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New CCD photoelectric observations of the contact binary GSC 02013-00288

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Abstract. We present the first set of complete light curves in the B, V, R and I bands observed photometrically in 2013 for the contact binary GSC 02013-00288 (=IK Boo) after its discovery without a filter. New ephemerids were determined. The O-C diagram shows a decrease in its orbital period by a rate $dP/dt = -1.979 \times 10^{-7}$ day/year.

Key words: contact binaries – IK Boo

1. Introduction

IK Boo (= GSC 2013-0288 = ROTSE1 J140846.30+292910.1 = NSVS 7727589) was reported by Akerlof et al. (2000) as a new discovered eclipsing binary. In 2005, Blättler obtained unfiltered CCD observations with a SBIG ST-7 camera attached to a 0.15 m Starfire refractor in Wald, Switzerland, during 6 nights between Jan 12, 2005 and May 27, 2005. Blättler and Diethelm (2006) reported the system to be an eclipsing W UMa type with an unfiltered magnitude (near R) range from 11.42 to 11.76 (11.96).

2. Observations

New CCD multi-colour photometry of a neglected contact W UMa binary IK Boo was carried out in BVRI standard Johnson filters using the 74-inch telescope of the Kottamia Observatory, Egypt. The capabilities of the telescope with the specification of the CCD camera were described by Azzam et al. (2008). The observations were obtained at the Newtonian focus on April 29/30 and May 1/2, 2013. The exposure times depend on the observing conditions and the filter used ranged from 20 to 90 seconds. The reduction of the CCD images was performed by using the C-Munipack software package. The comparison star SDSS J140847.47+292950.9 was used in the photometric reduction to obtain the light curves (LCs) of IK Boo.

Fig. 1 represents the BVRI LCs. It shows the differential magnitude (the variable minus comparison) versus the corresponding calculated phase obtained by our new ephemeris given below (eq. 2). The new timings of one primary and one secondary minima for each filter have been determined by the tracing paper method; the mean values are 24 56414.40282 and 24 56414.55549, respectively.

The observed LCs indicate a typical partial eclipsing short period of W UMa binary with broad maxima and narrow minima.

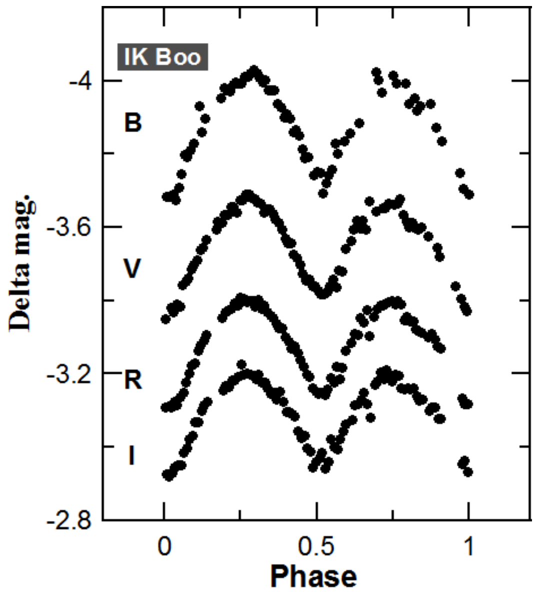

Figure 1. The BVRI light curves of IK Boo.

3. Period analysis

Blättler and Diethelm (2006) performed a linear regression to the first 10 times of minima obtained from a total of 176 measurements with the ROTSE1 data and they obtained the following light elements:

$$HJD(MinI) = 2453382^d.6264 + 0^d.303119E. \tag{1}$$

The new times of minima obtained from the present observations, together with 18 other minima times collected from the literature, are used to calculate the O-C residuals using eq. 1.

All minima used in the present analysis are CCD observed (11 primary and 9 secondary). So, we needn't a weighted fitting method. We have constructed the O-C diagram as seen in Fig. 2 and obtained, by using the linear and quadratic least squares methods, the new light elements:

$$HJD(MinI) = 2453382^d.62786 + 0^d.303117232E, \tag{2}$$

with SD=0.0027 day, r=0.923, and residual sum of squares $= 1.347 \times 10^{-4}$; and

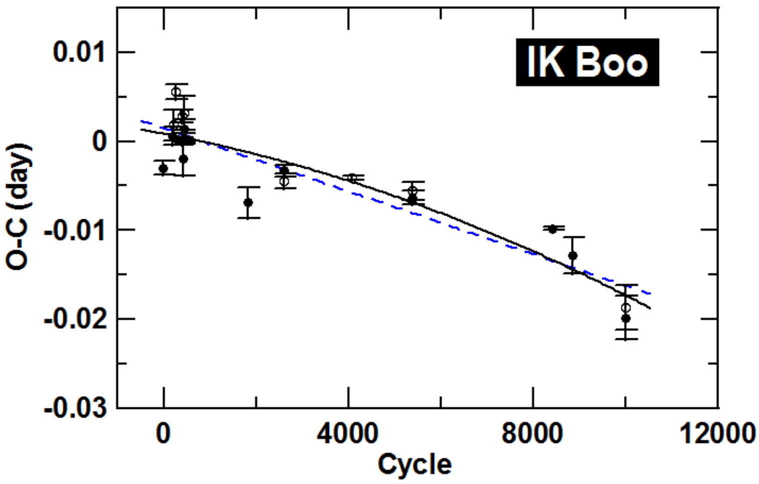

Figure 2. The O-C diagram of IK Boo. The filled circles for primary, the open circles for secondary minima. Error bars due to minima times determination.

$$HJD(MinI) = 2453382^d.6273 + 0^d.303118007\,E - 8.214 \times 10^{-11}\,E^2, \qquad (3)$$

with SD=0.0027 day, r=0.929, and residual sum of squares $= 1.250 \times 10^{-4}$.

It is clear that the primary and secondary minima follow the same trend and the orbital period looks to be continuously decreasing with a rate $dP/dt = -1.979 \times 10^{-7}$ day/year. A light curve solution is under analysis and the period variation study needs more minima times determinations in order to follow the cause of such period variability.

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