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STARK BROADENING MECHANISM IN ATMOSPHERES OF A, DA AND DB TYPE STARS

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Abstract. The influence of Stark broadening mechanism on Au II (λ=1740.48Å) and Ti II (λ= 3761.32Å) lines originating in layers of A, DA and DB type star atmospheres, have been considered.

1. INTRODUCTION

It was noted in several papers that Stark broadening mechanism is the main broadening mechanism in hot star atmosphere (see e.g. Dimitrijević 1989, Popović and Dimirtijević 1996a). Also, this mechanism may be important in the case of cooler stars as e.g. solar type stars (see Vince *et al.* 1985) especially in photospheric and subphotospheric layers.

It is very important to consider and to take into account the Stark broadening parameters in the case of the chemical abundance determination in the atmospheres of magnetic, CP stars and white dwarfs by using the atmosphere model method (see Hohlova 1994).

We have discussed here the importance of Stark broadening mechanism in stellar plasma with the help of Kurucz's (1979) model atmosphere of an A type star (T_{eff}=10000K, log$g$=4) and with models of DA (T_{eff}=10000K, log$g$=6) and DB (T_{eff}=15000K, log$g$=7) white dwarfs atmospheres (Wickramasinghe 1972).

2. RESULTS AND DISCUSSION

Considering that Au II (λ=1740.48Å) and Ti II (λ= 3761.32Å) lines have been used for gold and titanium abundance determination, respectively (for gold see e.g. Fuhrmann 1988, Adelman 1994, Wahlgren *et al.* 1995 and for titanium see e.g. Guthrie 1987, Boyarchuk and Savanov 1987), in CP stars, we have tested the influence of Stark mechanism on widths of these lines in layers of three hot star types.

We consider here Stark broadening mechanism with the help of an A-type (T_{eff}=10000 K, log$g$=4), DA(T_{eff}=10000K, log$g$=6) and DB (T_{eff}=15000K, log$g$=7) atmosphere models. Also, we use the Stark broadening parameters (Popović *et al.*

1998, Tankosić *et al.* 1998) calculated here, within the modified semiempirical approach (Dimitrijević and Konjević 1980, Popović and Dimitrijević 1996b).

The results of our investigation are presented in Figs. 1-3 and in Tables 1 and 2. As one can see from Fig. 1, for the case of hot A type star, Stark broadening mechanism is important for both considered lines. In photospheric layers the Stark broadening line width is one order of magnitude larger than thermal Doppler one. In higher layers of the stellar atmosphere (τ ≈-4) however,the thermal Doppler mechanism is more important.

As we can see from Figs. 2 an 3, in the case of white dwarfs atmospheres Stark broadening mechanism is important in all layers of atmospheres and in deeper atmosphere layers the Stark width is two or three orders of magnitude larger than thermal Doppler width. In Tables 1 and 2 the Stark and thermal Doppler widths for Au II (λ=1740.48 Å) and Ti II (λ=3761.32 Å) lines are shown as functions of optical depth, for an A-type star (T_{eff}=10000K, log$g$=4).

For all three considered atmosphere models Stark broadening effect for ivestigated lines should be taken into account in abundance determination.

Table 1. Thermal Doppler and Stark widths for Au II (λ=1740.48Å) line as a function of optical depth for an A type star (T_{eff}=10000K, log$g$=4).

tau	Stark FWHM[Å]	Thermal Doppler FWHM[Å]
-2.57851	0.786004E-05	0.145411E-03
-1.91422	0.286703E-04	0.149050E-03
-1.53557	0.653420E-04	0.152124E-03
-0.99829	0.356666E-02	0.355163E-03
-0.58649	0.935110E-03	0.196676E-03
-0.08239	0.210489E-02	0.223318E-03
0.09867	0.281302E-02	0.233914E-03

Table 2. Thermal Doppler and Stark widths for Ti II (λ=3761.32 Å) line as functions of optical depth for an A type star (T_{eff}=10000K, log$g$=4).

tau	Stark FWHM[Å]	Thermal Doppler FWHM[Å]
-2.57851	0.680424E-04	0.308503E-03
-1.91422	0.248070E-03	0.316223E-03
-1.53557	0.565113E-03	0.322746E-03
-0.99829	0.413068E-03	0.167404E-03
-0.58649	0.805063E-02	0.417266E-03
-0.08239	0.181118E-01	0.473791E-03
0.09867	0.241986E-01	0.496271E-03

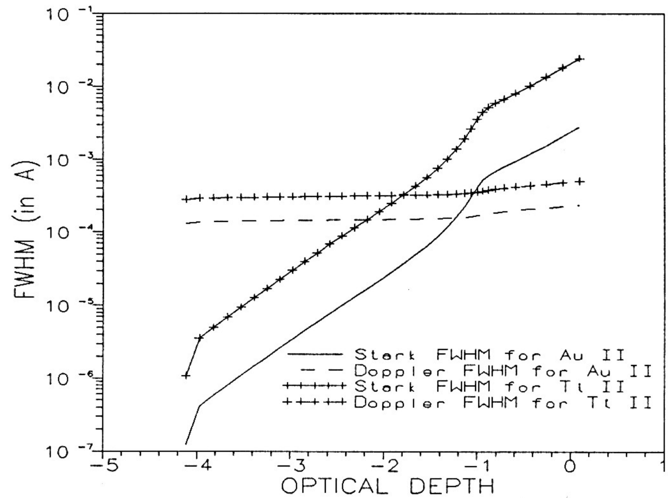

Fig. 1. Thermal Doppler and Stark widths for Au II (λ=1740.48 Å) and Ti II (λ=3761.32 Å) lines as functions of optical depth for an A type star (T_{eff}=10000K, log$g$=4).

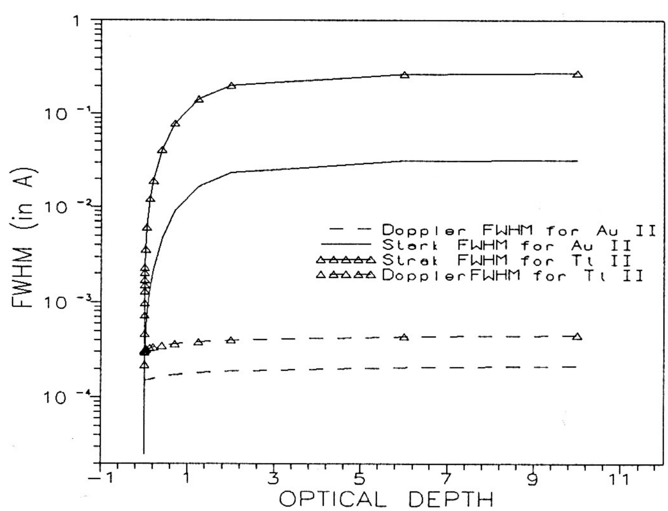

Fig. 2. Thermal Doppler and Stark widths for Au II (λ=1740.48 Å) and Ti II (λ=3761.32 Å) lines as functions of optical depth for DA (T_{eff}=10000K, log$g$=6) white dwarfs.

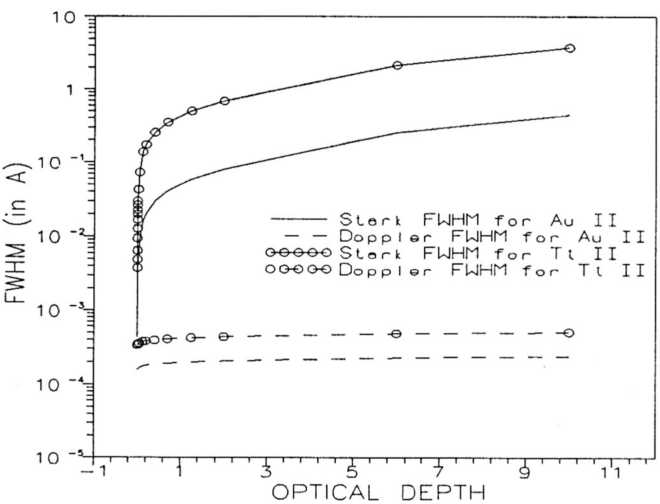

Fig. 3. Thermal Doppler and Stark widths for Au II (λ=1740.48 Å) and Ti II (λ=3761.32 Å) lines as functions of optical depth for DB (T_{eff}=15000K, log$g$=7) white dwarfs.

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