

STARK BROADENING PARAMETER TABLES FOR Al XI AND Si XII LINES OF ASTROPHYSICAL INTEREST

M. S. Dimitrijević¹ and S. Sahal–Bréchet²

¹ *Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia*

² *Laboratoire "Astrophysique, Atomes et Molécules"
Département Atomes et Molécules en Astrophysique
Unité associée au C.N.R.S. No 812
Observatoire de Paris–Meudon, 92190 Meudon, France*

(Received: October 20, 1993)

SUMMARY: Using a semiclassical approach, we have calculated electron–, proton–, and He III–impact line widths and shifts for 7 Al XI and 9 Si XII multiplets as a function of temperature and perturber density.

1. INTRODUCTION

Stark broadening parameters for spectral lines for ions within the lithium isoelectronic sequence have particular importance for the investigation of regularities and systematic trends, due to its simplicity (one optical electron) for theoretical research. Results of such investigations are of interest for acquisition of new data by interpolation and for critical evaluation of existing experimental and theoretical data, particularly in astrophysics. The astrophysical importance of multiply charged ion lines is increasing due to the development of UV astronomy from space and owing to the development of researches on the physics of stellar interiors (Seaton, 1987).

In order to investigate the behavior of Stark

broadening parameters along an isoelectronic sequence as far as possible without the significant influence of relativistic effects, we have calculated electron–, proton–, and He III– impact line widths and shifts for 7 Al XI and 9 Si XII multiplets, by using the semiclassical-perturbation formalism (Sahal–Bréchet 1969ab). A summary of the formalism is given in Dimitrijević and Sahal–Bréchet (1991). Discussion and analysis of the obtained results, and all details of the calculations will be published in the principal article elsewhere (Dimitrijević, and Sahal–Bréchet, 1994). Since data are not linear with perturber density (N), due to the Debye screening effect, which is often important at high densities of interest for subphotospheric layers, we will present here the data for $N = 10^{18} - 10^{23} \text{ cm}^{-3}$ and temperatures from 500,000 K up to 4,000,000 K.

Table 1. This table shows electron-, proton-, and He III- impact broadening parameters for Al XI and Si XII for perturber densities of $10^{18} - 10^{23} \text{ cm}^{-3}$ and temperatures from 500,000 to 4,000,000 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. Table 1 is also available in electronic form: see the editorial in *Astron. Astrophys.* 1992, Vol. 266, No 2, page E1 or in *Astron. Astrophys. Suppl. Series* 1992, Vol. 96, No 3, and Dimitrijević and Sahal—Bréchet, 1994.

PERTURBER DENSITY = 0.1E+20 cm-3							
PERTURBERS ARE:		ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
Al XI 2S-3P	500000.	0.298E-03	0.306E-05	0.136E-04	0.194E-04	0.266E-04	0.381E-04
48.3 A	1000000.	0.223E-03	0.293E-05	0.254E-04	0.286E-04	0.504E-04	0.572E-04
C=0.43E+19	2000000.	0.169E-03	0.246E-05	0.405E-04	0.379E-04	0.810E-04	0.768E-04
	4000000.	0.131E-03	0.174E-05	0.510E-04	0.455E-04	0.103E-03	0.923E-04
Al XI 2P-5S	500000.	0.553E-03	0.954E-04	0.199E-03	0.218E-03	*0.398E-03	*0.413E-03
35.2 A	1000000.	0.446E-03	0.933E-04	0.264E-03	0.267E-03	*0.534E-03	*0.529E-03
C=0.12E+19	2000000.	0.360E-03	0.769E-04	0.333E-03	0.315E-03	*0.672E-03	*0.639E-03
	4000000.	0.287E-03	0.615E-04	0.392E-03	0.361E-03	*0.788E-03	*0.739E-03
Al XI 3P-4S	500000.	0.671E-02	0.583E-03	0.825E-03	0.119E-02	0.165E-02	0.232E-02
157.3 A	1000000.	0.524E-02	0.568E-03	0.137E-02	0.152E-02	0.280E-02	0.303E-02
C=0.45E+20	2000000.	0.414E-02	0.516E-03	0.182E-02	0.183E-02	0.373E-02	0.371E-02
	4000000.	0.330E-02	0.417E-03	0.228E-02	0.216E-02	0.463E-02	0.438E-02
Al XI 3P-5S	500000.	0.598E-02	0.832E-03	0.175E-02	0.192E-02	*0.355E-02	*0.363E-02
105.3 A	1000000.	0.477E-02	0.812E-03	0.234E-02	0.236E-02	*0.472E-02	*0.465E-02
C=0.11E+20	2000000.	0.382E-02	0.668E-03	0.294E-02	0.278E-02	*0.593E-02	*0.563E-02
	4000000.	0.304E-02	0.534E-03	0.348E-02	0.320E-02	*0.693E-02	*0.643E-02
PERTURBER DENSITY = 0.1E+21 cm-3							
Al XI 2S-2P	500000.	0.105	-0.182E-02	0.560E-03	-0.205E-02	0.107E-02	-0.387E-02
554.4 A	1000000.	0.761E-01	-0.221E-02	0.187E-02	-0.400E-02	0.363E-02	-0.784E-02
C=0.55E+23	2000000.	0.557E-01	-0.220E-02	0.463E-02	-0.649E-02	0.915E-02	-0.130E-01
	4000000.	0.416E-01	-0.203E-02	0.795E-02	-0.903E-02	0.158E-01	-0.182E-01
Al XI 2S-3P	500000.	0.298E-02	0.218E-04	0.135E-03	0.184E-03	0.264E-03	0.345E-03
48.3 A	1000000.	0.223E-02	0.256E-04	0.254E-03	0.282E-03	0.504E-03	0.548E-03
C=0.43E+20	2000000.	0.169E-02	0.238E-04	0.405E-03	0.378E-03	0.810E-03	0.756E-03
	4000000.	0.131E-02	0.168E-04	0.510E-03	0.454E-03	0.103E-02	0.921E-03
Al XI 2P-3S	500000.	0.204E-02	0.171E-03	0.119E-03	0.281E-03	0.236E-03	0.528E-03
54.3 A	1000000.	0.155E-02	0.169E-03	0.274E-03	0.426E-03	0.550E-03	0.827E-03
C=0.15E+21	2000000.	0.121E-02	0.170E-03	0.493E-03	0.555E-03	0.990E-03	0.111E-02
	4000000.	0.949E-03	0.148E-03	0.650E-03	0.665E-03	0.132E-02	0.136E-02
Al XI 2P-4S	500000.	0.279E-02	0.341E-03	0.563E-03	0.760E-03		
39.6 A	1000000.	0.221E-02	0.363E-03	0.937E-03	0.102E-02		
C=0.33E+20	2000000.	0.177E-02	0.350E-03	0.124E-02	0.125E-02		
	4000000.	0.142E-02	0.282E-03	0.157E-02	0.148E-02		
Al XI 2P-5S	500000.	0.547E-02	0.687E-03	*0.200E-02	*0.189E-02		
35.2 A	1000000.	0.442E-02	0.812E-03	*0.264E-02	*0.256E-02		
C=0.12E+20	2000000.	0.357E-02	0.748E-03	*0.333E-02	*0.313E-02		
	4000000.	0.285E-02	0.599E-03	*0.392E-02	*0.359E-02		
Al XI 3P-4S	500000.	0.671E-01	0.501E-02	0.823E-02	0.109E-01	*0.165E-01	*0.200E-01
157.3 A	1000000.	0.524E-01	0.528E-02	0.137E-01	0.148E-01	*0.277E-01	*0.282E-01
C=0.45E+21	2000000.	0.414E-01	0.509E-02	0.182E-01	0.182E-01	*0.373E-01	*0.360E-01

STARK BROADENING PARAMETER TABLES FOR Al XI AND Si XII LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1E+21 cm ⁻³							
PERTURBERS ARE:		ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
Al XI 3P-5S	500000.	0.592E-01	0.597E-02	*0.178E-01	*0.167E-01		
105.3 A	1000000.	0.473E-01	0.706E-02	*0.234E-01	*0.226E-01		
C=0.11E+21	2000000.	0.379E-01	0.649E-02	*0.294E-01	*0.277E-01		
	4000000.	0.302E-01	0.521E-02	*0.348E-01	*0.318E-01		
PERTURBER DENSITY = 0.1E+22 cm ⁻³							
Al XI 2S-2P	500000.	1.05	-0.152E-01	0.555E-02	-0.182E-01	0.103E-01	-0.304E-01
554.4 A	1000000.	0.761	-0.202E-01	0.187E-01	-0.379E-01	0.361E-01	-0.710E-01
C=0.55E+24	2000000.	0.557	-0.211E-01	0.463E-01	-0.641E-01	0.913E-01	-0.125
	4000000.	0.416	-0.201E-01	0.795E-01	-0.902E-01	0.158	-0.180
Al XI 2S-3P	500000.	0.295E-01	-0.111E-03	0.134E-02	0.159E-02	*0.254E-02	*0.256E-02
48.3 A	1000000.	0.221E-01	0.253E-05	0.254E-02	0.259E-02	*0.498E-02	*0.469E-02
C=0.43E+21	2000000.	0.168E-01	0.132E-03	0.405E-02	0.369E-02	*0.809E-02	*0.703E-02
	4000000.	0.130E-01	0.154E-03	0.510E-02	0.453E-02	*0.103E-01	*0.894E-02
Al XI 2P-3S	500000.	0.204E-01	0.118E-02	0.119E-02	0.243E-02	*0.234E-02	*0.387E-02
54.3 A	1000000.	0.155E-01	0.131E-02	0.274E-02	0.391E-02	*0.548E-02	*0.703E-02
C=0.15E+22	2000000.	0.120E-01	0.154E-02	0.494E-02	0.540E-02	*0.994E-02	*0.103E-01
	4000000.	0.948E-02	0.146E-02	0.650E-02	0.663E-02	*0.132E-01	*0.131E-01
Al XI 2P-4S	500000.	0.268E-01	0.121E-02				
39.6 A	1000000.	0.214E-01	0.199E-02				
C=0.33E+21	2000000.	0.172E-01	0.282E-02				
	4000000.	0.138E-01	0.273E-02				
Al XI 2P-5S	500000.	0.461E-01	0.213E-04				
35.2 A	1000000.	0.385E-01	0.256E-02				
C=0.12E+21	2000000.	0.317E-01	0.484E-02				
	4000000.	0.257E-01	0.560E-02				
Al XI 3P-4S	500000.	0.651	0.190E-01				
157.3 A	1000000.	0.511	0.297E-01				
C=0.45E+22	2000000.	0.405	0.414E-01				
	4000000.	0.323	0.399E-01				
Al XI 3P-5S	500000.	0.514	0.160E-03				
105.3 A	1000000.	0.421	0.221E-01				
C=0.11E+22	2000000.	0.343	0.418E-01				
	4000000.	0.277	0.486E-01				
PERTURBER DENSITY = 0.1E+23 cm ⁻³							
Al XI 2S-2P	500000.	10.5	-0.489E-01	0.501E-01	-0.119	0.795E-01	-0.137
554.4 A	1000000.	7.61	-0.136	0.186	-0.328	0.348	-0.526
C=0.55E+25	2000000.	5.57	-0.160	0.462	-0.594	*0.908	*-1.09
	4000000.	4.16	-0.180	0.794	-0.882	*1.57	*-1.68
Al XI 2S-3P	500000.	0.274	-0.254E-02	*0.118E-01	*0.921E-02		
48.3 A	1000000.	0.208	-0.161E-02	*0.248E-01	*0.205E-01		
C=0.43E+22	2000000.	0.159	-0.876E-03				
	4000000.	0.124	0.184E-04				

PERTURBER DENSITY = 0.1E+23 cm ⁻³								
PERTURBERS ARE:			ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	
Al XI 2P-3S	500000.	0.190	-0.413E-02	*0.115E-01	*0.138E-01			
54.3 A	1000000.	0.147	0.257E-02	*0.274E-01	*0.305E-01			
C=0.15E+23	2000000.	0.115	0.696E-02					
	4000000.	0.911E-01	0.109E-01					
Al XI 2P-4S	500000.	0.189	-0.205E-01					
39.6 A	1000000.	0.165	-0.446E-02					
C=0.33E+22	2000000.	0.140	0.509E-02					
	4000000.	0.116	0.151E-01					
Al XI 2P-5S	500000.	0.229	-0.398E-01					
35.2 A	1000000.	0.228	-0.126E-01					
C=0.12E+22	2000000.	0.210	0.129E-02					
	4000000.	0.183	0.244E-01					
Al XI 3P-4S	500000.	5.04	-0.301					
157.3 A	1000000.	4.19	-0.644E-01					
C=0.45E+23	2000000.	3.44	0.767E-01					
	4000000.	2.81	0.223					
Al XI 3P-5S	500000.	2.97	-0.346					
105.3 A	1000000.	2.75	-0.110					
C=0.11E+23	2000000.	2.43	0.990E-02					
	4000000.	2.08	0.212					

STARK BROADENING PARAMETER TABLES FOR Al XI AND Si XII LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1E+20 cm ⁻³							
PERTURBERS ARE:		ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
Si XII 2S-3P	500000.	0.194E-03	0.162E-05	0.629E-05	0.101E-04	0.123E-04	0.198E-04
40.9 A	1000000.	0.144E-03	0.167E-05	0.134E-04	0.157E-04	0.266E-04	0.316E-04
C=0.34E+19	2000000.	0.108E-03	0.141E-05	0.218E-04	0.217E-04	0.433E-04	0.438E-04
	4000000.	0.833E-04	0.102E-05	0.287E-04	0.261E-04	0.582E-04	0.529E-04
Si XII 2P-4S	500000.	0.169E-03	0.226E-04	0.291E-04	0.468E-04	0.587E-04	0.911E-04
33.3 A	1000000.	0.133E-03	0.223E-04	0.541E-04	0.625E-04	0.109E-03	0.125E-03
C=0.25E+19	2000000.	0.107E-03	0.206E-04	0.722E-04	0.756E-04	0.147E-03	0.152E-03
	4000000.	0.856E-04	0.168E-04	0.916E-04	0.884E-04	0.187E-03	0.179E-03
Si XII 2P-5S	500000.	0.327E-03	0.532E-04	0.109E-03	0.127E-03	*0.220E-03	*0.243E-03
29.6 A	1000000.	0.265E-03	0.532E-04	0.147E-03	0.154E-03	*0.303E-03	*0.305E-03
C=0.97E+18	2000000.	0.213E-03	0.443E-04	0.192E-03	0.184E-03	*0.383E-03	*0.373E-03
	4000000.	0.170E-03	0.355E-04	0.235E-03	0.209E-03	*0.469E-03	*0.430E-03
Si XII 3P-4S	500000.	0.412E-02	0.329E-03	0.429E-03	0.672E-03	0.863E-03	0.131E-02
131.9 A	1000000.	0.320E-02	0.323E-03	0.788E-03	0.912E-03	0.158E-02	0.102E-02
C=0.36E+20	2000000.	0.252E-02	0.299E-03	0.105E-02	0.109E-02	0.216E-02	0.220E-02
	4000000.	0.200E-02	0.243E-03	0.137E-02	0.130E-02	0.273E-02	0.265E-02
Si XII 3P-5S	500000.	0.358E-02	0.464E-03	0.956E-03	0.111E-02	*0.193E-02	*0.214E-02
88.5 A	1000000.	0.285E-02	0.462E-03	0.130E-02	0.135E-02	*0.267E-02	*0.269E-02
C=0.87E+19	2000000.	0.228E-02	0.385E-03	0.168E-02	0.163E-02	*0.340E-02	*0.329E-02
	4000000.	0.181E-02	0.308E-03	0.205E-02	0.186E-02	*0.410E-02	*0.376E-02
Si XII 3P-3D	500000.	2.74	-0.582E-01	0.119	-0.251	0.236	-0.491
4880.8 A	1000000.	2.06	-0.565E-01	0.258	-0.369	0.515	-0.737
C=0.49E+23	2000000.	1.57	-0.488E-01	0.450	-0.485	0.910	-0.985
	4000000.	1.22	-0.350E-01	0.596	-0.585	1.19	-1.18
PERTURBER DENSITY = 0.1E+21 cm ⁻³							
Si XII 2S-2P	500000.	0.804E-01	-0.116E-02	0.258E-03	-0.119E-02	0.490E-03	-0.223E-02
504.6 A	1000000.	0.578E-01	-0.148E-02	0.907E-03	-0.239E-02	0.175E-02	-0.467E-02
C=0.50E+23	2000000.	0.420E-01	-0.144E-02	0.248E-02	-0.410E-02	0.487E-02	-0.819E-02
	4000000.	0.312E-01	-0.137E-02	0.477E-02	-0.589E-02	0.948E-02	-0.119E-01
Si XII 2S-3P	500000.	0.194E-02	0.110E-04	0.628E-04	0.954E-04	0.122E-03	0.179E-03
40.9 A	1000000.	0.144E-02	0.142E-04	0.134E-03	0.155E-03	0.267E-03	0.304E-03
C=0.34E+20	2000000.	0.108E-02	0.138E-04	0.218E-03	0.216E-03	0.433E-03	0.432E-03
	4000000.	0.833E-03	0.101E-04	0.287E-03	0.260E-03	0.582E-03	0.527E-03
Si XII 2P-3S	500000.	0.126E-02	0.939E-04	0.525E-04	0.146E-03	0.103E-03	0.274E-03
45.6 A	1000000.	0.956E-03	0.963E-04	0.143E-03	0.232E-03	0.288E-03	0.452E-03
C=0.11E+21	2000000.	0.737E-03	0.938E-04	0.258E-03	0.321E-03	0.519E-03	0.641E-03
	4000000.	0.577E-03	0.855E-04	0.364E-03	0.385E-03	0.743E-03	0.778E-03
Si XII 2P-4S	500000.	0.169E-02	0.188E-03	0.292E-03	0.431E-03	*0.588E-03	*0.780E-03
33.3 A	1000000.	0.134E-02	0.207E-03	0.541E-03	0.610E-03	*0.109E-02	*0.117E-02
C=0.25E+20	2000000.	0.107E-02	0.204E-03	0.722E-03	0.754E-03	*0.147E-02	*0.148E-02
	4000000.	0.856E-03	0.166E-03	0.916E-03	0.882E-03	*0.187E-02	*0.178E-02

PERTURBER DENSITY = 0.1E+21 cm ⁻³							
PERTURBERS ARE:		ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
Si XII 2P-5S	500000.	0.325E-02	0.368E-03	*0.109E-02	*0.112E-02		
29.6 A	1000000.	0.262E-02	0.466E-03	*0.147E-02	*0.148E-02		
C=0.97E+19	2000000.	0.212E-02	0.435E-03	*0.192E-02	*0.184E-02		
	4000000.	0.169E-02	0.346E-03	*0.236E-02	*0.208E-02		
Si XII 3P-4S	500000.	0.412E-01	0.275E-02	0.430E-02	0.620E-02	*0.866E-02	*0.113E-01
131.9 A	1000000.	0.320E-01	0.300E-02	0.788E-02	0.891E-02	*0.158E-01	*0.170E-01
C=0.36E+21	2000000.	0.252E-01	0.296E-02	0.105E-01	0.109E-01	*0.216E-01	*0.214E-01
	4000000.	0.199E-01	0.241E-02	0.137E-01	0.130E-01	*0.273E-01	*0.264E-01
Si XII 3P-5S	500000.	0.356E-01	0.319E-02	*0.956E-02	*0.985E-02		
88.5 A	1000000.	0.283E-01	0.405E-02	*0.130E-01	*0.130E-01		
C=0.87E+20	2000000.	0.227E-01	0.377E-02	*0.168E-01	*0.162E-01		
	4000000.	0.180E-01	0.300E-02	*0.205E-01	*0.186E-01		
Si XII 2P-3D	500000.	0.135E-02	-0.131E-04	0.379E-04	-0.926E-04	0.733E-04	-0.174E-03
44.1 A	1000000.	0.987E-03	-0.131E-04	0.101E-03	-0.154E-03	0.199E-03	-0.302E-03
C=0.40E+20	2000000.	0.733E-03	-0.123E-04	0.177E-03	-0.216E-03	0.354E-03	-0.431E-03
	4000000.	0.554E-03	-0.584E-05	0.261E-03	-0.264E-03	0.529E-03	-0.534E-03
PERTURBER DENSITY = 0.1E+22 cm ⁻³							
Si XII 2S-2P	500000.	0.804	-0.962E-02	0.255E-02	-0.104E-01	0.469E-02	-0.171E-01
504.6 A	1000000.	0.579	-0.134E-01	0.908E-02	-0.226E-01	0.175E-01	-0.421E-01
C=0.50E+24	2000000.	0.421	-0.139E-01	0.248E-01	-0.405E-01	0.485E-01	-0.787E-01
	4000000.	0.312	-0.136E-01	0.477E-01	-0.588E-01	0.949E-01	-0.117
Si XII 2S-3P	500000.	0.193E-01	-0.667E-04	0.621E-03	0.823E-03	*0.117E-02	*0.132E-02
40.9 A	1000000.	0.143E-01	0.653E-05	0.133E-02	0.143E-02	*0.263E-02	*0.262E-02
C=0.34E+21	2000000.	0.108E-01	0.814E-04	0.218E-02	0.211E-02	*0.432E-02	*0.403E-02
	4000000.	0.829E-02	0.909E-04	0.287E-02	0.260E-02	*0.581E-02	*0.513E-02
Si XII 2P-3S	500000.	0.126E-01	0.670E-03	0.525E-03	0.126E-02	0.103E-02	0.200E-02
45.6 A	1000000.	0.955E-02	0.754E-03	0.143E-02	0.213E-02	*0.287E-02	*0.387E-02
C=0.11E+22	2000000.	0.738E-02	0.858E-03	0.258E-02	0.313E-02	*0.520E-02	*0.596E-02
	4000000.	0.577E-02	0.846E-03	0.364E-02	0.384E-02	*0.744E-02	*0.756E-02
Si XII 2P-4S	500000.	0.164E-01	0.681E-03	*0.291E-02	*0.342E-02		
33.3 A	1000000.	0.130E-01	0.113E-02	*0.542E-02	*0.530E-02		
C=0.25E+21	2000000.	0.105E-01	0.166E-02	*0.722E-02	*0.719E-02		
	4000000.	0.838E-02	0.160E-02	*0.916E-02	*0.877E-02		
Si XII 2P-5S	500000.	0.280E-01	0.127E-05				
29.6 A	1000000.	0.233E-01	0.155E-02				
C=0.97E+20	2000000.	0.191E-01	0.289E-02				
	4000000.	0.155E-01	0.325E-02				
Si XII 3P-4S	500000.	0.402	0.107E-01	*0.428E-01	*0.494E-01		
131.9 A	1000000.	0.313	0.168E-01	*0.783E-01	*0.771E-01		
C=0.36E+22	2000000.	0.247	0.242E-01	*0.105	*0.104		
	4000000.	0.196	0.233E-01	*0.137	*0.129		

STARK BROADENING PARAMETER TABLES FOR Al XI AND Si XII LINES OF ASTROPHYSICAL INTEREST

PERTURBER DENSITY = 0.1E+22 cm ⁻³							
PERTURBERS ARE:		ELECTRONS		PROTONS		He III	
TRANSITION	T(K)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)	WIDTH(A)	SHIFT(A)
Si XII 3P-5S	500000.	0.315	0.236E-04				
88.5 A	1000000.	0.257	0.134E-01				
C=0.87E+21	2000000.	0.208	0.250E-01				
	4000000.	0.167	0.282E-01				
Si XII 2P-3D	500000.	0.134E-01	0.240E-04	0.376E-03	-0.802E-03	0.716E-03	-0.129E-02
44.1 A	1000000.	0.980E-02	-0.428E-05	0.101E-02	-0.143E-02	*0.198E-02	-0.262E-02
C=0.40E+21	2000000.	0.728E-02	-0.689E-04	0.177E-02	-0.211E-02	*0.354E-02	-0.404E-02
	4000000.	0.551E-02	-0.508E-04	0.261E-02	-0.263E-02	*0.529E-02	-0.520E-02
PERTURBER DENSITY = 0.1E+23 cm ⁻³							
Si XII 2S-2P	500000.	8.04	-0.298E-01	0.224E-01	-0.658E-01	0.336E-01	-0.697E-01
504.6 A	1000000.	5.78	-0.917E-01	0.897E-01	-0.194	0.167	-0.305
C=0.50E+25	2000000.	4.21	-0.106	0.249	-0.375	0.483	-0.685
	4000000.	3.12	-0.123	0.477	-0.576	0.945	-1.10
Si XII 2S-3P	500000.	0.181	-0.180E-02	*0.540E-02	*0.479E-02		
40.9 A	1000000.	0.136	-0.104E-02	*0.131E-01	*0.114E-01		
C=0.34E+22	2000000.	0.103	-0.540E-03	*0.217E-01	*0.184E-01		
	4000000.	0.797E-01	0.427E-04	*0.286E-01	*0.249E-01		
Si XII 2P-3S	500000.	0.119	-0.230E-02	0.510E-02	0.713E-02		
45.6 A	1000000.	0.916E-01	0.166E-02	*0.143E-01	*0.168E-01		
C=0.11E+23	2000000.	0.712E-01	0.393E-02	*0.260E-01	*0.271E-01		
	4000000.	0.559E-01	0.647E-02	*0.364E-01	*0.366E-01		
Si XII 2P-4S	500000.	0.118	-0.128E-01				
33.3 A	1000000.	0.102	-0.304E-02				
C=0.25E+22	2000000.	0.860E-01	0.301E-02				
	4000000.	0.710E-01	0.902E-02				
Si XII 2P-5S	500000.	0.146	-0.253E-01				
29.6 A	1000000.	0.143	-0.843E-02				
C=0.97E+21	2000000.	0.130	0.637E-03				
	4000000.	0.113	0.142E-01				
Si XII 3P-4S	500000.	3.18	-0.184				
131.9 A	1000000.	2.62	-0.432E-01				
C=0.36E+23	2000000.	2.13	0.456E-01				
	4000000.	1.73	0.133				
Si XII 3P-5S	500000.	1.90	-0.219				
88.5 A	1000000.	1.73	-0.732E-01				
C=0.87E+22	2000000.	1.51	0.494E-02				
	4000000.	1.28	0.123				
Si XII 2P-3D	500000.	0.127	0.246E-02	0.347E-02	-0.475E-02		
44.1 A	1000000.	0.938E-01	0.168E-02	*0.999E-02	-0.116E-01		
C=0.40E+22	2000000.	0.701E-01	0.101E-02	*0.176E-01	-0.185E-01		
	4000000.	0.532E-01	0.403E-03	*0.261E-01	-0.253E-01		

2. RESULTS AND DISCUSSION

Our results for 7 Al XI and 9 Si XII multiplets are shown in Table 1, for perturber densities $10^{18} - 10^{23} \text{ cm}^{-3}$ and temperatures $T = 500,000 - 4,000,000 \text{ K}$. We also specify a parameter c (Dimitrijević and 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 $0.1 < NV \leq 0.5$ 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.

The analysis of present results is given in Dimitrijević and Sahal-Bréchet (1994).

Acknowledgements – This work is a part of French–Yugoslav collaboration through the project "L'élargissement Stark des raies spectrales des plasmas astrophysiques et de laboratoire", it is also a part of the project "Physics and dynamics of celestial bodies", supported by Ministry for Science and Technology of Serbia.

REFERENCES

- Dimitrijević, M. S., and Sahal-Bréchet, S.: 1984, *JQSRT* **31**, 301.
 Dimitrijević, M. S., and Sahal-Bréchet, S.: 1994, *Astron. Astrophys. Suppl. Series* in press.
 Dimitrijević, M. S., Sahal-Bréchet, S., and Bomnier, V.: 1991, *Astron. Astrophys. Suppl. Series*, **89**, 581.
 Griem, H. R.: 1974, *Spectral Line Broadening by Plasmas*, Academic Press, New York.
 Sahal-Bréchet, S.: 1969a, *Astron. Astrophys.* **1**, 91.
 Sahal-Bréchet, S.: 1969b, *Astron. Astrophys.* **2**, 322.
 Sahal-Bréchet, S.: 1991, *Astron. Astrophys.* **245**, 322.
 Seaton, M. J.: 1987, *J. Phys. B* **20**, 6363.

ТАБЕЛЕ ПАРАМЕТАРА ШТАРКОВОГ ШИРЕЊА ЛИНИЈА Аl XI и Si XII ОД ЗНАЧАЈА У АСТРОФИЗИЦИ

М. С. Димитријевић¹ и S. Sahal-Bréchet²

¹ *Астрономска опсерваторија, Волгина 7, 11050 Београд, Југославија*

² *Laboratoire "Astrophysique, Atomes et Molécules"
Département Atomes et Molécules en Astrophysique
Unité associée au C.N.R.S. No 812
Observatoire de Paris-Meudon, 92190 Meudon, France*

УДК 52–355.3
Претходно саопштење

Користећи семикласичан прилаз, израчуна-
те су ширине и помераји спектралних линија, про-
узроковани сударима са електронима, протонима

и He III, за 7 мултиплета Al XI и 9 мултиплета Si
XII. Резултати су дати у функцији температуре и
концентрације пертурбера.