ASPECTRAL VARIABILITY OF THE SUPERGIANT STAR HD21389

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The results of spectral observations of the supergiant star HD21389 were presented. Variations of the spectral parameters and profiles of the Hα line were discovered. It is supposed that variability of the profiles, radial velocity and other parameters are connected each with other and also these changes may be a manifestation of complex motions in the atmosphere of HD 21389.

Keywords: supergiant stars; spectroscopy, stellar wind; accretion; individual: HD21389.

1. INTRODUCTION

The supergiant star HD21389 belongs to the stars with P Cyg type profile Hα line. According to [1–5], its spectral class is A0Ia, apparent magnitude is m_v = 4.53 mag, mass is M =19.3 $M_\odot$, radius is R=97 $R_\odot$, luminosity is log ($L/L_\odot$) =4.87, effective temperature is T_{eff} = 10500 K, acceleration of gravity at the surface is log g =1.70, and rotation velocity is vsin i = 53 km/s. It is believed that it belongs to the OB1 association.

Spectral observations of the stars HD21389 in 2005-2014 were carried out using a CCD detector in the echelle spectrometer mounted at the Cassegrain focus of the 2-m telescope of the Shamakhy Astrophysical Observatory [6]. The spectral resolution was R=15000, and the spectral range λ 4700 – 6700 Å. The signal-to-noise ratio was S/N=200. Two spectra of the target stars were obtained on each night of observation. The average exposure was 600-900s, depending on the image quality. Note that, fast changes in the spectra during the night weren't found. Therefore the profiles observed in one night were averaged. In addition to the observations of the target stars, we also obtained numerous spectra of standard

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stars, the day and night backgrounds, flat fields, and comparison stars, to enable analysis of the stability of the telescope-spectrograph complex.

The Echelle spectra were processed by the standard technique using the DECH20 and DECH20t software [7]. The errors in our equivalent widths (W) do not exceed 5%, and the errors in the radial velocities (Vr) are no larger than $\sim$ 2 km/s. Appropriate heliocentric corrections were included during data processing. Profiles of the Hα, Hβ, HeI, etc. lines in the spectra of star HD21389 were investigated.

As shown in fig.1, on 11.11.2006, we have observed an inversion of the P Cyg profile of the Hα line. The inverse P-Cyg profile may be explained by the high-velocity motion of wind matter away from the observer. This suggests that, as a result of a strong stellar wind, the absorption component of the Hα line is shifted to the red region of the profile while the emission component is blue shifted.

From fig. 1 it is visible that when in the Hα is observed inverse P Cyg profile, the structure of the profile of Hβ changed a little and this line displaced to longer wavelength. It is interesting that when the Hα is observed inverse P Cyg, the profile of He I λ5876 Åline does not change (fig.2). It means that in this case, the deep layers of the HD 21389 atmosphere are relatively stable.

It is known that the Hα and Hβ lines form in the upper layers of the stellar atmosphere, in the region of generation of stellar wind [1]. The variable wind and its accelerated motion in supergiants is caused by the strong flux of radiation from the star. Outer atmospheres of supergiant stars are exposed to more intense changes than internal. Thus, the stellar radiation flux and the variable stellar wind lead to corresponding changes in the outer layers of the atmosphere and the star envelope. As a result, we observe variable absorption and emission components of different forms of the Hα line P Cyg-profile of the star HD21389.

2. CONCLUSIONS

1. The absorption profile of the Hα line in the spectra of the star HD21389 depending on a phase of instability of the star atmosphere has difficult structure. In an active phase this line has inverse P Cyg profile. On the red and violet wings of the profile appear and disappear emission components. All measured parameters of the Hα line show variability. It is supposed that variability of the profiles, radial velocity and other parameters are connected with each other and also these changes may be a manifestation of complex motions in the atmosphere of HD 21389.

2. Appearance and disappearance of asymmetry in the profile of Na I D doublet and formation of the Hα line type inverse P Cyg occurs synchronously in an active phase of the atmosphere of HD 21389. We assume that these changes are

formed under the influence of the general mechanism which might be responsible for the observed variation is the growth of the envelope of the star with a following ejection of matter.

3. Our researches showed that the values of radial velocity of the FeII lines change with time. However, we found no correlation of these changes with the period of 7.7 days which was founded by previous authors.

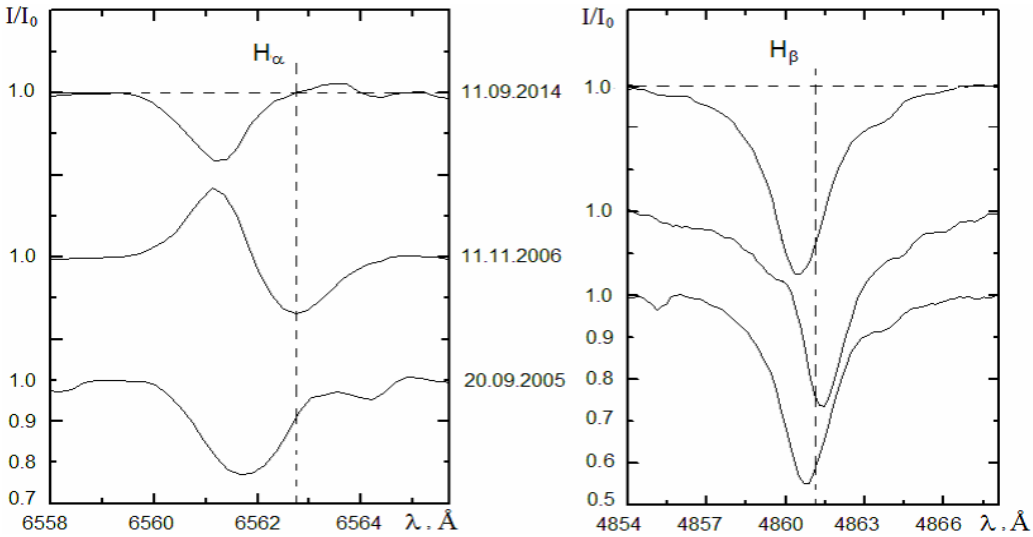

Fig. 1. Profiles of the Hα and Hβ lines of HD 21389 on different dates.

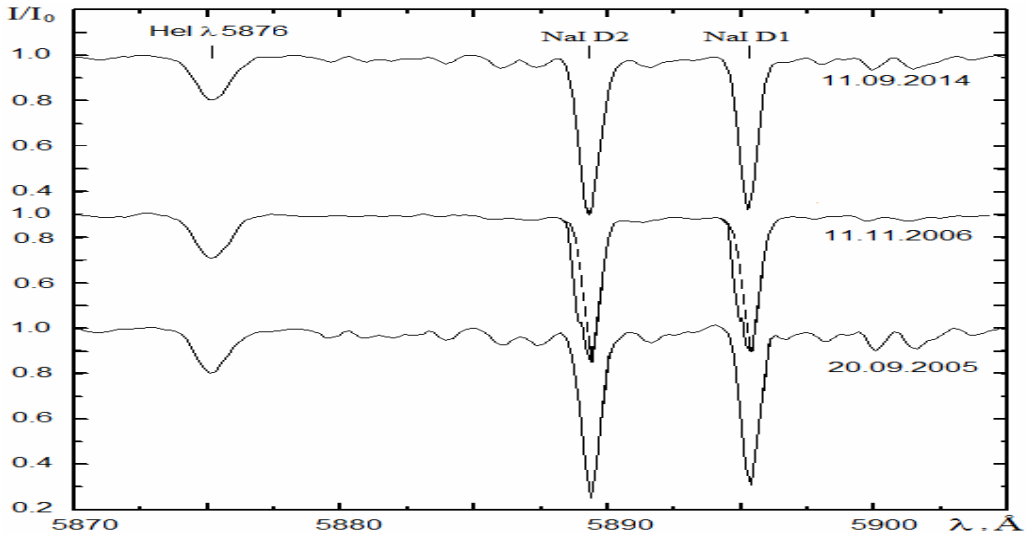

Fig. 2. Profiles of the HeI and NaD lines of HD21389 on different dates.

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