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ON THE STARK BROADENING OF K VIII LINES

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Abstract. Using a semiclassical approach, we have calculated electron-, proton-, and doubly charged helium-impact line widths and shifts for 4 K VIII multiplets, for perturber densities $10^{18} - 10^{22}$ cm^{-3} and temperatures T = 200,000 – 3,000,000 K.

1. INTRODUCTION

Spectral lines of potassium are present in Solar (Moore, Minnaert and Houtgast, 1966) and stellar spectra (Merrill, 1956). For example, potassium has been found in the ejecta of SN 1987 A supernova (Trimble, 1991). Potassium is a product of alpha processes - neutron capture on slow time scale, and the data on the spectral line broadening parameters of potassium in various ionization stages are of interest for the considering and modelling of subphotospheric layers (Seaton, 1987), particularly radiative transfer in stellar interiors. Such data are also of interest for the fusion plasmas and laser-produced plasmas research and for the investigation of soft X-ray lasers (see e.g. Griem and Moreno, 1990; Fill and Schöning, 1994).

Within the the semiclassical-perturbation formalism (Sahal-Bréchot 1969ab), we have calculated electron-, proton-, and He III-impact line widths and shifts for 4 potassium XI multiplets. The used semiclassical perturbation formalism has been discussed and reviewed e.g. in Dimitrijević *et al.* (1991) and Dimitrijević and Sahal - Bréchot (1996).

2. RESULTS AND DISCUSSION

Energy levels for potassium VIII lines have been taken from Bashkin and Stoner (1978). All other details of calculations are given in Dimitrijević and Sahal-Bréchot (1998a).

Table 1
This Table shows electron- and proton-impact broadening full half-widths (FWHM) and shifts for K VIII for a perturber density of 10^{19} cm^{-3} and temperatures from 200,000 up to 3,000,000 K. By deviding C with the full linewidth we obtain an estimate for the maximum perturber density for which the line may be treated as isolated and tabulated data may be used.

PERTURBER DENSITY = 1.E+19cm-3

PERTURBERS ARE:		ELECTRONS		PROTONS	
TRANSITION	T(K)	WIDTH(Å)	SHIFT(Å)	WIDTH(Å)	SHIFT(Å)
KVIII 3s 3p	200000.	0.445E-01	-0.444E-03	0.672E-03	-0.262E-03
519.4Å	500000.	0.291E-01	-0.466E-03	0.168E-02	-0.616E-03
C=0.52E+22	1000000.	0.218E-01	-0.551E-03	0.250E-02	-0.969E-03
	1500000.	0.187E-01	-0.517E-03	0.297E-02	-0.118E-02
	2000000.	0.169E-01	-0.506E-03	0.316E-02	-0.133E-02
	3000000.	0.148E-01	-0.490E-03	0.345E-02	-0.149E-02
KVIII 3p 4s	200000.	0.141E-01	0.903E-03	0.464E-03	0.945E-03
221.3 Å	500000.	0.983E-02	0.108E-02	0.120E-02	0.156E-02
C=0.25E+21	1000000.	0.772E-02	0.104E-02	0.185E-02	0.194E-02
	1500000.	0.677E-02	0.102E-02	0.219E-02	0.215E-02
	2000000.	0.620E-02	0.989E-03	0.244E-02	0.233E-02
	3000000.	0.549E-02	0.888E-03	0.284E-02	0.256E-02
KVIII 3p 5s	200000.	0.135E-01	0.183E-02	0.142E-02	0.194E-02
142.8 Å	500000.	0.985E-02	0.174E-02	0.264E-02	0.273E-02
C=0.41E+20	1000000.	0.794E-02	0.171E-02	0.342E-02	0.331E-02
	1500000.	0.703E-02	0.159E-02	0.391E-02	0.368E-02
	2000000.	0.646E-02	0.146E-02	0.430E-02	0.391E-02
	3000000.	0.573E-02	0.127E-02	0.508E-02	0.418E-02
KVIII 3p 3d	200000.	0.391E-01	0.513E-03	0.982E-03	0.226E-03
441.4 Å	500000.	0.255E-01	0.658E-03	0.212E-02	0.521E-03
C=0.38E+22	1000000.	0.192E-01	0.754E-03	0.298E-02	0.801E-03
	1500000.	0.166E-01	0.803E-03	0.329E-02	0.973E-03
	2000000.	0.150E-01	0.768E-03	0.350E-02	0.110E-02
	3000000.	0.133E-01	0.752E-03	0.376E-02	0.122E-02

The complete results of our calculations of electron-, proton-, and He III-impact line widths and shifts for 4 potassium VIII multiplets, for perturber densities 10^{18}–10^{22} cm^{-3} and temperatures T = 200,000 – 3,000,000 K, will be published elsewhere (Dimitrijević and Sahal-Bréchot, 1998ab). Here, in Table 1, only data for perturber density of 10^{19} cm^{-3}, as a sample of obtained results are shown. We also specify the parameter C (Dimitrijević and S.Sahal-Bréchot, 1984), which gives an estimate of the maximum perturber density for which the line may be treated as isolated when divided by the corresponding full width at half maximum.

The results shown here are the first Stark broadening data concerning potassium VIII spectral lines. Besides the interest of such data for astrophysical and laboratory plasma research, they are of significance for the theoretical considerations of systematic trends along isoelectronic sequences and development and rafinement of the Stark broadening theory for multiply charged ion lines.

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