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ON THE STARK BROADENING OF Sc X LINES

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Abstract. Using a semiclassical approach, we have calculated electron-, proton-, and ionized helium-impact line widths and shifts for 4 Sc X multiplets, for perturber densities 10^{19}–10^{22} cm^{-3} and temperatures T = 200,000 – 5,000,000 K.

1. INTRODUCTION

Scandium is present in stellar and solar plasma, so that the various atomic data concerning this element, including Stark broadening parameters of its spectral lines for various ionization stages are of interest for stellar and solar physics. Particularly for the modelling and theoretical considerations of subphotospheric layers, atomic data on higher ionization stages are of interest (Seaton, 1997). Of course, Stark broadening parameters for multiply charged scandium ion lines are as well of interest for the laboratory plasma research, testing and developping of the Stark broadening theory for multicharged ion lines, and investigations of systematic trends along isoelectronic sequences.

By using the semiclassical-perturbation formalism (Sahal-Bréchot 1969ab), we have calculated electron-, proton-, and He III-impact line widths and shifts for 4 scandium X multiplets. A short review of the formalism is given e.g. in Dimitrijević *et al.* (1991) and Dimitrijević and Sahal - Bréchot (1996).

2. RESULTS AND DISCUSSION

Energy levels for scandium X lines have been taken from Bashkin and Stoner (1978). All other details of calculations are given in Dimitrijević and Sahal-Bréchot (1998). Our results for electron-, proton-, and He III-impact line widths and shifts for 4 scandium X multiplets, for perturber densities 10^{19}– 10^{22} cm^{-3} and temperatures T = 200,000 – 5,000,000 K, will be published elsewhere (Dimitrijević and Sahal-Bréchot, 1998). We present here in Table 1, only data for perturber density of 10^{19} cm^{-3}. We also specify a parameter C (Dimitrijević and S.Sahal-Bréchot, 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 full width at half maximum.

Table 1. This table shows electron- and proton-impact broadening full half-widths (FWHM) and shifts for Sc X for a perturber density of 10^{19} cm^{-3} and temperatures from 200,000 up to 5,000,000 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)
Sc X 3S-3P	200000.	0.257E-01	-0.164E-03	0.146E-03	-0.876E-04
422.9 A	500000.	0.165E-01	-0.196E-03	0.473E-03	-0.225E-03
C=0.42E+22	1000000.	0.121E-01	-0.259E-03	0.871E-03	-0.393E-03
	2000000.	0.916E-02	-0.244E-03	0.127E-02	-0.579E-03
	3000000.	0.787E-02	-0.238E-03	0.146E-02	-0.706E-03
	5000000.	0.661E-02	-0.231E-03	0.165E-02	-0.815E-03
Sc X 3P-4S	200000.	0.499E-02	0.227E-03	0.606E-04	0.201E-03
147.3 A	500000.	0.337E-02	0.299E-03	0.251E-03	0.390E-03
C=0.14E+21	1000000.	0.258E-02	0.284E-03	0.440E-03	0.542E-03
	2000000.	0.203E-02	0.270E-03	0.643E-03	0.652E-03
	3000000.	0.178E-02	0.258E-03	0.756E-03	0.722E-03
	5000000.	0.151E-02	0.223E-03	0.915E-03	0.821E-03
Sc X 3P-5S	200000.	0.399E-02	0.376E-03	0.193E-03	0.380E-03
96.3 A	500000.	0.283E-02	0.427E-03	0.478E-03	0.622E-03
C=0.32E+20	1000000.	0.225E-02	0.425E-03	0.720E-03	0.760E-03
	2000000.	0.182E-02	0.401E-03	0.933E-03	0.910E-03
	3000000.	0.161E-02	0.358E-03	0.110E-02	0.101E-02
	5000000.	0.139E-02	0.301E-03	0.133E-02	0.111E-02
Sc X 3P-3D	200000.	0.206E-01	-0.669E-04	0.204E-03	-0.321E-04
357.5 A	500000.	0.133E-01	-0.681E-04	0.591E-03	-0.835E-04
C=0.30E+22	1000000.	0.970E-02	-0.969E-04	0.971E-03	-0.156E-03
	2000000.	0.731E-02	-0.794E-04	0.134E-02	-0.247E-03
	3000000.	0.629E-02	-0.788E-04	0.146E-02	-0.299E-03
	5000000.	0.530E-02	-0.730E-04	0.160E-02	-0.367E-03

Experimental data or other theoretical data on the scandium X Stark broadening parameters do not exist. The corresponding experimental data will be of course very useful for checking and further development and rafinement of the theory of multicharged ion lines.

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