Special Astrophysical Observatory

STARS2016

Spectroscopy of magnetic CP stars in binary and multiple systems

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Role of multiplicity in stellar physics

- Binary stars are the important method to ‘weight’ the stars
- Frequency of multiple systems is closely related to the process of star formation:
  - mass of a protostellar cloud,
  - processes of cloud fragmentation.
- Magnetic field may affect the formation of close pairs

What is the real number of multiples?

- Total number of magnetic CP stars is more than 500 at the moment (>150 new mCP's from 2006)
- To detect a binary system different methods are in use (direct imaging, active and adaptive optics, speckle interferometry, spectroscopy)
- The frequency of spectroscopic binaries is sensitive to selection effects (radial velocity varies slowly or non-uniformly)
- Problem of 'hidden' binaries among newly discovered magnetic stars is related to the insufficient number of observations

Interesting cases of binary and multiple stars

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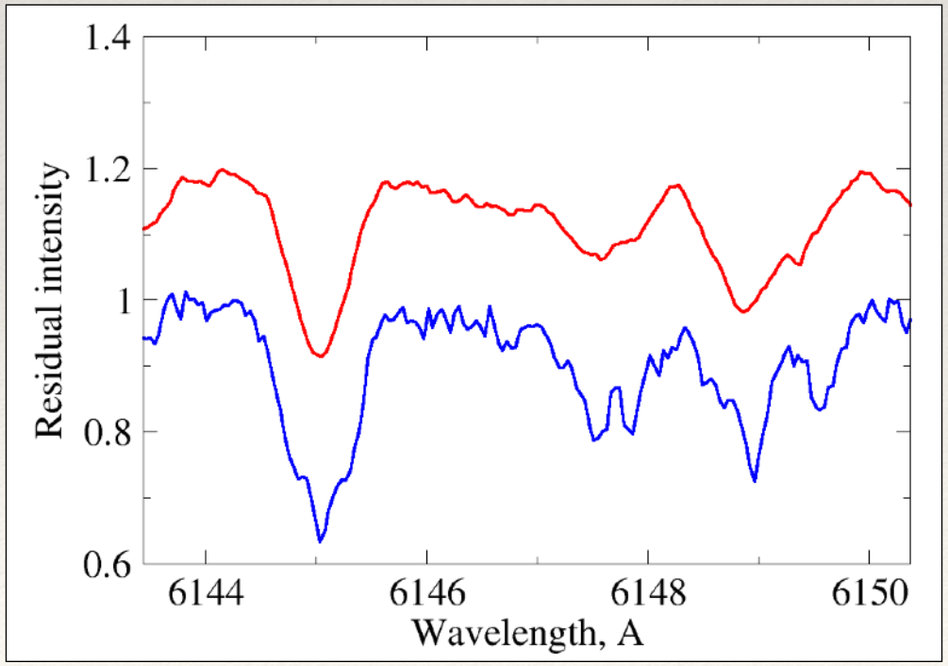
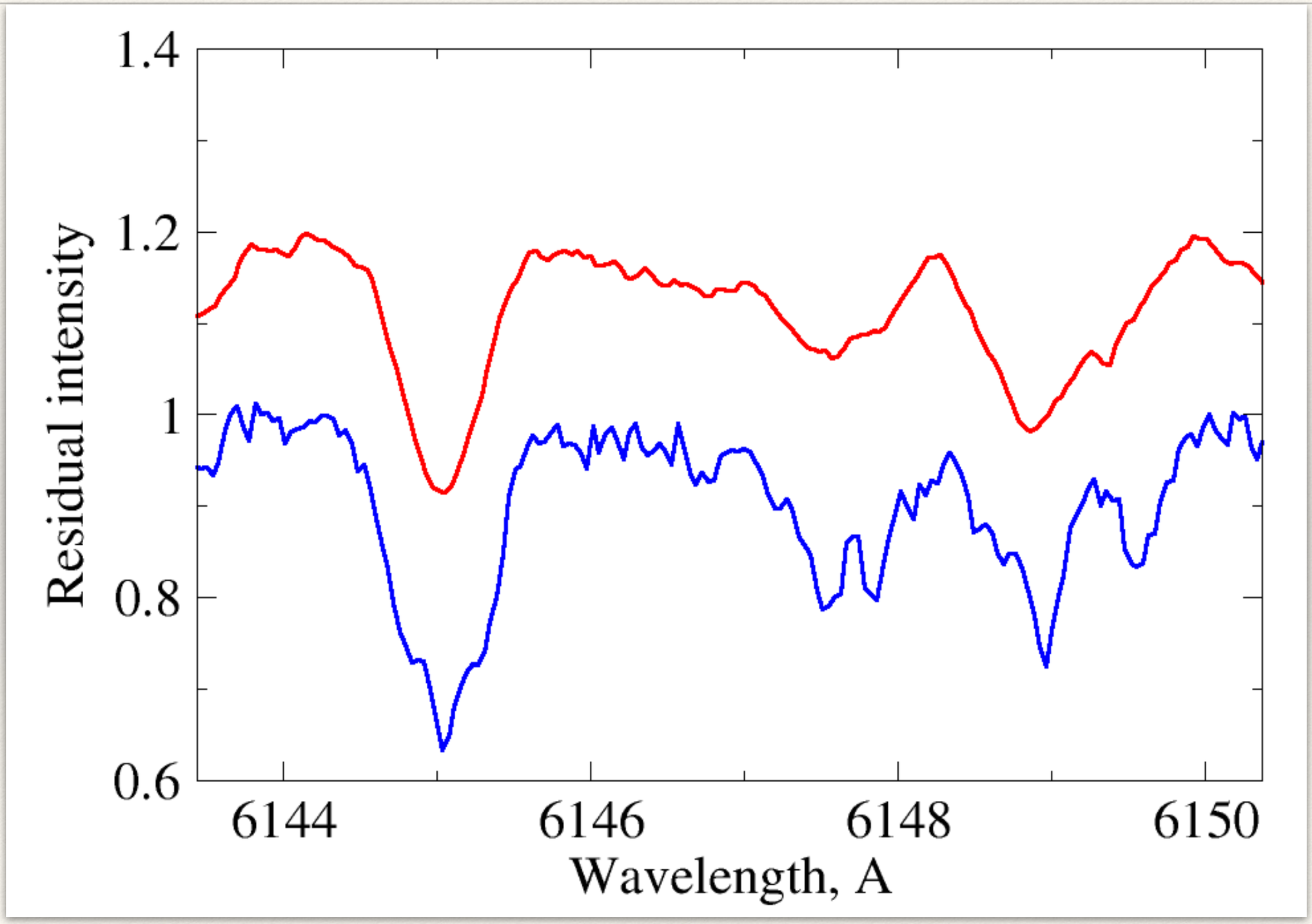
- **BD +40° 175** is the only visual binary where both components (m_V = 9.5 and 9.9 mag, ρ = 3.7″) are magnetic (opposite polarity)
- Surface field was measured from echelle spectra and exceeds 10 kG
- Physical properties are typical to roAp (Teff = 7700 K, log g = 4.0, abundance anomalies for Pr, Nd, and Tb)
- Rotational periods are unknown

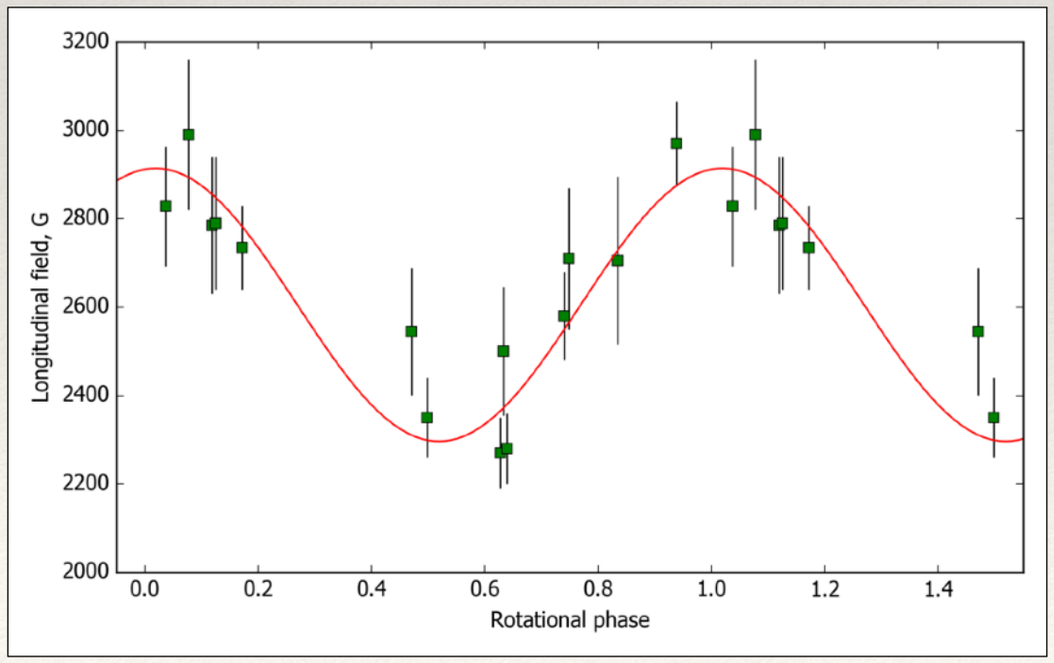


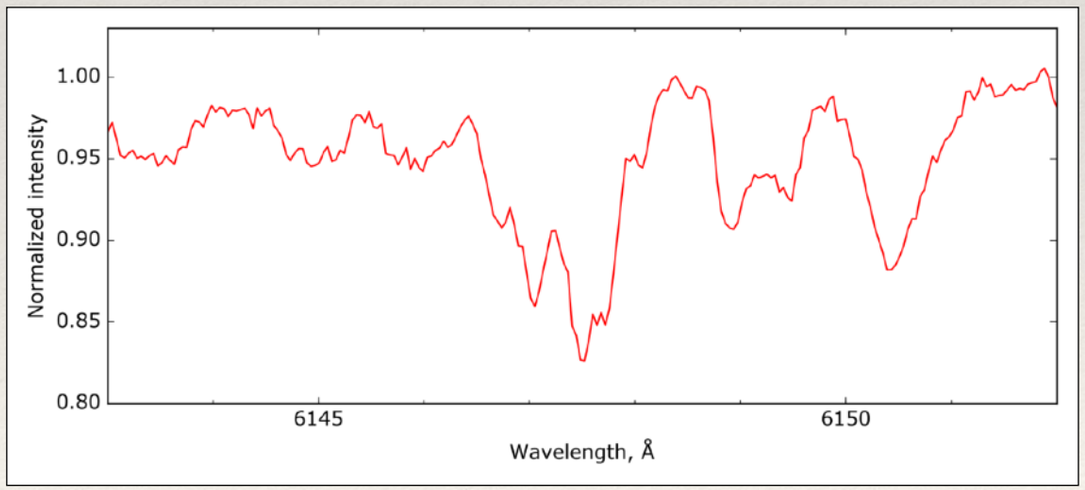
Interesting cases of binary and multiple stars. BD +40° 175



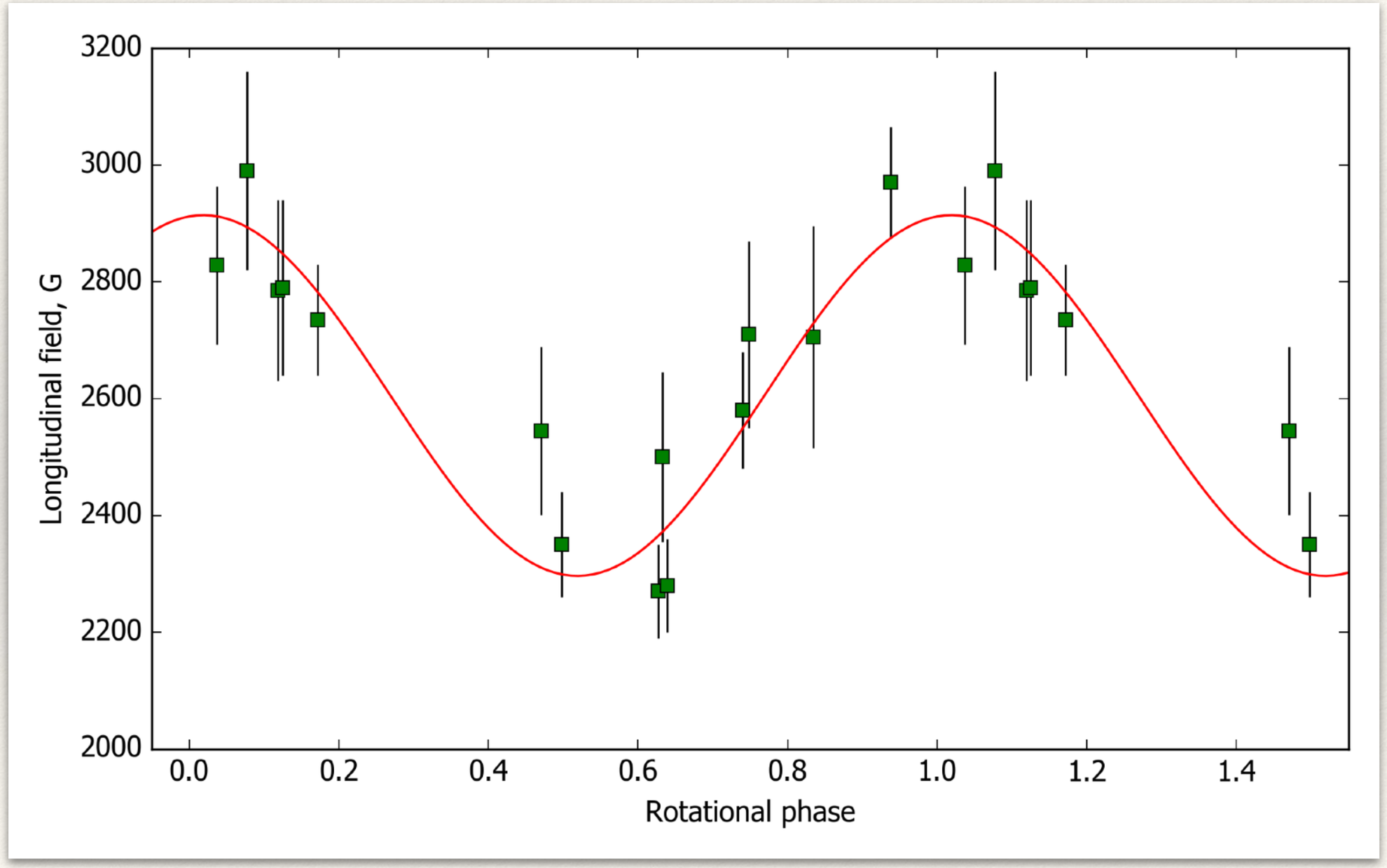
Interesting cases of binary and multiple stars

- **HD 6757** is a known multiple system ADS 936 AB (m_1 = 8.05, m_2 = 9.5 mag, ρ = 0.3″ (1876), 0.7″ (2015)). Expected orbital period is about 1000 years
- Ongoing monitoring of the magnetic field at SAO's 6-m telescope
- Rotational period P_{rot} = 2.655 days
- Magnetic dipole model: $B_d \approx 9800$ G, $\beta \approx 25°$, $i \approx 15°$ if $R \approx 2R_\odot$. From spectra $\langle B_s \rangle$ = 10400 ± 400 G





Interesting cases of binary and multiple stars. HD 6757



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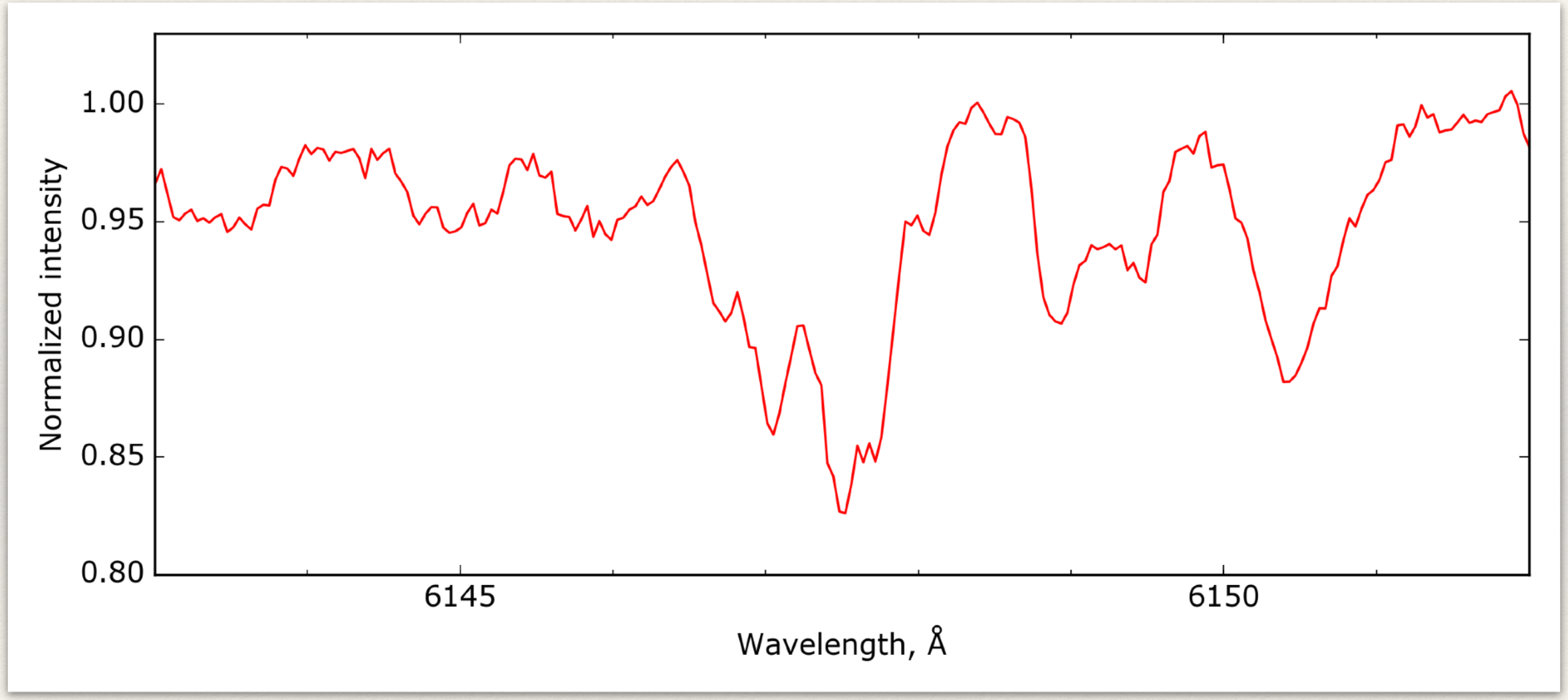
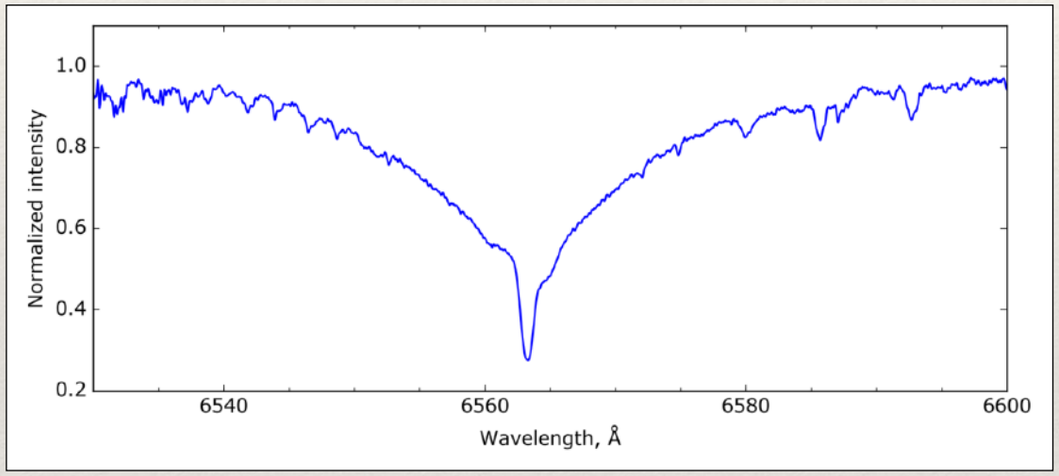
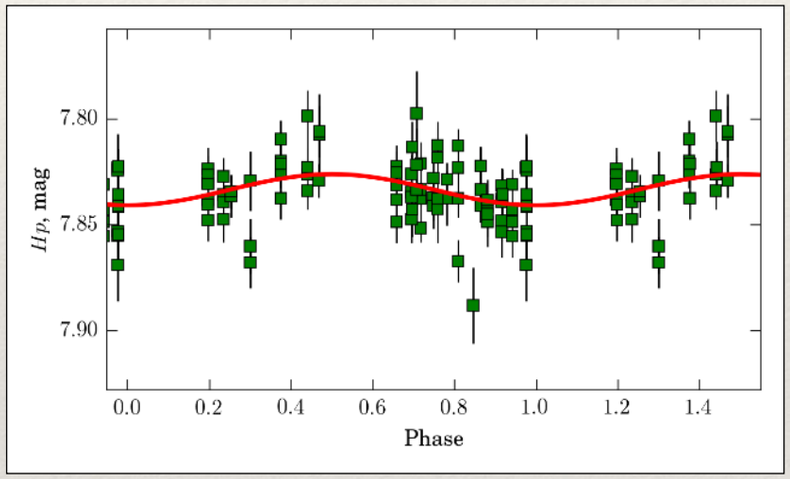


Interesting cases of binary and multiple stars

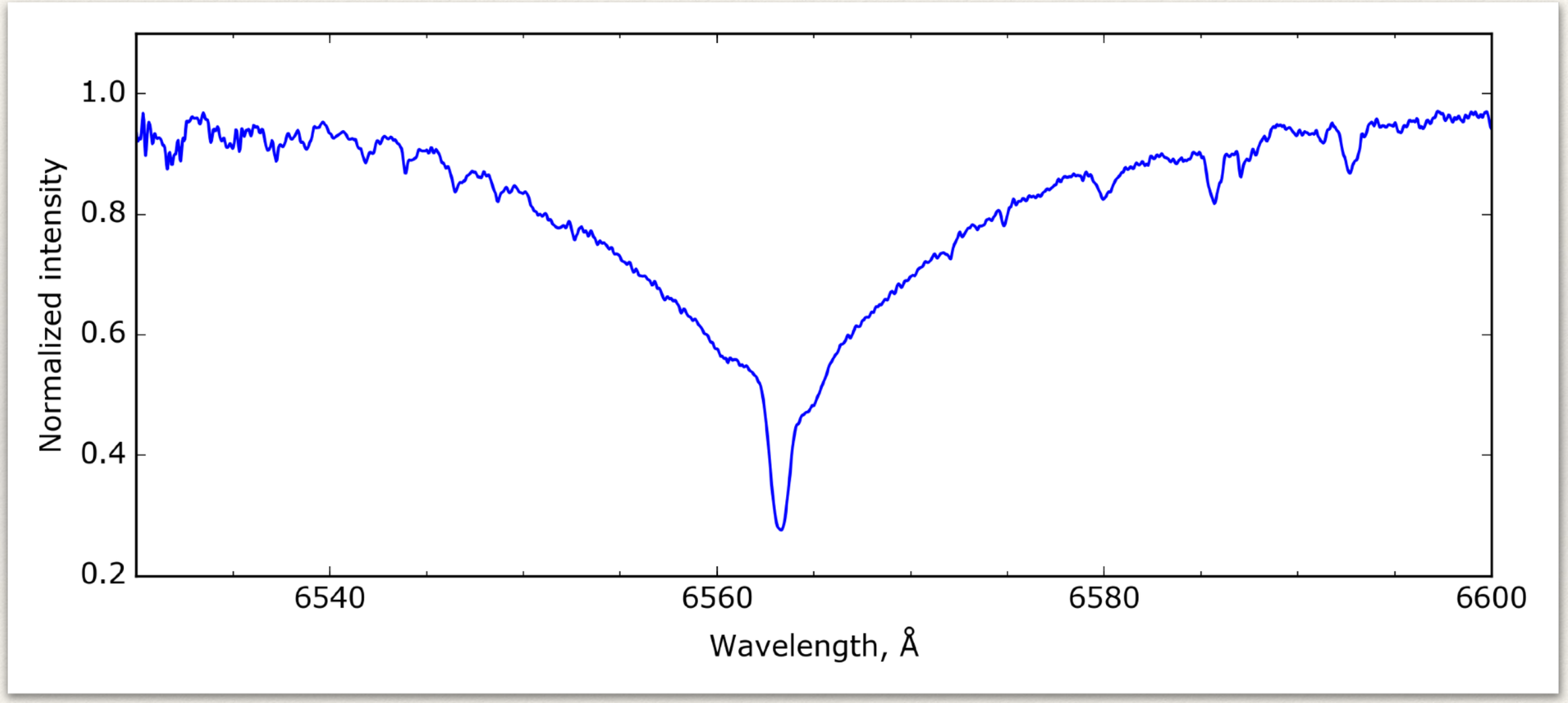
- **HD 6757** shows the signatures of at least one additional component (features in hydrogen lines and photometric variability with P = 358 days)





- The radial velocity of brighter component is nearly constant (-5 km/s). The secondary is a spectroscopic binary star.

Interesting cases of binary and multiple stars. HD 6757



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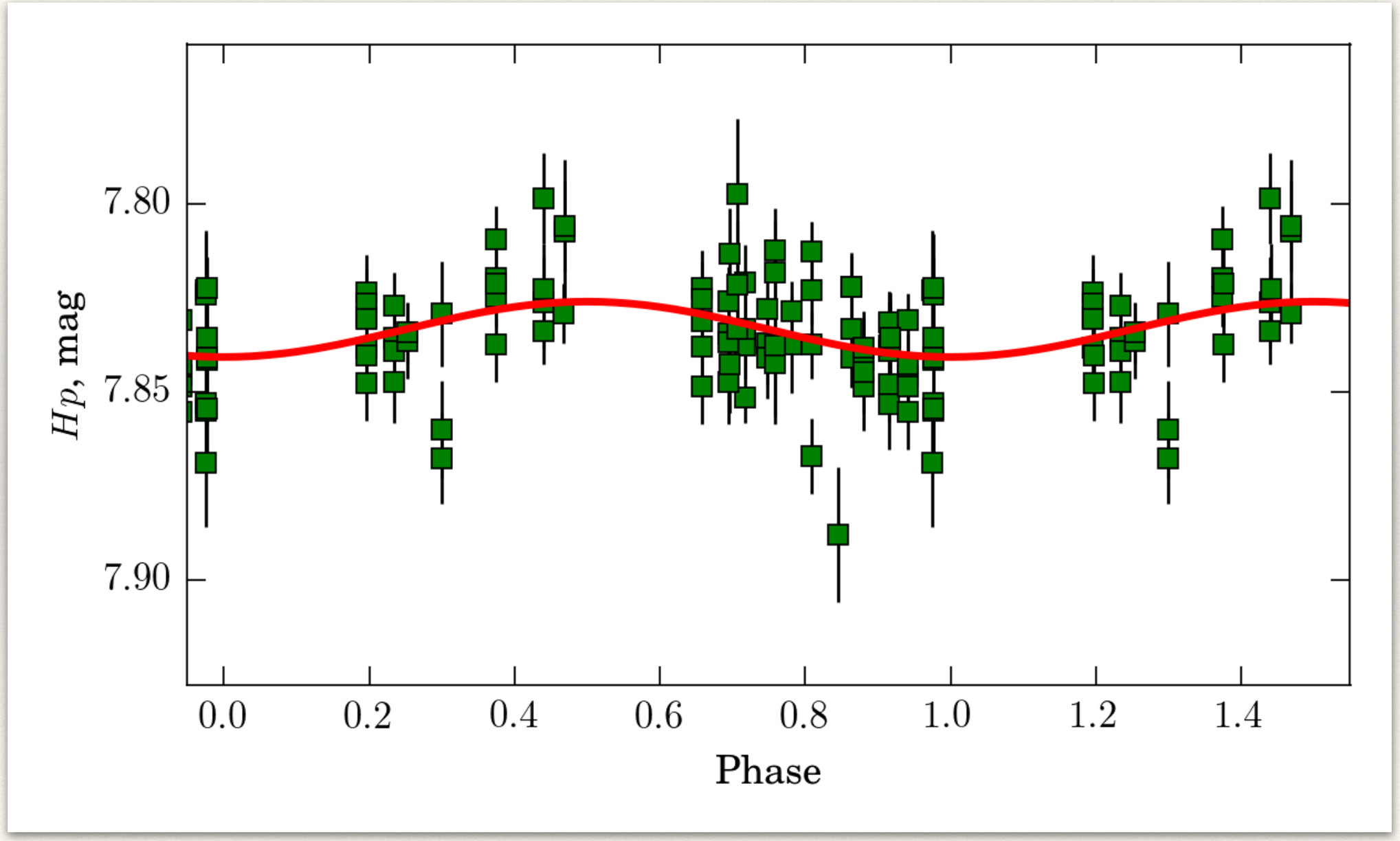

Interesting cases of binary and multiple stars

- **HD 36313** is a member of Ori OB1 association (*t* is about 2 Myr).
- Binary system (ρ = 0.2″, Δm = 1.5 mag)
- Main component is a fast rotating star ($v\sin i > 80$ km/s, P_{rot} = 1.1786 days)
- Composite spectrum contains narrow lines of the secondary star ($v\sin i$ = 25 km/s)
- The longitudinal field is measurable only in hydrogen wings (-1.5…+2 kG)

See in details in poster **A4**

Future prospectives

- To combine the data of spectroscopy, photometry and speckle-interferometry
- To make careful analysis of all available data for the new magnetic stars discovered at SAO
- To continue the monitoring of the selected stars with the 6-m telescope