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INFLUENCE OF COLLISIONS WITH CHARGED PARTICLES ON HEAVY METAL SPECTRAL LINE PROFILES IN SPECTRA OF A STARS AND WHITE DWARFS

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Abstract. The significance of trace element spectral data, including Stark broadening parameters, increases with the development of space-born spectroscopy. 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. In this work semiclassical theory (Sahal-Bréchot 1969ab) was applied particularly 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, modified semiempirical theory (Dimitrijević and Konjević 1980, Dimitrijević and Kršljanin 1986) was used.

Here, we obtained Stark broadening parameters, widths and shifts, 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. In the case with the available experimental and other theoretical data for the considered spectral lines we analized an agreement or a disagreement with our theoretical results. Also, here we considered the contributions of different collision processes to the total Stark width in comparison with the Doppler one.

We consider the effect of Stark broadening on the shapes of CrII spectral lines observed in stellar atmospheres of 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.

The Stark broadening parameters obtained here, contribute also to the creation of a set of such data for as large as possible number of spectral lines, of significance for a number of problems in astrophysical, laboratory and technological plasma research.