Determination of atmosphere parameters of K giants

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Abstract

The determination of the atmosphere parameters of stars is one of important problems of modern astrophysics. One of the most accurate methods is model atmosphere method, ie. the computation of the theoretical (synthetic) spectrum using suitable model atmosphere.

The synthetic spectrum is computed using the model atmosphere, i.e. the dependence of the important physical parameters (density, temperature, electron density, eventually occupation of the most important energy levels of atoms and ions) on the atmosphere depth. The most appropriate program for the calculation of model atmosphere of late type K giants is Kurucz's program ATLAS9 (Kurucz 1992; 1993). One of its advantages is involving of large number of opacity sources, more than 58 million line transitions, which is important for cool stars.

The program SYNSPEC36 (Hubený, Lanz 1995) computes the synthetic spectrum from the model atmosphere in the given wavelength interval. Accurate values of constants describing each line (mainly wavelengths, oscillator strengths, energy levels and damping parameters) are necessary to obtain a good fit of the observed spectrum. That is why we utilized the internet VALD database (Piskunov et all 1995).

The computation of atmosphere parameters of stars (i.e. effective temperature, surface gravity and chemical composition) is minimalisation of the differences between observed and synthetic spectrum by changing of the atmosphere parameters. For an example of the minimalisation results for star α Ari see fig. 1.

The method was discussed and first results for four K giants were given in the proceedings of the Czech and Slovak conference (Krtička 1998) and in the European journal in the paper (Krtička, Štefl 1999). These results were included in the diploma thesis (Krtička 1998) too. Moreover, we have calculated atmosphere parameters of 117 K giants and paper is now prepared (Krtička, Štefl 1999).

The computation of the model atmosphere and the synthetic spectrum is computer time consuming task. Consequently, an minimalisation used to match the observed spectra is highly exacting also. Moreover, a huge amount of the dates (characterizing atomic and molecular lines) for such a computation are necessary. We acknowledge the Brno Supercomputing Center for kindly provided computer time and disk space, which enabled such an extensive computation.

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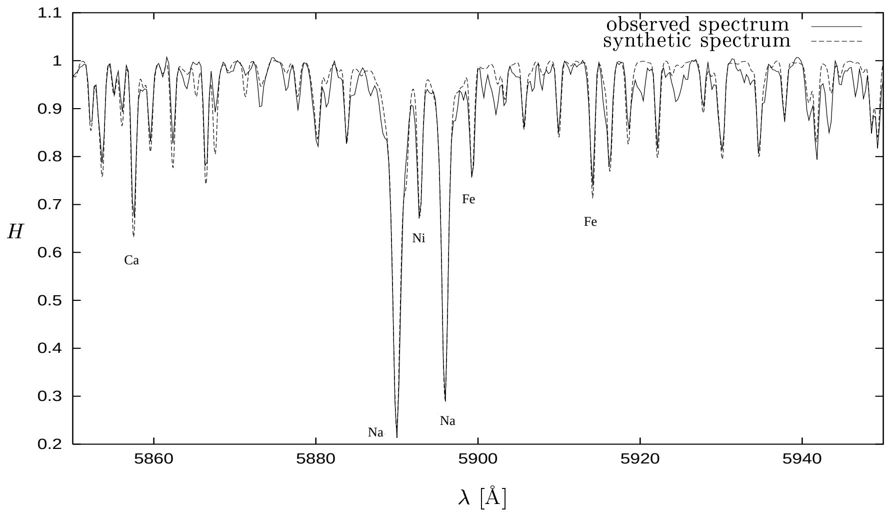

Figure 1: Comparison of the observed (solid line) an synthetic (dashed line) spectra of α Ari in the region of well-known sodium doublet. The graph shows the dependence of the relative flux H (y-axis) on the wavelength (x-axis). Selected lines are identified. From Krtička, Štefl (1999).

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