Possible HeI 6678 Emission Activity in γ Cas
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1. Introduction

Spectroscopically γ Cas has been investigated mostly in the Balmer lines, mainly in Hα. Recent studies considered He and Fe lines as well as the kinematics of the circumstellar shell (Hanuschik, 1994, Smith, 1995). It is believed that a local density enhancement - a one-armed density spiral - is embedded in the accretion disk of γ Cas.

The precession of this density enhancement has been observed interferometrically by Berio, et al. (1999). They found that this enhanced equatorial density pattern may be located at 1.5 stellar radii from the star's surface. Stee, et al. (1998) proposed that He excitation and ionization, particularly HeI 6678, extend to 2.3 stellar radii.

The probably time-dependent mass loss from the primary component of the γ Cas binary system allows us to assume that both photospheric and disk density variations lead to the observed double peak profile variations. Recent investigations of Smith, (1995), Harmanec, et al. (2000) and Miroshnichenko, et al. (2002) give detailed information about long-term monitoring of the phase and time dependent radial velocities and equivalent widths of the HeI 5875 emission but not for the HeI 6678 line.

2. Results

First spectra from Pollmann with a resolution R~8500 come from May 2002 obtained with the grating spectrograph of the 400 mm Schmidt-Cassegrain telescope of the Vereinigung der Sternfreunde Köln. The spectra of Stober were taken with a 300 mm Newton telescope and a Littrow-grating spectrograph (R~8000). Usually, about 100 CCD spectra, with integration times of 20-30 sec. were combined. Each single spectrum has been carefully examined for cosmic rays.

In case of any cosmic ray appearence the respective spectrum has been rejected not to introduce artificial flaws within the nightly sum spectrum. The complete data reduction and equivalent widths measurement have been done according to a standard procedure as already described in Pollmann (1997). The accuracy of a EW measurement was determined in each sum spectrum according to the method of Chalabaev, and Maillard (1983).

The size of the error bars of individual data points correspond to the maximum standard deviation of 14%. Our S/N ratio was always between 400 and 1600. To evaluate the time behavior of emission activity and to reduce error bars, we combined individual values of the equivalent widths of the violet component EW(v) and the red component EW(r) to the sum EW (v+r) = EW(v) + EW(r) as presented in Fig.1.

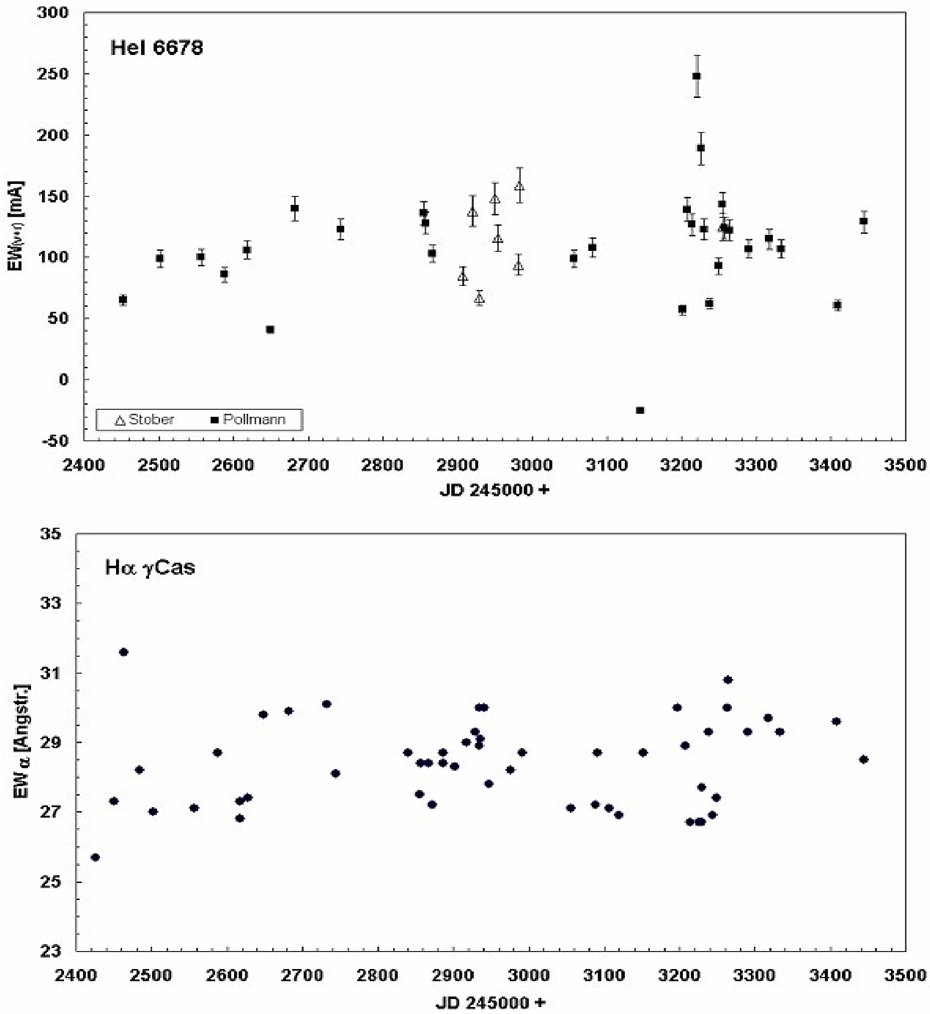

Fig. 1: Comparison of the time behavior of the HeI6678- and Hα-emissions in the same time interval.

In fig. 2 single spectra are combined as an "average normal spectrum" for the period May 2002 - March 2004 (JD 2452452 - 2453081).

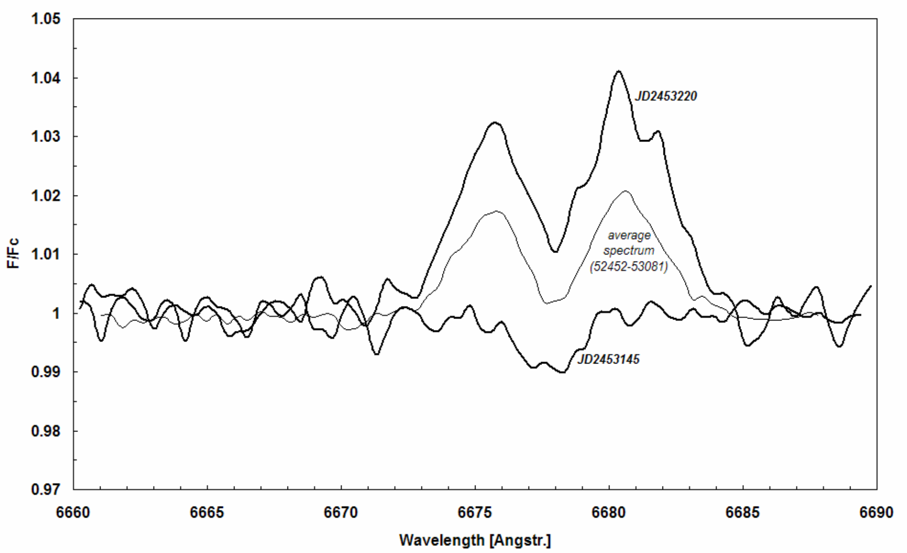

Fig. 2: Comparison of the "average normal spectrum" to the HeI6678 absorption spectrum at JD 2453145 and maximum emission spectrum at JD2453220

On May 19, 2004 (JD2453145) we observed HeI 6678 only as weak absorption of EW (v+r) = 25 mA but followed by a strong and short outburst until about August 02 (JD2453220) with a maximum of EW (v+r) = -255 mA. To illustrate these two „events" the appropriate spectra are printed together with the "average normal spectrum" in fig. 2. For clarification we show in fig 3. the extrem spectra at JD2453145 and JD2453220 between 6500-6700 Angstr.

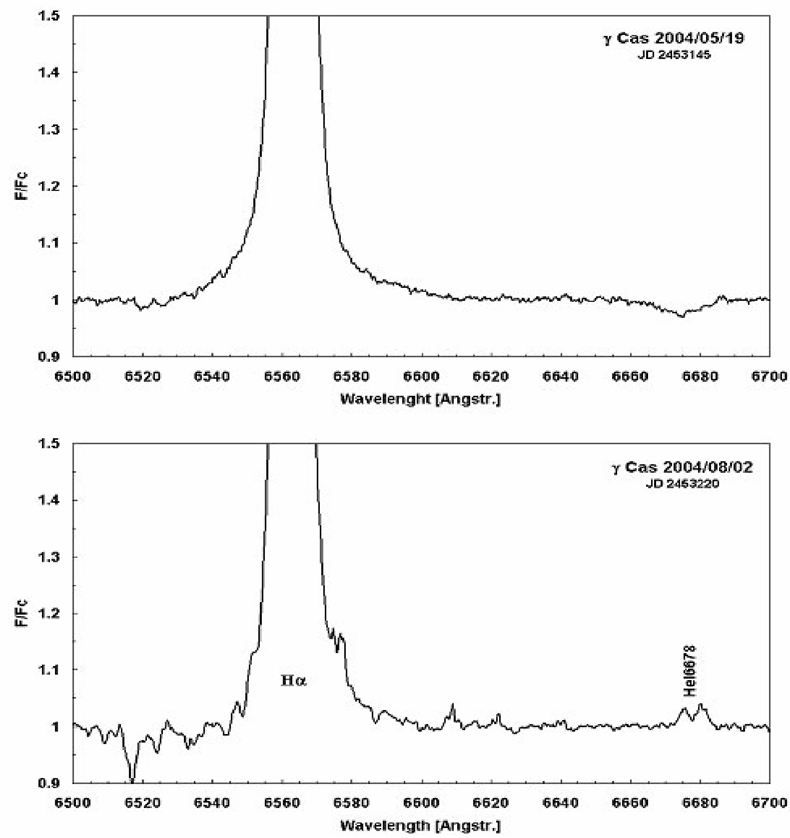

Fig. 3: To the elucidation the spectra of the "extreme events" at JD2453145 and JD2453220 in the 6500-6700 Angstr.-section

To find any correlation between HeI 6678 activity and Hα emission we show EW (v+r) and EW (Hα) in Fig 1. With to our Hα error bars of 5 A we are not able to claim for any EW correlation between these to lines within the time interval of 2453140-340. It seems, that in certain exceptional cases ♑ Cas shows a more or less constant emission activity of the HeI 6678 line of 1-2% of the continuum, as visible in our average normal spectrum and as seen by Smith (1995). For this reason a further continuous monitoring seems to be of large interest.

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