RADIUS DETERMINATION FOR NINE SHORT PERIOD CEPHEIDS

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From November, 1981 to March, 1982, nine Pop I and Pop II cepheids of periods between 1.5 and 4.2 days have been monitored, in Geneva photometry from La Silla Observatory (Chile) and in radial velocities from the Haute-Provence Observatory (France). These cepheids are listed in Table 1. Figure 1 shows an example of the light, colour and velocity curves for EU Tau, a small amplitude cepheid with a period of 2.10 days.

Table 1 Period in days, mean radius in $R_\odot$ and cepheid type according to Szabados (1977) for the nine cepheids studied.

	P	Ro	Rem.	Type
SW Tau	1.583	10.5		II
EU Tau	2.103	46		Is
BB Gem	2.307	26:		II
BE Mon	2.705	30		I
V465 Mon	2.7132	((42))	Bin	Is
DX Gem	3.135	(40:)	Bin?	Is
SZ Tau	3.150	36		Is
ST Tau	4.0347	39		I
V508 Mon	4.134	42		Is

The mean radii have been determined with the Wesselink's method described by Burki and Benz (1982). These mean radii are given in Table 1. The radius variation of EU Tau is reproduced in Figure 1d: the solid line is taken from the integration of the velocity curve and the points are calculated from the magnitude and colour values. The best value of the mean radius is chosen by minimizing the dispersion of the points around the curve.

The radial velocity analysis reveals that V465 Mon and possibly also DX Gem are spectroscopic binaries. Thus, the Wesselink radius of these two stars is affected by the presence of a companion (Burki, 1984).

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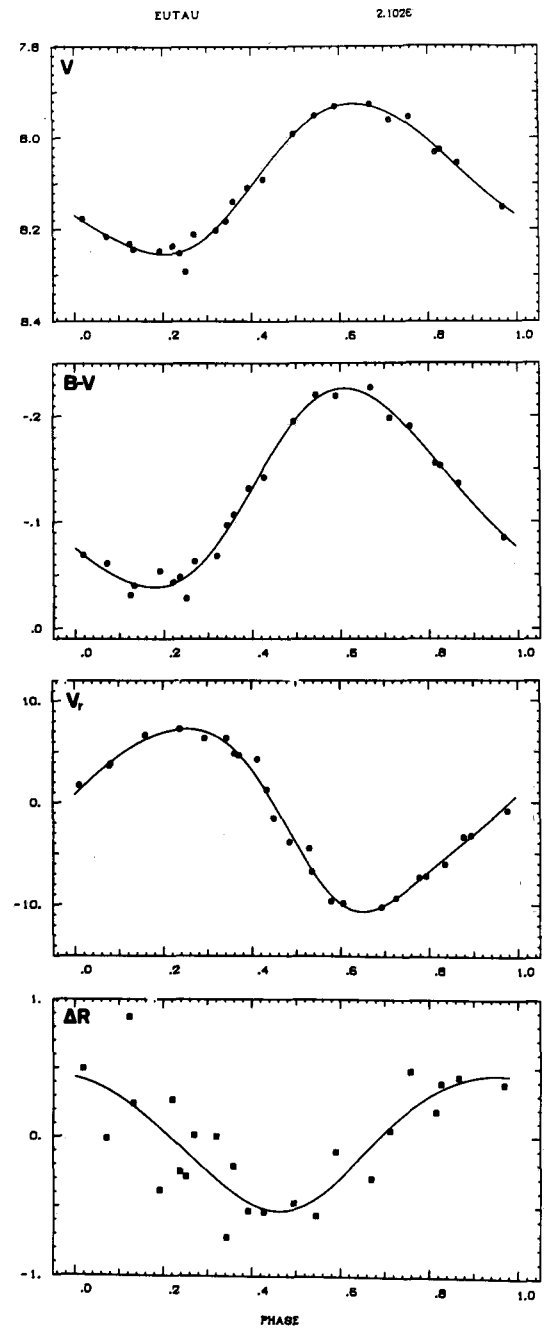

Figure 1: Variation in magnitude V, Geneva index [B-V] , radial velocity V_r in km/sec and radius in solar unit in the case of EU Tau.

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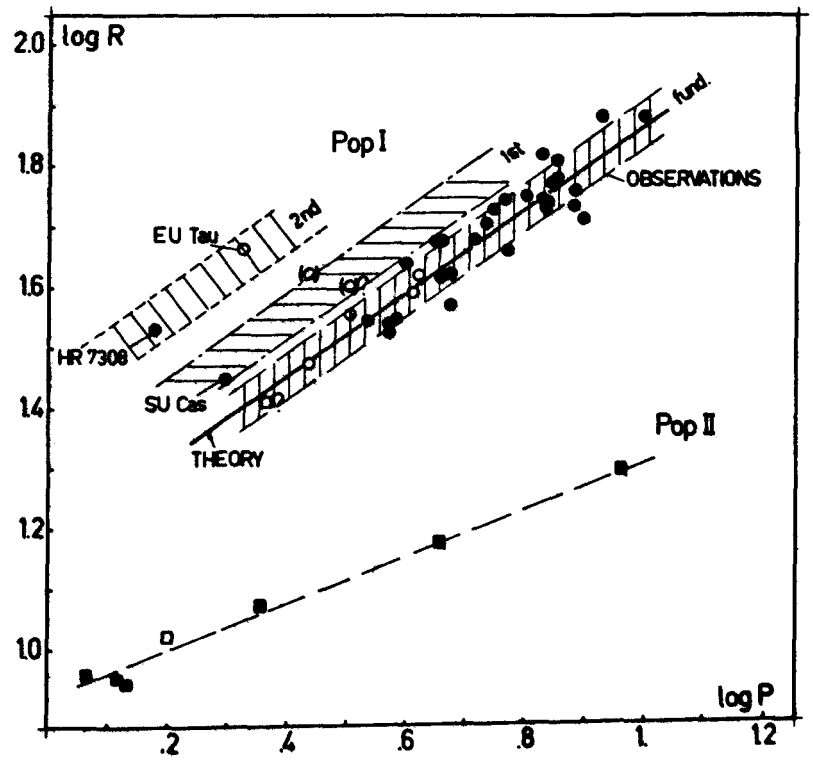

Figure 2: The period-radius relation for Pop I and Pop II cepheids with period shorter than 10 d. The radii stem from Fernie (1984), Cox (1979), Gieren (1982), Imbert (1981, 1983, 1984), Burki and Benz (1982), Burki et al. (1982), Wolley and Carter (1973). The cepheids analysed in this paper are noted by open symbols. Binary cepheids have been excluded, except for the stars analysed in this paper, V465 Mon and DX Gem, marked within parentheses.

Figure 2 shows the period-radius relations for the cepheids with P < 10d. One can see that:

1) Four cepheids, BE Mon, SZ Tau, ST Tau and V508 Mon are well placed in the relation for Pop I cepheids.

2) The two binaries V465 Mon and DX Gem are clearly above this relation.

3) SW Tau is in agreement with the relation for Pop II cepheids.

4) BB Gem, classified Pop II by Szabados (1977) agrees with the relation for Pop I cepheids. For this cepheid, new measurements are required because the radius determination is very uncertain.

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The linear regression gives for Pop I cepheids in the fundamental mode:

$$\log R = 0.701 \log P + 1.175$$

with a residual dispersion of 0.039 in log R. This relation is indicated by vertical hachures in Figure 2. We would like to point out the perfect agreement between this observational relation and the theoretical relations of Cogan (1978):

$$\log R = 0.70 \log P + 1.17$$

and Fernie (1984):

$$\log R = 0.694 \log P + 1.177$$

The observational relations for the first and second overtones have been estimated by displacing the relation for the fundamental mode by respectively 0.14 and 0.35 in log P. We see that:

1) SU Cas seems to be indeed a 1st overtone pulsator, as first claimed by Gieren (1976).
2) The 2nd overtone pulsation of HR 7308 (V473 Lyr) is confirmed (see Burki et al., 1982). Recall that this star is the classical cepheid with the shortest period known (1.5 d) and that its amplitude varies by a factor of 15 in a period of 1200 d.
3) EU Tau is another probable cepheid pulsating in the 2nd overtone.

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