INVESTIGATION OF THE ATMOSPHERE OF HR8334 (ν CEP, A2IA) STAR

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The atmosphere of the HR8334 (ν Cep, A2Ia) star is studied by the atmosphere model. The effective temperature Teff of the star and the surface gravity g are determined by comparing the observational and theoretical estimates of equivalents widths W the Balmer lines Hβ, Hγ , Hδ and [c1],Q photometric indexes : Teff = 9200$\pm$200K, logg = 1.4 $\pm$ 0.2. Based on FeII lines the microturbulent velocity is determined: ξt = 6km/sec. In the atmosphere of the star the iron abundances are calculated and compared with the abundance in the Sun. The iron abundances are determined by the comparison of measured from observation and theoretically calculated values of equivalent width FeII lines. The iron abundance is close to the abundance in the Sun: logϵ (FeII) = 7.54

Keywords: fundamental parameters - stars; chemical composition - stars; individual-HR8334 (ν Cep, A2Ia) .

1. INTRODUCTION

In this work the atmosphere of the HR8334(A2Ia) star is studied by the atmosphere model. The effective temperature Teff of the star, the surface gravity g in the atmosphere, the microturbulent velocity ξt, iron and carbon abundances are determined.

The observation material of the star was obtained from the Kasseqren focus of the 2m telescope ShAO, with the CCD (R=5600,S/N>150). The equivalent width of the spectral lines was measured.

2. ATMOSPHERE PARAMETERS: EFFECTIVE TEMPERATURE, SURFACE GRAVITY

The effective temperature and the surface gravity of the star is determined by model method. The following criteria have been used:

1. Comparison of the measured from observation and theoretically calculated values of the equivalents widths W the Balmer lines Hβ, Hγ , Hδ;

2. Comparison of the measured from observation and theoretically calculated values of the [c1] index;

3. Comparison of the measured from observation and theoretically calculated values of the Q index.

In the uvbyβ photometric system the index [c1] is determined by the expression [c1] = c1 - 0.2(b - y). In the UBV photometric system the Q is determined by the expression Q = (U - B) - 0.72(B - V). The parameters [c1] , β, Q are exempt from the effects of the interstellar space. The observing values of these parameters are determined from catalog [1] (Hauck & Mermilliod 1998). For calculation of the theoretical values of the parameters [c1] , Q the work (Castelli et al. 2003) are used [2]. The logg - Teff diagram is constructed on the base of above mentioned criteria (Figure 1). From this diagram the star's parameters

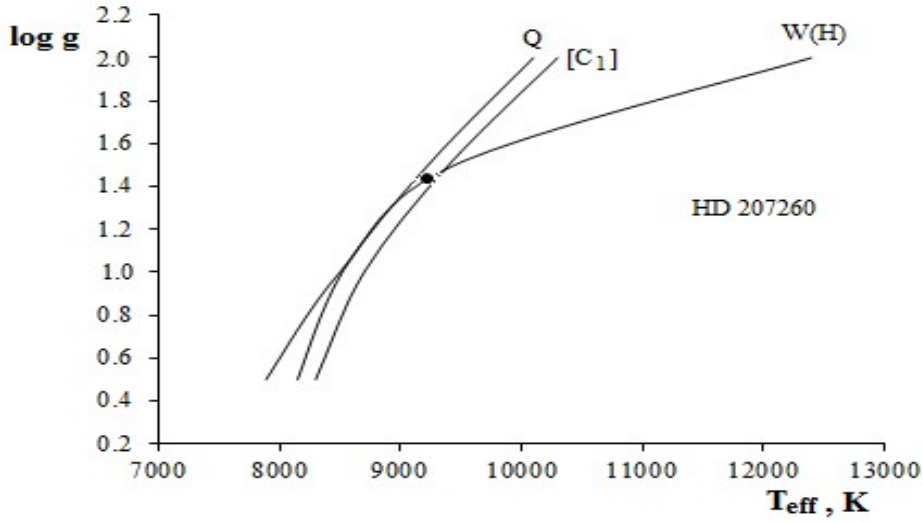

Fig. 1. A diagram determined the Teff and log parameters of the HR 8334 star.

are defined: Teff = 9200 $\pm$ 200K, logg = 1.4 $\pm$ 0.2. In [3] (Lyubimkov 2009) the applying method is described in detail and the accuracy of thismethod is justified. Therefore, the determined values in this paper is perfect from the results obtained of other authors.

3. MICROTURBULENT VELOCITY, CHEMICAL COMPOSITION

To determine the microturbulent velocity ξt it must be a plurality of lines that contain a wide equivalent widths W range of the atoms or ions of any given element. The microturbulent velocity ξt is chosen such that the abundance of elements determined by the different lines does not change with the increasing of the equivalent widths W. The most lines in the studied spectrum are the FeI and then the FeII lines. However, the effect of the LTE extremes to the neutral iron lines is significant. If the calculations are carried out in LTE, the abundance determined on the FeI lines is less than the abundance when refused from LTE [4, 5] (Boyarchuk et al. 1985; Thevenin & Idiart 1999). Unlike FeI lines there is no effect of the LTT extremesto the the FeII lines. Therefore, in the atmosphere of the star, the microturbulent velocity ξt and the iron abundance are determined on FeII lines.

As is shown in Lyubimkov and Samedov (Lyubimkov & Samedov 1990) [6] that the velocity ξt increases with the altitude of the height in the the atmosphere of spectral classes stars F. The effect is more effective if the line is stronger. For weak lines, this dependence is not taken into account and it is assumed that the microturbulent velocity ξt is constant in the atmosphere of star. Only the weak lines are used when determining the microturbulent velocity ξt. These lines are formed in deep layers of the atmosphere, these layers are parallel and in LTE form.

The iron abundance logϵ(FeII) is calculated by giving different values to the microturbulent velocity ξt based on the Kurucz model [7] (Kurucz 1993) with the parameter Teff = 9200K, logg = 1.4 The iron abundance is determined on the basis of comparison of the values measured from observation and theoretically calculated equivalent width of lines FeII. The atomic data of the spectral lines were taken from the database VALD-2 [8] (Kupka et al. 1999). There is no correlation between logϵ(FeII) and W, when ξt = 6km/sec (Figure 2). Thus, in the the atmosphere of star the value for the microturbulent velocity ξt = 6km/sec is determined. At the same time, the iron abundance is determined too: logϵ (Fe) = 7.54 . The parameter [Fe/H] = Δ $log\epsilon$ = logϵ (Fe)- $log\epsilon_{\odot}$ (Fe) is called the metallicity indicator of the star. Here $log\epsilon_{\odot}$ (Fe) = 7.47 is the iron abundance in the Sun [9] (Scott et al. 2015). The parameters of the star are: Teff = 9200 $\pm$ 200K, logg = 1.4 $\pm$ 0.2, ξt = 6km/sec, logϵ (Fe) = 7.54 , [Fe/H] = 0.07, The abundance of metals in the star is almost equal to the abundance in the Sun. The HR8334 (A2Ia) star and the Sun have the same chemical composition. This result is an important in the point of view of the Galactic chemical evolution.

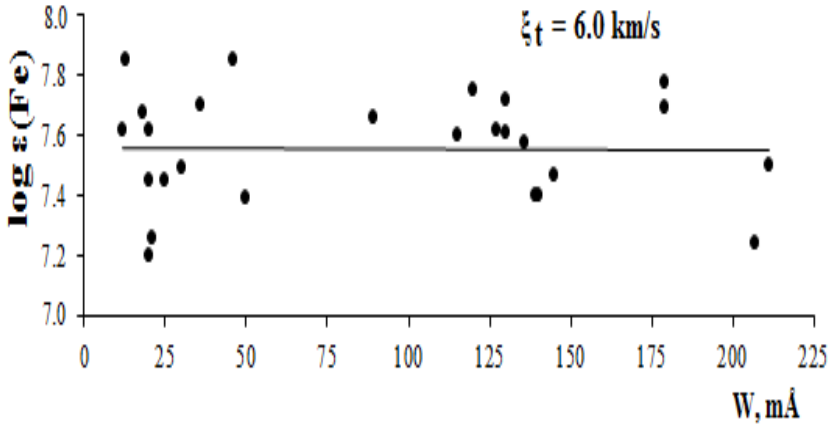

Fig. 2. Determination of the microturbulent velocity ξt .

4. MAIN RESULTS

1. Using the model method the effective temperature Teff of the HR8334 (A2Ia) star and and the surface gravity g are determined: Teff = 9200± 200K, logg = 1.4 ±0.2. 2. Based on the FeII lines the microturbulent velocity ξt is determined: ξt = 6km/sec. 3. In the atmosphere of the star the iron are calculated and compared with the abundance in the Sun. It has been found that the iron abundance is close to abundance in the Sun.

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