Lineprofile observations of ϕ Per

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Summary

The results presented here treat the long-term monitoring of line profile behavior of the Hα- and HeI6678-emission in the binary system ϕ Per. The system is quite well understood from today's view, nevertheless the observation of the line profile variations for amateurs is an expressed exciting affair.

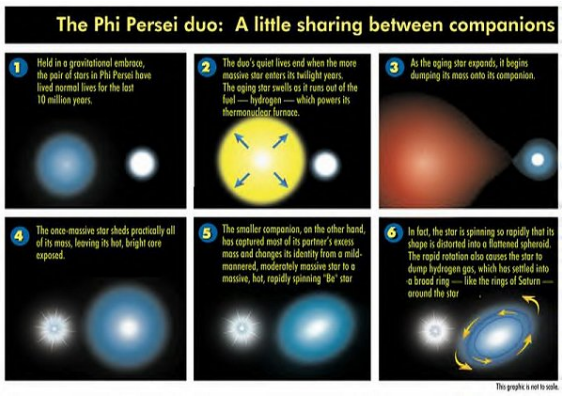
The unusual double star system ϕ Per consists of a quickly rotating Be star (B0.5IV) and an invisible companion with one rotating period of ~127 days in its orbit. From investigations with the Hubbel Space Telescope was found for the first time in the total spectrum of the system a clear proof of the spectrum of the companion:

a small hot star of the spectral type sdO with 1 solar mass and an effective temperature of 53000 K, which probably represents the remaining product of the mass exchange with a very more solid star. An astronomical artist succeeded, to paint a beautiful rendition of today's conceptions of the star system (Fig. 1).

The design represents the star system with an assumed angle of inclination of 80° in the rotating phase of the upper conjunction figurativy. The primary star right above appears flattened and because of the extremely high rotation speed (Vsin i = 450 km/sec) gravitation-colluded.

The inner edge of the disk, which it faces the hot companion has a bright appearance because this range is heated by the secondary star up to the ionization. This hot secondary star (subdwarf) appears in the foreground (at the bottom left hand corner) with radiation characteristics, the one stellar wind suggests Thaller e.a. (1995).

From observations of the HeII line at 4686 Å one takes on for the secondary star likewise a zirkumstellare disk, which after present conceptions one feeds again by disk material of the primary component. The total development way of the star system after today's realizations the following illustration points in different stages:



One of the main features in the total spectrum of ϕ Per are the phase dependency of the Hα- (Fig.2) and the HeI6678-emissions (Fig.3). The period amounts 126.6731 days.

Fig. 1: Artistic rendition of the today's conception the system ϕ Per

From October 2000 untill February 2003 I could observe with a grating spectrograph five cycles of the system. The dependency of the line profile variation of the phase is good to recognize by the continuing change of the V- and R-component (Fig. 2). In addition the extreme width of the emission is to be considered because of the high rotation velocity (~ 450 km/sec).

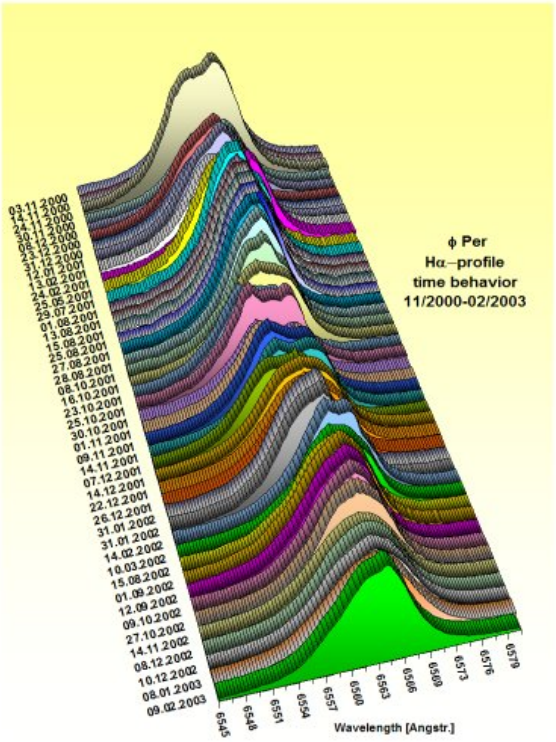


Fig 2. Behavior of the Hα-emission as a function of the phase

Very exact analyses of orbital phase variations were also accomplished at some selected HeI emissions Stefl, Hummel, Rivinius (2000). The most important realizations from these observations (1993-96) are summarized the following:

The helium emission profiles show a combination of two kinds of variation:

1) those already admitted orbital variation
2) Long-term variations of the asymmetrical V/R relationship

The orbital variation of the HeI6678-emission can be found with amateur spectrograph

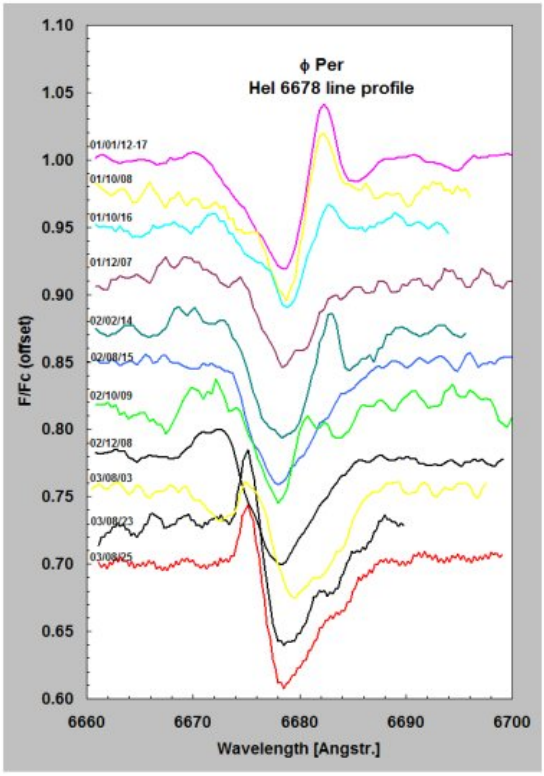


Fig. 3: Behavior of the HeI6678-emission as function of phase

In Fig. 3 are represented the single spectra of my observations of 2001 until 2003 one above the other as a function of the phase. The stellar absorption of the HeI6678 was standardized with a spline function on the continuum level. Thus the weak emission component becomes more clearly visible. It is to be seen clear that the wavelength of the emission shifts as a function of the phase from red to violet.

References

Stefl S., Hummel, W., Rivinius Th., A&A 2000, April
Thaller, M. L. e.a., 1995, ApJ, 448, 878