

FREQUENCY ANALYSIS OF TWO-YEARS OBSERVATIONS OF RR LYRAE

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ABSTRACT. 2964 photoelectric observations of RR Lyrae were obtained at the Odessa observatory during two years: 1977 and 1978. Observations were transformed to standard BV photometric system and frequency-analyzed in the interval 0.08–700 days. A number of harmonics were detected. The main harmonic coincides with the well known photometric period ($\nu_0=1.764129$), second harmonic ($\nu_B=1.789093$) is related with a period of Blazhko effect. There is a sequence of harmonics, which can be written by equation $\nu = k\nu_0 + \nu_B$ where $k=0,1,2,3,4$. Two harmonics are connected with known periods of RR Lyrae: 123 days and four years.

Key words: Stars: individual – Stars: pulsation – Stars: RR Lyrae

The long series of photoelectric observations of RR Lyrae were published by Walraven (1949), Hardie (1955), Preston et al. (1965), Onderlicka and Vetesnik (1968).

Observations of Walraven (1949) and Onderlicka and Vetesnik (1968) were obtained in instrumental system and cover full curves of main period. Preston et al. (1965) observed in UBV system only maxima of light curves. We tried to obtain the full light-curves of RR Lyrae in standard BV system for different phases of Blazhko effect. Here after we give preliminary results of 14 years observations of RR Lyrae: two-years interval.

Two-colors photoelectric observations of RR Lyrae, numbering 2964, were performed with a photoelectric photometers attached to the 8-inch refractor and 20-inch reflector of Odessa astronomical observatory at observational sta-

tion Mayaki. Observations obtained at two telescopes were reduced to the standard BV photometric system. We tried to obtain the full light curve at the different phases of Blazhko effect. The observations cover two years: 1977 and 1978.

Our data were frequency-analyzed by making use of Deeming (1975) method. We tried to investigate the complete light variations of RR Lyrae. For this purpose we use the standard method of finding harmonics in light curves. We made frequency analysis, found the most powerful harmonic, the mean light curve corresponding to this harmonic was subtracted from data, and begun this cycle again. V, B and B-V values were processed independently.

Results of this procedure for B and B-V are shown in Table 1. The first four columns in Table 1 are the number of harmonic, period in days, frequency in cycles per day, amplitude. The last two columns of this table contain the possible interpretation of harmonic.

The first harmonic (ν_0) is a well known photometric period of RR Lyrae. The second harmonic (ν_B) is connected with the period of Blazhko effect of RR Lyrae (41 day). Harmonics 2, 3, 4, 6, 7, 13 can be treated as a sequence:

$$\nu = k\nu_0 + \nu_B$$

where $k=0,1,2,3,4$.

Fifth harmonic (beating period 1186 days = 3.25 years) can be connected with a 3.8–4.8 year cycle of RR Lyrae. This cycle was found by Detre and Spreid (1973). We must to mention that our observation cover two years. The beating period of harmonic 14 is very close to 123-day period (Walraven, 1949) and can be

Table 1. Results of the frequency analysis of RR Lyrae.

	P (days)	ν	Ampl. (magn.)	$1/(\nu - \nu_0)$ (days)	Possible Interpretation
B, 2964 observations in all phases of the main period					
1	0.566852	1.764129	1.00		ν_0
2	0.558942	1.789093	0.37	40.06	ν_B
3	0.141215	7.081391	0.20		$3\nu_0 + \nu_B$
4	0.281429	3.553295	0.18		$\nu_0 + \nu_B$
5	0.566581	1.764971	0.18	1186.94	
6	0.113059	8.844958	0.12		$4\nu_0 + \nu_B$
7	0.188036	5.318124	0.14		$2\nu_0 + \nu_B$
8	0.492173	2.031807	0.13		
9	0.281721	3.549613	0.11	271.60	
10	0.344821	2.900054	0.10		
B-V, 2964 observations in all phases of the main period					
11	0.566848	1.764140	0.23		ν_0
12	0.558867	1.789326	0.09	39.70	ν_B
13	0.141212	7.081527	0.05		$3\nu_0 + \nu_B$
B-V, 1640 observations near maximum of the main period					
14	0.564359	1.771932	-	128.34	

treated as rotation period of RR Lyrae.

Harmonic 8 was not detected in V observations.

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