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Four New Double-Mode Cepheids, Pulsating in First and Second Overtone Modes

A. V. Khruslov
Russia, Tula

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(E-mail for contact: khruslov@bk.ru)

#	Name	Other	Coord (J2000)	Type	Max	Min	System	Period	Epoch (JD)	type	Sp	Comment	L.Curve	Find.Chart	Data
1		GSC 4818-03792	07 00 33.97, -02 20 54.6	CEP(B)	11.6	12.2	V	(see Comments)	(see Comments)	max		Comm. 1	1.PNG		ASAS 070034-0220.9
2		TYC 7670 02632 1	08 34 33.99, -41 34 35.9	CEP(B)	11.17	11.42	V	(see Comments)	(see Comments)	max		Comm. 2	2.PNG		ASAS 083434-4134.6
3		GSC 9002-00686	13 17 13.76, -66 04 59.6	CEP(B)	11.6	12.0	V	(see Comments)	(see Comments)	max		Comm. 3	3.PNG		ASAS 131714-6605.0
4		TYC 0467 03223 1	19 13 50.72, +02 51 20.0	CEP(B)	11.14	11.57	V	(see Comments)	(see Comments)	max		Comm. 4	4.PNG		ASAS 191351+0251.3

Comments:

1. According to ASAS-3 data, GSC 4818-03792, listed in the ASAS catalog of variable stars (Pojmanski et al. 2002) as a fundamental-mode Cepheid (period 0.87965 d), is actually a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453674.10 + 0.87962 x E (the first overtone mode) and JD(max) = 2453674.01 + 0.70772 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1=0.8046 is typical of beat Cepheids, pulsating in the first and second overtone modes. J-H = 0.393 (2MASS).

2. According to ASAS-3 data, TYC 7670 02632 1, listed in the ASAS catalog of variable stars (Pojmanski et al. 2002) as a fundamental-mode Cepheid (period 1.16666 d), is actually a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453426.16 + 1.16662 x E (the first overtone mode) and JD(max) = 2453426.48 + 0.939354 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1=0.8052 is typical of beat Cepheids, pulsating in the first and second overtone modes. B-V = 1.113 (Tycho2), J-H = 0.451 (2MASS).

3. According to ASAS-3 data, GSC 9002-00686, listed in the ASAS catalog of variable stars (Pojmanski et al. 2002) as a fundamental-mode Cepheid (period 0.913165 d), is probably a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453693.41 + 0.91308 x E (the first overtone mode) and JD(max) = 2453693.12 + 0.734376 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1=0.8043 is typical of beat Cepheids, pulsating in the first and second overtone modes. J-H = 0.374 (2MASS).

4. According to ASAS-3 data, TYC 0467 03223 1, listed in the ASAS catalog of variable stars (Pojmanski et al. 2002) as a fundamental-mode Cepheid (period 1.257787 d), is actually a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453729.16 + 1.25771 x E (the first overtone mode) and JD(max) = 2453729.40 + 1.01121 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1=0.8040 is typical of beat Cepheids, pulsating in the first and second overtone modes. B-V = 1.387 (Tycho2), J-H = 0.409 (2MASS).

Remarks:

I present a new investigation of four known Cepheids. The variability of these stars was reported by Pojmanski (2002).

I re-analysed the ASAS-3 data using the period-search software developed by Dr. V.P. Goranskij for Windows environment. According to ASAS-3 data, the variables are double-mode Delta Cephei stars, pulsating in the first and second overtone modes. Their period ratios, P2/P1, are typical of radially pulsating double-mode Cepheids. Along with the light curves, I present power spectra of the four Cepheids, for the raw data and after subtraction of the first-overtone oscillations. The structure of the power spectra shows that the secondary periods are real. The tabulated coordinates of the variables were drawn either from the Tycho-2 or 2MASS catalogs.

References:

Pojmanski G., 2002, Acta Astronomica, 52, 397