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

A. V. Khruslov
Tula, Russia

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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 4064-00179	04 10 05.43, +61 46 38.2	CEP(B)	13.2	13.75	R	(see Comments)	(see Comments)	max		Comm. 1	1.PNG		NSVS 2030690 NSVS 2058214
2		TYC 5992 02251 1	07 43 42.49, -20 50 20.3	CEP(B)	9.52	9.68	V	(see Comments)	(see Comments)	max		Comm. 2	2.PNG		ASAS 074343-2050.3
3	NSV 6647	TYC 8690 02031 1	14 23 45.70, -58 29 25.0	CEP(B)	11.3	11.8	V	(see Comments)	(see Comments)	max		Comm. 3	3.PNG		ASAS 142346-5829.4

Comments:

1.

The variability of GSC 4064-00179 = NSVS 2030690 = NSVS 2058214 was discovered by Khruslov (2005) from ROTSE-I/NSVS data (Wozniak et al. 2004; also see http://skydot.lanl.gov/nsvs). The variable was classified as a CWB Cepheid with the period of 1.1136 d. This variability type was chosen because of the variable's position at a distance from the galactic plane (b = +7.4 deg) somewhat larger than typical of classical Cepheids and a period somewhat too short. At that time, I analyzed only the ROTSE data without photometric correction flags (higher precision data). Now I performed a repeated analysis of the NSVS data, also retaining those with photometric correction flags and thus considerably increasing the number of data points. In this analysis, I rejected all observations with uncertainties in excess of 0.15 mag (plotted as small dots). As a result, I was able to reveal two periodicities of the star, characteristic of double-mode Cepheids.

Mode	Frequency, c/d	Semi-amplitude, Rmag	Period, days	Epoch, HJD
f1	0.8982	0.172	1.1133	2451497.64
f2	1.1181	0.046	0.8944	2451498.18

The period ratio P2/P1 = 0.8034 is typical of beat Cepheids pulsating in the first and second overtone modes.
J-H = 0.493 (2MASS).

2.

The variability of TYC 5992 02251 1 = ASAS 074343-2050.3 was reported by Pojmanski (2002). ASAS 074343-2050.3, listed in the ASAS catalog of variable stars as a first-overtone Cepheid (period 0.73629 d), is actually a double-mode Cepheid.

Mode	Frequency, c/d	Semi-amplitude, V mag	Period, days	Epoch, HJD
f1	1.358192	0.041	0.736273	2453455.43
f2	1.685727	0.010	0.593216	2453455.40
f1+f2	3.04395	0.005	0.328521	2453455.40

The period ratio P2/P1 = 0.8057 is typical of beat Cepheids pulsating in the first and second overtone modes.
B-V = 1.233 (Tycho2).
TYC 5992 02251 1 is a close visual double star 2MASS 07434278-2050155 (J=9.437, J-H = 0.259) and 2MASS 07434249-2050204 (J=8.234, J-H = 0.443), and thus the tabulated amplitude is too low. The brighter of the stars probably varies, its J-H color index is more typical of Cepheids.

3.

The variability of NSV 6647 = TYC 8690 02031 1 = ASAS 142346-5829.4 was reported by Strohmeier et al. (1964). The star, listed in the ASAS catalog of variable stars as an RRAB variable (period 0.631294 d), is actually a double-mode Cepheid.

Mode	Frequency, c/d	Semi-amplitude, V mag	Period, days	Epoch, HJD
f1	1.584103	0.190	0.631272	2453556.358
f2	1.972822	0.029	0.506888	2453556.358

The period ratio P2/P1 = 0.8030 is typical of beat Cepheids pulsating in the first and second overtone modes.
B-V = 0.848 (Tycho2), J-H = 0.351 (2MASS).

Remarks:

I present a new investigation of three known pulsating variables.

I re-analysed the ASAS-3 and ROTSE-I/NSVS data (Wozniak et al. 2004) using the period-search software developed by Dr. V.P. Goranskij for Windows environment. According to the data, the stars are double-mode Cepheids, pulsating in the first and second overtone modes. The period ratios, P2/P1, are typical of double-mode variables pulsating in the first and second overtone modes. The tabulated coordinates of the variables were drawn from the Tycho2 and 2MASS catalogs.

References:

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