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STARK BROADENING OF Kr II SPECTRAL LINES

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Abstract. Stark widths and shifts for 19 lines from $5s-5p$ transition of Kr II are calculated within the modified semiempirical approach. The obtained Stark widths are compared with available experimental data.

1. INTRODUCTION

Stark broadening data for many transitions of many atoms and ions are needed for diagnostic of laboratory and astrophysical plasma. Such data for Kr II lines have additional theoretical interest for investigation of regularities and systematic trends for singly charged noble gase ions (see e.g. Di Rocco 1990, Purić et al. 1991, Bertuccelly and Di Rocco 1993) and have been considered experimentally and theoretically in a number of papers. However, for singly charged krypton lines for Stark broadening parameters exist only calculations by using various approximate methods. Bertuccelli and Di Rocco (1993) have calculated Kr II Stark broadening parameters by using analytical expression for the cross sections and rate coefficients and also with the help of semiempirical method (Griem 1968). Also exist estimates based on the dependence on atomic number and the upper level ionization potential, established from the consideration of regularities (Di Rocco 1990, Purić et al. 1991, Bertuccelli and Di Rocco 1991, 1993).

In this paper the Stark broadening parameters for 19 spectral lines from 5s-5p transition array of singly charged kripton have been calculated by using the modified semiempirical approach (Dimitrijević and Konjević 1980), due to the complexity of Kr II spectrum, calculations were performed as in Popović and Dimitrijević (1996a). Our aim is to compare obtained data with existing experimental and theoretical results in order to test the applicability of the modified semiemprical method for a complex spectra as Kr II.

2. RESULTS AND DISCUSION

The atomic data needed for calculation were taken from Sugar and Musgrove (1991). Stark widths, determined by using the modified semiempirical approach, as well as the discussion of regularities within multiplets and comparison with other theoretical results (Di Rocco 1990, Bertuccelli and Di Rocco 1991, 1993) will be published elsewhere (Popović and Dimitrijević 1996).

Our results have been compared in Table 1 with numerous available experimental data (Brandt et al. 1981, Vitel and Skowronek 1987, Konjević and Uzelac 1989, Lesage et al. 1989, Bertuccelli and Di Rocco 1990). Obtained results are in good agremeent with experimental data.

Table 1. Comparison of theoretical Stark widths (w_{th} - FWHM) with experimental data. (L) - Lesage et al. 1989, (BDR) - Bertuccelli and Di Rocco 1991, (VS) - Vitel and Skowronek 1987, (UK) - Uzelac and Konjević 1989, (B) - Brandt et al. 1981. Stark width are given for an electron density of $10^{23}\mathrm{m}^{-3}$.

Transition	λ (nm)	T (1000 K)	w_m (nm)	w_{th} (nm)	w_m/w_{th}	Ref.
$5s^4P - 5p^4S^0$	414.5	14.5	0.030	0.0259	1.16	(BDR)
$5s^4P - 5p^4P^0$	473.9	11.0	0.049	0.0361	1.36	(L)
		12.0	0.029	0.0361	0.80	(B)
		11.5	0.040	0.0353	1.13	(UK)
		11.65	0.039	0.035	1.10	(UK)
		11.9	0.048	0.0347	1.38	(UK)
		12.0	0.041	0.0346	1.18	(B)
		12.5	0.039	0.0339	1.15	(UK)
		12.75	0.039	0.0335	1.17	(UK)
		14.5	0.041	0.0310	1.32	(BDR)
		14.9	0.0304	0.0302	1.00	(VS)
		15.5	0.0302	0.0298	1.02	(VS)
		15.7	0.025	0.0288	0.87	(VS)
		16.2	0.026	0.0293	0.89	(VS)
		17.4	0.025	0.0283	0.87	(VS)
	465.89	11.0	0.045	0.0346	1.30	(L)
		11.5	0.040	0.0341	1.17	(UK)
		11.65	0.041	0.0339	1.20	(UK)
		11.9	0.039	0.0334	1.18	(UK)
		12.5	0.040	0.0327	1.23	(UK)
		12.75	0.039	0.0324	1.21	(UK)
		14.5	0.039	0.0299	1.30	(BDR)
		14.9	0.029	0.0292	1.00	(VS)
		15.5	0.029	0.0288	1.01	(VS)
		16.2	0.027	0.0282	0.95	(VS)
		17.4	0.028	0.0273	1.02	(VS)
	483.2	14.5	0.039	0.0334	1.17	(BDR)
	520.8	12.0	0.038	0.0375	1.01	(B)
$5s^4P - 5p^4D^0$	429.29	11.0	0.030	0.0284	1.06	(L)
		14.5	0.038	0.0244	1.56	(BDR)

Table 1, continued

Transition	λ (nm)	T (1000 K)	w_m (nm)	w_{th} (nm)	w_m/w_{th}	Ref.
	435.55	11.0	0.039	0.0300	1.30	(L)
		11.5	0.038	0.0294	1.28	(UK)
		11.65	0.039	0.0292	1.34	(UK)
		11.9	0.038	0.0289	1.32	(UK)
		12.5	0.039	0.0282	1.38	(UK)
		12.75	0.038	0.0279	1.37	(UK)
		14.5	0.046	0.0258	1.78	(BDR)
		14.9	0.025	0.0252	0.99	(VS)
		15.5	0.026	0.0248	1.05	(VS)
		16.2	0.024	0.0244	0.97	(VS)
		17.4	0.020	0.0235	0.86	(VS)
	443.1	11.0	0.031	0.0329	0.94	(L)
		14.5	0.037	0.0283	1.31	(BDR)
	476.57	11.0	0.051	0.0380	1.34	(L)
		11.0	0.039	0.0380	1.03	(B)
		12.0	0.039	0.0364	1.07	(B)
		14.5	0.044	0.0326	1.35	(BDR)
	481.1	14.5	0.031	0.0330	0.94	(BDR)

References

Bertuccelli, D. and Di Rocco, H. O. : 1991, *Phys. Scr.* **44**, 138.

Bertuccelli, D. and Di Rocco, H. O. : 1993, *Phys. Scr.* **47**, 747.

Brandt, T., Helbig, V., Nick, K. P. : 1981, Spectral line shapes (Ed. Wende B.), Berlin, W. de Gruyter.

Dimitrijević, M. S. and Konjević, N. : 1980, *J. Quant. Spectrosc. Radiat. Transfer*, **24**, 451.

Di Rocco, H. O. : 1990, *J. Appl. Phys.* **68**, 3732.

Griem, H. R. : 1968, *Phys. Rev.* **165**, 258.

Lesage, A., Abadie, D. and Miller, M. H. : 1989, *Phys. Rev.* A, **40**, 1367.

Pittman, T. L. and Konjević, N. : 1986, *J. Quant. Spectrosc. Radiat. Transfer*, **35**, 247.

Popović, L. Č. and Dimitrijević, M. S. : 1996a, *Phys. Scr.* **53**, 325.

Popović, L. Č. and Dimitrijević, M. S. : 1996b, in preparation.

Purić, J., Djeniže, S., Labat, J., Srećković, A. and Platiša, M. : 1991, *Contrib. Plasma Phys.* **31**, 63.

Sugar, J. and Musgrove, A. : 1991, *J. Phys. Chem. Ref. Data* **20**, 875.

Uzelac, N. I. and Konjević, N. : 1989, *J. Phys.* B, **22**, 2517.

Vitel, Y. and Skowronek, M. : 1987, *J. Phys.* B, **20**, 6493.