

A NEW DOUBLE-MODE CEPHEID IN SCUTUM

The variability of BD-10°4669 (GSC 5681.0292; $\alpha = 18^{\text{h}}22^{\text{m}}27^{\text{s}}.1$, $\delta = -10^{\circ}07'29''$ (J2000.0); $l = 20^{\circ}.6$, $b = +1^{\circ}.7$) was discovered on Moscow collection plates taken with the 40-cm astrograph in Crimea.

The new variable was estimated by eye in *B* band on 221 plates for the interval JD2438964–48179. The variability range is $10^{\text{m}}.5 - 11^{\text{m}}.5$. *B*-band magnitudes of comparison stars (Table 1) were measured photoelectrically by L.N. Berdnikov (private communication).

Table 1. Comparison Stars

GSC	$\alpha(2000.0)$	$\delta(2000.0)$	<i>B</i>
5681.1238	18 ^h 22 ^m 22 ^s .4	-10°05'53''	10 ^m .63
5681.0344	18 ^h 22 ^m 44 ^s .7	-10°00'23''	11 ^m .78

The results of the frequency analysis are presented in Figure 1. The step in frequency is about 10^{-5} c/d. We can see the existence of two frequencies in the spectrum – f_0 and f_1 and their 1-day aliases. The second group of frequencies (f_0 and 1-day aliases) is more clearly seen in Figure 1b, where f_1 is whitened.

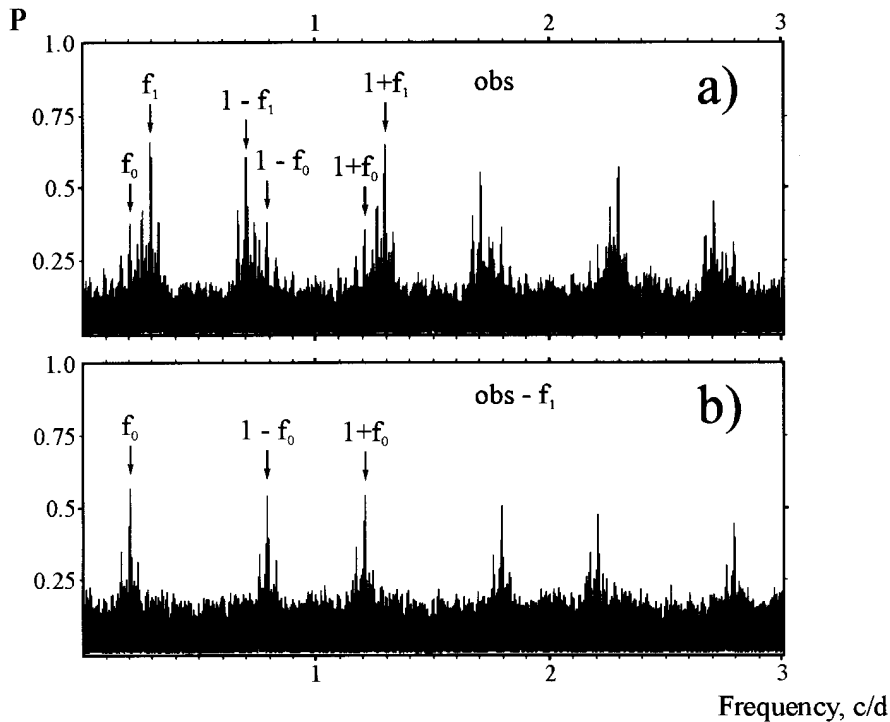


Figure 1. The power spectra

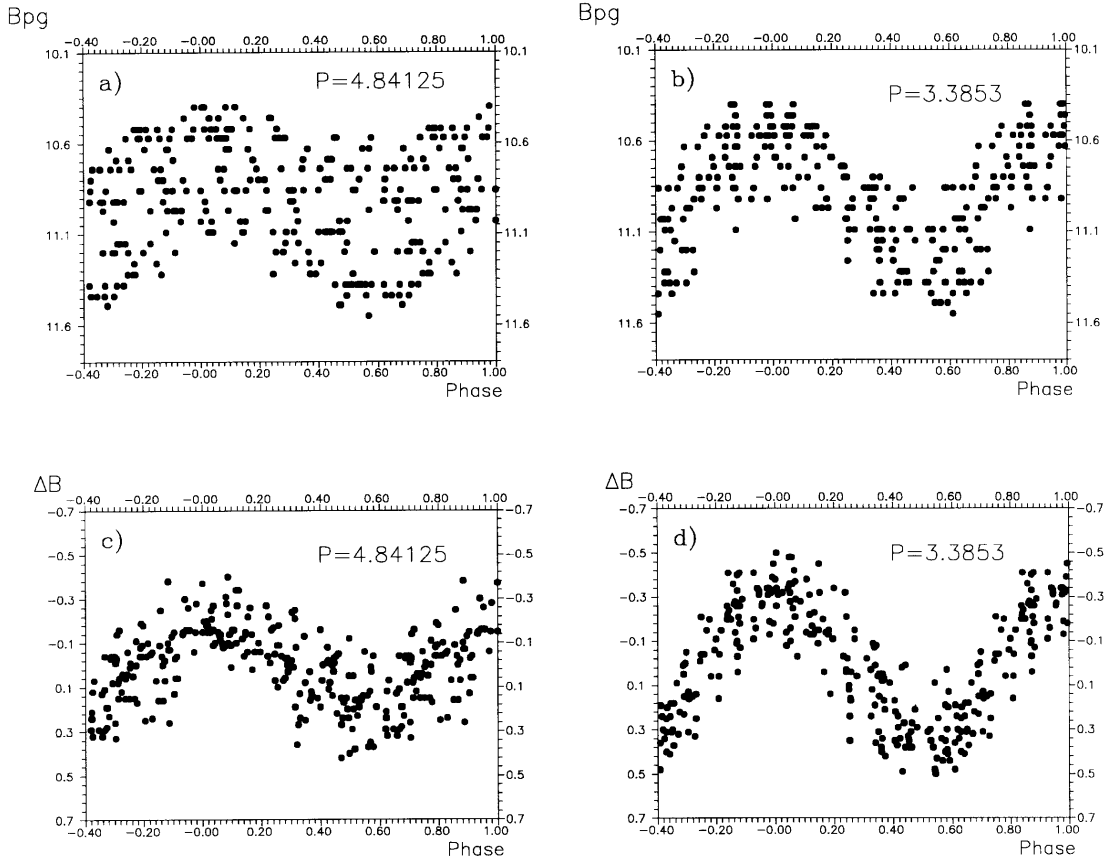


Figure 2. The phased light curves: a.) fundamental mode; b.) first overtone mode; c.) fundamental mode where first overtone has been whitened; d.) first overtone where fundamental mode has been whitened

The peaks in the spectrum at frequencies f_1 and $1 + f_1$ are almost equal. But, to have a reasonable decision, we should consider the frequency f_1 as real. In this case, the periods and the period ratio $P_1/P_0 = f_0/f_1 = 0.699$ are typical for double-mode Cepheids. The shapes of the phased light curves, constructed with the periods P_0 and P_1 (Fig. 2cd), are in agreement with the CEP(B) type too. The first overtone phased light curve has a sinusoidal shape ($M - m \sim 0.5$).

So, we classify BD-10°4669 as a new Cepheid, pulsating in two radial modes with the light elements:

$$JD_{\max} = 2447733.42 + 4^d 84125 \times E \text{ (fundamental mode) and}$$

$$JD_{\max} = 2441177.37 + 3^d 3853 \times E \text{ (first overtone mode).}$$

The error of period determinations is $\pm 0^d 0001$.

Average amplitudes in B band are $A_0 \approx 0^m 40$ and $A_1 \approx 0^m 65$. It is necessary to mention that, among Galaxy's double-mode Cepheids, the only one, AX Vel, has the amplitude of an first overtone mode exceeding that of the fundamental mode. BD-10°4669 is the second known double-mode Cepheid with the same peculiarity. But this is not a rare phenomenon. Among 30 beat Cepheids (that pulsate in fundamental and first overtone modes), discovered by MACHO Project in LMC, 11 show the strongest peak in the power spectrum at the first overtone (Alcock et al., 1995).

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