Contrib. Astron. Obs. Skalnaté Pleso **38**, 401 – 402, (2008)

Electron-impact broadening of ionized chromium lines for Ap star atmospheres analysis

M.S. Dimitrijević[1], T. Ryabchikova[2,3], Z. Simić[1], L.Č. Popović[1] and M. Dačić[1]

[1] *Astronomical Observatory, Volgina 7, 11160 Belgrade, Serbia (E-mail: mdimitrijevic@aob.bg.ac.yu)*

[2] *Institute of Astronomy, Russian Academy of Science, Pyatnitskaya 48, 119017 Moscow, Russia*

[3] *Institute for Astronomy, University of Vienna, Türkenschanzstrasse 17, A-1180 Vienna, Austria*

Received: January 10, 2008; Accepted: February 12, 2008

Abstract. The influence of Stark broadening on the shapes of Cr II spectral lines observed in stellar atmospheres is considered.

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

1. Introduction

Chromium is one of the most peculiar elements in the atmospheres of magnetic chemically peculiar stars. In order to provide the atomic data required to calculate lines profiles of this element, we have calculated Stark widths and shifts for the strongest Cr II multiplets. The calculations were performed within the semi-classical perturbation formalism after Sahal-Bréchot (1969 a, b). Our results for seven Cr II multiplets are shown in Table 1 of Dimitrijević *et al.* (2007). The results obtained are used to analyze the contribution of Stark broadening in CP star spectra, and here an example of the analysis of Dimitrijević *et al.* (2007) is given.

2. Results and discussion

It is not possible to check Stark damping constants using the spectra of the normal stars. No Cr II lines in the entire optical region are sufficiently strong to show substantial Stark wings in hotter stars, while in cooler stars (the Sun for example) the van der Waals effect is absolutely dominant. Therefore we can investigate the Stark broadening effect only in the spectra of chemically peculiar (Ap) stars.

As an example we chose the Ap star HD 133792, with $T_{\rm eff}$ = 9400 K, $\log g$ = 3.7, and a mean Cr overabundance of +2.6 dex relative to the Sun. We used a spectrum retrieved through the ESO archive, and all calculations

were carried out with the SYNTH3 code (Kochukov, 2006) for synthetic spectrum determinations. All details of the calculations are given by Dimitrijević *et al.* (2007).

A good agreement between observations and calculations for weak Cr II lines demonstrates the existence of a stratified Cr distribution, while four strong Cr II lines demonstrate a good accuracy of the Stark constants obtained in the present work. Figure 1 shows a comparison between the observed line profiles of three Cr II lines and our synthetic calculations.

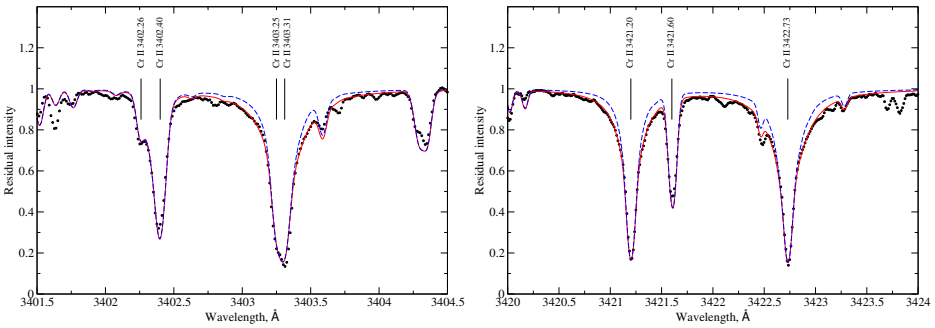

Figure 1. Comparison between the observed Cr II 3403.30 (**left**) and 3421.20, 3422.73 Å (**right**) line profiles (dots) and synthetic calculations with the Stark parameters from the present paper (full line) and those from Kurucz (1993) (dashed line).

We may conclude also that the line wings of Cr II lines in spectra of Ap stars are caused by the Stark-broadening mechanism.

In the end, we note that new Stark parameters are particularly important for the study of Cr stratification in Ap stars in the $9000 - 10\,000$ K temperature range, where this stratification may be obtained only from a careful study of the line profiles of multiplet 3 Cr II lines, whose Stark broadening parameters are analyzed here and shown by Dimitrijević *et al.* (2007).

References

Dimitrijević, M.S., Ryabchikova, T., Simić, Z., Popović, L.Č., Dačić, M.: 2007, *Astron. Astrophys.* **469**, 681

Kochukhov, O.: 2006, in *Physics of Magnetic Stars*, eds.: I.I. Romanyuk and D.O. Kudryavtsev, Special Astrophys. Obs. RAS, Nizhnij Arkhyz, 61

Kurucz, R.L.: 1993, *CD-ROM* 13, 22, 23, SAO, Cambridge

Sahal-Bréchot, S.: 1969 a, *Astron. Astrophys.* **1**, 9

Sahal-Bréchot, S.: 1969 b, *Astron. Astrophys.* **2**, 322