PHOTOMETRICAL STUDY OF SU UMA-TYPE BINARY RZ LMI DURING THE SUPEROUTBURST IN 2001

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ABSTRACT. We perform the photometry of the SU UMa-type binary, RZ LMi during the superoutburst in 2001. The star displayed the superoutburst decay with a rate $\sim 0.^m07$/day. We detected the superhumps with an amplitude up to $0.^m2$. Some of the superhumps show the eclipse-like feature. The ephemeris for maxima is HJD$= 2451933.5939(6) + 0.059296(40) \cdot E$.

Key words: Stars: variable: cataclysmic: UG SU: RZ LMi

1. Introduction

RZ LMi was discovered as a variable star by Lipovetskiy and Stepanian (1981). Green et al. (1986), Szkody and Howell suggested RZ LMi to be a dwarf nova. Robertson et al. showed that behaviour of this dwarf nova is similar to those of ER UMa and V1159 Ori. Pikalova and Shugarov (1995) on the base of inspection of 300 photoplates from the SAI collection found that within $JD = 2446019 - 2446208$ RZ LMi displayed the brightness variations with extremely short cycle 21.2 days (or 23.3 days). Nogami et al. (1995) found some shorter interval between two neighbour superoutbursts – supercycle length ($\sim$ 19days) and discovered the superhump period (0.05946 days). So RZ LMi is a unique binary among SU UMa type stars at least due to its extremely short supercycle. For example, the shortest sypercycle in a "classical" dwarf nova V503 Cyg is 89 days (Harvey et al. 1995). Here we perform the results of our observations of RZ LMi during four nights over one of the superoutburst in 2001, that are the part of a multilongitude campaign organised by J. Patterson.

2. Observations

Our observations of RZ LMi have been carried out at the 380-mm Kassegrain telescope (K-380) of the Crimean astrophysical observatory in the standard Johnson R band. The exposure time was 100^s. The start and the end of observations, number of measurements, maximal and minimal brightness in respect to the comparison star are given in the Table 1. The accuracy of a single measurement was $0.^m03$.

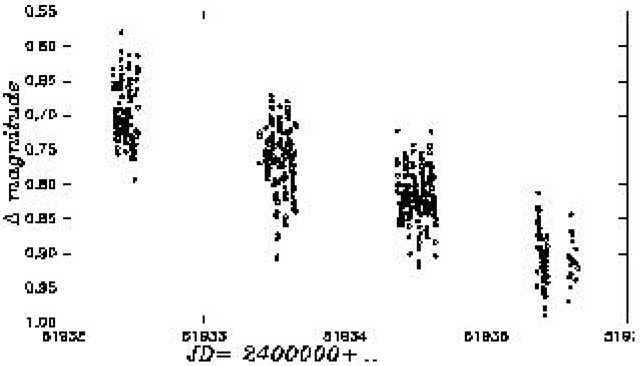

Figure 1: The light curve of RZ LMi during the superoutburst 2001

Table 1. Journal of observations.

JD	JD	N	m_{min}	m_{max}
51932.3477	51932.5313	129	0.794	0.580
51933.3906	51933.6523	163	0.908	0.672
51934.3672	51934.6445	198	0.919	0.723
51935.3633	51935.6563	77	0.990	0.813

3. Results

The known observations of RZ LMi show an extremely short duration of its superoutburst. The plateau of superoutburst in RZ LMi lasts no longer then 7 days (while in another SU UMa type binaries it could reachs 14 days). We observed approximately half of the RZ LMi superoutburst duration. The long-term trend corresponded to the plateau of superoutburst decline is shown in Fig.1. The fading of RZ LMi was about $\sim 0.^m07$/day. Note that Nogami et al. (1995) found a rate of plateau brightness fading in V band $\sim 0.^m1$/day in 1995. The same rate obtained Honneycutt et al. (1995) also in V band for the folded 1992-94 light curve.

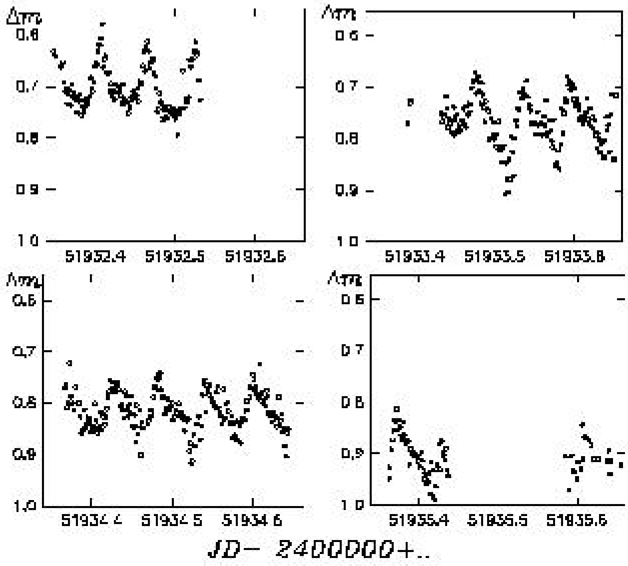

Figure 2: Nightly light curves of RZ LMi

Table 2. Maxima timings for RZ LMi.

JD	O-C (day)	σ
51932.4084	0.0177	0.0014
51932.4654	0.0153	0.0012
51933.4760	0.0150	0.0035
51932.4084	0.0177	0.0014
51932.4654	0.0153	0.0012
51933.4760	0.0150	0.0035
51933.5377	0.0172	0.0008
51933.5931	0.0132	0.0012
51934.4285	0.0161	0.0008
51934.5395	0.0082	0.0019
51934.6008	0.0101	0.0028
51935.3715	0.0078	0.0015

Similar value could be crudely estimated from photografic data by Pikalova and Shugarov (1995).

During the superoutburst, the prominent superhumps have been detected with amplitude up to $\sim 0.^m2$. The original light curves are shown in Fig.2. Over the course of the outburst the profile of the superhump changed from a symmetric shape to an asymmetric one (see Fig.2): The ascending branch became more steep than descending branch. For the superhumps with more steep ascending branch, the appearence of the eclipse-like feature in some minima is seen.

Using the code of Marsakova and Andronov (1996) we calculated the timings of a sharp maxima and the residuals (O-C) according to the ephemeris by Nogami et al. (1995):

$$Max = HJD2449781.009 + 0.05946 \times E \qquad (1)$$

The result is presented in Fig.3. The (O-C)s were decreasing during the superoutburst. We fitted our data by the line and by the parabola. The fitting

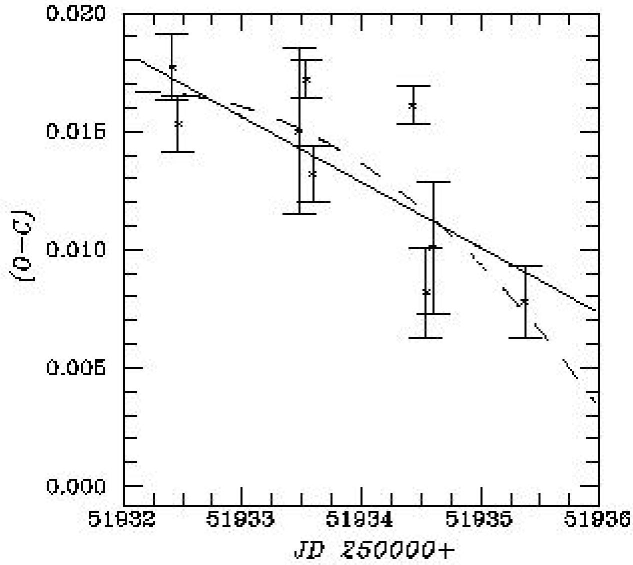

Figure 3: The (O-C) diagram for the time of the maxima calculated using the ephemeris (1). Line corresponds to a new ephemeris (2) and the dashed line - to the parabolic fit.

by parabola is slightly better: we got a less residuals after subtraction it from the original (O-C)s, then if we subtract the staight line. The residuals calculated as standard deviations are $0.^d00217$ for parabola and $0.^d00223$ for line. It could indicate the decrease of the superhump period. However, the quadratic ter $Q = (-3.3 \pm 2.6) \cdot 10^{-6}$ days/cycle^2. Thus the decrease is not statistically significant.

This event often (but not always) is observable in different SU UMa-type stars.

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