Radial and Nonradial Pulsations as Probes of Stellar Physics
ASP Conference Series, Vol. 259, 2002
C. Aerts, T.R. Bedding, & J. Christensen-Dalsgaard, eds.

The Slowly Pulsating B Star HD 147394[1]

M. Briquet, A. Noels

Institut d'Astrophysique et Géophysique, Université de Liège, Belgium

C. Aerts

Instituut voor Sterrenkunde, Katholieke Universiteit Leuven, Belgium

P. Mathias

Observatoire de la Côte d'Azur, Nice, France

Abstract. HD 147394 is a Slowly Pulsating B star for which we found three periods in the moments of the Si II 4128-4130 lines: $f_1 = 0.8008$ c/d, f_2=0.7813 c/d and f_3=0.6710 c/d. A mode identification is performed by using the moment method.

1. Introduction

From the HIPPARCOS mission, a huge number of B-type stars have been classified as new Slowly Pulsating B stars (SPBs, Waelkens et al., 1998). A sample among these SPBs has been selected for a long-term photometric and spectroscopic monitoring (De Cat, these proceedings; Mathias et al., these proceedings). We present here the analysis of one of these stars HD 147394, which is a B5 IV star falling in the SPB instability strip (see e.g. Pamyatnykh, 1999).

2. Frequency analysis

The HIPPARCOS data reveal the frequency 0.8002 c d^{-1}. This frequency reduces the variance by about 47%. After prewhitening, we find several candidate frequencies but we are not able to choose one.

We have 254 useful spectra obtained with the spectrograph Aurélie at OHP during 7 separate weeks of monitoring, spread over 460 days. We extracted the measurements of the doublet Si II centered at $\lambda\lambda\,4128, 4130$ Å. From these spectral lines we computed the first three velocity moments $\langle v^1 \rangle$, $\langle v^2 \rangle$ and $\langle v^3 \rangle$ (see Aerts et al., 1992) with the aim of performing a frequency analysis. We note that the first moment of a spectrum is the radial velocity. We obtained the same results with two methods and for both lines. For $\langle v^1 \rangle$, we found subsequently $f_1 = 0.8008$ c d^{-1}, f_2=0.7813 c d^{-1} and f_3=0.6710 c d^{-1}. We note that f_1 is

[1]Based on observations obtained at the Observatoire de Haute-Provence

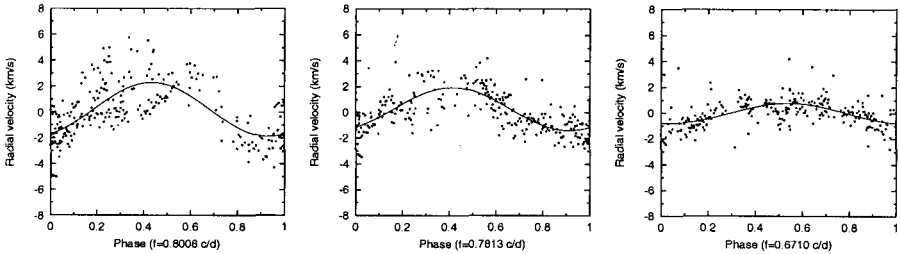

Figure 1. Left: phase diagram of the radial velocity computed from the Si II 4130 line for $f_1 = 0.8008$ c d^{-1}, middle: phase diagram of the data prewhitened with f_1 for $f_2 = 0.7813$ c d^{-1}, right: phase diagram of the data prewhitened with f_1 and f_2 for $f_3 = 0.6710$ c d^{-1}.

the frequency found in the HIPPARCOS data. For $\langle v^2 \rangle$, we found f_1 and for $\langle v^3 \rangle$, we found subsequently f_1, f_2 and f_3. These frequencies lead to a reduction of the variance of respectively 83%, 39% and 78% for $\langle v^1 \rangle$, $\langle v^2 \rangle$, and $\langle v^3 \rangle$. In Fig. 1, we show phase diagrams for the radial velocity of the Si II 4130 Å line.

3. Mode identification by the moment method and future plan

We performed a mode identification by using the moment method (Aerts, 1996). The identification of modes is performed by comparing the amplitudes of the first three observed moments of a line profile with theoretically calculated ones by means of a discriminant.

We note that the method is less accurate for multiperiodic stars than for monoperiodic stars because it does not make use of the interaction of the different modes. However, it allows to obtain a limited set of the most likely modes, among which the real modes must appear.

We plan to check the result of this preliminary mode identification and to find more precise values for the velocity parameters by line-profile fitting. In fact, for the more probable modes given by the moment method, we will compute the moments from the velocity field on the stellar surface for a grid of parameters and compare them with the observed ones at each time of observation. In that way, we can choose the modes which give the best fit compared to the observations. The outcome of the mode identification will be shown in a forthcoming paper.

References

Aerts, C., De Pauw, M., & Waelkens, C. 1992, A&A, 266, 294
Aerts, C. 1996, A&A, 314, 115
Pamyatnykh, A.A. 1999, Acta Astron., 49, 119
Waelkens, C., Aerts, C., Kestens, E., et al. 1998, A&A, 330, 215

https://doi.org/10.1017/S0252921100016109 Published online by Cambridge University Press