

V-Brightness and H α -Spectroscopy of the Be-Star γ Cas

In addition to the meanwhile probably well known cooperation between AAVSO and „ASPAs“ Active Spectroscopy in Astronomy“ concerning the LBV-Star P Cygni, a further similar cooperation between ASPA and the Hungarian variable star observer Ferenc Puskas has cheerfully developed for the prototype of all Be-Stars, γ Cassiopeia.

Ferenc Puskas is observing γ Cas since 2001 visually (with binoculars) and has introduced until end of 2008 a remarkable monitoring of the star's Luminosity pattern. Today the cooperation between ASPA and F. P. allows to compare the spectroscopic H α -Monitoring with the visual luminosity pattern for this seven year period (see fig1). As far as known to the authors this represents the up to now absolutely longest time scale of this kind (at least for γ Cas).

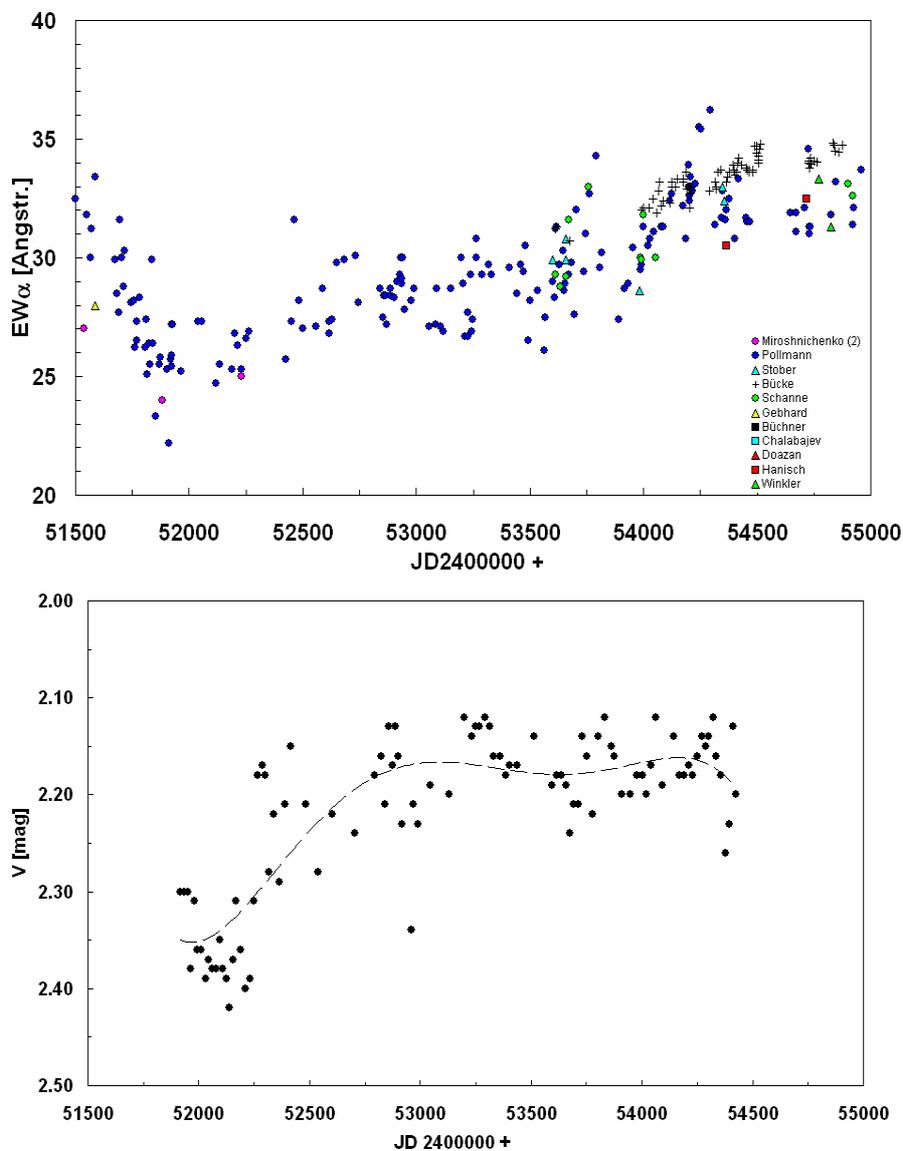


Fig 1: Comparison of the time related behavior of the H α -equivalent width of γ Cas (upper graph; from observations of the ASPA-Group and other sources) with visual luminosity estimates observed with binoculars by F. Puskas

The $H\alpha$ -equivalent width is since its minimum in 01/2001 obviously positively correlated with the luminosity of V. A professional ESO astronomer supporting the ASPA-group wrote about this result: „*This is a very interesting composition of excellent data. It is a pleasure to see that amateurs are continuing where the professionals have terminated their work*“. It was recommended to investigate the line profiles of the spectra in more detail because they contain much more information than just the $H\alpha$ -equivalent width. Unfortunately the spectroscopic $H\alpha$ -monitoring with the required high resolution ($R\sim 14000$) is only performed since 1997. Therefore this suggestion could not be realized.

The chronological behavior of V in the lower graph of fig. 1 is a combination of monthly averages from almost daily estimates. F. Puscas lives in Hungary in a rural area which allows him to estimate the star's luminosity in this unusually high frequency. As far as known to the authors a comparable investigation exists for the Be-Star χ Draconis from the year 1994 (K. Juza et al., *Astron. & Astrophys. Suppl. Ser.* 107, 403-411). In this project it is demonstrated by using the positive correlation of the $H\alpha$ -equivalent width to the V-luminosity (fig. 2) that the maximum luminosity coincides with the increase in $H\alpha$. The authors discovered positive correlation for so called pole-one-stars, and anti-correlation for so called equator-on-stars.

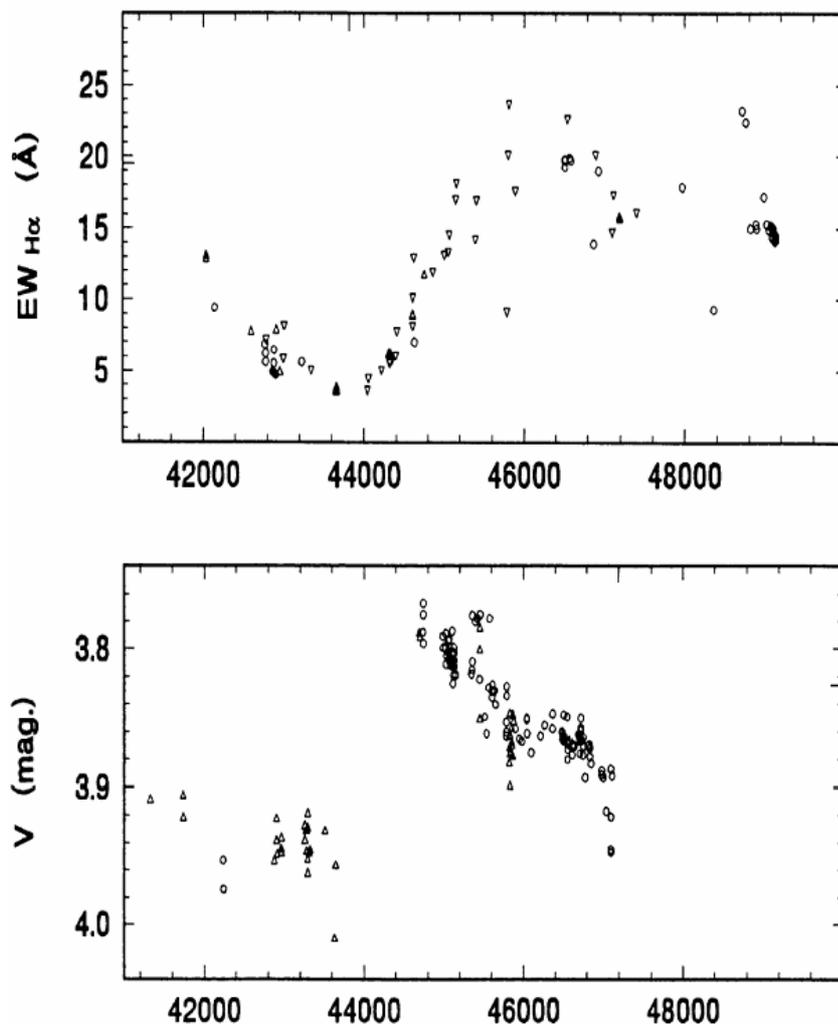


Fig. 2: Positive correlation of $H\alpha$ -equivalent width and V-luminosity in χ Draconis (K. Juza et al., *Astron. & Astrophys. Suppl. Ser.* 107, 403-411)

The supporting professional astronomer (Dr. D. Baade, ESO) proposed to refine the positive correlation at γ Cas by combining the graphs of $H\alpha$ versus V. This is shown in fig. 3.

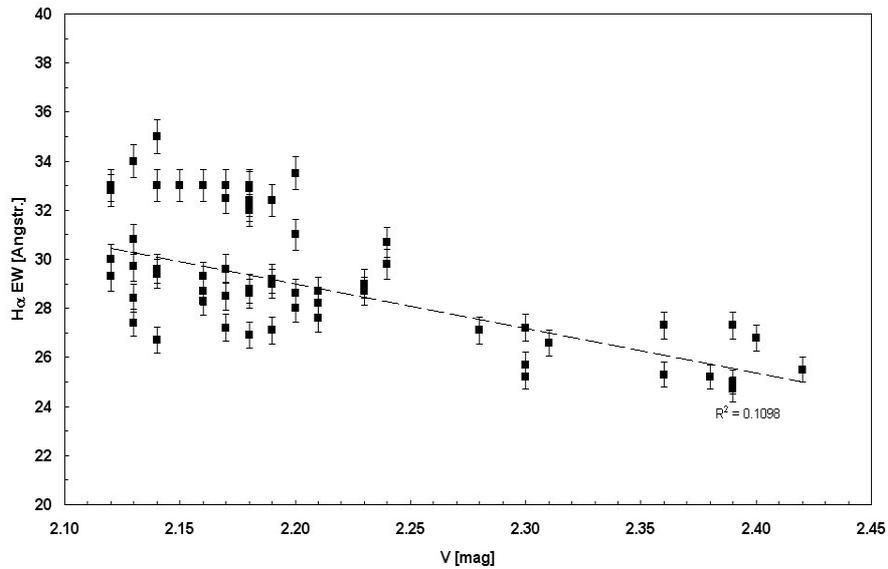


Fig. 3: $H\alpha$ -EW versus V to demonstrate the obvious correlation at γ Cas.

A comparison of time periods as in fig. 1 and 2 allows only a limited demonstration of the degree of correlation. The trend, however, becomes obvious. The quality of the correlation in fig.3 is mainly influenced by the known inconsistencies of visual luminosity estimates. Nevertheless there is no doubt that there is an interdependence.

As pure amateurs we are currently not in a position to offer a consistent physical interpretation of the observed interdependencies. We therefore would like to refer readers interested in further discussions to the publications by K. Juza et al. cited in this paper. In addition we would like to mention the related interpretations of P. Harmanec in Hvar Obs. Bulletin 7, 55.

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