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Poster paper

ON THE INFLURENCE OF STARK BROADENING OF Cr I LINES IN THE Cr-RICH Ap STAR β CrB ATMOSPHERES

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Chromium is one of the most anomalous elements in Ap stars. It was shown to be concentrated in the deeper atmospheric layers in Ap stars β CrB and in γ Equ, where electron density is high enough to favor the Stark broadening mechanism, the most significant pressure broadening mechanism for A and B stars. Most Cr I, and Cr II, lines in the optical spectral region have rather small Stark damping constants so no measurable Stark wings appeared. However, Cr I, lines from $4p - 4d$ transitions are known to have fairly large Stark damping constants according to calculations made by Kurucz.

We present here new calculations of Cr I Stark line widths and shifts based on the semi-classical perturbation approach of Sylvie Sahal-Bréchot. Electron-, proton-, and ionized helium-impact line widths and shifts for nine Cr I spectral lines from the $4p^7P^0 - 4d^7D$ multiplet, were calculated for a perturber density of 10^{14} cm^{-3} and for temperatures T = 2,500 − 50,000 K.

The results were used to investigate the influence of Stark broadening effect on Cr I line shapes in the atmosphere of the Cr-rich Ap star β CrB. In spite of the rather large Stark damping constants, the effect is not observable in stars with solar Cr abundance. In hot stars where electron and proton densities are high, the Cr I, lines considered here are generally very weak, while in cooler stars (solar type) other broadening effects are more significant where these lines are strong enough. The only chance to look at Stark effect is in stratified atmosphere of a Cr-rich Ap star, such as the well known magnetic star β CrB.

Our analysis of the Cr-rich Ap star β CrB line shapes was based on its spectrum obtained in February 1998 with the MuSiCoS spectropolarimeter mounted on the 2 m telescope at Pic du Midi observatory (R=35000).It was found (Dimitrijević et al, 2005) that the contribution of proton and He ii collisions to the line width and shift is significant and comparable, and is sometimes even larger than electron-impact contribution depending of the electron temperature. Moreover, not only the Stark line width, but also the Stark shift may contribute to the blue as well as to the red asymmetry of the same line depending on the electron-, proton-, and He ii density in stellar atmosphere. The results were used to investigate the influence of Stark broadening effect on Cr i line shapes in the atmosphere of the Cr-rich Ap star β CrB.

References

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