IRON ABUNDANCES IN THE ATMOSPHERES OF HD10700 & HD146233

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ABSTRACT. There are many different means to determine physical parameters of stars and their abundances by spectral analysis. In our work we draw our attention to the rotational and microturbulence velocities as well as metallicities for the stars of known effective temperature and surface gravity. We carried fits of LTE synthetic spectra to the observed spectra of HD10700 and HD146233. THese stars are knows aa solar-twins except slightly higher rotational velocities in both cases and higher magnetical activity i of HD10700. We adopted ABEL software (Pavlenko Ya.V.) to fit to HD10700, HD146233 spectra obtained on Camino Observatory, Chilie. Selected stars looks like. We compare our results with previous work of Valenti & Fischer (2005).

Key words: solar-type stars, properties, abundances;

1. Introduction

The majority of spectral research begins with effective temperature and surface gravity determinations, which are based on data of photometry and astrometry. Having defined these values usual analysis continues with solving Radiation Transfer Equation for selected number of elements in order to match equivalent widthes and/or profiles of spectral lines (Pavlenko 2003). Our approach assumes direct fits to observed spectra instead of equivalent width measuring. Along with iron abundances determination we used our technique to determine microturbulence and rotational velocity.

2. Observational Spectra

Our stars are similar to the Sun. One is G8 type and another is F8. We may see their basic parameters in table below.

Name	Sp Class	T_{eff} (Model)	Log g	[Fe/H]
HD10700	G8V	5513 348 (5283)	4.59	-0.5
HD146233	F8V	6074 470 (5791)	4.41	0.0

Spectroscopic observations (R=46000) and maintenance data were obtained using Fibred Extended Range Optical Spectrograph (FEROS) installed on 2.2m Max-Planck Telescope at the European Southern Observatory (La Silla site in Chile). The exposure time was about 120-480 seconds. Each observing night commenced with collecting collateral data for further spectra reduction, i.e. flat-fields, bias, arc frames, in accordance with the standard ESO calibration plan, see Jenkins et. al. (2008).

3. Synthetic Spectrum

Plane-parallel LTE model atmospheres with 1D convection mixing and no energy divergence were computed using SAM12 program (Pavlenko 2003) which is based on ATLAS12 (Kurucz 1999). Opacities calculations are based on Sneden et al. (1976) approach. VALD2 line list (Kupka et.al. 1999) was used for our synthetic spectra computations. For absorption line profile we adopted Voigt function.

All synthetic spectra were computed with step

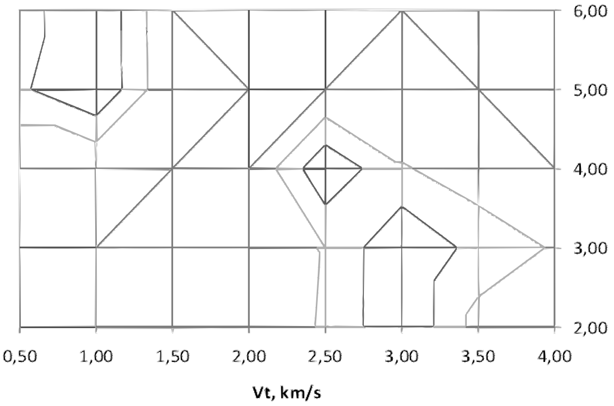
$$\Delta\lambda = 0.025\mathring{A}$$

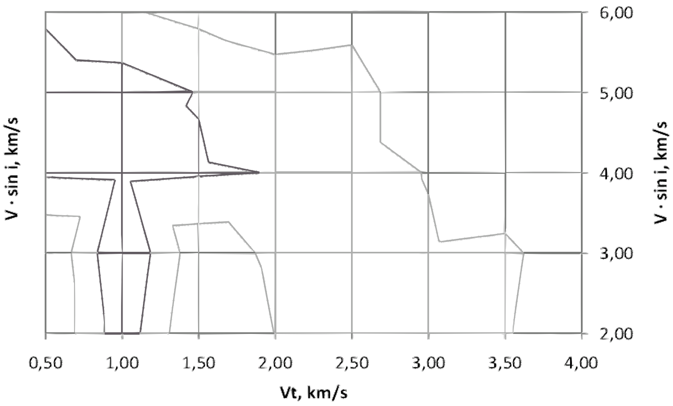
using WITA6 and ABEL8 programs (Pavlenko 2003). We carried out the set of semi-automatic fits to observed spectra for a grid of adopted V sin i, Vt values and Fe I/Fe II abundances.

Quality of our fits characterizes by function of projected rotational velocity (v_i), microturbulence (v_t) and normalization factor (n):

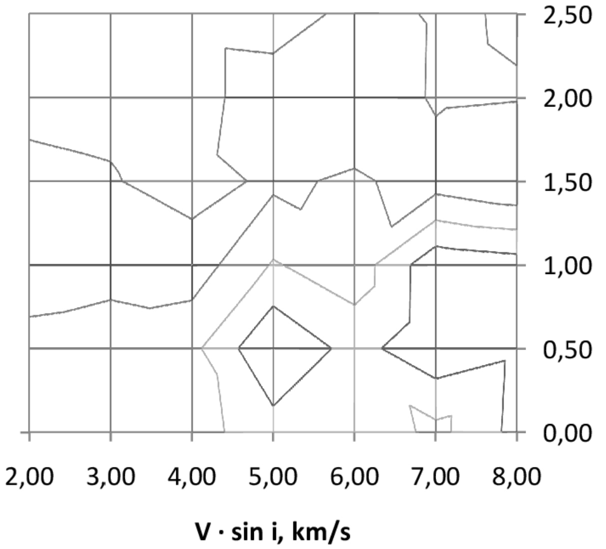
$$S(f_{v_i}, f_n, f_{v_t}) = \sum_{\nu} (F_\nu - (F_\nu^x)^2$$

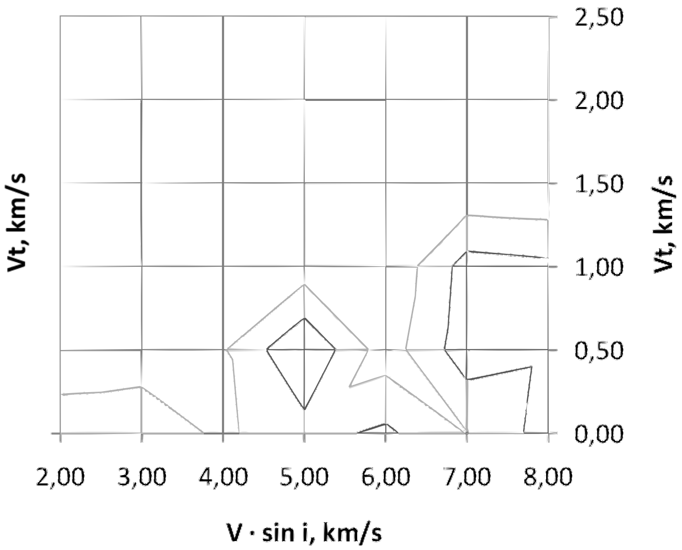
Each combination of n, v_i, v_t and [Fe/H] gives us



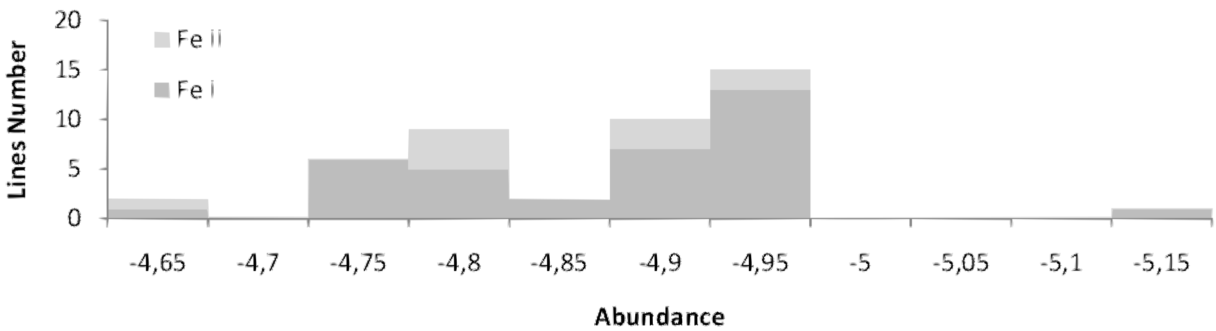


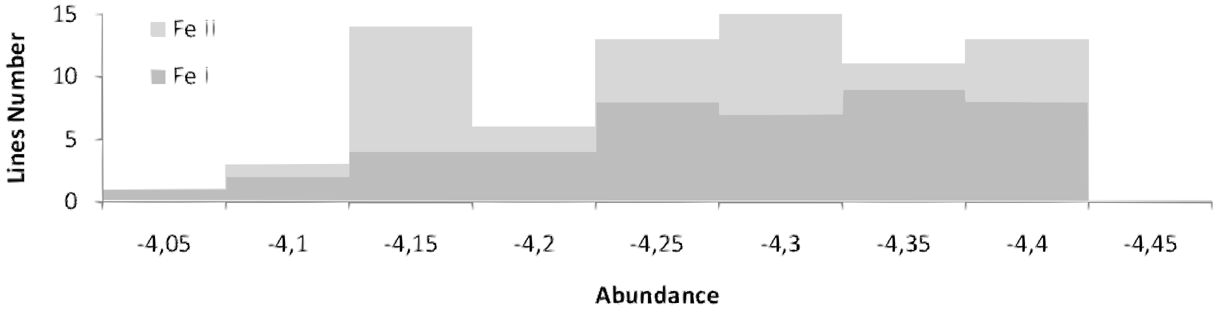
Figures 1 and 2. HD10700. Dependence of S values on rotational velocity and microturbulence velocity. Minimum of S corresponds to V_t=1.0km/s and V sin i=5.0 km/s for both Fe I and Fe II lines.





Figures 3 and 4. HD146233. Dependence of S values on rotational velocity along with microturbulence velocity. Minimum of S corresponds to V_t=0.5km/s and V sin i=5.0 km/s for both Fe I and Fe II lines





Figures 5 and 6. Histograms show number of lines that indicate log N(Fe) for HD10700 and HD146233 respectively.

more or less good fit to observational spectra. The best fit characterizes by minimum of S.

It is important to note that we did not account lines that weaker than average noise level, in our case it is about 3%. Also were excluded lines that fit worse than on 30%. In most cases it is induced by blends in observed spectra and by mistakes in line lists.

4. Results & Conclusions

Results represent abundances for metal-deficient star HD10700 and star-like HD146233 in comparison with previous work (Valenti 2005). Contour surface below shows S distribution for different sets of v_i and v_t. The point of minimum indicates most appropriate values of projected rotational velocity and microturbulence.

Our analysis was done for neutral and one-time ionized Iron to verify log g of our model atmosphere. Histograms below show how many lines give us that or another log N(Fe) for selected star.

As we can see from the table our results in a good agreement with Valenti and Fischer work with only discrepancy in determined V sin i values, which can be explained by different sets of examined lines.

HD10700	Our Result	Valenti & Fischer
V_t	1.0 km/s	0.85 km/s (fixed)
V sin i	5.0 km/s	2.0 km/s
Fe/H	-0.5 dex	-0.52 dex

HD146233	Our Result	Valenti & Fischer
V_t	0.5 km/s	0.85 km/s (fixed)
V sin i	5.0 km/s	2.6 km/s
Fe/H	0.1 dex	0.03 dex

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