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STARK WIDTHS PREDICTIONS FROM TEMPERATURES DEPENDENCIES OF SEVERAL MULTIPLY CHARGED IONS SPECTRAL LINES

MARA ŠĆEPANOVIĆ
Faculty of Natural Sciences and Mathematics, University of Montenegro, Montenegro
E-mail: mara.scepanovic@gmail.com

Abstract. Stark widths dependence on electron temperature of different emitters has been evaluated and discussed. It has been verified that the found relations can be used for prediction of Stark line widths in case of ions for which observed data, or more detailed calculation are not yet available.

1. RESULTS

In order to investigate Stark parameter regularities Purić (1996), an accurate set of theoretical and experimental data is needed for multiplet, supermultiplet, transition array, homologous, isoelectronic, and isonuclear sequences; or the same type of transition (for instance resonance) along the Periodical system of elements for different stages of ionisation, under the same plasma conditions characterized by particular electron density and temperature. Therefore, the Stark parameter dependencies on the electron density and temperature have to be well determined to make possible to normalize data given for different temperatures and densities to particular ones at which the types of regularities have to be investigated. Of special interest are dependencies on the rest core charge of the emitter within isoelectronic or isonuclear sequences or on the nuclear charge number within particular transitions of homologous group of atoms or ions, and on the upper level ionization potential in all the above mentioned cases. The Stark parameter dependence on the electron density is well established, and in the case of nonhydrogenic emitters is linear. However, Stark width dependence on the electron temperature is different from line to line for all spectra. Therefore, the correction to the temperature dependence has to be done with great care for all data used, in particular case of the verification of certain type of mentioned dependencies and regularities. For instance, instead of the commonly adopted temperature dependence of $T^{-1/2}$ for ion lines, one has to use, from line to line Purić and Šćepanović (1999 and Ref. therein) and Purić at all (2008 and Ref. therein), the whole spectrum of functions of the form:

$$W^* = A + BT^{-C} \qquad (1)$$

In Table 1. we have prediction values Starks widths for multiplay charged ions of different elements, according to Eq. 1. on two different electron temperatures. Also in Fig. 1. we can see a few graphic elements by which we determine the coefficients A, B and C for each line separately.

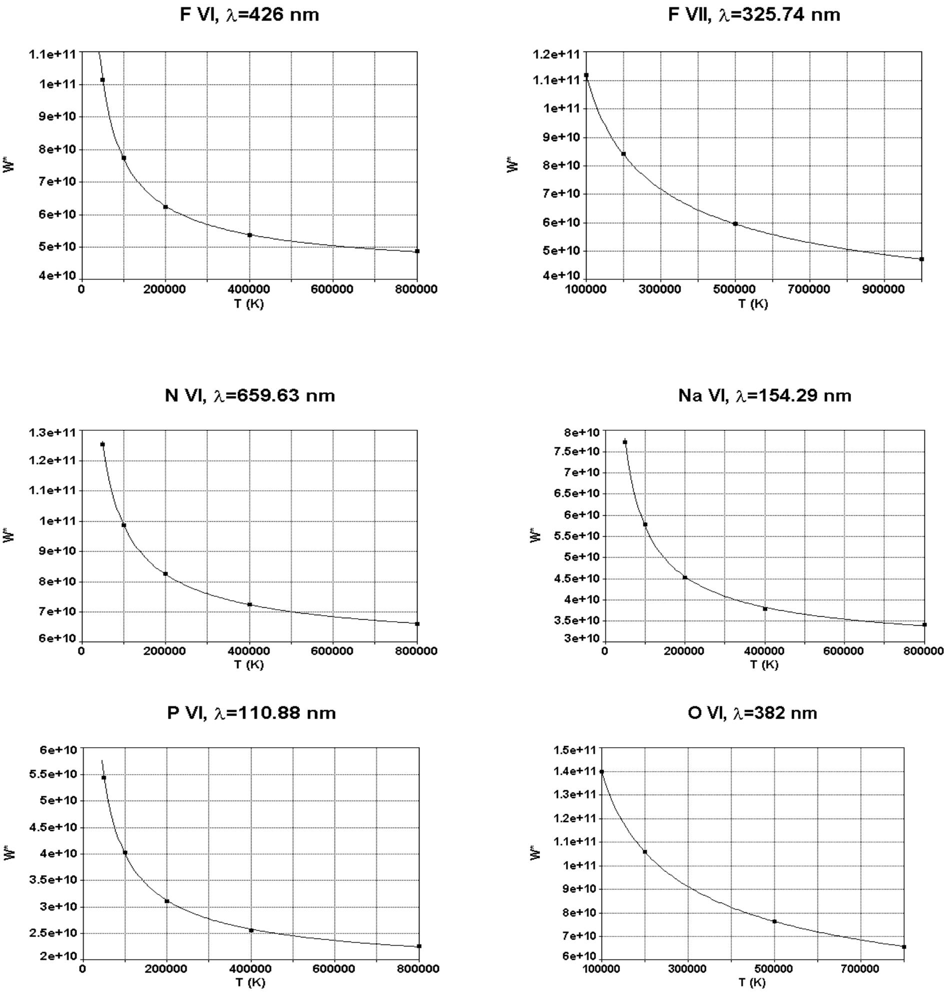

Figure 1: Graphics for several elements by which we determine the coefficients A, B and C for each line separately.

Table 1. Stark full half widths of multiply charged ions for several spectral lines for an electron density $Ne=1\cdot10^{23}m^{-3}$ at different electron temperatures

emitter	λ[nm]	w ($T=2,5\cdot10^5K$)	w ($T=5\cdot10^5K$)
Na VI	134,5	1,92982E-05	1,78424E-05
Na VI	127,8	1,73517E-05	1,60487E-05
Na VI	123,9	1,64312E-05	1,53975E-05
Si VI	99,5	8,04534E-06	7,40832E-06
O VI	184,1	8,62016E-05	7,91132E-05
N VI	2833,7	4,11477E-03	3,87388E-03
N VI	1901,5	1,52823E-03	1,42781E-03
F VI	535,2	1,51336E-04	1,36346E-04
O VI	1033,8	1,02702E-03	9,26325E-04
F VI	126,9	3,84267E-05	3,61807E-05
S VI	464,7	1,12024E-03	1,02859E-03
S VI	649,2	2,43786E-03	2,25211E-03
S VI	364	1,80489E-03	1,68416E-03
O VI	357,9	4,18587E-03	3,89922E-03
N VI	13698,6	6,2746E-01	6,05555E-01
F VI	2562,8	1,38735E-02	1,30818E-02
S VI	710,6	1,04021E-03	9,43428E-04
O VI	11850	6,38742E-01	5,87476E-01
S VI	289,8	5,74188E-04	5,2949E-04
O VI	536,3	3,10976E-03	2,8771E-03
S VI	390,2	6,35472E-04	5,84165E-04
F VI	410,7	2,0749E-03	1,99346E-03
S VI	251,6	6,38389E-04	5,91816E-04
O VI	3820	8,21037E-02	7,54622E-02
S VI	937,1	1,95227E-03	1,7701E-03
N VI	6596,3	1,92183E-01	1,83151E-01
F VI	4266	6,14176E-02	5,80484E-02
F VI	2320,1	1,65073E-02	1,55986E-02
Ne VI	2046,4	1,09673E-02	1,03272E-02
Na VI	1542,9	5,6939E-03	5,35056E-03
Si VI	1228,5	2,69469E-03	2,5229E-03
Si VI	1165,2	2,44565E-03	2,28783E-03
Si VI	1293,5	2,82755E-03	2,64605E-03
Si VI	1133,2	2,23238E-03	2,08896E-03
P VI	1108,8	1,97945E-03	1,85284E-03
Na VI	1422,8	4,11768E-03	3,88454E-03
Si VI	983,8	1,37328E-03	1,26451E-03
P VI	717	7,51296E-04	6,88369E-04
O VI	447,8	2,73435E-03	2,53319E-03

S VI	249,1	3,84228E-04	3,52749E-04
F VI	410,7	2,0749E-03	1,99346E-03
O VI	318,4	3,45125E-03	3,21396E-03
S VI	191,5	5,29184E-04	4,93607E-04
F VI	237,2	1,46871E-03	1,36246E-03
F VI	20128,8	6,47782E+00	6,25269E+00
S VI	1986,9	3,5875E-02	3,3184E-02
S VI	691,8	9,02378E-03	8,42867E-03
O VI	1172,1	4,28343E-02	3,98488E-02
S VI	974,2	1,2391E-02	1,15156E-02
O VI	1172,1	4,28343E-02	3,98488E-02
S VI	974,2	1,2391E-02	1,15156E-02
F VI	9843,5	1,48261E+00	1,41745E+00
S VI	2598,4	5,43478E-02	5,01684E-02
O VI	9362,9	1,69189E+00	1,57036E+00
O VI	986,3	3,61757E-02	3,34385E-02
S VI	628,2	6,29456E-03	5,88095E-03
S VI	4192,5	4,18947E-01	3,9314E-01
F VII	134,8	3,58347E-05	3,2458E-05
F VII	885,6	6,48754E-04	5,86232E-04
F VII	113	4,21543E-05	3,84764E-05
F VII	392	1,29238E-03	1,19186E-03
F VII	3257,4	4,94429E-02	4,52571E-02
F VII	335,2	1,29818E-03	1,19784E-03
F VII	855,8	1,7587E-02	1,63248E-02
F VII	7961,1	1,15883E+00	1,08795E+00
F VII	736,5	1,66232E-01	1,54333E-01
F VII	15703,5	9,23724E+00	8,58837E+00
Ne VI	138,6	2,26701E-05	2,13184E-05

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