Non-radial Pulsations of γ Cas

Motivated by the paper of S. Yang et al. "Non-radial oscillations of the Be star γ Cas" (Pub. of the Astr. Soc. of the Pacific, 100, 1988), I have tried to reproduce this kind of investigation with my own observations on July 14/18/19/20 of this year. My primary aim has been to find moving sub-features within the HeI 4471 absorption line, which were caused by non-radial pulsations, so called beta Cep pulsations.

The time series of spectra were obtained with the LHIRES III Littrow-spectrograph (spectral resolution R ~ 14000, reciprocal dispersion of 12.7 Å mm^{-1}) on a 14" SC-telescope, with integration times of 150-400 sec. for the individual spectra (Fig. 1). This corresponds to a dispersion of 0.114 Å per pixel.

For the most part, 4-10 individual spectra have been used for a sum spectrum. The S/N in all sum spectra has been higher than 1000. The numbers at the left of each panel indicate the mean observation time as fraction of a day. The spectra have been smoothed by application of a high order spline function.

Because the quality of observation was the best on July 19/20, I tried to find in these spectra moving sub-features within the residuals as differences from the average spectrum (Fig. 2). Contrary to the results of the above mentioned paper, both residual panels don't show any clearly recognizable moving sub-features, although the dispersion almost is comparable to the investigation of S. Yang et al. The question is why?

A further result of the observation is the variation of the absorption depth of the line. This is the case at the end of the July 14 observation (γ Cas almost at zenith at my location) and during the entire July 18 observation. Because of this variability, I evaluated the equivalent width of all spectra.

The EW-time behavior of these 4 nights is shown in Fig. 3. I know that the single scalar parameter EW, which integrates over the line profile, doesn't show the line-profile variations, but I think it is legitimate in this case.

Here is the question: What is the reason for this clear EW variability? Can beta Cep pulsations explain it? On the other hand, as my long-term monitoring of the HeI 6678 line in Fig. 4 shows, considerable variations in EW can occur. Is it possible that the HeI 4471 absorption was filled up with emission?

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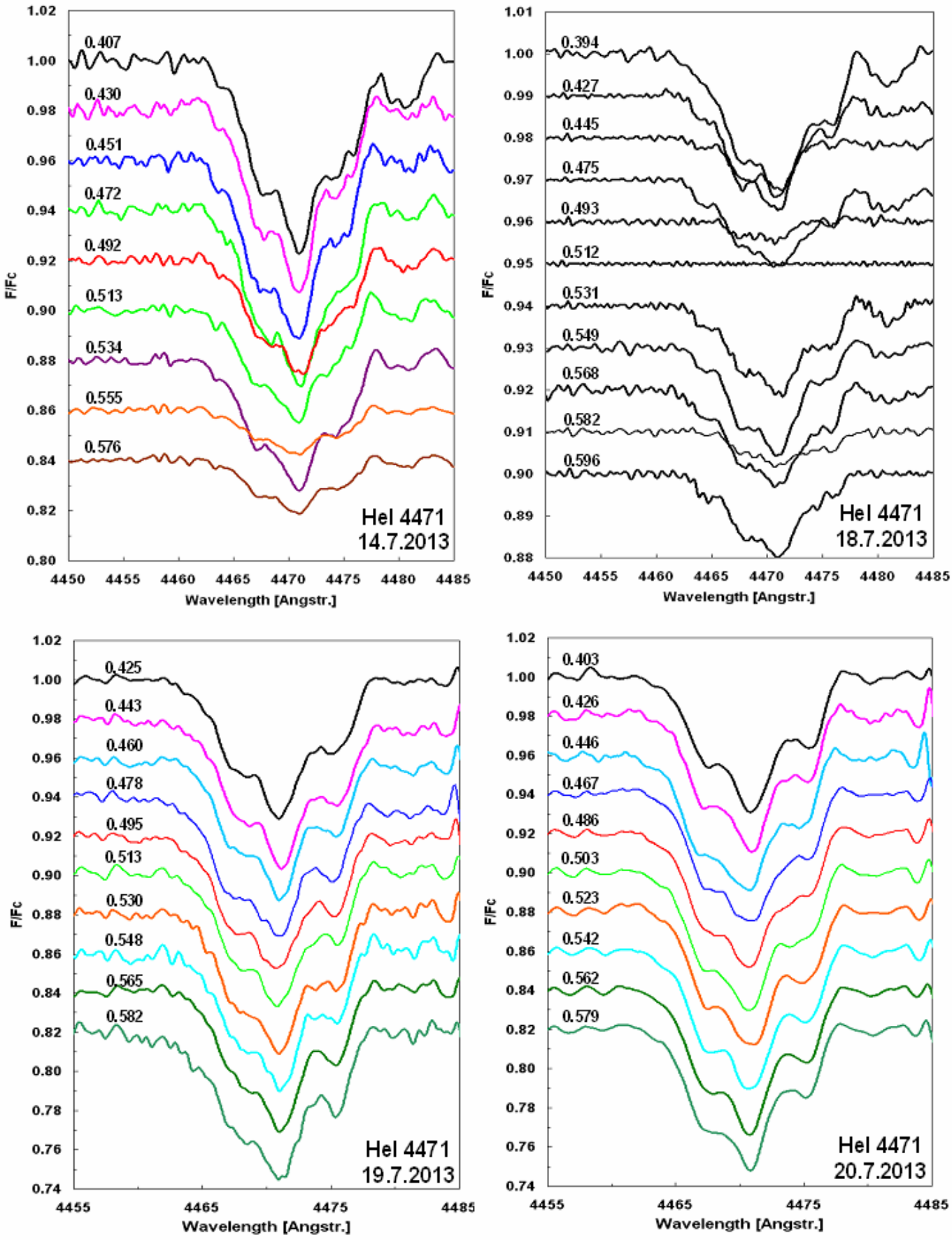

Fig.1: Time series of spectra of all observations 2013 July 14/18/19/20

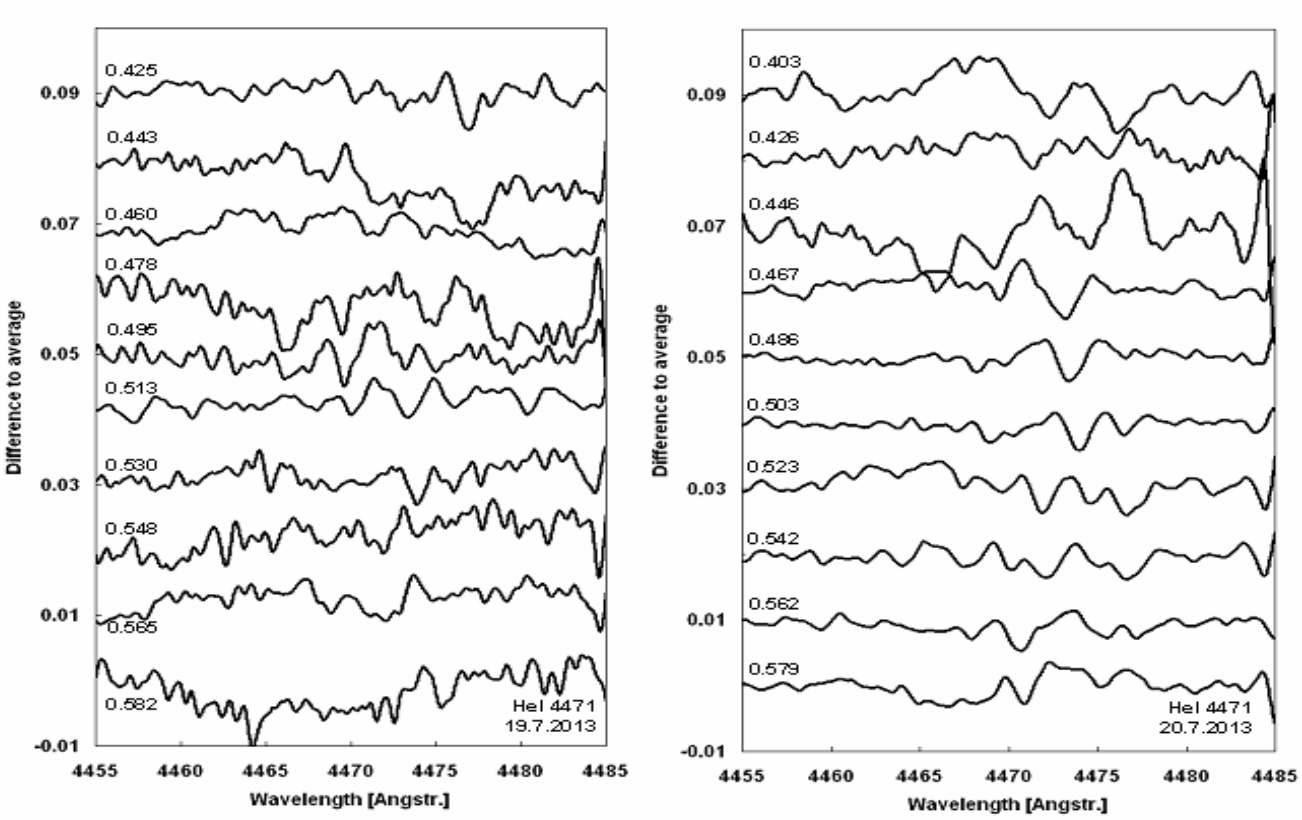

Fig. 2: Residual spectra formed by taking the difference between the spectra in Fig. 1 and the average spectrum from the time series

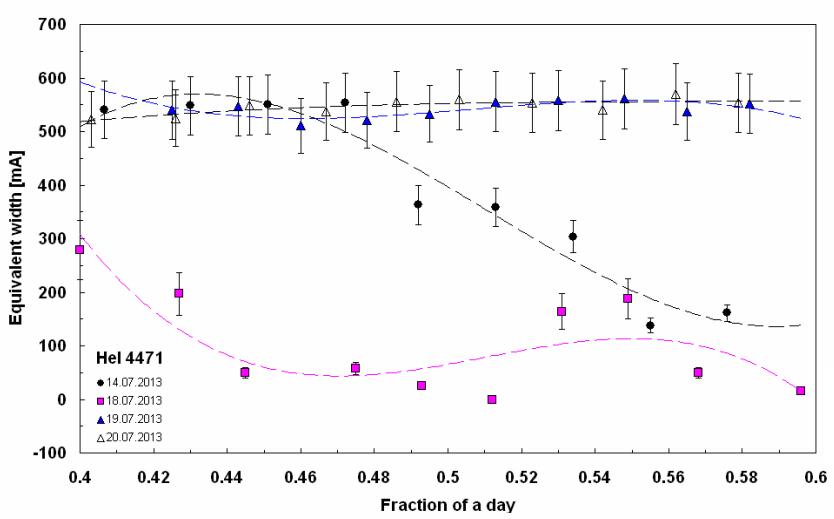

Fig. 3:.
The EW time behavior of all 4 nights

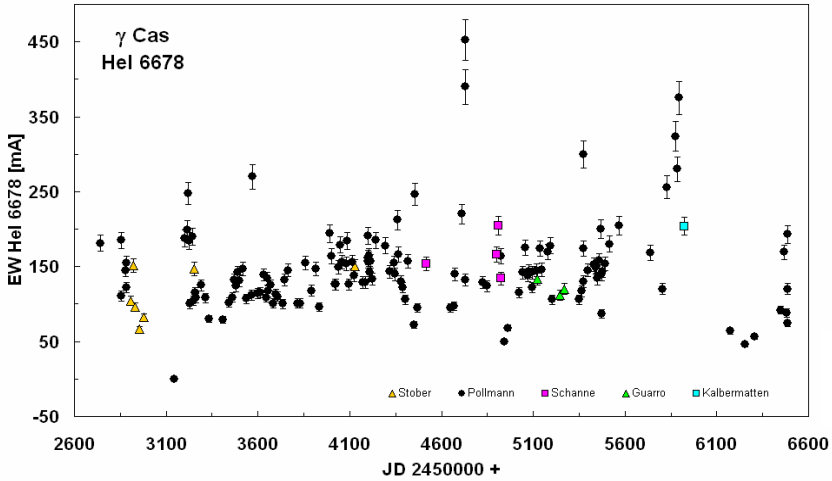

Fig. 4:
EW long-term monitoring of HeI6678