

Periastron monitoring of Pleione November 2019 to February 2020

The extraordinary successful ARAS periastron passage campaign of 28 Tau from November 2019 to February 2020 has been an excellent example of how to combine typical $H\alpha$ line profile parameter in order to document the process of gravitational effects of the companion star on the Be star disk of this binary system. The attached Fig. summarizes the long-term monitoring of the parameter equivalent width $H\alpha$ EW (1a), central depression $H\alpha$ CD (1b) and $H\alpha$ V/R (1c).

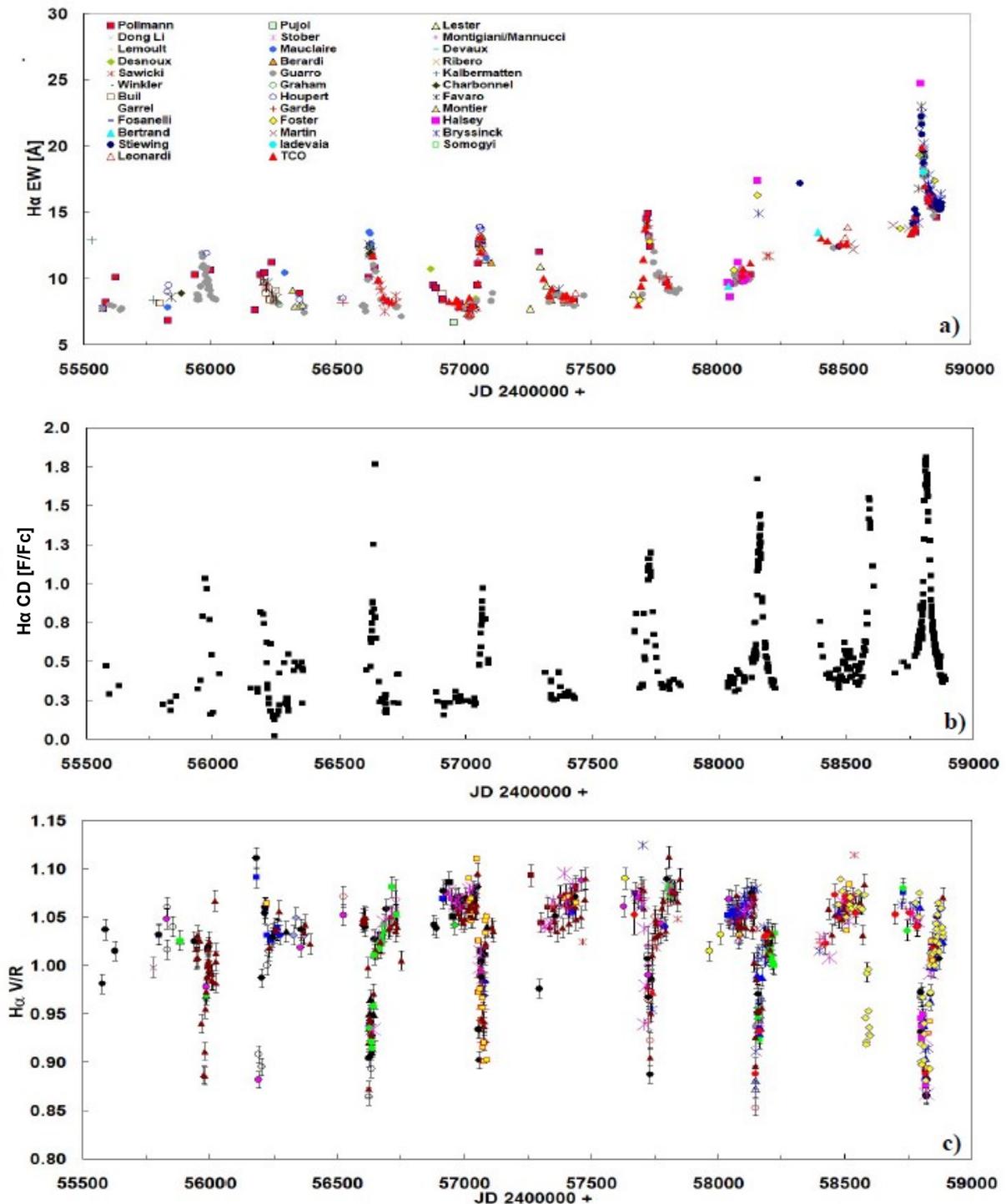


Fig. 1a-c: Simultaneous changes of the disk $H\alpha$ parameter EW, CD, V/R, during periastron passages from December 2010 to February 2020

The increase of the EW (1a) with a simultaneous decrease of CD (1b) during each individual periastron phase means that due to the tidal torque from the companion (Martin, et al. 2011), the H α line intensity may become larger and the emission peaks (V and R) become closer, showing a variable intensity behaviour (1c), because of the disc density increase.

So, during each periastron passage, the parameter EW, CD and V/R periodically offer the opportunity to evaluate the typical, characteristic change of each, in agreement with the others. All the mutual confirmations of these parameters are shown in the spectra, a process that repeats every time during the periastron passage of the companion star.

The clearly pronounced periodicity of the parameter CD suggests, of course, doing a period analysis. This is shown in Fig. 2 as PDM periodogram, and as phase diagram in Fig. 3.

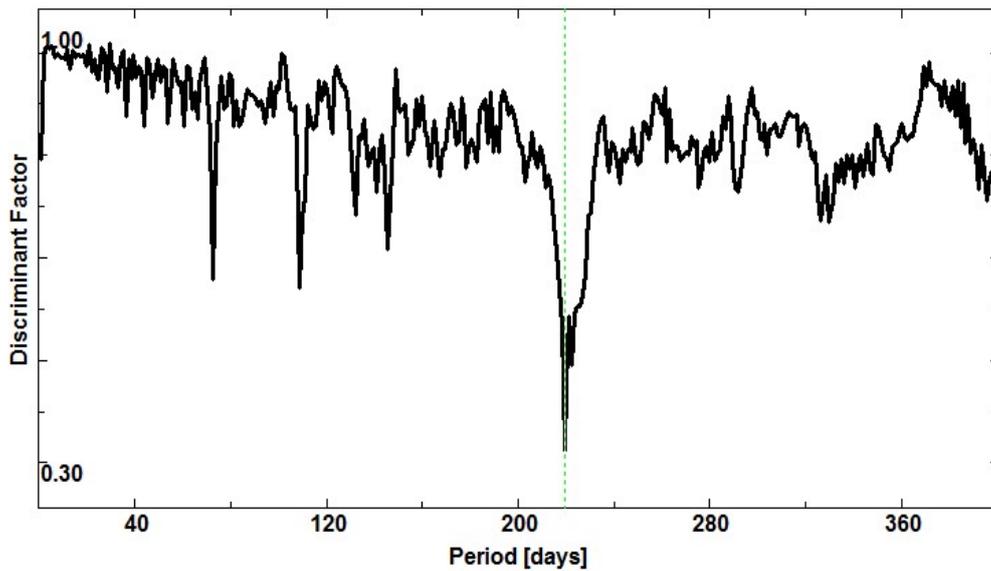


Fig. 2: PDM Period analysis of the H α profile parameter CD for 14 periastron passages; Period = 218.0167 d (\pm 0.0732)

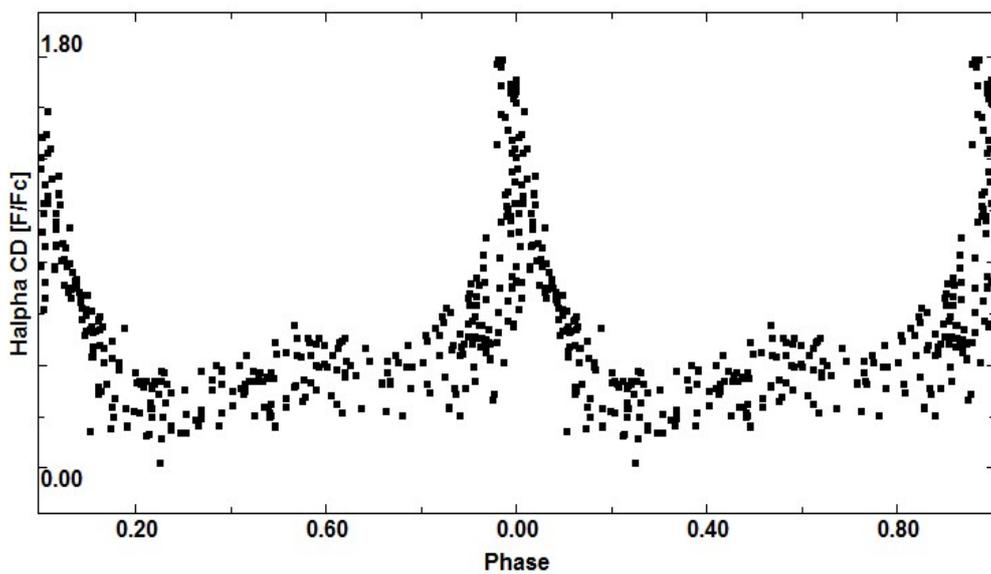


Fig. 3: Phase diagram of the found period in Fig. 2

This period of 218.0167 days agrees very well with the period of the V/R ratio and the shell radial velocity found by Katahira et al. (1996), Nemravova et al. (2010) and Pollmann (2015). Katahira et al. (1996) analyzed shell RV's from the two consecutive shell phases separated by some 34 years, and found for this spectroscopic binary an orbital period of 218 days. Those phases of activity of the star which are a result of the periastron passages of the companion, are manifest as strong changes in the central depression depth H α CD, the H α EW and H α V/R, and according to Hirata (2007), are referred to as "maximum shell phases".

The next periastron passages will take place on June 28th 2020 (JD2459029), February 1th 2021 (JD2459247) and September 7th 2021 (JD2459465).

References

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