The HeI 6678 Double Peak Emission in γ Cas

In the past, γ Cas was examined spectroscopically mainly in the area of the Hα line, but with the establishment of a research branch for Be stars at the Ruhr University Bochum (Germany) under the direction of Prof. Dachs and Dr. Reinhard Hanuschik around 1993-94, studies were carried out with the aim of learning more about the kinematics of circumstellar disks around Be stars.

Above all, this included investigations on the helium lines, i.e. those areas of the Be star disk in the immediate vicinity of the central star. Based on model calculations by the Japanese Be star researcher Okazaki, it was assumed that so-called "one-armed density zones" also preceeds around the star in these disc areas close to the star.

These equatorial density enhancements were found to be located approximately 1.5 star radii from the star surface. In 1998 the French astronomer Phillip Stee confirmed that the HeI emission line at 6678 Å was responsible for the excitation and ionization of the helium in an extended range up to about 2.3 star radii.

This HeI emission at 6678 Å (Fig. 1) became an important diagnostic feature for the investigation of the star-related activity areas. It was recognized that a time-dependent photospherical mass loss of the primary star, density variations and thus the typical double peak profile variations - known as the so-called V / R ratio - resulted in this emission.

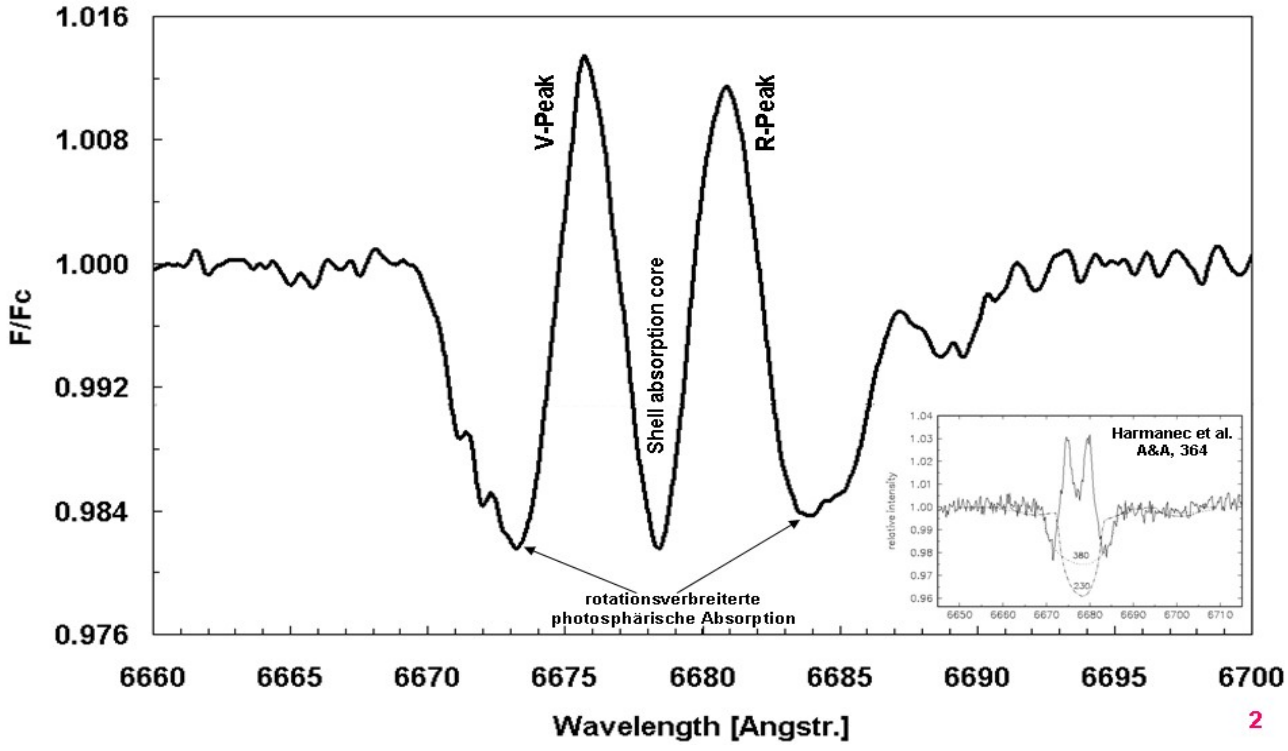

Fig. 1

The V / R ratio is the peak height ratio of the violet to the red emission peak and describes as a main characteristic density variations in the gas disks of Be stars. Until about 2012 there was no information in the literature about possible V/R periodicities of the HeI-6678 double peak emission line in the spectrum of γ Cas.

The accuracy of the V / R measurements is essentially determined by the S / N and the accuracy of the local continuum. In addition, the definition of the line wings and the underlying photospherical absorption line profile (Fig. 2) are important. To calculate the V / R ratio, the violet and red absorption minima (Fig. 2), which were previously connected by linear interpolation, were divided, thus achieving the required standardization according to F / Fc = 1.

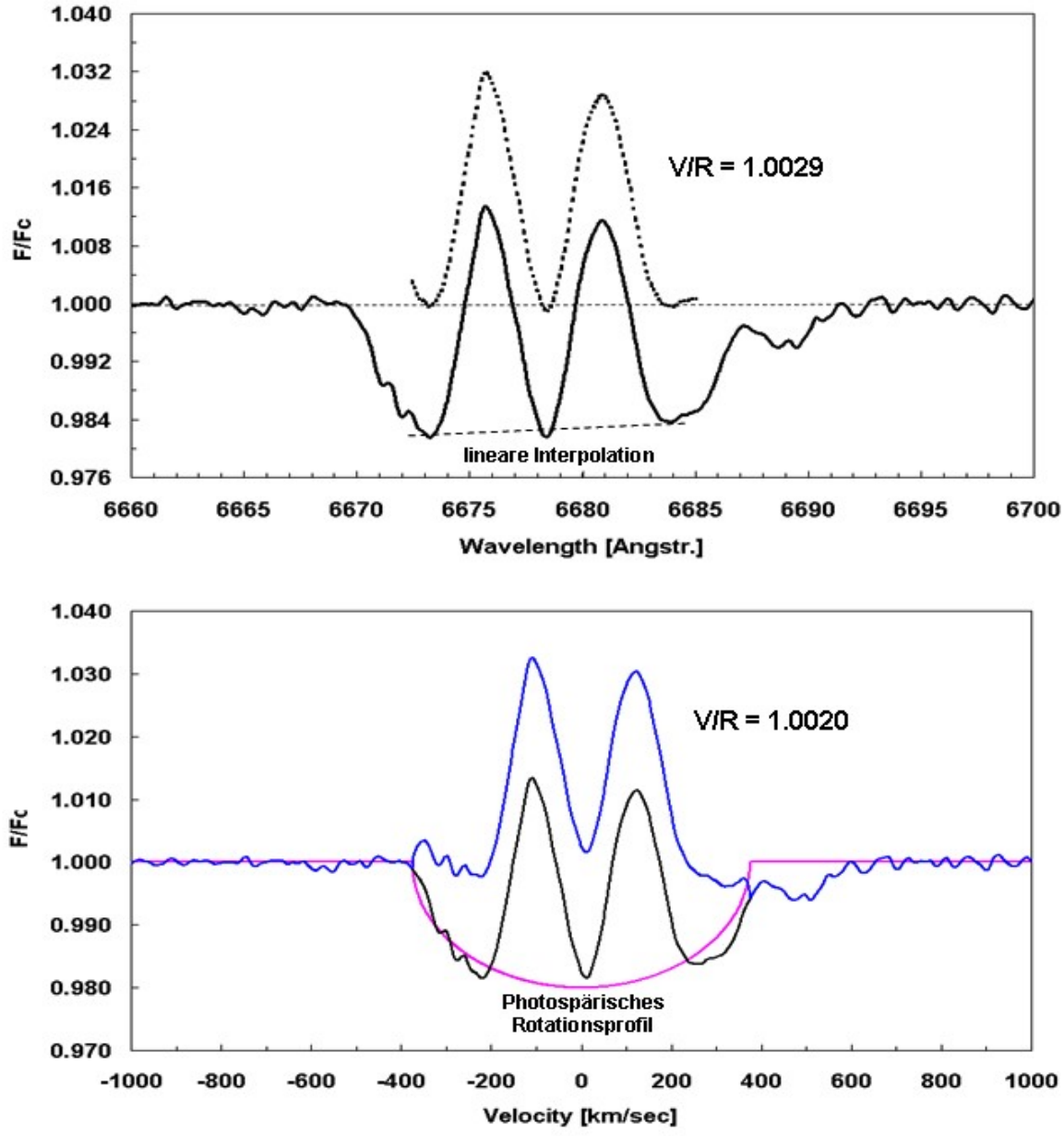

Fig. 2

Another method of separating emissions from the photospherical absorption profile is by subtracting a fitted, theoretical absorption profile (Fig. 2). A comparison of these two methods on one and the same spectrum led to a deviation of linear interpolation in the order of 0.01% in V / R.

The V and R intensities that were separated from the photospherical absorption profile in this way are then the line maxima that were used for further evaluation. The average accuracy of the V / R measurements was around ± 2%.

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