"Peremennye Zvezdy",
Prilozhenie,
vol. 9, N 31 **(2009)**

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

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Received: 20.10.2009; accepted: 5.11.2009
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#	Name	Other	Coord (J2000)	Type	Max	Min	System	Period	Epoch (JD)	type	Sp	Comment	L.Curve	Find.Chart	Data
1		GSC 0736-01231	06 27 34.78, +09 49 49.7	CEP(B)	11.5	11.9	V	(see Comments)	(see Comments)	max		Comm. 1	1.PNG		ASAS 062735+0949.8 NSVS 9822479
2		GSC 0746-01186	06 41 34.57, +07 56 39.6	CEP(B)	12.2	12.7	V	(see Comments)	(see Comments)	max		Comm. 2	2.PNG		ASAS 064135+0756.6 NSVS 9842280 NSVS 12516509
3		GSC 6567-01616	08 11 32.10, -28 21 17.8	RR(B)	12.2	12.8	V	(see Comments)	(see Comments)	max		Comm. 3	3.PNG		ASAS 081132-2821.3

Comments:

1. According to ASAS-3 data, ASAS 062735+0949.8, listed in the ASAS catalog of variable stars (Pojmanski 2002) as a first-overtone Cepheid (period 1.06806 d), is actually a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453761.65 + 1.06802 x E (the first overtone mode) and JD(max) = 2453761.54 + 0.85905 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. To improve the periods, I have also analysed the NSVS observations of the variable (Wozniak et al. 2004; also see http://skydot.lanl.gov/nsvs). The second-overtone pulsations were not found in the NSVS data, apparently because of the small number of observations. J-H = 0.394 (2MASS).

2. According to ASAS-3 data, ASAS 064135+0756.6, listed in the ASAS catalog of variable stars (Pojmanski 2002) as a fundamental-mode or first-overtone Cepheid (period 1.28859 d), is actually a double-mode Cepheid. The phased light curves plotted for the following elements: JD(max) = 2453800.65 + 1.28861 x E (the first overtone mode) and JD(max) = 2453800.32 + 1.03153 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1 = 0.8005 is typical of beat Cepheids, pulsating in the first and second overtone modes. To improve the periods I have also analysed the NSVS observations of the variable (Wozniak et al. 2004; also see http://skydot.lanl.gov/nsvs). The NSVS data completely confirm the double-mode variability and the periods. J-H = 0.448 (2MASS).

3. According to ASAS-3 data, ASAS 081132-2821.3, listed in the ASAS catalog of variable stars (Pojmanski 2002) as an RRC star or a first-overtone Cepheid (period 0.457228 d), is actually a double-mode RR Lyrae variable star. The phased light curves plotted for the following elements: JD(max) = 2453456.144 + 0.457231 x E (the first overtone mode) and JD(max) = 2453456.065 + 0.366105 x E (the second overtone mode), are given in the Figure. The period ratio P2/P1=0.8007 is typical of variables radially pulsating in the first and second overtone modes. J-H = 0.318 (2MASS).

Remarks:

I present a new investigation of three known pulsating variables. 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 stars are double-mode variables, pulsating in the first and second overtone modes. Their period ratios, P2/P1, are typical of radially pulsating double-mode variables. Along with the light curves, I present power spectra of the three variable stars, 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 from the 2MASS catalog.

References:

Pojmanski, G., 2002, Acta Astronomica, 52, 397
Wozniak, P.R., Vestrand, W.T., Akerlof, C.W., et al., 2004, Astron. J., 127, 2436