SECULAR CHANGES IN THE LIGHT CURVE OF THE SHORT-PERIOD CEPHEID EU TAU

J.M. Matthews
Department of Astronomy, University of Western Ontario

W.P. Gieren
Observatorio Astronomico Nacional, Bogota, Colombia

Abstract. UBVRI photometry and radial velocity measurements of EU Tau obtained during three weeks in November/December 1987 have been used to (1) confirm the period, P = 2.1025 days, and epoch established by Fernie (1987, P.A.S.P., 99, 1093) and earlier observers, and (2) investigate apparent phase and/or amplitude discrepancies in the light curve first reported by Gieren and Matthews (1987, A.J., 94, 431). Comparison of these new data with photometry collected by different observers covering over two decades suggests that the light curve of EU Tau undergoes short-lived (less than about 2 pulsation cycles) changes which appear to occur with a period of roughly 19 - 21 days. Various possible sources of modulation - including binarity, double-mode beating and nonradial pulsations - are considered and rejected as unsatisfactory.

The general behaviour of the light curve can be simulated by a frequency spectrum with a central component at the observed pulsation frequency and 10 sidelobes of low amplitude (< 0.01 mag) and equal spacing (1/21 c/d). Such a pattern could be produced by weak rotational modulation of a single radial mode, but this requires a rotation period no greater than 21 days and a low inclination which would tend to lessen rotational effects. We argue that the most likely explanation of the proposed frequency spectrum is a variation in the star's pulsational limit cycle, caused by instability or resonant mode coupling. Auvergne (1986, Astron. & Astrophys., 159, 197) has already invoked a similar effect to account for the amplitude modulation of another short-period Cepheid, HR 7308. If such processes are occuring in EU Tau and other Cepheids, they will provide new observational constraints on models of Cepheid structure.

https://doi.org/10.1017/S0252921100011830 Published online by Cambridge University Press