A STUDY OF THE SHORT-PERIOD CEPHEID EU TAU R

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EU Tauri is a classical Cepheid with one of the shortest periods
(2.1) known. A Fourier decomposition study of its V light curve by
Simon & Lee (1981) revealed a peculiar position in phase-period dia-
grams, 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 ac-
curacy 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 sur-
fase brightness method of Barnes & Evans (1976) was applied to the new
data, and values of

\[ R = (18.4 \pm 1.8)R\odot \]
\[ d = 746 \pm 74 \text{ pc} \]

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

\[ M_V = -1.69 \pm 0.25 \]

for EU Tau. This value is about 0.5 mag fainter than the value pre-
dicted by recent calibrations of the P-L-C relation. A mean effective
temperature of 5970 K obtained from Flower's (1977) \( T_e - (B-V) \) cali-
bration produces a consistent absolute magnitude of \(-9.75\), 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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REFERENCES