

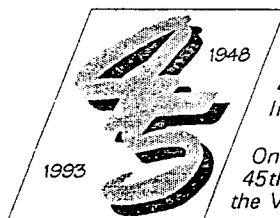
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STARK BROADENING OF Be II SPECTRAL LINES: COMPARISON OF DIFFERENT
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1. INTRODUCTION

Besides the interest for plasma spectroscopy [1-4], the Be II Stark-broadening parameters are important to astrophysicists since the surface content (abundance) of light elements, especially Li and Be, involves problems correlated with nucleogenesis, mixing between the atmosphere and the interior, and stellar structure and evolution [5]. Moreover, Be II profiles are of importance for opacity calculations [6], as well as for modelisation of stellar atmospheres and stellar plasma research.

By using the semiclassical-perturbation formalism [7-8] we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 30 Be II multiplets, in order to provide Stark broadening data for cases of all principal perturbers in stellar atmospheres. A summary of the formalism is given in Ref. [9]. Here, we present and discuss a comparison of our results for Be II with other theoretical results [6,10-11].

2. RESULTS AND DISCUSSION

Table 1. Comparison between the semiclassical calculation of width (FWHM) W and shift d , at electron density of 10^{17} cm^{-3} and $T = 5000 \text{ K}$ and $20,000 \text{ K}$. DSB - present results; JBG - Jones, Benett and Griem [10-11]; S - Seaton [6].

Transition	T(K)	WDSB (A)	WJBG (A)	WS (A)	dDSB (A)	dJBG (A)	dS (A)
2s-2p	5000	0.0801	0.144	0.0407	-0.0101	-0.0604	-0.0191
	20000	0.0445	0.0832	0.0286	-0.00499	-0.0347	-0.0121
2s-3p	5000	0.0555	0.0912	0.0598	0.00283	0.0358	0.00278
	20000	0.0420	0.0608	0.0397	0.00414	0.0214	0.00157
2p-3s	5000	0.133	0.155	0.127	0.0621	0.0789	0.0409
	20000	0.0723	0.102	0.0766	0.0371	0.0525	0.0220
2p-3d	5000	0.123	0.144	0.0978	0.00809	-0.0521	0.0104
	20000	0.0708	0.0870	0.0541	0.00183	-0.0278	0.00630
3s-3p	5000	11.0	12.2	8.54	-1.66	2.23	-0.522
	20000	7.56	8.84	6.21	-0.783	1.83	-0.332
3s-4p	5000	1.90	2.72		0.190	1.13	
	20000	1.57	2.18		0.151	0.753	
3p-4s	5000	3.60	3.84		1.50	1.77	
	20000	2.68	3.22		1.08	1.36	
3p-5s	5000	2.65	3.08		1.49	1.76	
	20000	2.14	2.92		1.12	1.48	
3p-3d	5000	336.	432.	280.	-22.6	-180.	-7.22
	20000	234.	302.	188.	-23.2	-113.	-4.34
3p-4d	5000	5.14	8.24		-0.507	1.32	
	20000	4.74	5.38		-0.139	0.360	
3d-4f	5000	3.33	6.60		0.583	-1.65	
	20000	2.49	3.96		0.231	-0.756	

Our results as a function of perturber density and temperature will be published elsewhere [12-13].

In Table 1, the present results are compared with semiclassical calculations of Jones, Benett and Griem [10-11] and with strong coupling calculations of Seaton [6]. We see that widths fall within the error bars of different methods with the exception of the resonance multiplet $2s - 2p$ and of the transitions $3p - 4d$ and $3d - 4f$ influenced by close perturbing levels. For shifts disagreements become larger and even the sign of shift is different for the last two of the mentioned multiplets

We may divide the cases of large disagreements in three groups.

(1) The case of close perturbing levels (Multiplets $3p - 3d$; $3p - 4d$; $3d - 4f$).

In such a case it is crucial to take into account Debye screening which will reduce width and might change the sign of shift. In Jones, Benett and Griem [10-11] Debye screening has not been taken into account. If we compare results of Jones et al [10-11] at electron density (N) of 10^{17} cm^{-3} with our results at $N = 10^{13} \text{ cm}^{-3}$ where the influence of Debye shielding is lower the agreement is better. For $3p - 4d$ multiplet e.g., we obtain shift of $+ 0.125 \text{ \AA}$ at $T = 20000 \text{ K}$ and $N = 10^{13} \text{ cm}^{-3}$ while at $N = 10^{17} \text{ cm}^{-3}$ our result is $- 0.139 \text{ \AA}$.

(2) The case when shifts are much smaller than widths ($2p - 3d$ and $3s - 3p$ multiplets). In such case cancelations between important contributions with different signs occur and the accuracy is smaller.

(3) The case of resonance lines ($2s - 2p$ multiplet). In such a case short range effects are important so that expected accuracy is lower than usually.

It should be noted also that shifts are generally of lesser accuracy than widths [14-16] and reliable experimental data for the shifts would be very helpful.

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