HD207260 (A2 IAE) STAR ATMOSPHERE: FUNDAMENTAL PARAMETERS, ABUNDANCE OF ELEMENTS

Z. A. Samedov [a,b], ***G. M. Hajiyeva*** [b], ***A. M. Khalilov*** [b],

S. Sh. Rajabova [b*], ***N. H. Samedova*** [b]

[a] *Department of Astrophysics, Baku State University, Z. Khalilov str.23, AZ 1148, Baku, Azerbaijan.*

[b] *Shamakhy Astrophysical Observatory named after N.Tusi, Azerbaijan National Academy of Sciences, Shamakhy region, Azerbaijan*

Abstract. The atmosphere of the HD207260 (A2Ia) star is studied by the atmosphere model. The effective temperature T_{eff} of the star and the surface gravity g are determined by comparing the observational and theoretical estimates of equivalents widths W the Balmer lines and [c1], Q photometric indexes: $T_{eff} = 9200 \pm 200K$, $logg = 1.4 \pm 0.2$. Based on FeII lines the microturbulent velocity is determined: $\xi_t = 6km/sec$. The abundance of elementsin the atmosphere of star HD207260 (A2Ia) has been determined. A deficiency in the content of carbon elements and an excess of sodium was found compared with the solar chemical composition. The content of other elements is close to the content of the Sun.

Keywords: fundamental parameters–stars–chemical composition - stars–individual-HD207260 (A2Ia) .

1. INTRODUCTION

In this work the atmosphere of the HD207260 (A2Ia) star is studied by the atmosphere model. The effective temperature T_{eff} of the star, the surface gravity g in the atmosphere, the microturbulent velocity ξ_t, 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.

* E-mail: sevinj_rajabova@mail.ru

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 $H_\beta, H_\gamma, H_\delta$;

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 $[c1] = c10.2(by)$. In the UBV photometric system the Q is determined by the expression $Q = (UB)0.72(BV)$. 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 T_eff diagram is constructed on the base of above mentioned criteria (Figure1). From this diagram the star's parameters are defined:

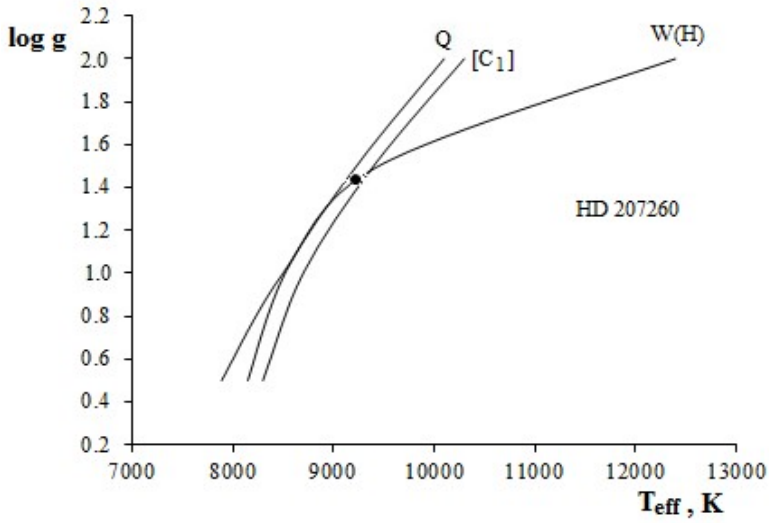

Fig. 1. A diagram determined the T_{eff} and logg parameters of the HD 207260 star.

$T_{eff} = 9200 \pm 200K, logg = 1.4 \pm 0.2$. In [3] (Lyubimkov 2009) the applying method is described in detail and the accuracy of thismethod is justified. There-

fore, the determined values in this paper is perfect from the results obtained of other authors.

3. MICROTURBULENT VELOCITY

To determine the microturbulent velocity t 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 ξ_t 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 ξ_t and the iron abundance are determined on FeII lines.

As is shown in Lyubimkov and Samedov (Lyubimkov Samedov 1990) [6] that the velocity ξ_t 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 ξ_t is constant in the atmosphere of star. Only the weak lines are used when determining the microturbulent velocity ξ_t. These lines are formed in deep layers of the atmosphere, these layers are parallel and in LTE form.

The iron abundance $log\varepsilon$(FeII) is calculated by giving different values to the microturbulent velocity ξ_t based on the Kurucz model [7] (Kurucz 1993) with the parameter $T_{eff} = 9200K, logg = 1.4$ 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-3(http://vald.astro.uu.se). There is no correlation between $log\varepsilon$(FeII) and W, when $\xi_t = 6km/sec$ (Figure2).

Thus, in the the atmosphere of star the value for the microturbulent velocity $\xi_t = 6km/sec$ is determined. At the same time, the iron abundance is determined too: $log\varepsilon(Fe) = 7.54$. The parameter $[Fe/H] = \Delta log\varepsilon = log\varepsilon(Fe) log\varepsilon_{\odot}(Fe)$ is called the metallicity indicator of the star. Here $log\varepsilon_{\odot}(Fe) = 7.47$ is the iron abundance in the Sun [8] (Scott et al. 2015). The parameters of the star are: $T_{eff} = 9200 \pm 200K, logg = 1.4 \pm 0.2, \xi_t = 6km/sec, log\varepsilon(Fe) = 7.54, [Fe/H] = 0.07$. The abundance of metals in the star is almost equal to the abundance in the Sun.

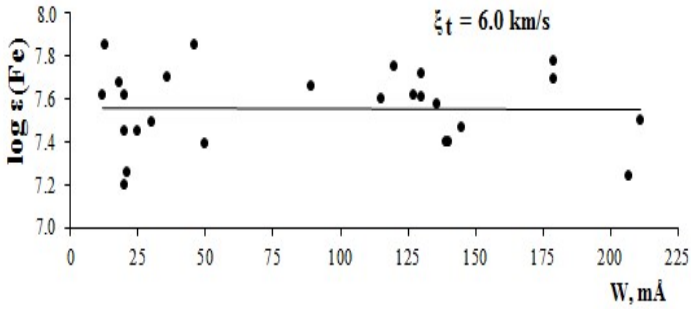

Fig. 2. Determination of the microturbulent velocity ξ_t

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.

4. CHEMICAL COMPOSITION

Chemical composition of the HD 207260 (A2Ia) star has been determined using model method. The determination of the chemical composition using model method is based on the comparison of observationally measured and theoretically calculated values of the equivalent widths of the spectral lines of the elements.

Based on Kuruch model [7] with $T_{eff} = 9200K, logg = 1.4$ parameters, the abundance of elements is calculated by assigning $\xi_t = 6.0km/s$ to microturbulent velocity.Atomic data of spectral lines are taken from the VALD-3 (http://vald.astro.uu.se) database. The abundance of elements is given on a logarithmic scale. $log\varepsilon_{\odot}$ values are taken from [8, 9].

Difference in the number of elements in the star and the Sun $[el/H] = log\varepsilon(el) - log\varepsilon_{\odot}(el)$ is given in Figure 3. According to reference (literature) data the elements subject to non-LTE adjustments in the amount have been shown with open circles. The arrow indicates the direction of such adjustments.According to [10], these lines are significantly affected by the non-LTE (deviation from LTT) effect, the amount of log (N) should be adjusted around -1.0 dex.According to [11], non-LTE analysis of CI lines adjusts the amount of log (C) around -0.3 dex.Therefore, it is necessary to calculate the amount of elements C and N in the atmosphere of the Cep star in the case of non-LTE (Figure3). As is seen, in the atmosphere of the HD207260 (A2Ia) star, the lack of element C and the excess of element N has been revealed. The amount of other elements is close to those of the Sun. Thus, the considerations of the Theory of Evolution are confirmed based on the observations. So, HD207260 (A2Ia) star and the Sun

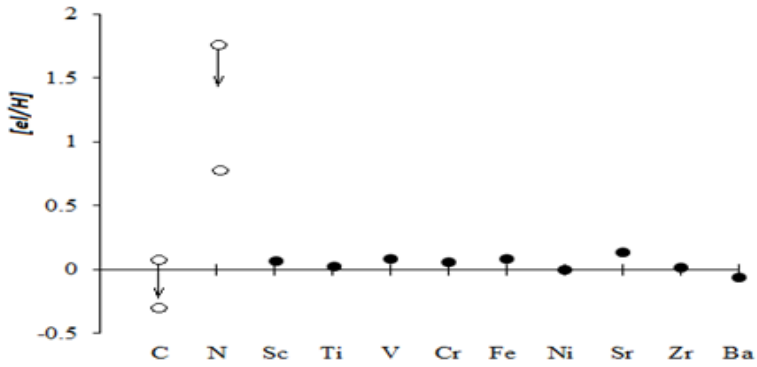

Fig. 3. Chemical composition HD207260 (A2Ia).

have been created of the same chemical substance. There was an evolutionary variability in the initial amounts of the carbon and nitrogen elements, while the initial amount of the other elements remained constant.

5. MAIN RESULTS

1.Using the model method the effective temperature T_{eff} of the HD207260 (A2Ia) star and and the surface gravity g are determined: $Teff = 9200 \pm 200K, logg = 1.4 \pm 0.2$.

2.Based on the FeII lines the microturbulent velocity ξ_t is determined: $\xi_t = 6km/sec$.

3. The content of the elements was determined by comparing the observed and therotically calculated eqvivalent width of spectral lines of elements. A deficiency in the content of carbon elements and an excess of sodium was found compared with the solar chemical composition. The content of other elements is close to the content of the Sun.

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