

Spectral variations of Be/shell star Pleione connected with its 218^d binary period

L. Iliev¹ and A. Miroshnichenko^{2,3}

¹ *Institute of Astronomy, Bulgarian Academy of Sciences, Bulgaria (E-mail: liliev@astro.bas.bg, iliev_lubomir@yahoo.com)*

² *University of North Carolina, Greensboro, USA*

³ *Fesenkov Astrophysical Institute, Almaty, Kazakhstan*

Received: November 15, 2024; Accepted: January 18, 2025

Abstract. Pleione is a prototype of a group of Be/shell stars that represent cyclic changes in their spectral appearance. The star was suspected to be a binary or multiple system. In the present study we are trying to obtain more precise picture of going on spectral changes of Pleione by data-mining in existing archives of Be stars spectral observations. New results reveal unknown before details about developments in the circumstellar envelope of Pleione, connected with the interactions in the system.

Key words: emission line stars – binary stars – Be stars – shell stars – circumstellar disks

1. Introduction

Pleione was proved as a binary system with 218.023^d period (see Nemravová et al., 2010, and references therein). Spectral variations of Pleione connected with its binarity were reported by Pollmann (2018) and Iliev (2019). Iliev et al. (2023) described outburst of H α emission based on observations from ESO-VLT. It was found that this outburst coincides with a periastron passage in Pleione's binary system. Here we report detailed study of a set of parameters of H α emission line in the spectrum of the star during 4 other periastron passages in the binary system. Observations, used in the present study were retrieved from the archives of BeSS database (Neiner, 2018; Neiner et al., 2011), and Three College Observatory (North Carolina University, Greensboro, USA).

2. Results

1. There is obvious connection between episodes of increase of strength of H α emission and binary solution with 218.023^d period of Pleione's.
2. Level of the central absorption core of H α in such activity episodes significantly exceeds the continuum level in all of the measured observational sets.
3. As seen from Fig 1 and Fig 2, significant variations of the examined elements

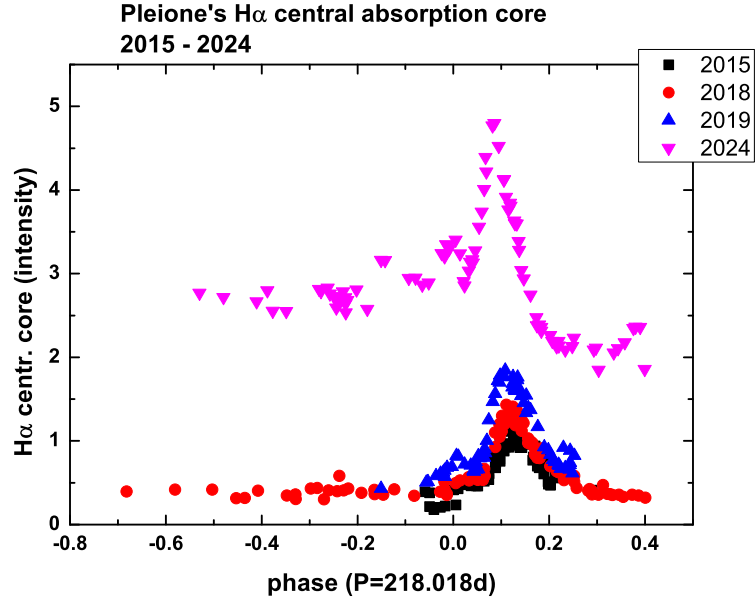


Figure 1. Variations of central absorption core of H α emission in the spectrum of Pleione during periastron passages in 2015, 2018, 2019 and 2024.

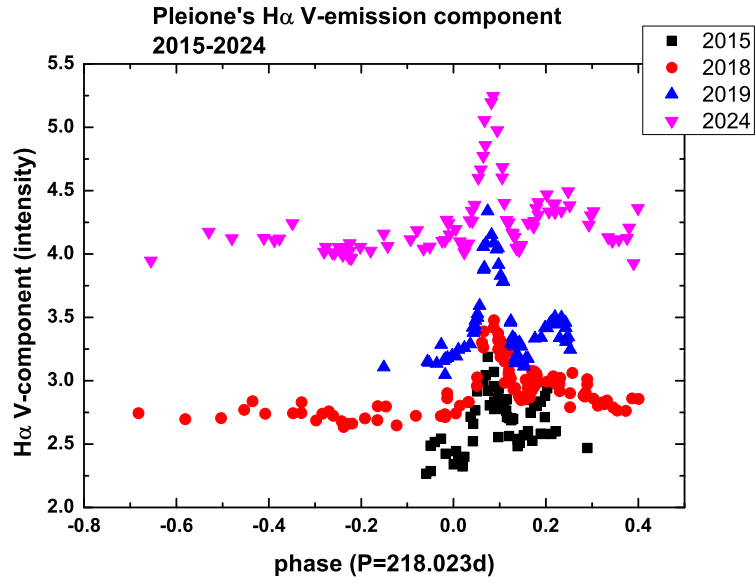


Figure 2. Variations of V-emission component of H α in the spectrum of Pleione during periastron passages in 2015, 2018, 2019 and 2024.

of the $H\alpha$ emission profile reach maximum approximately 20 days (at phase 0.1) after the periastron passage (which is at phase 0.0) and last until about phase 0.22. The overall increase of emission level in 2024 is connected with spectral-phase transition of Pleione, registered in 2022.

4. V-emission component passes through a secondary maximum on some of the cycles (Fig. 2) due to possible existence of structure in the emitting envelope around Pleione.

5. In a contrast, significant variations of the V/R ratio of $H\alpha$ start immediately after the periastron passage (Fig. 3).

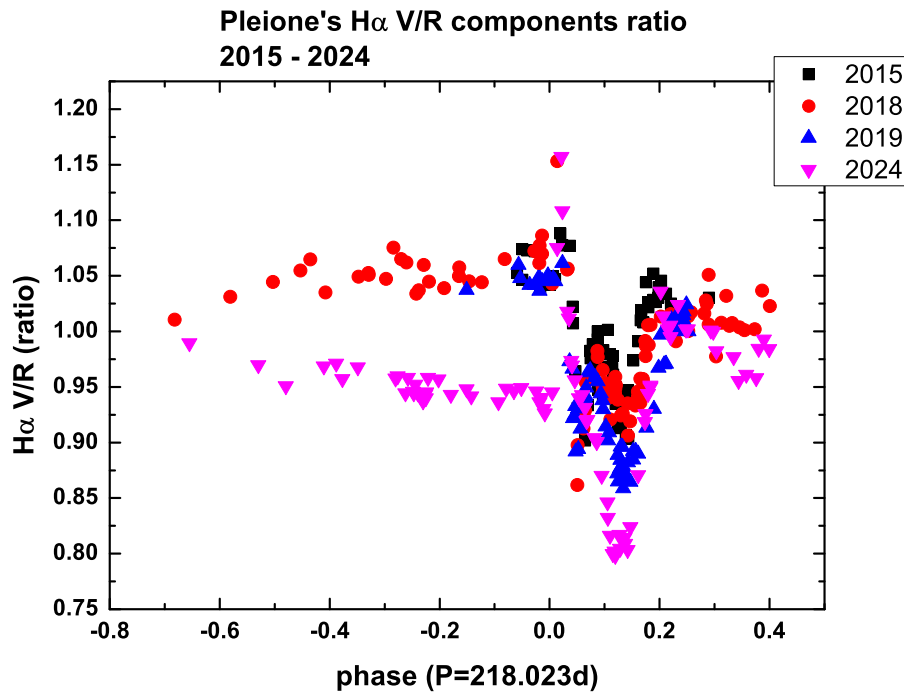


Figure 3. Variations of V/R ratio of $H\alpha$ emission components in the spectrum of Pleione during periastron passages in 2015, 2018, 2019 and 2024.

Acknowledgements. The authors are extremely thankful to dozens of amateur astronomers that contributed to the Database of Be Star Spectra (BeSS) and to the organizers of the information in it for the excellent and very useful work. This work made intensive use of International Virtual Observatory tools and facilities.

References

- Iliev, L., Binarity of Pleione and its influence on the circumstellar disk. 2019, in IAU Symposium, Vol. **346**, *High-mass X-ray Binaries: Illuminating the Passage from Massive Binaries to Merging Compact Objects*, ed. L. M. Oskinova, E. Bozzo, T. Bulik, & D. R. Gies, 149–151
- Iliev, L., Kubat, J., Kubatova, B., & Dankova, L., Spectral activity episode of the Be-shell star Pleione in 2013-2018. 2023, *Bulgarian Astronomical Journal*, **39**, 3
- Neiner, C., The BeSS database: a fruitful professional-amateur collaboration. 2018, in *SF2A-2018: Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics*, ed. P. Di Matteo, F. Billebaud, F. Herpin, N. Lagarde, J. B. Marquette, A. Robin, & O. Venot, Di
- Neiner, C., de Batz, B., Cochard, F., et al., The Be Star Spectra (BeSS) Database. 2011, *Astronomical Journal*, **142**, 149, DOI:10.1088/0004-6256/142/5/149
- Nemravová, J., Harmanec, P., Kubát, J., et al., Properties and nature of Be stars. 27. Orbital and recent long-term variations of the Pleiades Be star Pleione = BU Tauri. 2010, *Astronomy and Astrophysics*, **516**, A80, DOI:10.1051/0004-6361/200913885
- Pollmann, E., Precession of the Disk in Pleione Study of the H α Line Profile. 2018, *Information Bulletin on Variable Stars*, **6239**, 1, DOI:10.22444/IBVS.6239