

STARK BROADENING OF HEAVY METAL SPECTRAL LINES IN ATMOSPHERES OF CHEMICALLY PECULIAR STARS

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Abstract. Data on the Stark broadening of heavy metal spectral lines are of interest not only for laboratory but also for astrophysical plasma research as e.g. for stellar spectra analysis and synthesis. Here, we investigated theoretically the influence of collisions with charged particles on heavy metal spectral line profiles for Te I, Cr II, Mn II, Au II, Cu III, Zn III, Se III, In III and Sn III in spectra of A stars and white dwarfs. We applied semiclassical theory of Sahal-Bréchet since the most of published results in literature until now are determined using this method. When it can not be applied in an adequate way, due to the lack of reliable atomic data, we used modified semiempirical theory of Dimitrijević & Konjević, Dimitrijević & Kršljanin.

Stark broadening parameters, widths and shifts, were obtained for spectral lines of neutral emitter Te I, singly charged emitters Cr II, Mn II and Au II and doubly charged emitters Cu III, Zn III, Se III, In III and Sn III.

We considered as well the contributions of different collision processes to the total Stark width in comparison with Doppler one. In this case we obtained distributions for elastic, strong, inelastic collisions from upper and lower levels.

For example, chromium lines are interesting due to their presence in stellar atmospheres, so that they give possibility to determine chromium abundance and investigate chromium stratification in stellar atmospheres and to be used for the diagnostics of stellar plasma and for more refined synthesis of stellar spectra. We consider the effect of Stark broadening on the shapes of Cr II spectral lines observed in the spectra of stars in the middle part of the main sequence. Stark broadening parameters were calculated by the semiclassical perturbation approach. For stellar spectra synthesis, the improved version SYNTH3 of the code SYNTH for synthetic spectrum calculations was used. Stark broadening parameters for Cr II spectral lines of seven multiplets belonging to 4s-4p transitions were calculated. New calculated Stark parameters were applied to the analysis of Cr II line profiles observed in the spectrum of Cr-rich star HD 133792. We found that Stark broadening mechanism is very important and should be taken into account, especially in the study of Cr abundance stratification.