Magnetic Fields throughout Stellar Evolution
Proceedings IAU Symposium No. 302, 2013
P. Petit, M. Jardine & H. Spruit, eds.

doi:10.1017/S1743921314002397

The unusual binary HD 83058 in the region of the Scorpius-Centaurus OB association

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Abstract. We present the results of high-resolution spectroscopy of the binary system HD 83058 situated in the region of the Sco-Cen OB association. On the base of the radial-curve solution we have determined the elements of the orbit and determined the period $P = 2.365102$ days. We have disentangled the spectra of the two components of the system and derived the basic parameters of both components. We have shown that moving features in the Si III line profiles seen in the spectra of the primary can be interpreted in the frame of the assumption of the rotation of local spot-like inhomogeneities on the stellar surface. We have also found that the lines in the spectrum of the secondary show another type of variability.

Keywords. Line:profiles – (Stars:) binaries – Stars: fundamental parameters – Stars: early-type – Stars: spots – Stars: individual (HD 83058)

1. Observations and determination of the system parameters

The southern early-type star HD 83058 is situated in the region of the Sco-Cen OB association. Early it has been revealed that: a) the object is a binary system with the orbital period about 2.3 days, b) two components of the system show different types of spectral variability (Telting *et al.* 2006, Jilinski *et al.* 2010). The aim of our study is to determine the orbital elements of the system and the fundamental parameters of its components as well as to investigate the spectral variability of both components of the system.

Seventeen high-resolution spectra ($R = 48\,000$) were obtained in 2007 – 2009 using the FEROS spectrograph at the 2.2m telescope of ESO at La Silla, Chile. We applied the standard method of fitting the observed phase diagram of radial velocities Vr for each components of the binary by the theoretical curve for orbital motion. The least-square method was used for calculations. As a result, we obtained the following values of orbital elements:

$e = (1.7 \pm 0.1)^{-7}$; $P = 2.365102 \pm 0.000022$ days; $\mathrm{MJD}_0 = 54000.8770 \pm 0.0096$ days for the moment when radial velocities of the primary (A) and the secondary (B) components are equal: $V\mathrm{r(A)} = V\mathrm{r(B)} = \gamma$, after what the component A begins to move away from the observer; $K(\mathrm{B}) = 137.1 \pm 0.1\ \mathrm{km\,s^{-1}}$, $K(\mathrm{A}) = 81.6 \pm 0.1\ \mathrm{km\,s^{-1}}$; $\gamma = 12.1 \pm 0.1\ \mathrm{km\,s^{-1}}$.

We determined the basic parameters of the A and B components using the method of constructing the combined synthetic spectrum of the system. For each of the components A and B, we applied the LTE model spectra calculated with the code SYNTH+ROTATE

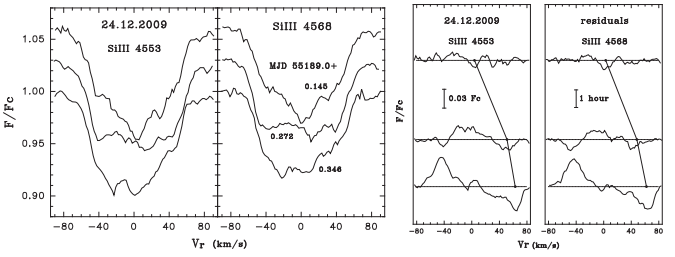

Figure 1. Typical line profiles variations observed in the component A.

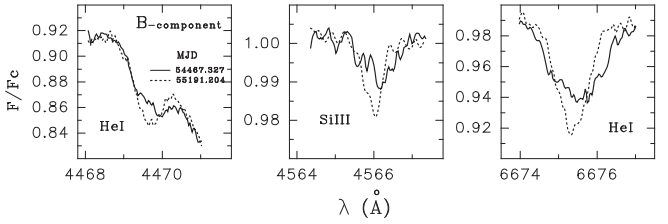

Figure 2. Profiles of some lines in the spectrum of the component B.

(Piskunov 1992) and non-LTE spectra obtained with the code TLUSTY (Hubeny & Lanz 1992). As a result, the following parameters have been obtained:

Component A: $T_{\rm eff} = 25700 \pm 400$ K, $\log g = 4.27 \pm 0.05$, $\xi_{\rm turb} = 5.5 \pm 0.5$ km s^{-1}, $v \sin i = 57.4 \pm 1.0$ km s^{-1};

Component B: $T_{\rm eff} = 19200 \pm 600$ K, $\log g = 4.03 \pm 0.20$, $\xi_{\rm turb} = 5.5 \pm 0.5$ km s^{-1}, $v \sin i = 27.0 \pm 1.4$ km s^{-1};

The ratio of the stellar radii is $R_B/R_A = 0.66 \pm 0.03$.

2. Spectral variability of the components A and B

The spectral variability of the component A manifests itself in a form of moving local features on the Si III line profiles. An example of these variations for the date 24.12.2009 is shown in Fig. 1. We tested the assumption that these features are the result of rotation of spot-like inhomogeneities on the stellar surface, probably of magnetic origin. Analyzing positional change of separate features placed at different latitudes φ, we have obtained that during three dates 24, 25 and 26.12.2009 the features, rotating with approximately the same period $P = 1.10 \pm 0.04$ days were observed at the latitudes $\varphi = 0°$, $41°$, and $28°$, respectively.

ss In contrast to the component A, the line profiles in the spectrum of the component B demonstrate another type of variability. We have found that in some dates the profiles of all lines become wider, less deep, and slightly red-shifted. Some examples are shown in Fig. 2.

Acknowledgements. N. A. D. acknowledges support of the PCI/MCTI, Brazil, under the Project 302350/2013-6.

References

Hubeny, I. & Lanz, T. 1992, *A&A*, 262, 501
Jilinski, E., Ortega, V. G., Drake, N. A., & de la Reza, R. 2010, *ApJ*, 721, 469
Piskunov, N. E. 1992, *Stellar Magnetism*, 92
Telting, J. H., Schrijvers, C., Ilyin, I. V., *et al.* 2006, *A&A*, 452, 945

https://doi.org/10.1017/S1743921314002397 Published online by Cambridge University Press