Publ. Obs. Astron. Belgrade No. 49 (1995), 135-138

STARK BROADENING OF O V LINES

M. S. DIMITRIJEVIĆ
Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia
E-mail mdimitrijevic@aob.aob.bg.ac.yu

S. SAHAL-BRÉCHOT
Observatoire de Paris, 92190 Meudon, France
E-mail sahal@obspm.fr

Abstract. Using a semiclassical approach, we have calculated electron-, proton-, and He III-impact line widths and shifts for 19 O V multiplets.

1. INTRODUCTION

The astrophysical interest of oxygen is obvious due to its high cosmical abundance and presence of its different ionization stages in stellar atmospheres. By using the semiclassical-perturbation formalism (Sahal-Bréchot 1969ab), we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 19 O V multiplets, in order to continue our research of multiply charged ion line Stark broadening parameters. A summary of the formalism is given in Dimitrijević *et al.* (1991).

2. RESULTS AND DISCUSSION

Energy levels for O V lines have been taken from Moore (1980). Oscillator strengths have been calculated by using the method of Bates and Damgaard (1949) and the tables of Oertel and 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 He III- impacts have been calculated. Our results for 19 O V multiplets will be published elsewhere (Dimitrijević and Sahal - Bréchot, 1994, 1995), for perturber densities 10^{17} - 10^{22}cm^{-3} and temperatures T = 40,000 - 2,000,000K. Here will be given in Table 1 only an example of obtained results.

In addition to the present data for 19 O V multiplets, Stark broadening data for 50 O V multiplets for which the set of atomic data needed for semiclassical calculation presently does not exist, have been calculated within the modified semiempirical approach (Dimitrijević and Konjević 1980) and published recently (Dimitrijević 1993a). For 29 of these 50 O V multiplets not included here, exist as well in Dimitrijević (1993b) data calculated within the approximate semiclassical approach (Eq. 526 in Griem 1974).

TABLE I

This Table shows electron- and proton-impact broadening parameters for O V, for perturber density of $10^{17}cm^{-3}$ and temperatures from 40,000 to 2,000,000 K. Transitions and averaged wavelengths for the multiplet (in $\AA$) are also given. By using c (see Eq. (5) in Dimitrijević *et al.*, 1991), we obtain an estimate for the maximum perturber density for which the line may be treated as isolated and tabulated data may be used.

		Perturbers			
		Electrons		Protons	
Transition	T(K)	Width (Å)	Shift (Å)	Width (Å)	Shift (Å)
		Perturber density = 1 x 10^{+17} cm^{-3}			
O V 2S-2P	40000.	0.810E-03	0.189E-04	0.123E-05	-0.199E-05
629.7 Å	100000.	0.516E-03	-0.999E-05	0.477E-05	-0.506E-05
C= 0.63E+20	200000.	0.369E-03	-0.987E-05	0.113E-04	-0.947E-05
	500000.	0.245E-03	-0.129E-04	0.230E-04	-0.168E-04
O V 2P 3S	40000.	0.375E-03	0.152E-04	0.327E-05	0.138E-04
248.5 Å	100000.	0.250E-03	0.260E-04	0.153E-04	0.258E-04
C= 0.12E+19	200000.	0.191E-03	0.263E-04	0.275E-04	0.356E-04
	500000.	0.138E-03	0.250E-04	0.447E-04	0.455E-04
O V 2P 4S	40000.	0.631E-03	0.645E-04	0.349E-04	0.557E-04
174.6 Å	100000.	0.445E-03	0.723E-04	0.738E-04	0.832E-04
C= 0.19E+18	200000.	0.352E-03	0.699E-04	0.986E-04	0.100E-03
	500000.	0.264E-03	0.614E-04	0.135E-03	0.124E-03
O V 2P 3D	40000.	0.257E-03	-0.932E-05	0.224E-05	-0.147E-05
220.4 Å	100000.	0.166E-03	-0.775E-06	0.637E-05	-0.347E-05
C= 0.15E+19	200000.	0.122E-03	-0.170E-05	0.103E-04	-0.555E-05
	500000.	0.864E-04	-0.198E-07	0.152E-04	-0.834E-05
O V 2P 4D	40000.	0.657E-03	0.105E-04	0.224E-04	0.234E-04
170.2 Å	100000.	0.463E-03	0.120E-04	0.431E-04	0.379E-04
C= 0.10E+18	200000.	0.366E-03	0.127E-04	0.581E-04	0.464E-04
	500000.	0.276E-03	0.989E-05	0.814E-04	0.586E-04
O V 3D 4F	40000.	0.810E-02	-0.165E-03	0.271E-03	-0.446E-03
728.7 Å	100000.	0.555E-02	-0.152E-03	0.623E-03	-0.717E-03
C= 0.19E+19	200000.	0.433E-02	-0.974E-04	0.929E-03	-0.875E-03
	500000.	0.327E-02	-0.535E-04	0.134E-02	-0.110E-02

TABLE I (Cont.)

Transition	T(K)	Electrons Width (Å)	Electrons Shift (Å)	Protons Width (Å)	Protons Shift (Å)
O V 3D 5F	40000.	0.160E-01	-0.119E-02	0.363E-02	-0.358E-02
509.4 Å	100000.	0.119E-01	-0.114E-02	0.528E-02	-0.489E-02
C= 0.14E+18	200000.	0.959E-02	-0.889E-03	0.701E-02	-0.566E-02
	500000.	0.722E-02	-0.656E-03	0.939E-02	-0.670E-02
O V 2P 3S	40000.	0.222E-03	0.690E-05	0.935E-06	0.564E-05
215.2 Å	100000.	0.144E-03	0.130E-04	0.552E-05	0.116E-04
C= 0.17E+19	200000.	0.108E-03	0.163E-04	0.112E-04	0.162E-04
	500000.	0.779E-04	0.151E-04	0.205E-04	0.216E-04
O V 2P 4S	40000.	0.370E-03	0.346E-04	0.110E-04	0.231E-04
156.2 Å	100000.	0.253E-03	0.445E-04	0.275E-04	0.367E-04
C= 0.33E+18	200000.	0.199E-03	0.416E-04	0.417E-04	0.443E-04
	500000.	0.149E-03	0.387E-04	0.585E-04	0.557E-04
O V 3P 4S	40000.	0.107E-01	0.679E-03	0.237E-03	0.456E-03
716.3 Å	100000.	0.736E-02	0.849E-03	0.574E-03	0.728E-03
C= 0.69E+19	200000.	0.577E-02	0.803E-03	0.855E-03	0.885E-03
	500000.	0.433E-02	0.742E-03	0.119E-02	0.113E-02
O V 3S 3P	40000.	0.852E-01	-0.101E-02	0.812E-03	-0.259E-03
2784.8 Å	100000.	0.567E-01	-0.100E-02	0.198E-02	-0.609E-03
C= 0.14E+21	200000.	0.431E-01	-0.170E-02	0.291E-02	-0.963E-03
	500000.	0.315E-01	-0.148E-02	0.388E-02	-0.143E-02
O V 2P 3D	40000.	0.187E-03	-0.824E-05	0.158E-05	-0.230E-05
192.9 Å	100000.	0.121E-03	-0.214E-05	0.493E-05	-0.507E-05
C= 0.67E+18	200000.	0.897E-04	-0.191E-05	0.847E-05	-0.747E-05
	500000.	0.634E-04	-0.933E-06	0.137E-04	-0.106E-04
O V 2P 4D	40000.	0.497E-03	0.150E-05	0.126E-04	0.451E-05
151.5 Å	100000.	0.348E-03	0.498E-05	0.227E-04	0.865E-05
C= 0.12E+18	200000.	0.273E-03	0.521E-05	0.292E-04	0.119E-04
	500000.	0.206E-03	0.506E-05	0.378E-04	0.153E-04
O V 3P 3D	40000.	0.282	-0.697E-02	0.278E-02	-0.464E-02
5591.4 Å	100000.	0.189	-0.644E-02	0.829E-02	-0.930E-02
C= 0.56E+21	200000.	0.143	-0.566E-02	0.135E-01	-0.129E-01
	500000.	0.105	-0.499E-02	0.204E-01	-0.169E-01

References

Bates, D. R., and Damgaard, A. : 1949, *Trans. Roy. Soc. London, Ser. A*, **242**, 101.
Dimitrijević, M. S. : 1993a, *Astron. Astrophys. Suppl. Series*, **100**, 237.
Dimitrijević, M. S. : 1993b, *Astro.Lett. and Communications*, **28**, 385.
Dimitrijević, M. S. and Konjević, N. : 1980, *JQSRT*, **24**, 451.
Dimitrijević, M. S., Sahal-Bréchot, S., and Bommier, V. : 1991, *Ast.on. Astrophys. Suppl. Series*, **89**, 581.
Dimitrijević, M.S., and Sahal-Brchot,S. : 1994, *Bull. Astron. Belgrade* **150**, 95.
Dimitrijević, M. S. and Sahal-Brchot, S. : 1995, *Astron. Astrophys. Suppl. Series*, in press.
Griem, H. R. : 1974, *Spectral Line Broadening by Plasmas*, Academic Press, New York and London.
Moore, C. E. : 1980, *Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, O V*, NSRDS-NBS 3, Section 9, U.S.Dept. of Commerce, Washington.
Oertel, G. K., and Shomo, L. P. : 1968, *Astrophys. J. Suppl. Series*, **16**, 175.
Sahal-Bréchot, S. : 1969a, *Astron.Astrophys.* **1**, 91.
Sahal-Bréchot, S. : 1969b, *Astron.Astrophys.* **2**, 322.
Van Regemorter, H., Hoang Binh Dy, and Prud'homme, M. : 1979, *J. Phys. B*, **12**, 1073.