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Photometry of the outburst of the WZ Sge-type dwarf nova IK Leo in 2024

O. Antoniuk[1], K. Antoniuk[1], E. Pavlenko[1], S. Shugarov[2], and P. Dubovsky[3]

[1] Crimean Astrophysical Observatory of the Russian Academy of Sciences, Nauchny, 298409 Russia

[2] Sternberg Astronomical Institute of the Moscow State University, 13 Universitetskij Pr., Moscow, 119991 Russia

[3] Vihorlatská hvezdáreň Observatory, 4 Mierová, Humenné, 06 601 Slovakia

Abstract. The multicolour photometric observations of the dwarf nova IK Leo in 2024, carried out at the Crimean Astrophysical Observatory, are presented. We obtained a corrected value of the superhump period during the outburst, which is 0.055953 days, and studied the evolution of its changes from the plateau stage to the slow decay of the outburst. Changes in the behaviour of colour indices during the outburst are considered.

Keywords: stars: dwarf novae, cataclysmic variables; individual: WZ Sge, IK Leo

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1 Introduction

Dwarf novae are the subclass of cataclysmic variables—close binary systems consisting of a Roche-lobe-filling star that accretes matter onto a white dwarf (Warner 1995). The light curve of WZ Sge-type dwarf novae is characterized by rare (up to decades) and long-lasting bright outbursts (up to 8^{m}). These systems are also characterized by rebrightenings, which are observed during the fading of the main outburst (Kato 2015). Among other dwarf novae, WZ Sge systems have the shortest orbital periods (about 85 min).

The outburst of the dwarf nova IK Leo was reported in February 2024. The previous known similar outburst occurred in 2006 (Uemura et al. 2008). The current observations of this binary were carried out at the Crimean Astrophysical Observatory on the AZT-11 telescope in the $BVRI$ bands. For a more complete analysis of the light curve of the outburst, data from the open sources AAVSO (V-band) and provided by the observers from Slovakia (V and R-bands) were used.

2 Observations

This outburst had an amplitude of over 5^{m}. On the light curve (Fig. 1b) we can distinguish a plateau of the outburst lasting 18 days, after which a "dip", a sharp weakening by 1^{m}, was observed for 3 days. Then there was a rebrightening lasting 7 days and a rapid fading of the outburst within 2–3 days. A pre-outburst brightness was not reached, there was a long phase of slow outburst weakening.

During the outburst, the light curve showed superhumps—periodic light variations typical for many dwarf novae. The average period of superhumps in the stage of the outburst plateau was 0.055953(16) days and it increased at the rate of 0.27×10^{-5} (Fig. 1a). The periodogram and phase curve for this period are shown on (Fig. 2). During the rebrightening, we also observed light variations with a close period, 0.055955(22) days, and during the slow fading phase, superhumps with a smaller period (0.055925 days) were observed too.

The overall light curve of the outburst in the $BVRI$ bands is shown (Fig. 3). It can be seen that the system becomes redder during the outburst weakening. This behaviour is consistent with the classic picture of the accretion disk in dwarf nova outbursts, in which a superhump source lies at the outermost part of the disk. A sharp jump in the B–I indices occurs on the descending branch of the rebrightening, but as the outburst slowly fades, a slight turn to the blue side can be observed.

3 Summary

Comparing the results obtained for the outburst in 2024 with the previously known outburst in 2006, the following conclusions can be made. The interval between neigh-

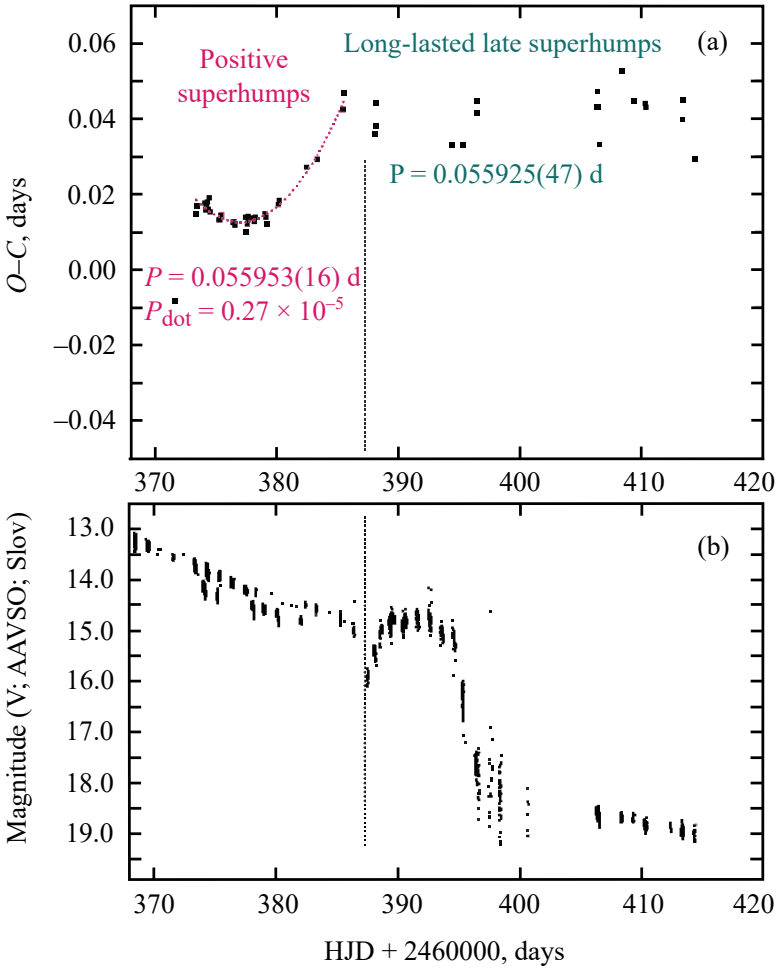

Fig. 1. Panel (a): $O-C$ for superhumps maxima. Panel (b): the overall light curve of the IK Leo outburst in V-band from CrAO, Slovakia, and AAVSO data.

bouring outbursts for this binary can be up to 18 years. The amplitude of the outburst is more than $5^{\rm m}$, and the duration of the outburst with the following rebrightening is about 28 days. During this interval, both outbursts exhibited a characteristic sharp short-term brightening ("dip"). The average superhump period during the outburst was 0.055953 days which is less than the value obtained for 2006. Comparing the superhump period at the plateau stage and during the rebrightening and following slow decay, we can assume the registration of late superhumps after the dip. The changes in the colour indices are consistent with the standard representation for dwarf novae outbursts.

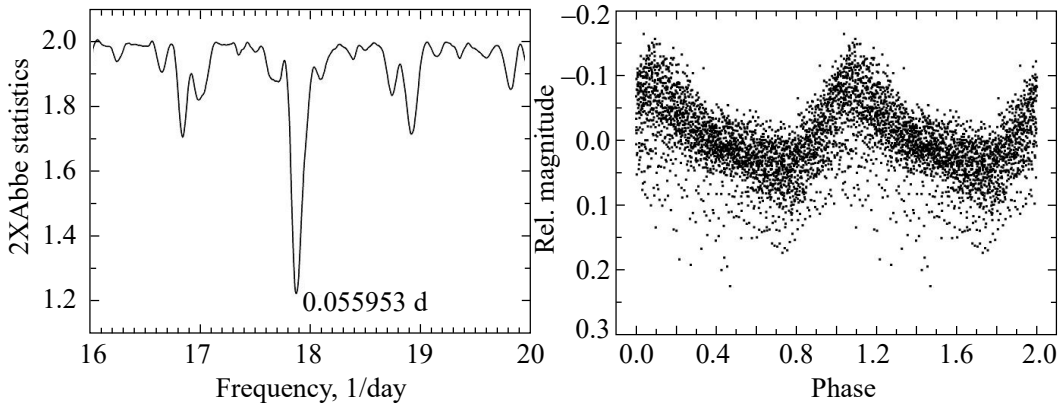

Fig. 2. Periodogram for superhumps at the outburst plateau stage and phase curve for the obtained period.

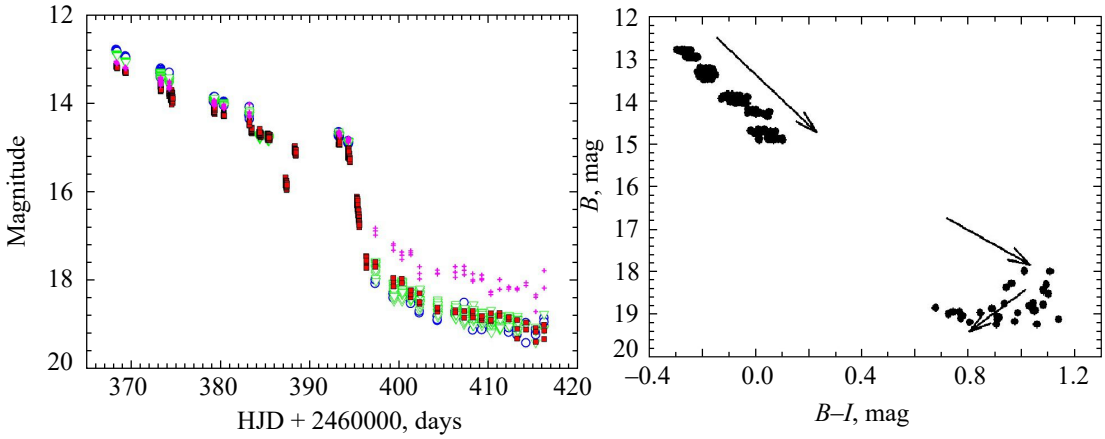

Fig. 3. The light curve of IK Leo in the $BVRI$ bands (blue circles, green triangles, red squares and pink crosses are B, V, R and I bands, respectively) and the changes in the B–I colour indices along the outburst (shown by the arrows).

References

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