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On Stark broadening of Mn II lines in Ap-star conditions

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Abstract. Stark broadening parameters for six Mn II lines are determined semi-classically and used to analyse the influence of this broadening mechanism on A-type star spectral line profiles. Results for the Mn II line at 2950.1 Å are presented here as an example of the data obtained.

Key words: line: formation – line profiles – atomic data – stars: atmospheres.

1. Introduction

Stark broadening of ionised manganese lines is of interest for the analysis and modelling of stellar spectra of, for example, HgMn stars (Wahlgren, Hubrig 2004). We calculated Stark broadening parameters for six Mn II lines within semi-classical perturbation theory (Sahal-Bréchot, 1969 a) and used them for the analysis of the influence of Stark broadening on A-type star spectral line profiles. Here we present as an example results for the Mn II line at 2950.1 Å.

2. Results and discussion

The results were obtained within the semi-classical perturbation formalism, developed and discussed in detail in Sahal-Bréchot (1969 a, b), and all details of the calculations will be given in Popović *et al.* (2008).

In Table 1, electron-impact broadening parameters (full width at half maximum W and shift d) for the Mn II line at 2950.1 Å for a perturber density of $10^{17}\mathrm{cm}^{-3}$ and temperatures from 5000 to 100 000 K, are given.

The results obtained are used to compare the thermal Doppler and Stark widths of the Mn II spectral line $\mathrm{a}^5\mathrm{S}$–$\mathrm{z}^5\mathrm{P}^o$ 2950.1 Å as a function of the Rosseland optical depth for a Kurucz (1979) model of an A star with $T_{\mathrm{eff}} = 10\,000$ K, $\log g = 4.5$. As one can see, Stark broadening may be of interest in deep subphotospheric layers. One should take into account that even when Stark width is smaller, this effect might be important in the far line wings.

Table 1. Electron-impact broadening parameters (full width at half maximum W and shift d in Å). The first set of values is calculated including the estimated maximal contribution of forbidden transitions. The second set of values, denoted by ($'$), is calculated taking into account only dipole-allowed transitions.

Transition	T[K]	W_e [Å]	d_e [Å]	$W_\mathrm{e}^{'}$ [Å]	$d_\mathrm{e}^{'}$ [Å]
	5 000	0.226	-0.394E-01	0.176	-0.653E-03
	10 000	0.165	-0.302E-01	0.130	-0.253E-02
a ^{5}S - z ^{5}P^o	20 000	0.121	-0.234E-01	0.969E-01	-0.258E-02
2950.1 Å	30 000	0.102	-0.193E-01	0.830E-01	-0.209E-02
	50 000	0.884E-01	-0.168E-01	0.713E-01	-0.282E-02
	100 000	0.800E-01	-0.137E-01	0.619E-01	-0.257E-02

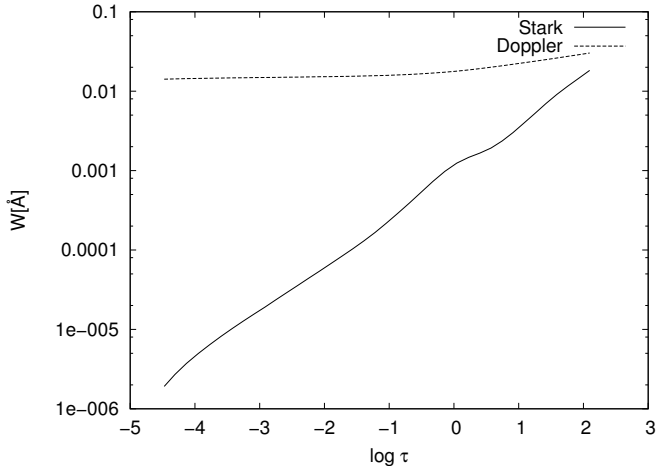

Figure 1. The thermal Doppler and Stark widths for the Mn II spectral line a^{5}S–z^{5}P^o 2950.1 Å as a function of Rosseland optical depth, $T_\mathrm{eff} = 10\,000$, $\log g = 4.5$.

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