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THE IMPORTANCE OF ELECTRON-IMPACT BROADENING IN HOT STAR ATMOSPHERES: THE CASE OF Zr II AND Zr III LINES

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In the atmospheres of early-type stars the main pressure broadening mechanism of spectral lines is the electron-impact broadening (Popović et al. 1999). Abundance anomalies are present in 10–20% of A- and B-type stars (so-called CP stars). Zirconium is usually overabundant in HgMn star atmospheres. HgMn star χ Lupi is characterized by the so-called "zirconium conflict", i.e. the fact that the zirconium abundance determination from Zr II lines is different than from Zr III lines (Sikström et al. 1999).

Using the Modified Semiempirical Method (MSE, Dimitrijević & Konjević 1980, Dimitrijević & Kršljanin 1986) we have calculated Stark broadening widths of two Zr II and two Zr III spectral lines. We calculated Stark widths of Zr II 232.47 nm, Zr II 193.85 nm, Zr III 194.105 nm and Zr III 194.023 nm spectral lines. We have synthesized the line profiles using the SYNTH code (Piskunov 1992) and ATLAS9 program (Kurucz 1993) for a stellar atmosphere which is similar to the atmosphere of χ Lupi (Leckrone 1999). In Table 1 the ratios of equivalent widths (EW) with and without Stark broadening effect as a function of abundance are given.

Table 1. The ratio of EWs for two Zr II and two Zr III spectral lines calculated with Stark broadening effect (EW_{st}) and without it (EW_0) as a function of zirconium abundance.

$\log (N_{Zr}/N_H)$ λ (nm) =	Zr II 232.47	Zr II 138.85	Zr III 194.023	Zr III 194.105
−6.0	1.062	1.073	1.172	1.211
−6.5	1.032	1.038	1.099	1.136
−7.0	1.017	1.019	1.049	1.073
−7.5	1.009	1.010	1.023	1.035

As one can see from Table 1, the Stark broadening effect is more important for higher zirconium abundance. The EW increases with abundance in all considered cases, but EW for Zr III is more sensitive to the zirconium abundance change than for Zr II lines. It may cause the errors of about 20% in zirconium abundance determination (Popović et al. 2000).

REFERENCES

Dimitrijević M. S., Konjević N. 1980, JQSRT, 24, 541

Dimitrijević M. S., Kršljanin V. 1986, A&A, 165, 269

Kurucz R. L. 1993, *Model Atmosphere Program ATLAS9*, published on CDROM13

Leckrone D. S., Proffitt C. R., Wahlgren G. M., Johansson S. G., Brege T. 1999, AJ, 115, 1454

Piskunov N.E. 1992, in *Stellar Magnetism*, eds. Yu. V. Glagolevskij & I. I. Romanyuk, Nauka Publishers, St. Petersburg, p. 92

Popović L.Č., Dimitrijević M. S., Ryabchikova T. 1999, A&A, 350, 719

Popović L.Č., Milovanović N., Dimitrijević M. S. 2000, A&AS, accepted

Sikström C.M., Lundberg H., Wahlgren G. M., Li Y. S., Lyngå C., Johansson S., Leckrone D. S. 1999, A&A, 343, 297