

Observations of a Fast Rotating Magnetic He–Rich Star HD 182180 at the 6–m Telescope

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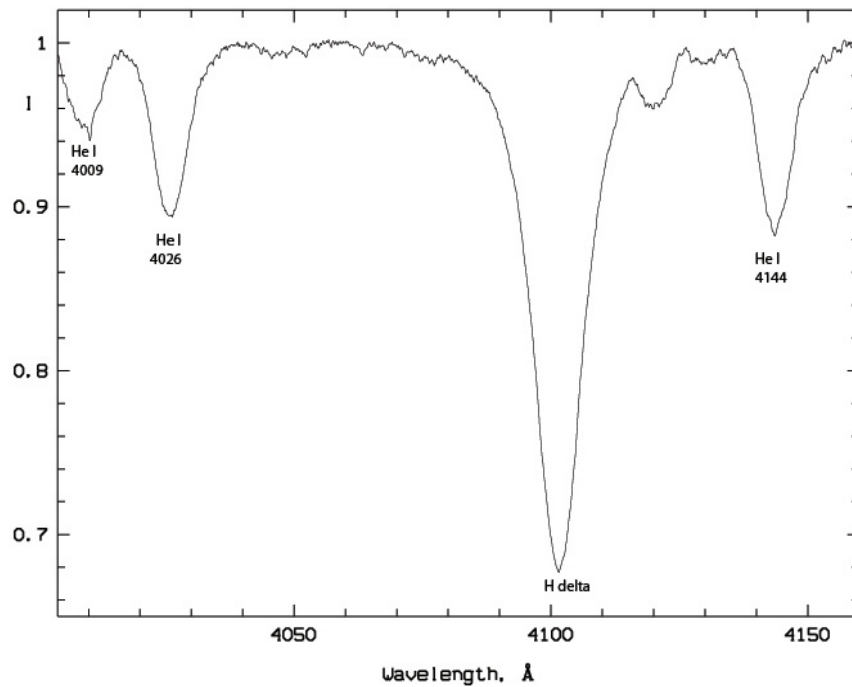


Figure 1: Fragment of a normalized spectrum of HD 182180 around H δ (averaged over 11 frames)

HD 182180 (HR 7355), B2Vn, $m_v = 6.02$ belongs to a small group of early stars (from B1V to B3V) which show unusually strong helium lines. It has an extremely short period of rotation $P = 0^d.521$, $v \sin i = 320$ km/s (for CP stars the average velocity of stellar rotation on the equator is about 120 km/s (McNally, 1965; Abt et al., 2002)). The star shows spectral and photometric changes (Rivinius et al., 2008). Just as it is expected, the magnetic field was detected recently by Rivinius et al. (2010) and Oksala et al. (2010).

Our data were obtained at the 6–m BTA telescope with the MSS spectrograph equipped with a super–achromatic quarter–wave retarder plate and a double slicer (Chountonov, 2004). Each individual measurement consisted of a sequence of exposures, taken at the retarder plate position angles in sequence 0° , 90° and again with respect to the axis of dichroic polarizer prism. The Zeeman spectra with $R = 15000$ in the region $\lambda\lambda 4000 - 4240$ Å have been registered. The dates of observing runs: 2008.05.23, 2009.07.04, 2009.07.05 (CCD 2K \times 2K) and 2010.05.31 (CCD 2K \times 4.6K). We also registered the NES echelle spectra without analyzer with $R = 40000$ in the region $\lambda\lambda 4400 - 5850$ Å. The date of the observing run: 2008.07.16.

1. A fragment of a normalized spectrum of HD 182180 around H δ is presented in Fig. 1. It was done combining 11 spectra after the extraction and normalization. The fragment contains 3 lines of He and H δ .

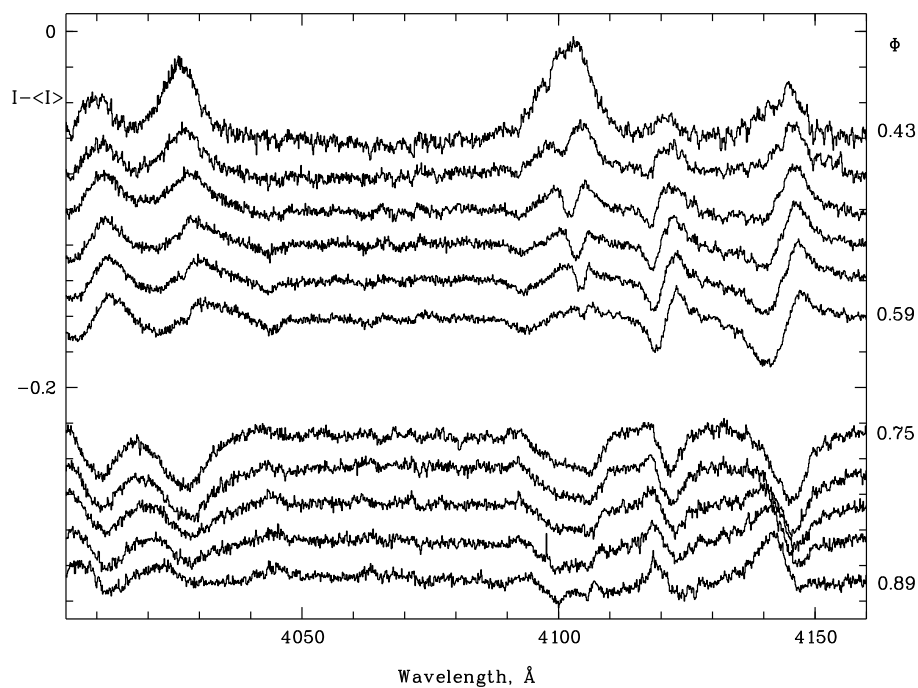


Figure 2: Difference between individual and average spectra in Fig. 1 with phase (vertically, on the right)

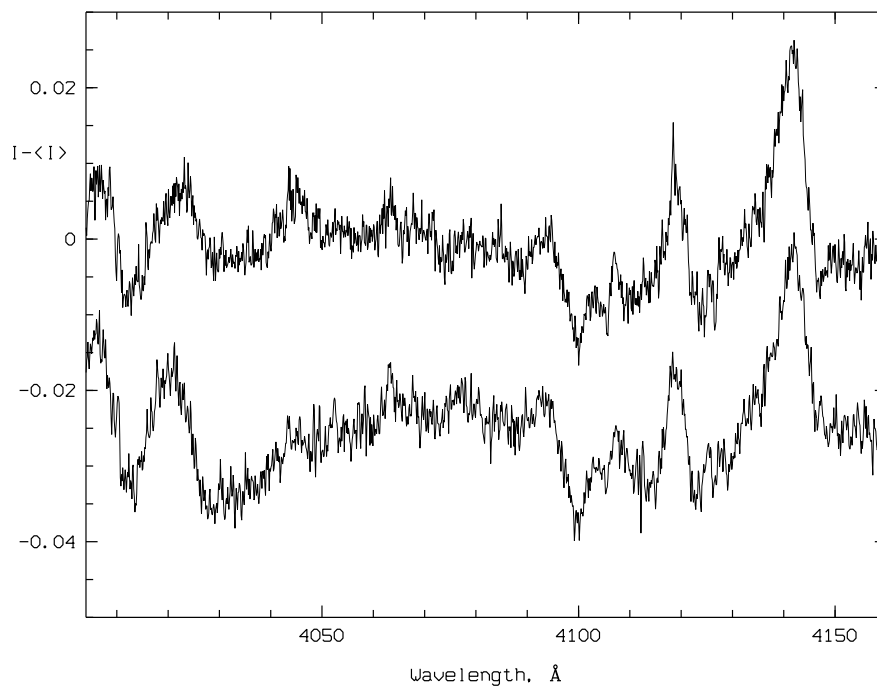


Figure 3: Almost in a year repeatability of spectral lines form (2009.07.05 and 2010.05.31) in an identical phase

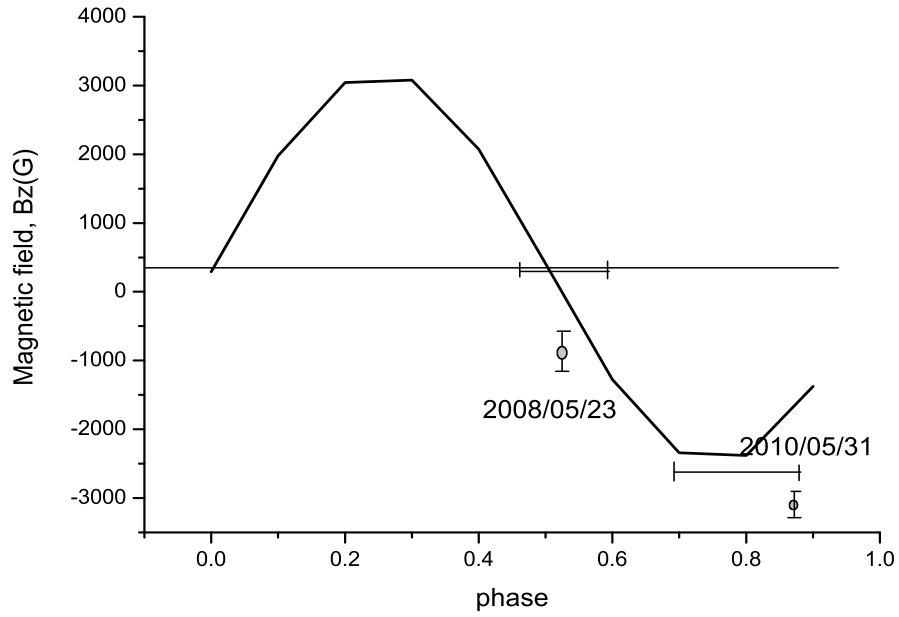


Figure 4: Longitudinal magnetic field variations with phase (the sine curve, Rivinius et al., 2010)

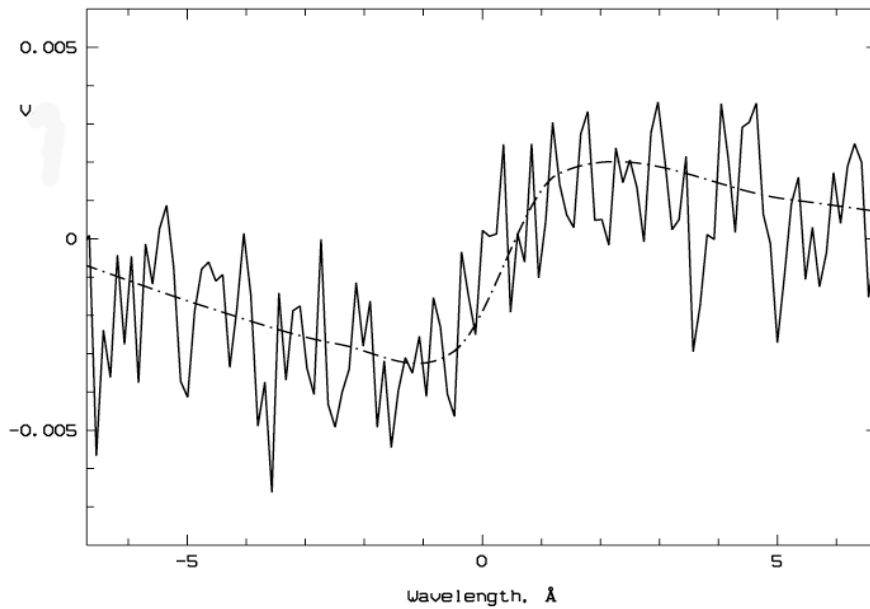


Figure 5: Stokes V -parameter averaged over five lines in phase 0.84

2. Variability with time and phase at the right part of the spectrum of this star occurs not only in the region of He lines, but also in H δ . The differences between individual and average spectra with phase are presented on Fig. 2.

3. Two spectra with an interval about 10 months in an identical phase are presented in Fig. 3. During approximately 600 periods of rotation the spectrum of HD 182180 has slightly changed. It means that the processes in the star were already stabilized.

4. The magnetic field of this star changes with time (with phase, the sine curve is constructed based on the data from Rivinius et al. (2010)). Our Zeeman spectra have been registered in the phases marked by horizontal bars, and our measurements of magnetic field are marked by points (Fig. 4).

5. Four He lines and H δ are reduced to a common wavelength to increase S/N and the Stokes V parameter is computed for the phase 0.84 (Fig. 5).

References

- Abt H. A., Levato H., Grosso M., 2002, *ApJ*, 573, 359
 Rivinius Th., Štefl S., Townsend R. H. D., Baade D., 2008, *A&A*, 482, 255
 Rivinius Th., Szeifert Th., Barrera L., Townsend R. H. D.; Štefl S., Baade D., 2010, *MNRAS*, 405, L46
 Chountonov G. A., 2004, in: Glagolevskij Yu. V., Kudryavtsev D. O., Romanyuk I. I. (eds), *Proc. Int. Conf., "Magnetic stars"*, Nyzhny Arkhyz, 286
 McNally D., 1965, *The Observatory*, 85, 166
 Oksala M. E., Wade G. A., Marcolino W. L. F., Grunhut J., Bohlender D., Manset N., Townsend R. H. D., 2010, *MNRAS*, 405, L51