ISSN 1512-1461

UDC 524.335.6-36

THE METALLICITY OF ATMOSPHERE OF THE POST AGB $HD161796$ $(F3Ib)$ STAR

Samedov Z. A[1,2]

1.Department of Astrophysics, Baku State University, Z. Khalilov str.23, AZ 1148, Baku, Azerbaijan.
2.Shamakhi Astrophysical Observatory, AZ 2656, Shamakhi, Azerbaijan.
E-mail: zahir.01@mail.ru

Abstract:
In the work the atmosphere of the post AGB $HD161796$ $(F3Ib)$ star is considered. In the atmosphere of the star the effective temperature T_{eff} and the surface gravity g are determined: $T_{eff} = 6550 \pm 200K, logg = 0.75 \pm 0.2$.
Based on the $FeII$ linesthe velocity of microturbulent velocity ξ_t *is determined:* $\xi_t = 6.5\, ^{km}/_{san}$. *In the atmosphere of the star the iron abundance is calculated and compared with the abudance in the Sun. 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 iron abundance is less than the abudance in the sun* $log\varepsilon(FeII) = 7.03 \pm 0.06$.

Keywords: *fundamental parameters - stars; chemical composition stars; individual-* $HD161796$ $(F3Ib)$.

INTRODUCTION

Post AGB stars are out of the asymptotic arm of giant stars, but are still stars that have not yet reached planetary nebulae space. Post AGB phase is the evolutionary phase between AGB and the emergence of planetary nebulae. The duration of this stage is very small: $\approx 10^3$ years. Post AGB stars are the second-class type A, F, G spectroscopic giant stars located far beyond the star-forming regions. These stars are different from normal supergiant stars, and they are extraordinarily supergiant stars. The masses of the Post AGB stars are smaller than the masses of normal giant stars, and their brightness is the brightness of normal giant stars. Post AGB stars are locate in the wide galactic width, and their spectrum is observe an infrared radiation excess. This shows the formation of the dust environment on the surface of the stars at the end of the AGB stage. These stars have the chemical composition in which can not explain the theory of modern evolution of stars. The determination of the chemical composition of the post AGB stars is one of the actual problems of astrophysics.

In this work, the metallicity of the atmosphere of the star has been determined. In our futurework it is envisaged to determine the abundance of light elements that have evolved in the chemical evolution. The observation material of the star was taken in the 2-meter telescope of the Shamakhi Astrophysical Observatory within the wavelength range $\lambda\lambda 3900 \div 6600 A\mathring{A}$, the atlas was constructed and the equivalent width of the spectral lines was measured.

ATMOSPHERE PARAMETERS: EFFECTIVE TEMPERATURE, ACCELERATION OF GRAVITY

The effective temperature of the star and the surface acceleration of gravity are determined by the model method. This method is shown in detail in [1].

We have investigated stars with this metod (for example [2-7])

The following criteria are used:

1. Comparison of the values of the index $[c_1]$ measured from observation and theoretically calculated.

The index $[c_1]$ is determined by the expression $[c_1] = c_1 - 0.2(b - y)$ in the the photometric system $uvby\beta$. This is exempt from the effect of absorption in the quantitative interstellar space. It is desirable to use the index $[c_1]$, when determining the fundamental parameters of stars by the model method.

2. Comparison of the measured from observation and theoretically calculated values of the index β. This quantity actually measures intensity on the line H_β, free from the interstellar absorption.

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

In the photometric system UBV the index Q is determined by the expression $Q = (U - B) - 0.72(B - V)$. The quantity Q is exempt from the interstellar absorption. The observed values of the quantities $[c_1], \beta, Q$ are calculated using the catalog [8]. The theoretical values of the quantities $[c_1], Q, \beta$ are calculateed using the [9,10].

The $log g - T_{eff}$ diagram is building on the base of the above criteria (Figure 1).

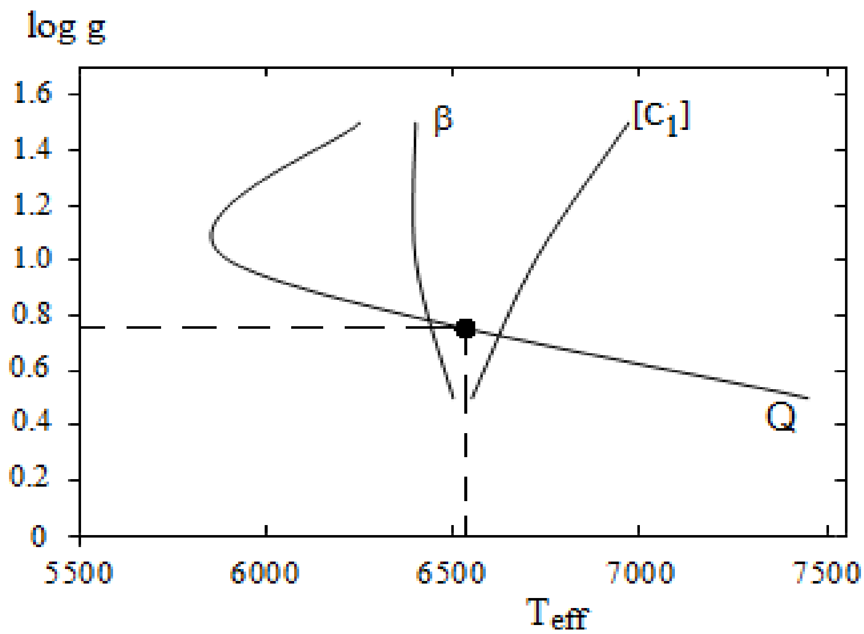

Figure 1. A diagram defining the T_{eff} and $\log g$ parameters of the HD161796 star

From this diagram the star's parameters are defined:
$T_{eff} = 6550 \pm 200K, \log g = 0.75 \pm 0.2$

MIKROTURBULENT VELOCITY, OF IRON ABUNDANCE ELEMENT

In the atmosphere of the star, mikroturbulent movement velocity ξ_t and amount of iron are determined by the lines $FeII$. To determine the mikroturbulent velocity ξ_t it must be a plurality of lines that contain a wide equivalent widhts range of the atoms or ions of any given element. The microturbulent movement velocity ξ_t is chosen such that the quantity of elements determined by the different linesdoes not change with the increasing of the equivalent widths W_λ.

ISSN 1512-1461

As is shown in L.S.Lyubimkov and Z.A.Samedov[11] that the velocity of microturbulent movementξ_t increases with the altitude of the height in the the atmosphere of spectral classstars$F$. The effect is more effective if the line is stronger. For weak lines, this dependence is neglected and it is assumed that the velocity of microturbulent movement$\xi_t$is stable in the atmosphere of star.Only the weaker lines are used when determining the velocity of microturbulent movementξ_t.These lines are formed in deep layers of the atmosphere, these layers are parallel and in LTT form.

The iron abudance $log\varepsilon(FeII)$ is calculated by giving different values to the velocity of microturbulent velociti ξ_t based on the Kurucz model [12] with the Teff=6550K,logg=0.75 parameter.The iron abudance 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 [13]. There is no correlation between $log\varepsilon(FeII)$ and W_λ when $\xi_t = 6.5\ ^{km}/_{san}$ (Fig 2).

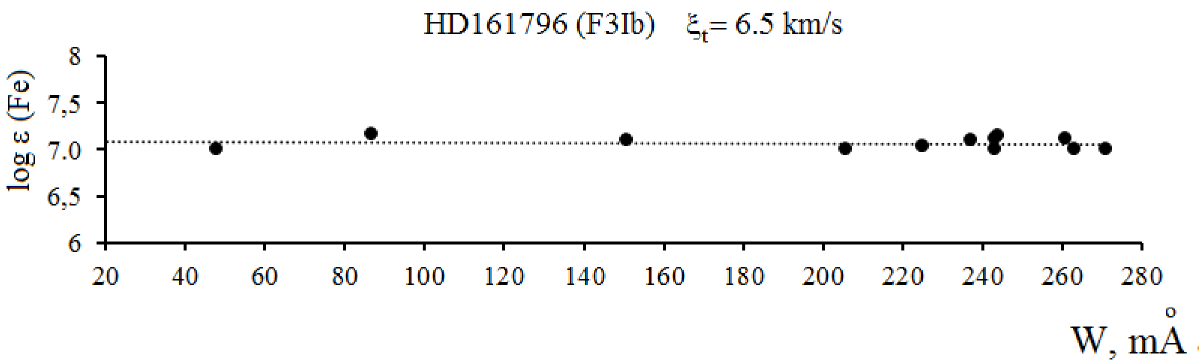

Figure 2. Determination of the velocity of microturbulent movementξ_t

Thus, inthe the atmosphere of star determines the value for the velocity of microturbulent movement$\xi_t = 6.5\ ^{km}/_{san}$. At the same time, the iron abundance determines too:
$log\varepsilon(Fe) = 7.03 \pm 0.06$

The paprameter $[^{Fe}/_{H}] = \Delta log\varepsilon = log\varepsilon(Fe) - log\varepsilon_{\odot}(Fe)$ is called the metallicity indicator of the star. Here $log\varepsilon_{\odot}(Fe)$ is the iron abundance in the sun: $log\varepsilon_{\odot}(Fe)$=7.45. [14].

The defined parameters of the star are:
$T_{eff} = 6550 \pm 200K, logg = 0.75 \pm 0.2, \xi_t = 6.5\ ^{km}/_{san}, log\varepsilon(Fe) = 7.03 \pm 0.05,\ [^{Fe}/_{H}] = -0.42$

As is shown, the amount of metal in the star is less than the Sun.

To explain this property of the chemical composition, it is assumed that the number of all elements in the post-AGB star atmosphere was originally normal (with solar structure)and then some of atoms of an element of iron group have been used on formation of dust particles as a result of formation of the dust environment on surfaces of these stars.

MAIN RESULTS

1.Using the model method the effective temperature $T_{eff}$of the star $HD161796\ (F3Ib)$ and the surface gravity g are determined: $T_{eff} = 6550K, logg = 0.75$

ISSN 1512-1461

2. Based on the $FeII$ lines the velocity of microturbulent ξ_t is determined: $\xi_t = 6.5\ ^{km}/_{san}$.
3. In the atmosphere of the star the iron abudance is calculated and compared with the abudance in the Sun.It has been found that the iron abudance is less than the amount in the sun $log\varepsilon(FeII) = 7.03 \pm 0.06$.

This articl has been edited " The 6th International Conference on Control and Optimization with Industrial Applications, 2018, Baku,Azerbaijan".

REFERENCES

1. Lyubimkov L.S.,. Lambert D.L, Rostopchin S.I., Rachkovskaya T.M., and Poklad D.B. Accurate fundamental parameters for A-, F- and G-type Supergiants in the solar neighbourhood // Monthly Notices Roy.Astron. Soc. 2010, v.402,p.1369- 1379
2. Ajabshirizadeh A.A.,MuradovA., Samedov Z.A. A model atmosphere analysis of the F6V star π^3Ori // Atrophysics and Space Science, 2004, v.293, p.289-294.
3. Khalilov, A. M.,Samedov, Z. A.; Hasanova, A. R., A study of the supergiant 89 Her // Astronomy Reports, 2008, v.52, p. 847–851
4. Kuli-zade D.M., Samedov Z.A., Gadirova U.R. On atmospheric parameters and chemical composition of Giant HD206731 (G8II) // International Journal of Current Research, 2015, v.7, p.13286-13291.
5. Samedov Z.A,Qadirova U.R. Investigation of the atmosphere of supergiant HD 14662 (F7Ib) // GESJ: Physics 2017, No.2 (18) p.19-24
6. Samedov Z. A., Gadirova U. R.Investigation of the atmosphere of the star HD 164136 (F2II) // Astronomy and Astrophysics (Caucasus), 2018 N3, p.91-96
7. Samedov Z.A. Investigation of the atmosphere of HR382 (*Φ CAS, F0 IA*) star // International Journal of Development Research, 2018, v.08, p. 21398-21400.
8. Hauck B., Mermilliod M. uvbyβ photoelectric photometric catalogue // Astron. Astrophys, Suppl.Ser., 1998, v.129, p.431-433
9. Castelli F., Kurucz R.L., 2003, in Piskunov N.E., Weiss W.W., Gray D.F., eds, Proc. IAU Symp. 210, Modelling of Stellar Atmospheres.Poster A20. Astron. Soc. Pac., San Francisco, p. A20
10. Castelli F., Kurucz R.L.Computed H_β indices from ATLAS 9 model atmospheres // Astron. and Astrophys. Astron. and Astrophys., 2006, v.454, p.333-340
11. Lyubimkov L.S., Samedov Z.A. Variability of the microturbulence in the atmospheres of F supergiants // Astrophysics, 1990, v.32, p.30-37.
12. Kurucz L.S., CD-ROM 13, ATLAS9 Stellar AtmospherePrograms and 2 km/s grid.Cambridge, Mass.;SmithsonianAstrophys.Obs., 1993.
13. Kupka F.N., Piskunov T., Ryabchikova T., Stempels H.C., Weiss W.W. VALD2: Progress of the Vienna Atomic Line Data Base // Astron. And Astrophys, Suppl.Ser., 1999,v.138, p.119-133
14. Scott L.S., Asplund M., Grevesse N., Bergemann M., and Sauval M. The elemental composition of the Sun.II. The iron group elements Sc to Ni // Astron. and Astrophys.,2015, v.26, p.573-606.

Article received: 2018-10-02