PERIOD OF DELTA CETI

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Abstract. A period analysis of δ Ceti has been carried out and it has been found that the period of δ Ceti is increasing at a rate of 0.86 s per century. It is concluded that in its post-Main-Sequence evolution δ Ceti is in the early shell hydrogen-burning phase.

1. Introduction

For the last few years the period of δ Ceti, a β Canis Majoris star has been a matter of controversy. A detailed study of the period of δ Ceti has been recently carried out by Lane (1977) and Ciurla (1979). Lane suggested that the period of δ Ceti was constant up to 1965 and thereafter it started increasing at a rate of 0.7 s per century. While Ciurla (1979) suggested that the period is increasing at a rate of 0.11 s per century right from 1901 onwards.

The author, in his previous paper (Mohan, 1979; hereafter called Paper I), suspected a sudden decrease in the period after 1976. But as the observations reported in Paper I were made only in one observing season, no definite conclusions could be drawn. Therefore, the star was re-observed during November 1979 and the results are reported in this paper.

2. Observations

The star δ Ceti was observed on two nights during November 1979 on the 38 cm reflector of the Uttar Pradesh State Observatory using a 1P21 photomultiplier cooled to $-20°C$ and B filter of the Johnson and Morgan (1953) system. The star γ Ceti was used as a comparison star. The magnitudes were corrected for atmospheric extinction using nightly extinction coefficients. The differential magnitudes (comparison-variable) have been plotted against JD(Hel) in Figure 1.

3. Period

The mean maxima of light variation as defined by Ciurla (1979), were obtained for the two observing seasons of 1978 and 1979 and these are listed in Table I along with the mean photometric maxima given by Ciurla (1979). In Paper I it was found that the period $0\overset{d}{.}1611380$ fits up to Tunca's 1977 observations but the same period could not explain the maxima obtained by the author during 1978 and therefore the author suspected a sudden decrease in the period somewhere
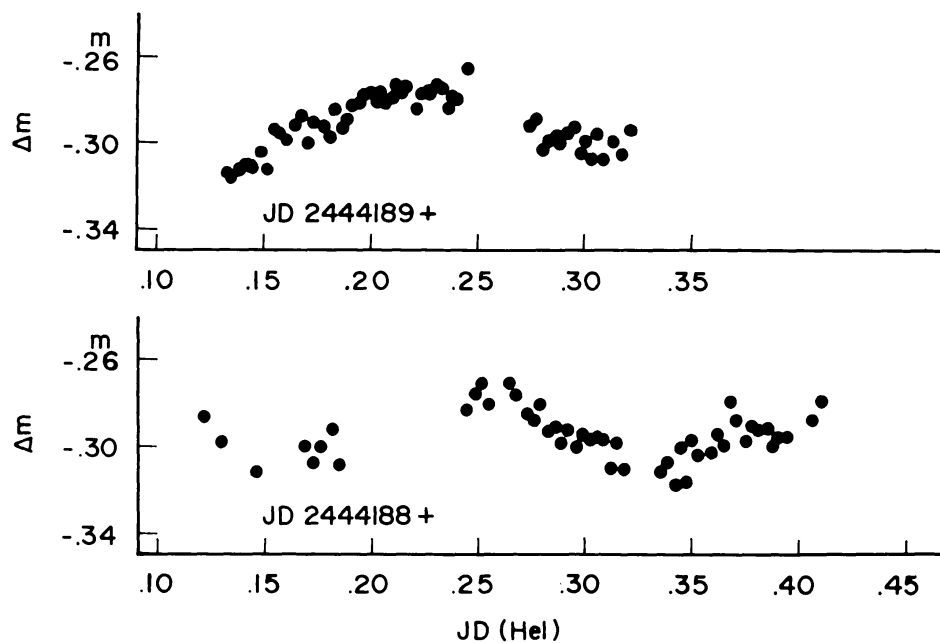
Fig. 1.   Light curves of δ Ceti

TABLE I

Season of observations	Max. light JD (Hel)	(0–C)	Reference
1963	2438338.4752 ±0.0014	−0.001	Jerzykiewicz (1965) and Van Hoof (1968)
1964	2438656.5604 ±0.0021	0.000	Van Hoof (1968)
1965	2439013.9638 ±0.0007	0.002	Jerzykiewicz (1971)
1969	2440559.1044 ±0.0038	0.000	Watson (1971)
1975	2442393.3488 ±0.0006	+0.015	Tunca (1977)
1976	2443061.8956 ±0.0061	0.000	Percy (Ciurla, 1979)
1976	2443101.2271 ±0.003	+0.015	Tunca (1977)
1978	2443794.265 ±0.001	−0.002	Mohan (1979)
1979	2444189.219 ±0.001	+0.002	This work

after 1976. By use of the ephemeris given by Jerzykiewicz (1971), the (O–C) values for the mean maxima obtained by the author are, respectively, $-0^d.17$ and $-0^d.13$ for 1978 and 1979.

Ciurla (1979) suggested that Tunca's (1977) maxima of light might only spuriously agree with the ephemeris given by Jerzykiewicz (1971). Therefore, excluding Tunca's observations we have fitted the following ephemeris in the mean maxima listed in Table I:

$$\text{Max. JD(Hel)} = 2438338.4763 + 0^d.16113668\ E + 2^d.20 \times 10^{-11}\ E^2 ,$$
$$\pm .0002 \quad \pm .00000003 \quad \pm .09(\text{s.e.}),$$

where E is the number of cycles.

The (O–C) values calculated with the help of above ephemeris for the maxima are given in column 3 of Table I.

The above ephemeris fits very well in the data and shows that the period is increasing at a rate of about 0.86 s per century. Lane (1977) obtained the rate of increase in the period to be 0.7 s per century from 1965 onwards, which is in close agreement to the value found by us but differs from the rate of 0.11 s per century given by Ciurla (1979).

The time of maximum light JD 2443061.8956 (± 0.0061) obtained from the observations made by Percy (Ciurla, 1979), which also lies in the duration of Tunca's observations, fits fairly well with the new ephemeris, while the (O–C) values for maxima obtained by Tunca (1979) cannot be explained. Therefore, as pointed out by Ciurla (1979), there may be some systematic error in the maxima given by Tunca (1977).

Comparing the observed rate of change in the period of light variation of the star δ Ceti with those calculated theoretically by Eggleton and Percy (1973) and Lesh and Aizenman (1974), we conclude that in its post-Main-Sequence evolution the star δ Ceti is in the early shell hydrogen-burning phase.

Acknowledgement

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