Publ. Astron. Obs. Belgrade No. 60 (1998), 83 – 86 *Poster*

THE ELECTRON-IMPACT BROADENING PARAMETERS FOR Ti II LINES

D. TANKOSIĆ, L.Č. POPOVIĆ and M.S. DIMITRIJEVIĆ
Astronomical Observatory, Volgina 7, 11160 Belgrade-74, Yugoslavia
E-mail dtankosic@aob.aob.bg.ac.yu
E-mail lpopovic@aob.aob.bg.ac.yu
E-mail mdimitrijevic@aob.aob.bg.ac.yu

Abstract. Here we present the electron-impact broadening parameters for Ti II lines. Calculation was performed by using the modified semiempirical approach.

1. INTRODUCTION

In order to provide to astrophysicists and physicists the needed electron-impact broadening parameters, a large set of such data, obtained by using the semiclassical perturbation formalism (see e.g. Dimitrijević *et al.* 1991) and the modified semiempirical approach (Dimitrijević and Konjević 1980, for emitters with complex spectra see also Popović and Dimitrijević 1996, 1997), has been created (see Dimitrijević 1996 and references therein). Here we present our results for Ti II lines. The calculations were performed by using the modified semiempirical approach.

2. RESULTS AND DISCUSSION

Energy levels for Ti II were taken from Wiese and Musgrove (1989). Oscillator strengths have been calculated by using Bates and Damgaard (1949) method. Here we present only Stark widths and shifts for the most intensive lines from $a^4F - z^4G^0$ and $a^4F - z^4F^0$ multiplets. The Stark widths (w_x) of other lines from these multiplets may by calculated as

$$w_x = w_l(\frac{\lambda_x}{\lambda_l})^2 \qquad (1)$$

with error bars of $\pm 30\%$. In Eq (1) w_l is the given Stark width and λ_l is the wavelength for the corresponding transition, while λ_x is the wavelength for the spectral line with width w_x. Besides the calculation with oscillator strengths within the Bates-Damgaard approximation, we performed as well, the same calculations by using different, calculated (Morton 1991) and measured (Danzmann and Kock 1980 and Blackwell *et al.* 1982, critically selected by Wiese and Musgrove 1989; Roberts *et al.* 1974) oscillator strengths, in order to analyze the influence of the different oscillator strengths values to electron-impact broadening parameters. The results of our investigation are

presented in Figs. 1 and 2. As we can see in Figs. 1 and 2 the differences between results obtained with the oscillator strengths from different sources give discrepancy between calculated Stark widths within the error bars of the MSE method in the case of $a^4F_{9/2} - z^4F^0_{9/2}$, while for the transition $a^4F_{3/2} - z^4G^0_{5/2}$ the Stark widths calculated within the Bates-Damgaard approximation are significantly smaller than those calculated with oscillator strengths from Morton (1991) and experimental oscillator strengths. Complete results of our calculations will be published elsewhere (Tankosić *et al.* 1998).

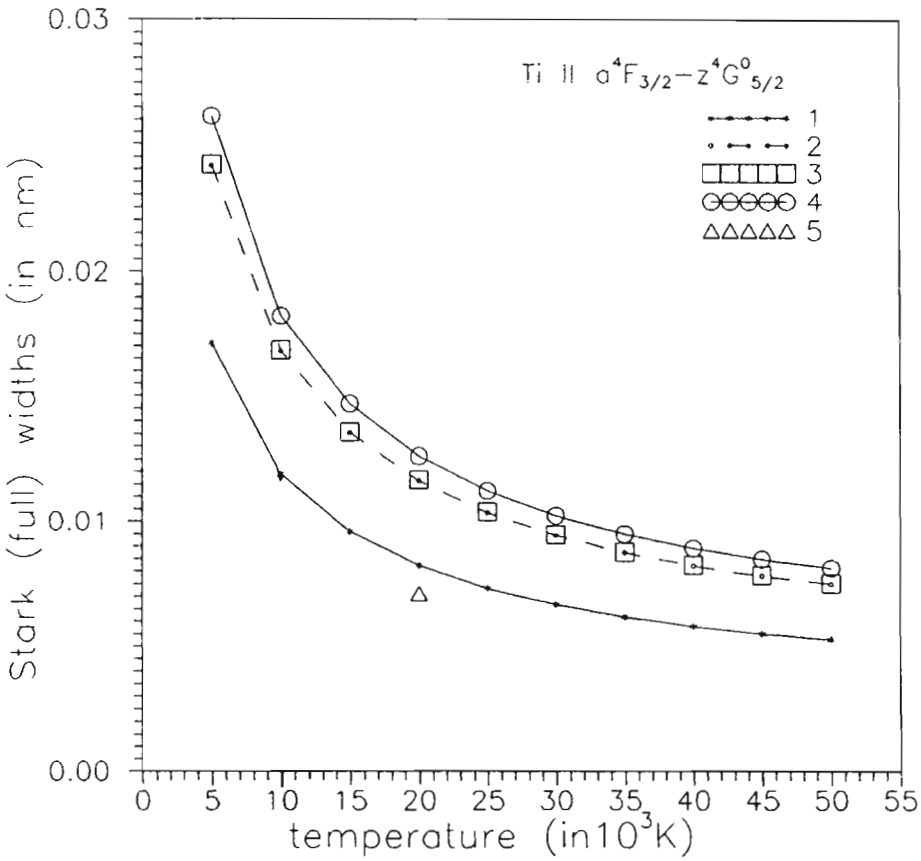

Fig. 1. Stark full width for Ti II $a^4F_{3/2} - z^4G^0_{5/2}$ (λ =338.47 nm) line as a function of temperature at an electron density of 10^{23}m^{-3}. Used notation: Results with- **1.**- oscillator strengths calculated by using the Bates-Damgaard method; **2.**- oscillator strengths given by Danzmann and Kock (1980) and Blackwell *et al.* (1982), critically selected by Wiese and Musgrove (1989); **3.**- oscillator strengths given by Roberts *et al.* (1974); **4.**- oscillator strengths given by Morton (1991). **5.**- The estimated Strak width on the basis of regularities and systematic trends given by Lakićević (1983)

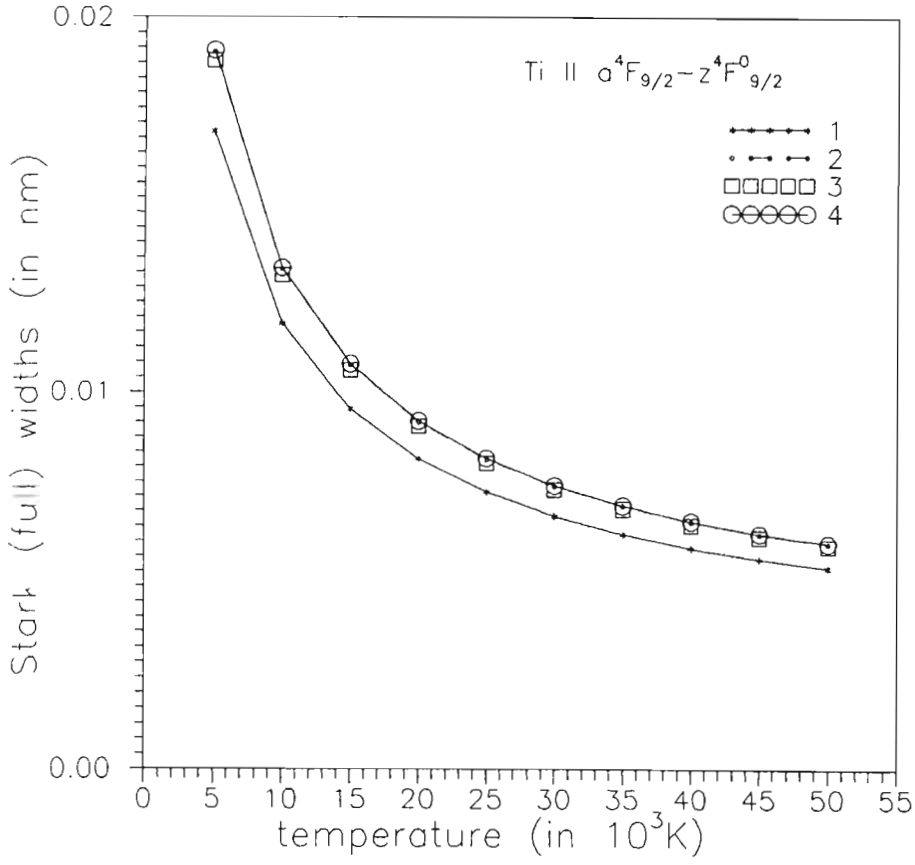

Fig. 2. Stark full width for Ti II $a^4F_{9/2} - z^4F^0_{9/2}$ (λ =323.55 nm) line as a function of temperature at an electron density of 10^{23}m^{-3}. Used notation: Results with- **1.**- oscillator strengths calculated by using Bates-Damgaard method; **2.**- oscillator strengths given by Danzmann and Kock (1980) and Blackwell *et al.* (1982), critically selected by Wiese and Musgrove (1989); **3.**- oscillator strengths given by Roberts *et al.* (1974); **4.**- oscillator strengths given by Morton (1991)

Table 1. Stark width (FWHM) and shift of Ti II lines at an electron density of 10^{23}m^{-3} as a function of temperature. The oscillator strengths were calculated in Bates-Damgaard approximation (Bates-Damgaard 1949).

Transition	T (K)	W (nm)	d (nm)
	5000.	0.171E-01	-0.389E-02
	10000.	0.119E-01	-0.278E-02
$a^4F_{3/2} - z^4G^0_{5/2}$	20000.	0.822E-02	-0.201E-02
	30000.	0.666E-02	-0.169E-02
$\lambda = 338.47$ nm	40000.	0.580E-02	-0.149E-02
	50000.	0.528E-02	-0.138E-02

Table 1. continued

Transition	T (K)	W (nm)	d (nm)
	5000.	0.170E-01	-0.337E-02
	10000.	0.118E-01	-0.241E-02
$a^4F_{9/2} - z^4F^0_{9/2}$	20000.	0.817E-02	-0.174E-02
	30000.	0.662E-02	-0.145E-02
$\lambda = 323.55$ nm	40000.	0.577E-02	-0.127E-02
	50000.	0.525E-02	-0.117E-02

References

Bates, D.R., Damgaard, A.: 1949, *Phil. Trans. Roy. Soc. London*, Ser. A, **242**, 101.

Blackwell, D.E., Menon, S.L.R., Petford, A.D.: 1982, *Mon. Not. R. Astron. Soc.*, **201**, 603.

Danzmann, K., Kock, M.: 1980, *J. Phys.*, **B 13**, 2051.

Dimitrijević, M.S., Konjević, N.: 1980, *JQSRT*, **24**, 454.

Dimitrijević, M.S., Bommier, V., Sahal-Bréchot, S.: 1991 *Astron. Astrophys. Suppl. Series*, **89**, 581.

Dimitrijević, M.S.: 1996, *Zh. Priklad. Spektrosk.*, **63**, 810.

Lakićević, I.S.: 1983, *Astron. Astrophys.*, **127**, 37.

Morton, D.S.: 1991, *Astrophys. J. Suppl. Series*, **77**, 119.

Popović, L.Č., Dimitrijević, M.S.: 1996, *Physica Scripta*, **53**, 325.

Popović, L.Č., Dimitrijević, M.S.: 1997, in The Physics of Ionized Gases, (eds. B. Vujičić, S. Djurović, J. Purić, Institute of Physics, Faculty of Siences University of Novi Sad, Yugoslavia.

Roberts, J.R., Voigt, P.A., Czernichowski, A.: 1974, *Astrophys. J.*, **197**, 791.

Tankosić, D., Popović, L.Č., Dimitrijević, M.S.: 1998, to be published

Wiese, W.L., Musgrove, A.: 1989, *Atomic Data for Fuson*-Vol. IV: Spectroscopic Data for Titanium, Chromium and Nickel, Vol. 1 Titanium, F-23.