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Synthetic spectra of CP stars compared with UVES spectra

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Abstract. Results from spectral analyses of some HgMn stars observed with UVES at high resolution and high S/N are available on-line in the form of plots showing superimposed observed and LTE-computed spectra. The material is available on line at http://wwwuser.oat.ts.astro.it/castelli/stars.html. The ranges studied are divided into 6 Å wide intervals. The plots have identifications, excitation potential of the lower level, and predicted line intensities written above the lines. Complete analyses covering the 3050-9500 Å region have been performed for two stars, HD 175640 and HR 6000. The on-line plots show the quality of the agreement between observations and computations and can be used as a template for other stars of the same spectral type. For instance, HD 175640 and HR 6000 are excellent examples of a very overabundant Mn ([+2.4]) star and of a very overabundant Fe ([+0.7]) star, respectively.
Key words: stars: abundances – stars: chemically peculiar

1. Introduction

The high-resolution and the high S/N ratio of the ESO-UVES spectra make them an excellent tool for studies of the peculiarities and chemical compositions of the observed stars. The very large spectral range covered by the instrument allows us to extend previous studies to spectral regions scarcely explored before, as those shortward of the Balmer discontinuity and longward of H_α.

Usually, a lot of information from the UVES spectra is lost because either equivalent widths of a selected sample of lines or short spectral ranges including specific profiles are discussed in the papers. Instead, the inspection of the whole UVES spectrum may lead to new results as in the case of the HgMn star HD 175640 which has lead us to note for the first time the small wavelength red-shift (0.2 Å) of the Ca II infrared triplet that we interpreted as due to an anomalous Ca isotopic composition (Castelli, Hubrig 2004 a). In the case of the CP star HR 6000 (Castelli, Hubrig 2007) we discovered new Fe II multiplets, never observed in the laboratory, which involve upper excitation levels near or even higher than the ionization limit (Johansson, 2007; Castelli *et al.*, 2007). Also emission lines were discovered for the first time in both stars.

To better explain our results and to make available all the possible information that can be extracted from the stellar spectra we started a project putting

on-line[1] all the comparisons between the observed and computed spectra produced in the course of our stellar analyses.

2. The spectra

The observed UVES spectra were reduced with the UVES pipeline Data Reduction Software and using standard IRAF routines.

The synthetic spectra were obtained from the SYNTHE procedure (Kurucz, 1993). Input models are ATLAS12 models computed for the individual stellar abundances. The line lists taken from the Kurucz database[2] were implemented by us as described in Castelli and Hubrig (2004 b, both paper and electronic Appendix). In particular, we replaced several log gf's of C I, C II, N I, O I, Si II, Ti II, Cr II, Hg I, Hg II with more up-to-date determinations found in the literature, we added missing lines of Ga II, Br II, Xe II, Ce III, Pr III, Nd III, Yb III, Pt II, and Au II, we added Stark broadening parameters of Si II, and we added hyperfine and isotopic components of Mn II, Ga II, Ba II, Pt II, Hg I, and Hg II. For Fe II, we are going to replace numerous log gf's from Kurucz (2005) with those from Kurucz (2007). For the optical region we also replaced the Fe I and Fe II log gf's from Fuhr *et al.* (1988) with the new critical compliation from Fuhr and Wiese (2006). The line lists, which we continually upgrade, are available on-line[3].

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