PERIOD ANALYSIS OF THE δ SCUTI STAR HD93044

LIU ZONG-LI
Beijing Astronomical Observatory, Chinese Academy of Sciences, Beijing, China

Abstract. HD93044 was observed electrophotometricaly on April 21, May 1, 2 and 4, 1991 at Xinglong Station of Beijing Astronomical Observatory. Combining the data with Li Zhi-ping's data together and a period analysis was completed using a program which consists of a combination of Fourier transforms of prewhitened data and the multifrequency least squares of brightness residuals (LSR). Three pulsation frequencies (11.90809, 16.79553, 22.44827 cycles per day) with visual amplitudes between 0.0056 and 0.0203 mag were found. The solution fits the observations to +0.0071 mag which is equal to the mean square deviation of observations. The first frequency (11.90809 cycles per day) must be the right value of the fundamental frequency of HD93044.

Key words: δ Scuti – period analysis

1. Introduction

Slettebak et al. (1968) gave some parameters of HD93044 and classified it as an A7 giant which is conformable with the mean colours of the star in the Geneva photometric system (Rufener 1981, Golay 1980). Heynderickx (1990) observed this star (from December 1984 to March 1985, and from January 1986 to February 1987) and obtained its one period (11.90808 cycles per day) by means of the PDM-technique described by Stellingwerf (1978). Li Zhi-ping et al.(1991) observed it in 1990 and obtained two frequencies (11.38927 and 22.49097 cycles per day).

As stated above, Heynderickx obtained only one frequency. He noted that the agreement of the fitted light curve with the data was rather poor during some nights. However, he was unable to detect a second oscillation period in the residuals of the light curves. So he thought that the pulsation amplitude of HD93044 is variable in some erratic way. Li Zhi-ping et al. obtained two frequencies, but the fundamental frequency was different from Heynderickx's. In order to understand the nature of this star and to obtain the correct values of the frequencies it was decided to observe this star again.

2. Observations and Period Analysis

HD93044 was observed from April 21 to May 4, 1991 with the 60-cm telescope at the Xinglong Station of Beijing Astronomical Observatory, China. The single-channel integration photometer equipped with an EMI6256B photomultiplier was used in the DC mode with the output digitized with a V/F converter. The Johnson V filter was used. Two comparison stars were used: HD93457 and HD93664. No evidence for any variability of them was found.

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The frequencies of HD93044 were determined using a program (Hao Jin-xin, 1991) which consists of a combination of Fourier transforms of prewhitened data and the multifrequency least squares of brightness residuals (LSR). And the program PERIOD (Breger, 1990) was used also. The calculated four frequencies are shown in Table I.

TABLE I
Four-frequency solution for HD93044

Frequency	Amplitude	Phase	Zeropoint	Residual
11.907±0.001	0.0209±0.0008	0.94±0.01	0.00015	0.0072
16.800±0.004	0.0074±0.0008	0.36±0.04		
21.756±0.005	0.0060±0.0008	0.58±0.05		
24.629±0.005	0.0060±0.0008	0.05±0.05		

The first frequency (11.907 cycles per day) is very closed to the value (11.90808 cycles per day) which was obtained by Heynderickx.

In order to obtain more accurate result the data obtained by Liu Zong-li were combined together with the data obtained by Li Zhi-ping et al. A period analysis of the new combined data was completed using the same method. A three-frequency solution was obtained. It is shown in Table II.

TABLE II
Three-frequency solution of the combined data

Frequency	Amplitude	Phase	Zeropoint	Residual
11.90809±0.00002	0.0203±0.0006	0.609±0.006	0.0003	0.0071
16.79553±0.00007	0.0064±0.0006	0.48±0.02		
22.44827±0.00008	0.0056±0.0006	0.50±0.02		

The fit of three-frequency solution of the combined data to the measurements is shown in Figure 1.

3. Conclusion and Discussion

The first frequency(11.90809 cycles per day) of three-frequency solution of the combined data is completely identical with the value (11.90808 cycles per day) obtained by Heynderickx. So it must be the right value of the fundamental frequency of HD93044. And it means that the fundamental frequency of this star has kept constant for at least 7 years from 1984 to 1991. The second frequency(16.79553 cycles per day) of three-frequency solution of the combined data is very closed to the value (16.780 cycles per day) of four-frequency solution of the data (from April to May 4, 1991). So it might

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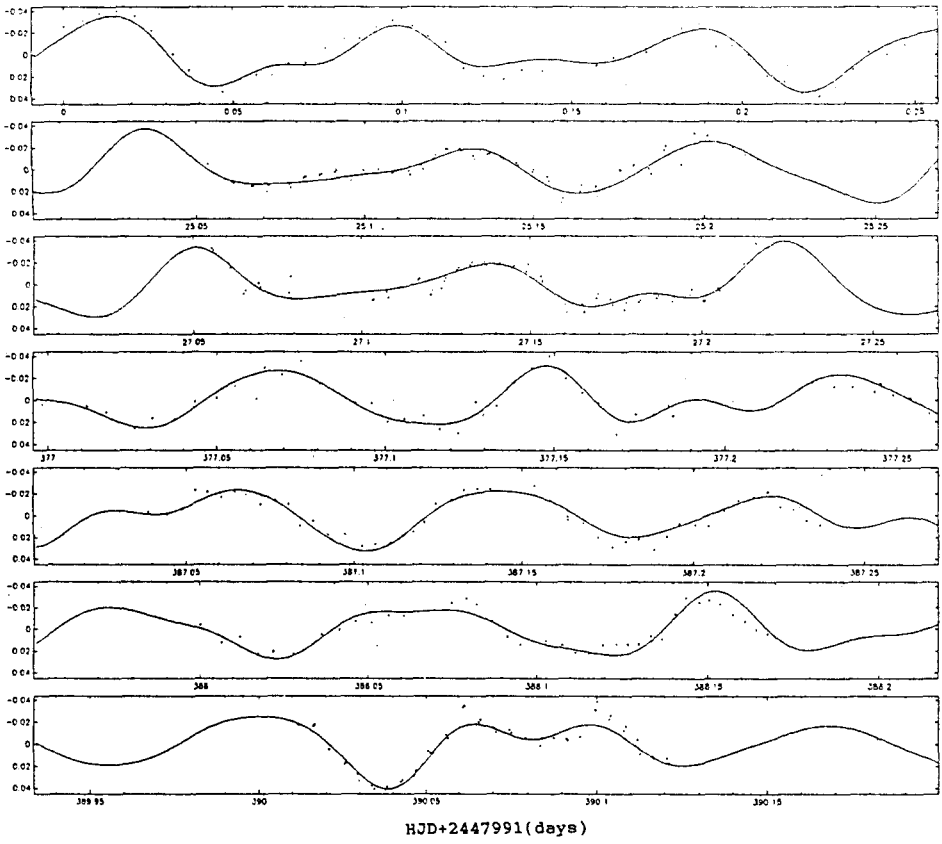

Fig. 1. Fit of three-frequency solution of the combined data to the measurements.

be the right value of the second frequency of this star. Furthermore it is obvious that the three-frequency fit is better than the one-frequency fit and two-frequency fit.

However, the value of the third frequency of the two sets of data are different each other. I think that the small data would be responsible for the disagreement between the different sets of data. In order to obtain the more accurate values of other frequencies, to give the more exact physical parameters to understand the nature of this star more observations and new period analysis are needed.

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