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RADII OF LOW-AMPLITUDE CEPHEIDS AND THEIR PULSATION MODE

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Low-amplitude Cepheids (DCEPS in GCVS, 1985) are a specific group of pulsating stars. In contrast to ordinary Cepheids, these stars have small light amplitudes ($0\overset{\mathrm{m}}{.}5$ V and lower) and practically sinusoidal light curves. It is usually assumed that such stars pulsate in the first overtone, whereas ordinary Cepheids, in the fundamental tone (GCVS, 1985). Theory of stellar pulsations gives the ratio of periods of the first overtone P_1 to the fundamental tone P_0, for galactic Cepheids, equal to 0.71 (see, for instance, Alcock et al., 1995).

For 13 Cepheids (see Table 1) classified as DCEPS in the GCVS, we have long sets of precise observations of radial velocity. Our radial velocity observations were made with A. Tokovinin's correlation spectrometer in 1987–1997. The majority of these observations were included in our two catalogues (Gorynya et al., 1992, 1996b).

We used these spectroscopic data together with photoelectric data (brightnesses V and color indices $B-V$) from the Sternberg Institute database (Berdnikov, 1995) to estimate the radii of such Cepheids using a nonlinear modification of the method described by Balona (1977). Note that Balona's method is, in principle, free from any significant influence of interstellar extinction.

Star	$\log P$	$R/R_\odot$	σ_R	Pulsation mode
FN Aql	0.9768	80	12	P_1
V1162 Aql	0.7305	60	14	P_1
BY Cas	0.5080	40	10	P_1
SU Cas	0.2899	33	8	P_1
V1726 Cyg	0.6271	55	5	P_1
X Lac	0.7360	61	7	P_1
EU Tau	0.3227	35	5	P_1
SZ Tau	0.4982	43	6	P_1
EV Sct	0.4901	46	14	P_1
FF Aql	0.6503	34	7	P_0
V636 Cas	0.9231	46	5	P_0
V532 Cyg	0.5163	31	8	P_0
Y Oph	1.2335	71	10	P_0

Table 1 gives the Cepheid radii and their formal r.m.s. errors. For calculations of radii of spectroscopic binaries SU Cas, FF Aql and V532 Cyg, we used pulsational radial velocity curves (after taking into account orbital motion, with elements from Gorynya et al., 1996a).

In the period–radius diagram, all stars fall into two groups with different period–radius relations (Fig. 1):

Group 1: FF Aql, V636 Cas, V532 Cyg, and Y Oph

Group 2: FN Aql, V1162 Aql, BY Cas, SU Cas, V1726 Cyg, X Lac, EV Sct, EU Tau, and SZ Tau

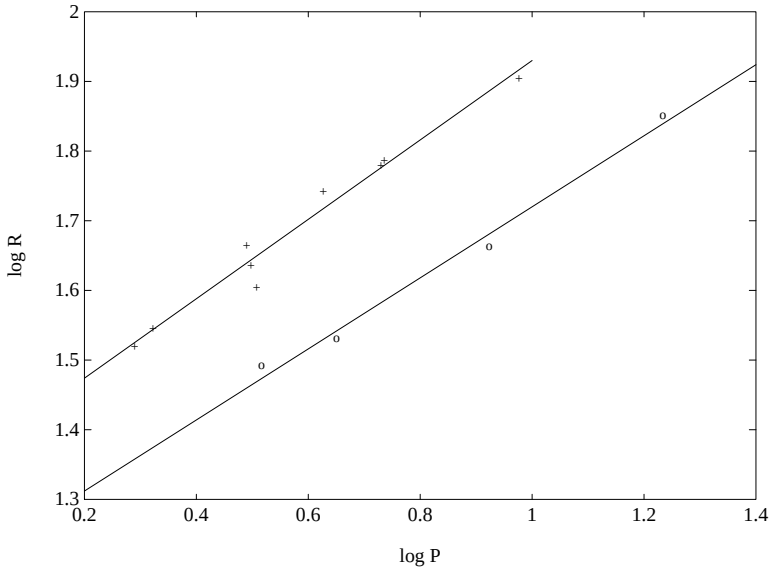

Figure 1. The period–radius diagram. Open circles, Group 1; crosses, Group 2

This segregation can be explained if we assume that stars of the two groups pulsate in different modes: group 1, in the fundamental tone; group 2, in the first overtone. Taking into account that $P_0 = P_1/0.71$, one can write:

$$\log R = \underset{\pm.03}{1.21} + \underset{\pm.04}{0.51} \log P_0 \qquad \text{for group 1}$$

$$\log R = \underset{\pm.02}{1.36} + \underset{\pm.04}{0.57} \log P_1 \qquad \text{for group 2}$$

or

$$\log R = \underset{\pm.03}{1.27} + \underset{\pm.04}{0.57} \log P_0 \qquad \text{for group 2}$$

With this assumption, the relations can be considered the same. This relation agrees well with that for single-mode Cepheids (Ripepi et al., 1997, Sachkov et al., 1997) and for double-mode Cepheids (Sachkov, 1997). Low-amplitude Cepheids have the same period–luminosity relation as the ordinary ones (Berdnikov et al., 1996). Therefore, the period–radius relations for low-amplitude and ordinary Cepheids must be the same.

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