	200000.	5.05	1.34	5.05	1.34	5.05	1.34
CIV 5D-6P	20000.	8.47	0.460					C IV 4P-9S	20000.	*8.73	*2.03	*8.73	*2.03	*8.73	*2.03
4786.8 A	50000.	6.98	0.413					1118.4 A	50000.	8.39	2.10	8.39	2.10	8.39	2.10
C= 0.12E+19	100000.	5.95	0.304					C= 0.72E+19	100000.	7.85	2.11	7.85	2.11	7.85	2.11
200000.	200000.	4.96	0.233					C= 0.72E+19	200000.	6.98	1.93	6.98	1.93	6.98	1.93
CIV 5D-7P	20000.	4.92	0.266					CIV 4D-6P	20000.	7.22	0.516E-01	7.22	0.516E-01	7.22	0.516E-01
2935.9 A	50000.	4.19	0.316	*0.396	*-0.294			1654.5 A	50000.	6.10	0.274	6.10	0.274	6.10	0.274
C= 0.44E+18	100000.	3.64	0.247	*0.469	*-0.355			C= 0.26E+19	100000.	5.29	0.338	5.29	0.338	5.29	0.338
200000.	200000.	3.06	0.202	*0.542	*-0.416	*0.449	*-0.335	C= 0.26E+19	200000.	4.48	0.320	4.48	0.320	4.48	0.320
CIV 5D-6F	20000.	8.90	0.129					CIV 4D-7P	20000.	7.78	0.224	7.78	0.224	7.78	0.224
4647.0 A	50000.	7.47	-0.122					1358.5 A	50000.	6.99	0.224	6.99	0.224	6.99	0.224
C= 0.64E+17	100000.	6.27	-0.218					C= 0.18E+19	100000.	6.23	0.337	6.23	0.337	6.23	0.337
200000.	200000.	5.10	-0.147					C= 0.18E+19	200000.	5.36	0.425	5.36	0.425	5.36	0.425

TABLE 2. This table shows electron-, proton-, and ionized-helium- impact broadening parameters for far UV C IV lines of large principal quantum number of the upper level, for a perturber density of  $10^{15} \text{ cm}^{-3}$  and temperatures from 20,000 to 200,000 K. The other notation is the same as in Table 1. Data for other densities may be provided by author upon request.

PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$			PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$			PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$			PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$			PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$			PERTURBER DENSITY = $0.10 \times 10^{16} (\text{cm}^{-3})$																																																																																					
PERTURBERS ARE	ELECTRONS	PROTONS	IONIZED HELIUM	PERTURBERS ARE	ELECTRONS	PROTONS	IONIZED HELIUM	PERTURBERS ARE	ELECTRONS	PROTONS	IONIZED HELIUM	PERTURBERS ARE	ELECTRONS	PROTONS	IONIZED HELIUM	PERTURBERS ARE	ELECTRONS	PROTONS	IONIZED HELIUM																																																																																	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	TRANSITION	T(K)	WIDTH(A)	SHIFT(A)																																																																													
C IV 2S-6P 212.4 A C = 0.27E+15	20000. 50000. 100000. 200000.	0.111E-03 0.923E-04 0.796E-04 0.672E-04	0.998E-05 0.933E-05 0.768E-05 0.581E-05	0.140E-04 0.186E-04 0.227E-04 0.270E-04	0.133E-04 0.170E-04 0.193E-04 0.224E-04	0.128E-04 0.166E-04 0.189E-04 0.218E-04	0.112E-04 0.140E-04 0.160E-04 0.184E-04	C IV 3P-6S 672.4 A C = 0.90E+16	20000. 50000. 100000. 200000.	0.730E-03 0.611E-03 0.530E-03 0.453E-03	0.247E-03 0.187E-03 0.154E-03 0.127E-03	0.849E-04 0.109E-03 0.137E-03 0.167E-03	0.665E-04 0.912E-04 0.117E-03 0.138E-03	C IV 3P-7S 206.6 A C = 0.15E+15	20000. 50000. 100000. 200000.	0.193E-03 0.166E-03 0.145E-03 0.124E-03	0.205E-04 0.187E-04 0.141E-04 0.112E-04	0.304E-04 0.403E-04 0.453E-04 0.494E-04	0.282E-04 0.354E-04 0.378E-04 0.445E-04	0.264E-04 0.344E-04 0.408E-04 0.479E-04	0.235E-04 0.287E-04 0.333E-04 0.366E-04	C IV 3P-8S 582.8 A C = 0.28E+16	20000. 50000. 100000. 200000.	0.164E-02 0.146E-02 0.132E-02 0.116E-02	0.746E-03 0.547E-03 0.442E-03 0.335E-03	0.267E-03 0.350E-03 0.401E-03 0.506E-03	0.228E-03 0.296E-03 0.350E-03 0.385E-03	C IV 3P-9S 562.9 A C = 0.18E+16	20000. 50000. 100000. 200000.	0.245E-02 0.224E-02 0.205E-02 0.180E-02	0.119E-02 0.888E-03 0.690E-03 0.520E-03	0.454E-03 0.592E-03 0.698E-03 0.745E-03	0.398E-03 0.513E-03 0.555E-03 0.730E-03	C IV 3P-6P 685.4 A C = 0.28E+16	20000. 50000. 100000. 200000.	0.117E-02 0.971E-03 0.837E-03 0.706E-03	0.102E-03 0.985E-04 0.810E-04 0.615E-04	0.145E-03 0.194E-03 0.235E-03 0.281E-03	0.139E-03 0.178E-03 0.201E-03 0.234E-03	0.117E-03 0.146E-03 0.166E-03 0.192E-03	C IV 3P-7P 628.7 A C = 0.14E+16	20000. 50000. 100000. 200000.	0.180E-02 0.154E-02 0.135E-02 0.115E-02	0.191E-03 0.174E-03 0.132E-03 0.104E-03	0.282E-03 0.373E-03 0.418E-03 0.456E-03	0.244E-03 0.318E-03 0.378E-03 0.443E-03	C IV 3P-6F 682.5 A C = 0.14E+14	20000. 50000. 100000. 200000.	0.221E-02 0.169E-02 0.135E-02 0.107E-02	0.655E-05 0.267E-05 -0.201E-04 -0.160E-04	0.448E-02 *0.616E-02 *0.620E-02 *0.564E-02	0.655E-05 0.267E-05 -0.201E-04 -0.160E-04	C IV 3P-7F 627.1 A C = 0.76E+13	20000. 50000. 100000. 200000.	0.375E-02 0.287E-02 0.230E-02 0.181E-02	0.897E-05 -0.486E-05 -0.454E-04 -0.310E-04	0.897E-05 -0.486E-05 -0.454E-04 -0.310E-04	C IV 3P-8S 239.1 A C = 0.71E+15	20000. 50000. 100000. 200000.	0.159E-03 0.138E-03 0.123E-03 0.107E-03	0.683E-04 0.503E-04 0.411E-04 0.320E-04	0.223E-04 0.313E-04 0.372E-04 0.428E-04	0.192E-04 0.258E-04 0.336E-04 0.347E-04	C IV 3P-8S 234.1 A C = 0.45E+15	20000. 50000. 100000. 200000.	0.259E-03 0.232E-03 0.210E-03 0.184E-03	0.121E-03 0.887E-04 0.717E-04 0.543E-04	0.431E-04 0.565E-04 0.649E-04 0.816E-04	0.365E-04 0.451E-04 0.483E-04 0.537E-04	C IV 2P-9S 230.9 A C = 0.31E+15	20000. 50000. 100000. 200000.	0.408E-03 0.373E-03 0.342E-03 0.300E-03	0.200E-03 0.150E-03 0.116E-03 0.878E-04	0.766E-04 0.996E-04 0.117E-03 0.126E-03	0.631E-04 0.724E-04 0.854E-04 0.104E-03	C IV 2P-6P 245.8 A C = 0.19E+14	20000. 50000. 100000. 200000.	0.256E-03 0.196E-03 0.159E-03 0.127E-03	0.163E-04 0.108E-04 0.695E-05 0.399E-05	0.130E-03 0.174E-03 0.188E-03 0.218E-03	0.124E-03 0.147E-03 0.162E-03 0.205E-03	*0.106E-03 *0.138E-03 0.164E-03 0.181E-03	C IV 2P-7P 238.2 A C = 0.17E+14	20000. 50000. 100000. 200000.	0.450E-03 0.350E-03 0.286E-03 0.230E-03	0.288E-04 0.194E-04 0.124E-04 0.671E-05	*0.189E-03 *0.228E-03 *0.249E-03 0.328E-03	*0.169E-03 *0.211E-03 *0.228E-03 *0.260E-03	C IV 3S-6P 595.5 A C = 0.21E+16	20000. 50000. 100000. 200000.	0.900E-03 0.744E-03 0.640E-03 0.540E-03	0.756E-04 0.707E-04 0.572E-04 0.428E-04	0.110E-03 0.146E-03 0.178E-03 0.213E-03	0.100E-03 0.130E-03 0.149E-03 0.176E-03	C IV 3S-7P 552.2 A C = 0.11E+16	20000. 50000. 100000. 200000.	0.140E-02 0.120E-02 0.105E-02 0.893E-03	0.143E-03 0.131E-03 0.981E-04 0.773E-04	0.217E-03 0.288E-03 0.325E-03 0.353E-03	0.189E-03 0.246E-03 0.291E-03 0.318E-03