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REFINEMENT OF THE FREQUENCIES OF PULSATION OF DELTA SCUTI

New photoelectric observations of δ Scuti taken on 1982 July 14 and 17 using the 0.41 m telescope of the Monash observatory are presented in Figures 1 and 2, ε Scuti (= HR 7032)was used as a comparison star, the differential magnitudes being corrected for atmospheric extinction.

Fitch (1976) compared a solution to the light curve of δ Scuti derived from Fourier analysis of Fath's data (1935, 1937, 1940) with one obtained from Fourier analysis of his own data obtained in 1972-73. Differences between the two solutions for the larger amplitude frequencies (f_o and f_{n1}) were small, using these differences Fitch calculated a fractional change in the fundamental frequency of -1.6×10^{-5} in 36 yr but cautioned that such small differences could be attributed to observational errors.

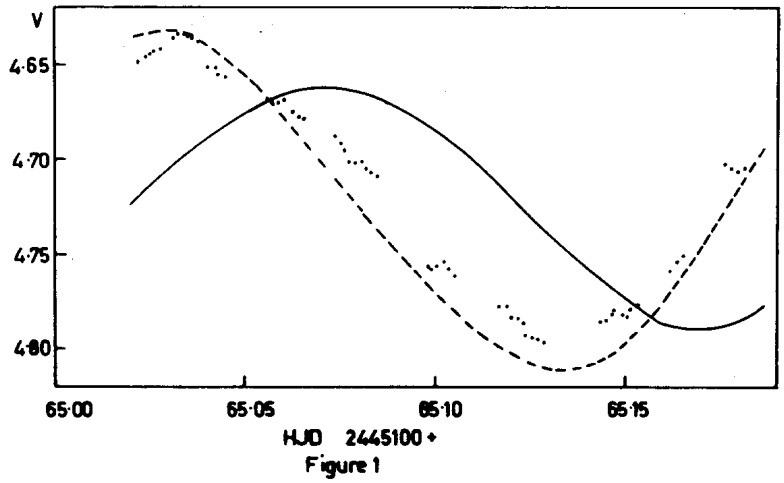

Figure 1

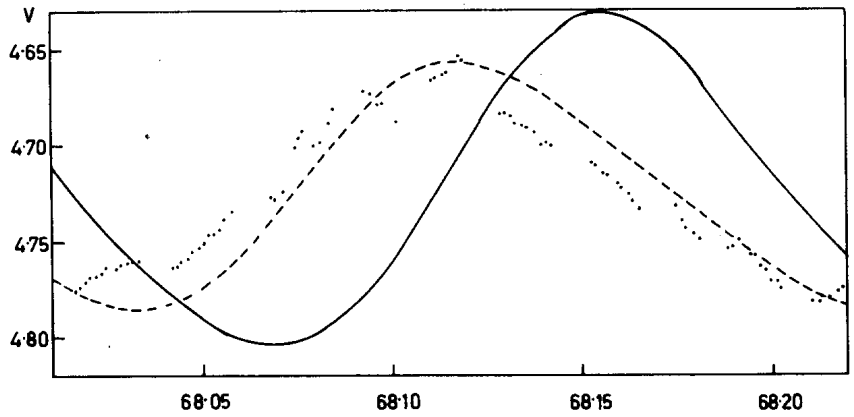

Figure 2

Moon and Keay (1982) used observations of a single maximum to refine the fundamental frequency of δ Scuti, data in Figures 1 and 2 are consistent with their refined value for the frequency of the fundamental mode of pulsation.

Using a similar argument to Moon and Keay it is unlikely that our observed light curves of δ Scuti are shifted by one or more complete cycles from the light curve predicted by Fitch's solution. These predicted light curves are given as solid lines in Figures 1 and 2.

Because Fitch defined an epoch some 40 years prior to his 1972-73 observations we found it necessary to choose a new epoch (=HJD 2441800) close to his observations, and to recalculate the phases accordingly. Data given by Fitch (1976) are adequately represented by this solution. Only the fundamental and first nonradial modes (f_o, f_{n1}) are known to sufficient precision to refine their values further. However these two frequencies, along with their second harmonics ($2f_o$, $2f_{n1}$) and sum (f_o+f_{n1}) describe most of the behaviour of δ Scuti.

Adjustment of Fitch's values for the fundamental and first nonradial frequencies gave the dashed curves in Figures 1 and 2, where f_o=5.160760 cycles day^{-1} and f_{n1} = 5.3540 cycles day^{-1}, the estimated errors being $\pm$ 0.000004 cycles day^{-1} and $\pm$ 0.00004 cycles day^{-1} respectively. This was the closest representation to the data achieved using only f_o, f_{n1}, and their harmonics and combination frequency. Small residuals between our solution for the light curve and the observations can be accounted for by other frequencies present and some observational uncertainty.

Comparing our result for the fundamental frequency with that given by Fath (1937), f_o = 5.160758, and that given by Fitch for Fath's data (1976), f_o = 5.160780, it appears that any change in f_o over 45 yr is small and probably due to observational uncertainty. Considering the precision of photoelectric photometry and the complicated nature of the light variations of δ Scuti, the fundamental mode of pulsation appears stable, any fractional secular changes are probably less than .000004 in 45 yr.

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