

A STUDY OF THE SHORT-PERIOD CEPHEID EU TAURI

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EU Tauri is a classical Cepheid with one of the shortest periods (2.1^d) known. A Fourier decomposition study of its V light curve by Simon & Lee (1981) revealed a peculiar position in phase-period diagrams, very similar to the star SU Cas which is probably an overtone pulsator (Gieren, 1982). This suggested the possibility that EU Tau might be another galactic overtone pulsator. In order to investigate this question, some 100 new photometric observations of this star on the UBVRI (Johnson) system were obtained with the #2 0.9m telescope of KPNO. Simultaneously, 43 CCD spectra of the star were secured on the Coudé feed telescope of KPNO which were measured for radial velocities using a correlation technique. These velocities have an internal accuracy of better than 0.5 km/s and define a complete velocity curve of EU Tau.

The new photometry shows that a secondary oscillation is present in this star which causes variations of the V magnitude at given phases corresponding to the primary period of about 0.02-0.03 mag. Inspection of the older light curves of the star of Guinan (1972) and Sanwal & Parthasarathy (1974) suggest that this double mode effect of similar size has been present during their observing seasons as well. The surface brightness method of Barnes & Evans (1976) was applied to the new data, and values of

$$R = (18.4 \pm 1.8)R_{\odot}$$
$$d = 746 \pm 74 \text{ pc}^{\odot}$$

for the mean radius and distance of the star were obtained. Using a method based on BVRI photometry given by Fernie (1982), a reddening value of $E(B-V) = 0.13$ was derived. The star's distance together with this reddening value yield an absolute magnitude of

$$M_{\langle V \rangle} = -1.69 \pm 0.25$$

for EU Tau. This value is about 0.5 mag fainter than the value predicted by recent calibrations of the P-L-C relation. A mean effective temperature of 5970 K obtained from Flower's (1977) $T_{\text{eff}} - (B-V)$ calibration produces a consistent absolute magnitude of -1.75 , using the mean radius obtained from the surface brightness method.

In conclusion, EU Tau is not a single mode overtone pulsator but rather a new double mode Cepheid with a very small amplitude of the

secondary oscillation. Its radius is close to the value expected for a normal single mode Cepheid of its period, suggesting that EU Tau has a normal mass for a classical Cepheid, thus not confirming the low-mass hypothesis for double mode Cepheids. However, EU Tau might be slightly sub-luminous when compared to single mode Cepheids of the same period.

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