Serb. Astron. J. № 159 (1999), 65 – 72 **UDC 52–355.3**
Preliminary report

STARK BROADENING DATA TABLES FOR SOME ANALOGOUS SPECTRAL LINES ALONG Li AND Be ISOELECTRONIC SEQUENCES

M. S. Dimitrijević

Astronomical Observatory, Volgina 7, 11160 Belgrade-74, Yugoslavia

(Received: February 8, 1999)

SUMMARY: By using the semiclassical perturbation approach, Stark broadening parameters due to the interaction with a selection of perturbers of interest for recently published experimental results for Li - like B III, C IV, N V and O VI $3s^2S$-$3p^2P^o$, and for Be - like B II, C III, N IV and O V $3s^3S$-$3p^3P^o$ multiplets, have been calculated. The results are presented as a function of temperature for a perturber density of $10^{17}cm^{-3}$.

The influence of resonance contribution for B II, differences in Stark broadening parameters if we take oscillator strengths calculated within the Coulomb approximation or taken from TOP Database, and the influence of transitions with different parent terms, have been discussed as well.

1. INTRODUCTION

Recently (Blagojević *et al.*, 1999), a study of plasma broadening and shifting of analogous spectral lines along Li and Be isoelectronic sequences has been performed. The aim of this paper is to test for such real experimental conditions, the influence of ion perturber mass and charge, the influence of the oscillator strength values difference, the influence of transitions with different parent terms, and the influence of the contribution of Feshbach resonances. Obtained data may be of interest as well for experimental and theoretical studies of such plasmas of interest for laboratory research and astrophysics.

2. RESULTS AND DISCUSSION

By using the semiclassical-perturbation formalism (Sahal–Bréchot, 1969ab), Stark broadening parameters due to the influence of a selection of ion perturbers of interest for recently published experimental results (Blagojević *et al.*, 1999) for Li - like B III, C IV, N V and O VI $3s^2S$-$3p^2P^o$ and for Be - like B II, C III, N IV and O V $3s^3S$-$3p^3P^o$ multiplets have been investigated. Electron-, proton-, and ionized helium-impact full widths at half maximum (FWHM) and shifts have been published previously for Li - like B III (Dimitrijević and Sahal–Bréchot, 1996ab), C IV (Dimitrijević, Sahal–Bréchot and Bo-

Table 1. This table shows Stark broadening parameters (Full widths at half maximum and shifts) for $3s^2S$ - $3p^2P^o$ Li - like B III, C IV, N V and O VI multiplets for a perturber density of 10^{17} cm^{-3} and temperatures from 20,000 up to 300,000 K. Transitions and averaged wavelengths for the multiplet (in $\AA$) are also given. If one divides C value with the Stark width value, we obtain an estimate for the maximum perturber density (in cm^{-3}) 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 = 1. E+17cm^{-3}

TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
Perturbers are:		He III		Cl II	
B III 3 S 3P	20000.	0.112	0.740E-01	0.793E-01	0.304E-01
7839.5 Å	50000.	0.190	0.127	0.101	0.455E-01
C = 0.19E+21	100000.	0.231	0.158	0.115	0.550E-01
	150000.	0.257	0.175	0.122	0.607E-01
	200000.	0.274	0.188	0.127	0.654E-01
	300000.	0.301	0.208	0.133	0.706E-01
Perturbers are:		Cl III		Cl IV	
B III 3 S 3P	20000.	0.129	0.671E-01	0.173	0.103
7839.5 Å	50000.	0.194	0.110	0.288	0.178
C = 0.19E+21	100000.	0.229	0.135	0.347	0.224
	150000.	0.249	0.149	0.382	0.253
	200000.	0.264	0.161	0.410	0.273
	300000.	0.280	0.176	0.437	0.298
Perturbers are:		Cl V		B II	
B III 3 S 3P	20000.	*0.207	*0.136	0.753E-01	0.320E-01
7839.5 Å	50000.	*0.372	*0.250	0.999E-01	0.486E-01
C = 0.19E+21	100000.	0.467	0.325	0.115	0.586E-01
	150000.	0.519	0.368	0.124	0.646E-01
	200000.	0.554	0.395	0.129	0.694E-01
	300000.	0.612	0.438	0.135	0.753E-01
Perturbers are:		B III		B IV	
B III 3 S 3P	20000.	0.123	0.701E-01	0.161	0.106
7839.5 Å	50000.	0.193	0.117	0.281	0.188
C = 0.19E+21	100000.	0.229	0.143	0.348	0.240
	150000.	0.251	0.159	0.385	0.269
	200000.	0.267	0.171	0.414	0.290
	300000.	0.286	0.187	0.456	0.320
Perturbers are:		B V			
B III 3 S 3P	20000.	0.187	0.140		
7839.5 Å	50000.	0.358	0.262		
C = 0.19E+21	100000.	0.470	0.344		
	150000.	0.525	0.391		
	200000.	0.564	0.421		
	300000.	0.624	0.467		
Perturbers are:		He III		C II	
CIV 3S 3P	20000.	0.133E-01	0.731E-02	0.132E-01	0.375E-02
5801.0 Å	50000.	0.331E-01	0.172E-01	0.231E-01	0.751E-02
C = 0.16E+21	100000.	0.491E-01	0.257E-01	0.285E-01	0.104E-01
	150000.	0.578E-01	0.315E-01	0.309E-01	0.117E-01
	200000.	0.615E-01	0.345E-01	0.327E-01	0.127E-01
	300000.	0.680E-01	0.384E-01	0.353E-01	0.141E-01
Perturbers are:		C III		C IV	
CIV 3S 3P	20000.	0.171E-01	0.724E-02	0.188E-01	0.103E-01
5801.0 Å	50000.	0.372E-01	0.165E-01	0.483E-01	0.255E-01
C = 0.16E+21	100000.	0.530E-01	0.242E-01	0.726E-01	0.388E-01
	150000.	0.586E-01	0.289E-01	0.862E-01	0.480E-01
	200000.	0.629E-01	0.309E-01	0.919E-01	0.527E-01
	300000.	0.682E-01	0.347E-01	0.102	0.587E-01

TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
Perturbers are:		C V		C VI	
CIV 3S 3P	20000.	0.196E-01	0.129E-01	0.199E-01	0.151E-01
5801.0 Å	50000.	0.558E-01	0.344E-01	0.620E-01	0.435E-01
C = 0.16E+21	100000.	0.888E-01	0.550E-01	0.105	0.712E-01
	150000.	0.111	0.673E-01	0.133	0.884E-01
	200000.	0.122	0.764E-01	0.152	0.101
	300000.	0.136	0.848E-01	0.170	0.113
Perturbers are:		He III		N III	
N V 3S 3P	50000.	0.711E-02	0.261E-02	0.924E-02	0.258E-02
4610.9 Å	100000.	0.132E-01	0.483E-02	0.153E-01	0.459E-02
C = 0.14E+21	150000.	0.165E-01	0.644E-02	0.189E-01	0.597E-02
	200000.	0.193E-01	0.739E-02	0.212E-01	0.677E-02
	300000.	0.224E-01	0.898E-02	0.231E-01	0.822E-02
Perturbers are:		N IV		N V	
N V 3S 3P	50000.	0.107E-01	0.382E-02	0.115E-01	0.501E-02
4610.9 Å	100000.	0.198E-01	0.721E-02	0.230E-01	0.978E-02
C = 0.14E+21	150000.	0.247E-01	0.960E-02	0.303E-01	0.133E-01
	200000.	0.290E-01	0.111E-01	0.352E-01	0.158E-01
	300000.	0.335E-01	0.135E-01	0.430E-01	0.192E-01
Perturbers are:		N VI		N VII	
N V 3S 3P	50000.	0.120E-01	0.612E-02	0.123E-01	0.722E-02
4610.9 Å	100000.	0.255E-01	0.124E-01	0.277E-01	0.149E-01
C = 0.14E+21	150000.	0.353E-01	0.170E-01	0.394E-01	0.208E-01
	200000.	0.411E-01	0.205E-01	0.470E-01	0.254E-01
	300000.	0.512E-01	0.250E-01	0.590E-01	0.309E-01
Perturbers are:		He III		O IV	
O VI 3S 3P	50000.	0.178E-02	0.377E-03	0.279E-02	0.549E-03
3820.0 Å	100000.	0.400E-02	0.777E-03	0.619E-02	0.115E-02
C = 0.12E+21	150000.	0.567E-02	0.114E-02	0.873E-02	0.169E-02
	200000.	0.688E-02	0.144E-02	0.105E-01	0.215E-02
	300000.	0.846E-02	0.193E-02	0.129E-01	0.287E-02
Perturbers are:		O V		O VI	
O VI 3S 3P	50000.	0.287E-02	0.710E-03	0.291E-02	0.866E-03
3820.0 Å	100000.	0.681E-02	0.152E-02	0.723E-02	0.190E-02
C = 0.12E+21	150000.	0.999E-02	0.228E-02	0.110E-01	0.286E-02
	200000.	0.125E-01	0.293E-02	0.140E-01	0.370E-02
	300000.	0.156E-01	0.395E-02	0.182E-01	0.506E-02
Perturbers are:		O VII		O VIII	
O VI 3S 3P	50000.	0.293E-02	0.101E-02	0.294E-02	0.115E-02
3820.0 Å	100000.	0.752E-02	0.224E-02	0.773E-02	0.259E-02
C = 0.12E+21	150000.	0.118E-01	0.341E-02	0.124E-01	0.397E-02
	200000.	0.153E-01	0.448E-02	0.164E-01	0.526E-02
	300000.	0.206E-01	0.621E-02	0.227E-01	0.734E-02

Table 2. Same as in Table 1 but for Stark broadening parameters for $3s^3S$ - $3p^3P^o$ Be - like B II, C III, N IV and O V multiplets.

PERTURBER DENSITY = 1. E+17 cm^{-3}

TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
Perturbers are:		Electrons	Without	He II	
B II 3S 3P	20000.	1.05	Resonance	0.121	0.195E-01
7033.0 Å	50000.	1.08	Contrib.	0.140	0.264E-01
C = 0.33E+21	100000.	1.07		0.147	0.316E-01
	150000.	1.03		0.150	0.349E-01
	200000.	1.00		0.152	0.367E-01
	300000.	0.949		0.154	0.391E-01
Perturbers are:		Cl II		Cl III	
B II 3S-3P	20000.	0.128	0.173E-01	*0.236	*0.389E-01
7033.0 Å	50000.	0.143	0.226E-01	0.276	0.555E-01
C = 0.33E+21	100000.	0.149	0.268E-01	0.293	0.665E-01
	150000.	0.151	0.290E-01	0.299	0.730E-01
	200000.	0.152	0.313E-01	0.303	0.764E-01
	300000.	0.155	0.341E-01	0.308	0.852E-01
Perturbers are:		Cl IV		B II	
B II 3S 3P	20000.	*0.335	*0.605E-01	0.125	0.183E-01
7033.0 Å	50000.	*0.399	*0.916E-01	0.142	0.242E-01
C = 0.33E+21	100000.	*0.434	*0.113	0.148	0.289E-01
	150000.	0.446	0.125	0.151	0.314E-01
	200000.	0.455	0.131	0.152	0.332E-01
	300000.	0.458	0.144	0.152	0.361E-01
Perturbers are:		B III		B IV	
B II 3S 3P	20000.	0.230	0.408E-01	*0.328	*0.633E-01
7033.0 Å	50000.	0.271	0.592E-01	*0.391	*0.974E-01
C = 0.33E+21	100000.	0.291	0.709E-01	*0.433	*0.120
	150000.	0.298	0.787E-01	0.446	0.132
	200000.	0.301	0.828E-01	0.451	0.142
	300000.	0.310	0.890E-01	0.461	0.153
Perturbers are:		B V			
B II 3S 3P	20000	*0.416	*0.879E-01		
7033.0 Å	50000.	*0.508	*0.141		
C = 0.33E+21	100000.	*0.568	*0.174		
	150000.	0.591	0.192		
	200000.	0.604	0.207		
	300000.	0.615	0.226		
Perturbers are:		PROTONS		He II	
C III 3S 3P	20000.	0.129E-01	-0.229E-03	0.164E-01	-0.229E-03
4650.1 Å	50000.	0.213E-01	-0.571E-03	0.238E-01	-0.552E-03
C = 0.22E+21	100000.	0.252E-01	-0.975E-03	0.270E-01	-0.894E-03
	150000.	0.272E-01	-0.123E-02	0.287E-01	-0.108E-02
	200000.	0.285E-01	-0.141E-02	0.299E-01	-0.124E-02
	300000.	0.305E-01	-0.169E-02	0.309E-01	-0.142E-02
Perturbers are:		C II		C III	
C III 3S 3P	20000.	0.184E-01	-0.228E-03	0.288E-01	-0.436E-03
4650.1 Å	50000.	0.248E-01	-0.535E-03	0.451E-01	-0.112E-02
C = 0.22E+21	100000.	0.280E-01	-0.832E-03	0.519E-01	-0.190E-02
	150000.	0.297E-01	-0.101E-02	0.554E-01	-0.231E-02
	200000.	0.305E-01	-0.114E-02	0.579E-01	-0.268E-02
	300000.	0.313E-01	-0.127E-02	0.607E-01	-0.316E-02

TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
Perturbers are:		C IV		C V	
C III 3S 3P	20000.	0.350E-01	-0.627E-03	0.394E-01	-0.801E-03
4650.1 Å	50000.	0.608E-01	-0.168E-02	0.733E-01	-0.224E-02
C = 0.22E+21	100000.	0.738E-01	-0.296E-02	0.953E-01	-0.408E-02
	150000.	0.795E-01	-0.382E-02	0.103	-0.538E-02
	200000.	0.834E-01	-0.434E-02	0.108	-0.613E-02
	300000.	0.885E-01	-0.525E-02	0.115	-0.749E-02
Perturbers are:		C VI			
C III 3S-3P	20000.	0.425E-01	-0.959E-03		
4650.1 Å	50000.	0.850E-01	-0.278E-02		
C = 0.22E+21	100000.	0.116	-0.523E-02		
	150000.	0.125	-0.701E-02		
	200000.	0.131	-0.807E-02		
	300000.	0.140	-0.982E-02		
Perturbers are:		He II		N II	
N IV 3S 3P	20000.	0.283E-02	-0.307E-03	0.363E-02	-0.306E-03
3481.8 Å	50000.	0.564E-02	-0.751E-03	0.646E-02	-0.719E-03
C = 0.17E+21	100000.	0.770E-02	-0.121E-02	0.811E-02	-0.110E-02
	150000.	0.832E-02	-0.146E-02	0.875E-02	-0.134E-02
	200000.	0.880E-02	-0.168E-02	0.918E-02	-0.152E-02
	300000.	0.943E-02	-0.189E-02	0.977E-02	-0.168E-02
Perturbers are:		N III		N IV	
N IV 3S 3P	20000.	0.457E-02	-0.576E-03	0.494E-02	-0.812E-03
3481.8 Å	50000.	0.102E-01	-0.150E-02	0.127E-01	-0.227E-02
C = 0.17E+21	100000.	0.144E-01	-0.254E-02	0.191E-01	-0.400E-02
	150000.	0.161E-01	-0.308E-02	0.228E-01	-0.507E-02
	200000.	0.170E-01	-0.356E-02	0.244E-01	-0.583E-02
	300000.	0.183E-01	-0.415E-02	0.264E-01	-0.697E-02
Perturbers are:		N V		N VI	
N IV 3S 3P	20000.	0.508E-02	-0.101E-02	0.511E-02	-0.119E-02
3481.8 Å	50000.	0.145E-01	-0.300E-02	0.159E-01	-0.371E-02
C = 0.17E+21	100000.	0.231E-01	-0.549E-02	0.269E-01	-0.696E-02
	150000.	0.284E-01	-0.716E-02	0.332E-01	-0.931E-02
	200000.	0.314E-01	-0.817E-02	0.377E-01	-0.107E-01
	300000.	0.340E-01	-0.997E-02	0.415E-01	-0.131E-01
Perturbers are:		N VII			
N IV 3S 3P	20000.	0.508E-02	-0.132E-02		
3481.8 Å	50000.	0.169E-01	-0.439E-02		
C = 0.17E+21	100000.	0.303E-01	-0.849E-02		
	150000.	0.374E-01	-0.115E-01		
	200000.	0.433E-01	-0.133E-01		
	300000.	0.490E-01	-0.163E-01		
Perturbers are:		He II		O III	
O V 3S 3P	50000.	0.156E-02	-0.321E-03	0.271E-02	-0.630E-03
2784.8 Å	100000.	0.247E-02	-0.567E-03	0.458E-02	-0.116E-02
C = 0.14E+21	150000.	0.303E-02	-0.737E-03	0.565E-02	-0.154E-02
	200000.	0.335E-02	-0.836E-03	0.641E-02	-0.176E-02
	300000.	0.362E-02	-0.102E-02	0.705E-02	-0.214E-02
Perturbers are:		O IV		O V	
O V 3S 3P	50000.	0.308E-02	-0.928E-03	0.330E-02	-0.122E-02
2784.8 Å	100000.	0.585E-02	-0.181E-02	0.672E-02	-0.243E-02
C = 0.14E+21	150000.	0.741E-02	-0.243E-02	0.903E-02	-0.333E-02
	200000.	0.864E-02	-0.290E-02	0.105E-01	-0.408E-02
	300000.	0.102E-01	-0.352E-02	0.128E-01	-0.493E-02
Perturbers are:		O VI		O VII	
O V 3S 3P	50000.	0.343E-02	-0.148E-02	0.351E-02	-0.175E-02
2784.8 Å	100000.	0.743E-02	-0.305E-02	0.801E-02	-0.368E-02
C = 0.14E+21	150000.	0.104E-01	-0.428E-02	0.115E-01	-0.523E-02
	200000.	0.122E-01	-0.526E-02	0.139E-01	-0.644E-02
	300000.	0.152E-01	-0.645E-02	0.173E-01	-0.808E-02

Table 3. Electron - impact broadening parameters calculated by using the oscillator strengths evaluated with help of the Coulomb approximation, with the oscillator strengths taken from TOP Data Base without and with the inclusion of the transitions with different parent terms. Plasma conditions and notation are the same as in Table 1.

PERTURBER DENSITY = 1. E+17 cm^{-3}

TRANSITION	T(K)	WIDTH(Å) Coulomb	SHIFT(Å)	WIDTH(Å) TOP Data	SHIFT(Å)	WIDTH(Å) TOP Data with forbidden trans.	SHIFT(Å)
B II 3S 3P	20000.	1.32	-.113	1.28	-0.927E-01	1.29	-0.134
7033.0 Å	50000.	1.17	-.934E-01	1.13	-0.758E-01	1.14	-0.110
C=.33E+21	100000.	1.10	-.714E-01	1.06	-0.568E-01	1.07	-0.849E-01
	150000.	1.05	-.569E-01	1.01	-0.467E-01	1.02	-0.698E-01
	200000.	1.02	-.570E-01	0.978	-0.484E-01	0.987	-0.684E-01
	300000.	.957	-.548E-01	0.920	-0.487E-01	0.930	-0.639E-01
CIII 3S 3P	20000.	0.524	-0.117E-01	0.606	-0.376E-02	0.611	-0.416E-02
4650.1 Å	50000.	0.369	-0.747E-02	0.406	-0.497E-02	0.409	-0.555E-02
C=0.22E+21	100000.	0.298	-0.129E-01	0.315	-0.930E-02	0.317	-0.979E-02
	150000.	0.266	-0.108E-01	0.276	-0.935E-02	0.279	-0.988E-02
	200000.	0.247	-0.108E-01	0.254	-0.840E-02	0.257	-0.899E-02
	300000.	0.222	-0.103E-01	0.228	-0.829E-02	0.231	-0.887E-02
N IV 3S 3P	20000.	0.236	-0.172E-02	0.220	-0.159E-02	0.228	-0.125E-02
3481.8 Å	50000.	0.155	-0.306E-02	0.143	-0.309E-02	0.149	-0.272E-02
C=0.17E+21	100000.	0.117	-0.310E-02	0.108	-0.320E-02	0.112	-0.284E-02
	150000.	0.101	-0.421E-02	0.934E-01	-0.420E-02	0.968E-01	-0.386E-02
	200000.	0.916E-01	-0.375E-02	0.848E-01	-0.380E-02	0.880E-01	-0.341E-02
	300000.	0.807E-01	-0.360E-02	0.746E-01	-0.366E-02	0.776E-01	-0.325E-02

mmier, 1991ab), N V (Dimitrijević and Sahal−Bréchot, 1992a), and O VI (Dimitrijević and Sahal−Bréchot, 1992b), and will not be repeated here. The data for electron- and He III-impact broadening exist for Be II, C III and N IV (Blagojević *et al.*, 1999), as well as for electron-, proton-, and He III-impact broadening for Be-like O V (Dimitrijević and Sahal−Bréchot, 1995ab). Proton-, He II-, and He III-impact parameters have been calculated for all emitters if not available. The corresponding data for B II when perturbers are Cl II - Cl IV and B II - B V, for B III when perturbers are Cl II - Cl IV and B II - B V, for C III and C IV when perturbers are C II - C VI, for N IV when perturbers are N II - N VI, for N V when perturbers are N II - N VII, for O V when perturbers are O III - O VII, and for O VI when perturbers are O IV - O VIII are calculated as well. The formalism used here, has been updated several times (Dimitrijević, Sahal−Bréchot, Bommier, 1991a; Sahal−Bréchot, 1974; Fleurier *et al.*, 1977; (Dimitrijević and Sahal−Bréchot, 1984, 1995c). A summary of the formalism is given in Dimitrijević, Sahal−Bréchot, Bommier (1991a).

Energy levels needed for calculations have been taken from Moore (1980). for O V and from Bashkin and Stoner (1975) for other emitters. Oscillator strengths have been calculated by using the method of Bates and Damgaard (1949) and the corresponding tables of Oertel and Shomo (1968). For higher levels, the method described in Van Regemorter *et al.* (1979) has been used. Our results for Li-like isoelectronic sequence are shown in Table 1 for a perturber density of 10^{17}cm^{-3} and temperatures T = 20,000 - 300,000 K for B III, and C IV, and T = 50,000 - 300,000 K for N V and O VI. We also specify a parameter C (Dimitrijević *et al.*, 1991a) which, when it is divided by the corresponding electron-impact full width at half maximum, gives an estimate for the maximum perturber density for which the line may be treated as isolated. Stark broadening data for Be-like isoelectronic sequence are shown in Table 2 for the same perturber density as in Table 1 and temperatures T = 20,000 - 300,000 K for B II, C III and N IV, and T = 50,000 - 300,000 K for O V. 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 consequently, the impact approximation is valid (Sahal−Bréchot, 1969ab). Values for $0.1 \leq$ NV ≤ 0.5 are denoted by an asterisk. At high densities, the results are no longer linear with density due to Debye screening. This effect is more important for the shift than for the width. One can see from Table 1 that perturber charge is more critical than perturber mass, which is particularly important for higher temperatures, when several ionization stages may be present in the same time.

Since there are two ways to include the resonance contribution (Fleurier *et al.*, 1977), it might be of interest to discuss them here, on the B II example. These two ways are the following. First of all, the increase of the collision strength at the excitation energy threshold due to resonances, may be calculated by using the semiclassical limit of Gailitis (1963) formula (see also Petrini, 1970). Then in the first method, this increase of the collision strength at the threshold is kept constant below the threshold. Such extrapolation is good when the emitter has numerous doubly excited states below the considered threshold, with the energy greater than the ionization energy of the lower ionization stage, like for multiply charged ions or highly excited states. Ii is assumed in the second method, that the corresponding increase at the threshold, of the cross section and not of the collision strength is constant below the threshold. Such extrapolation is more accurate where there are few resonances and gives a smaller value of the electron-impact width. The analysis in Fleurier *et al.*, (1977) shows that for low lying transitions of Mg II, Ca II, Sr II and Ba II, the agreement with experimental values is better if we take the second method, i.e. to keep constant below threshold, the corresponding increase of the cross section. Moreover, this analysis shows that the difference between values obtained without the resonance correction, and values obtained with the resonance correction according to the second method is only a few percents. The first method to include the resonance contribution is better for multiply charged ions. For B II however, it is not quite clear, and according to the analysis in Fleurier *et al.* (1977), the second method may be in better accordance with the experiment. Consequently, in Table 2 are presented as well electron-impact widths for B II, without the resonance correction. They may be compared with electron - impact widths, calculated with the inclusion of resonance contribution calculated by Blagojević *et al.* (1999) and shown in Table 2. One can see that the difference is not negligible for $T \leq$50.000 K, and increases toward the lower temperatures.

In order to test the influence of the differences in oscillator strength values, the oscillator strengths from the TOP base (the complete package of the opacity project (OP) data with the database management system is usually referred to as TOP base (Butler *et al.*, 1993; Cunto *et al.*, 1993)) have been taken for the Be-like isoelectronic sequence, where the expected differences are larger than for Li-like isoelectronic sequence. These oscillator strengths have been calculated in Tully *et al.* (1990). Such calculations have been performed for B II, C III and N IV, and corresponding results are shown in Table 3. In order to study the influence of the transitions with different parent terms, calculations with and without the inclusion of such transitions are performed. Such transitions are $2s3s^3S$ - $2p3s^3P^o$ for B II, $2s3s^3S$ - $2p3s^3P^o$, $2s3s^3S$ - $2p3d^3P^o$, $2s3p^3P^o$ - $2p3p^3D^o$, $2s3p^3P^o$ - $2p3p^3S^o$, $2s3p^3P^o$ - $2p3p^3P^o$ for C III, and $2s3s^3S$ - $2p3s^3P^o$, $2s3s^3S$ - $2p3d^3P^o$, $2s3s^3S$ - $2p3d^3P^o$, $2s3p^3P^o$ - $2p3p^3D^o$, $2s3p^3P^o$ - $2p3p^3S^o$, $2s3p^3P^o$ - $2p3p^3P^o$ for N IV. One can see in Table 3 that the influence of the transitions with different parent terms is not significant for widths but it is larger for shifts. One can see as well that the differences between widths calculated with oscillator strengths with TOP base values and with calculated within the Coulomb approximation are not of importance, while for shifts the differences are larger.

Presented data will equally be of interest, for a precise study of the influence of the composition of experimentally investigated plasma, on the Stark broadening parameters.

Acknowledgements – This work is a part of the project "Astrometrical, Astrodynamical and Astrophysical Investigations", supported by Ministry of Science and Technology of Serbia.

REFERENCES

Barnard, A.J., Cooper, J., Smith, E.W.: 1974, *J. Quant. Spectrosc. Radiative Transfer*, **14**, 1025.
Bashkin, S. and Stoner, Jr. J.J.: 1975, Atomic Energy Levels and Grotrian Diagrams, Vol. 1, North Holland, Amsterdam.
Bates, D.R. and Damgaard, A.: 1949, *Trans. Roy. Soc. London A* **242**, 101.
Blagojević, B., Popović, M.V., Konjević, N., Dimitrijević, M.S.: 1999, *J. Quant. Spectrosc. Radiative Transfer*, **61**, 361.
Butler, K., Mendoza, C., Zeippen, Z.J.: 1993, *J. Phys. B* **26**, 4409.
Cunto, W., Mendoza, C., Ochsenbein, F., Zeippen, C.J.: 1993, *Astron. Astrophys.* **275**, L5.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1984, *J. Quant Spectrosc. Radiative Transfer*, **31**, 301.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1992a, *Astron. Astrophys. Suppl. Series*, **95**, 109.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1992b, *Astron. Astrophys. Suppl. Series*, **93**, 359.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1995a, *Astron. Astrophys. Suppl. Series*, **109**, 551.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1995b, *Bull. Astron. Belgrade*, **150**, 95.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1995c, *Physica Scripta*, **52**, 41.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1996a, *Astron. Astrophys. Suppl. Series*, **119**, 369.
Dimitrijević, M.S. and Sahal−Bréchot, S.: 1996b, *Bull. Astron. Belgrade*, **153**, 101.
Dimitrijević, M.S., Bommier, V. and Sahal−Bréchot, S.: 1991a, *Astron. Astrophys. Suppl. Series*, **89**, 581.
Dimitrijević, M.S., Bommier, V. and Sahal−Bréchot, S.: 1991b, *Bull. Obs. Astron. Belgrade*, **144**, 65.
Fleurier, C., Sahal−Bréchot, S., Chapelle, J.: 1977, *J. Quant. Spectrosc. Radiative Transfer*, **17**, 595.
Gailitis, M.: 1963, *Sov. Phys. JETP*, **17**, 1328.
Griem, H.R.: 1974, Spectral Line Broadening by Plasmas, Academic Press, New York.
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.
Petrini, D.: 1970, *Astron. Astrophys.* **9**, 392.
Sahal−Bréchot, S.: 1969a, *Astron. Astrophys.* **1**, 91.
Sahal−Bréchot, S.: 1969b, *Astron. Astrophys.* **2**, 322.
Sahal−Bréchot, S.: 1974, *Astron. Astrophys.* **35**, 321.
Tully, J.A., Seaton, M.J., Berrington, K.A.: 1990, *J. Phys. B* **23**, 3811.
Van Regemorter, H., Hoang Binh Dy and Prud'homme, M.: 1979, *J. Phys. B* **12**, 1073.

ТАБЕЛЕ ПАРАМЕТАРА ШТАРКОВОГ ШИРЕЊА ЗА НЕКЕ АНАЛОГНЕ СПЕКТРАЛНЕ ЛИНИЈЕ ДУЖ Li И Be ИЗОЕЛЕКТРОНСКОГ НИЗА

М. С. Димитријевић

Астрономска опсерваторија, Волгина 7, 11160 Београд-74, Југославија

УДК 52−355.3
Претходно саопштење

Користећи семикласичан прилаз, израчунате су параметри Штарковог ширења услед деловања изабраних пертурбера, од значаја за недавно објављене експерименталне резултате, за Li - сличне B III, C IV, N V и O VI $3s^2S$-$3p^2P^o$, и за Be - сличне B II, C III, N IV и O V $3s^3S$-$3p^3P^o$ мултиплете. Резултати су дати у функцији температуре за концентрацију пертурбера од $10^{17}cm^{-3}$.

Такође су разматрани утицај доприноса резонанци у случају B II и разлике у параметрима Штарковог ширења, ако узмезо јачине осцилатора израчунате у оквиру Кулонове апроксимације или узете из TOP базе података. Осим тога, размотрен је и утицај пертурбујућих прелаза са различитим родитељским термовима.