

**CCD OBSERVATIONS OF A CLOSE
BINARY SYSTEM V1001 Cas IN 2009**

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Abstract. Photometric observations of a close binary system V1001 Cas was made in this study. System was discovered in 2004 by means of unfiltered observations made by Nakajima, Yoshida, and Ohkura. System's first observations in VRI filters were made in Ankara University Observatory with a 0.4 m Cassegrain Telescope attached to Apogee ALTA U47 CCD camera. First light curves of the system by using these observations were obtained. Also 4 new times of minima was calculated and the light elements were updated. After updating the light elements, a phase shift was also determined. The study is ongoing and the radial velocity curve will be acquired by means of spectral observations. As a result of the study, it is expected that physical parameters of the system will be extracted for the first time.

1. INTRODUCTION

A close binary system, V1001 Cas (MisV1222, GSC 3651-00655) was discovered in 2004 by Nakajima, Yoshida, and Ohkura who made only unfiltered observations (IBVS 5600). They thought that the type of system was β Lyr. But they couldn't reach an exact conclusion for the type of the system. In Table 1 their results for the system are given. As a result of literature survey, neither detailed photometric nor spectroscopic study was found for the system.

Table 1: Results of V1001 Cas by Nakajima, Yoshida, and Ohkura

RA (J2000)	$23^h 50^m 17^s.12$
Dec (J2000)	$+51^\circ 11' 29''.1$
Type	EB:
Mag.	13.61 - 14.71
Period	$0^d.428783$
Epoch	2452937.0855
Cross-identification(s)	MisV1222 = GSC 3651-00655 = UNSO-A2.0 1350.18742581

Table 2: New minima times calculated in this study

Time of min.(HJD)	Error	Min. type	Passbands	Method
2455058.3519	0.0001	I	VRI	CCD
2455058.5663	0.0002	II	VRI	CCD
2455060.4970	0.0001	I	VRI	CCD
2455060.2827	0.0002	II	VRI	CCD

Table 3: The differences in light levels in light curves of the system

	ΔV	ΔR	ΔI
$Max.I - Max.II(m_{0.25} - m_{0.75})$	0.018	0.019	0.012
$Min.I - Min.II(m_{0.00} - m_{0.50})$	1.062	0.824	0.560
$Min.I - Max.I$	1.179	0.991	0.828
$Min.II - Max.II$	0.136	0.186	0.280

2. OBSERVATIONS AND DATA REDUCTION

Photometric observations in VRI passbands were obtained on 14, 16 August 2009 at Ankara University Observatory by using an Apogee ALTA U47 CCD camera attached to 0.4 m Schmidt-Cassegrain Telescope. The field of view of the CCD image was 11x11 arcmin. Exposure times for V, R and I passbands were 22 s, 18 s, and 20 s respectively for the observations made on 14 August. These exposure times were 23 s, 17 s, 20 s in the same order for the observations made on 16 August.

The data reduction was made by the relevant tasks of IRAF software. GSC 3651 548 was used as comparison star and GSC 3651 196 was used as check star. Both comparison and check stars were observed in the same CCD frame.

Four new minima times were calculated from my observations by using Kwee and van Woerden (1956)'s method. New light elements were determined by using these new minima times and taken from previous studies. In Table 2, new minima times are given.

Revised Linear Ephemeris was obtained as

$$HJD(MinI) = 2452937.0825 + 0^d.428799 \times E. \quad (1)$$

Light curves in V, R, I passbands were built by using 627, 645, 637 images, respectively. Obtained light curves which were phased by using new light elements given by Equation (1), are shown in Fig. 1. Same light curves which were phased by using light elements given in IBVS 5600 are shown in Fig. 2. As seen from these figures there is a significant phase shift for 5 years period. Primary minima must be in 0.00 phase but as seen in Fig. 2 it is around 0.19 phase. This means that there is a 0.19 phase shift. Also the differences in the light levels in the three passbands are shown in Table 3.

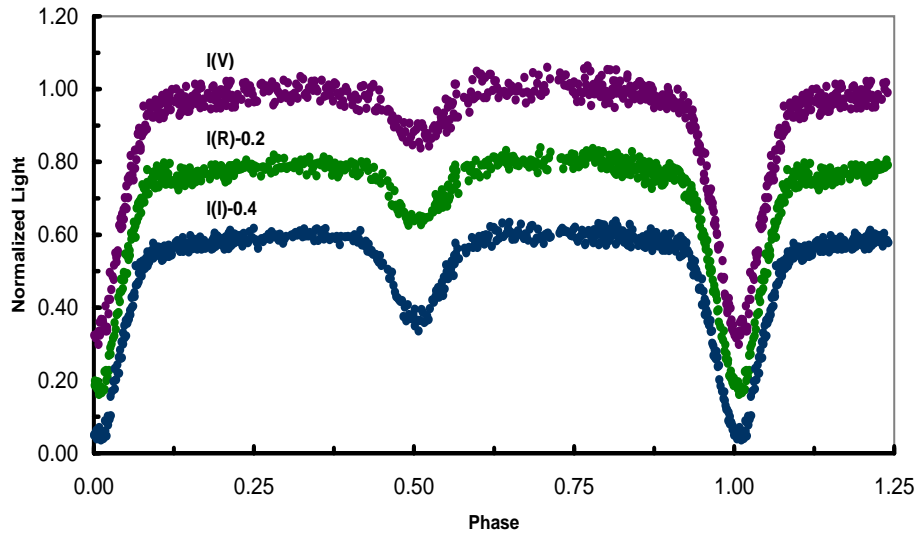


Figure 1: Observed light curves in V, R and I passbands, phased by using new light elements

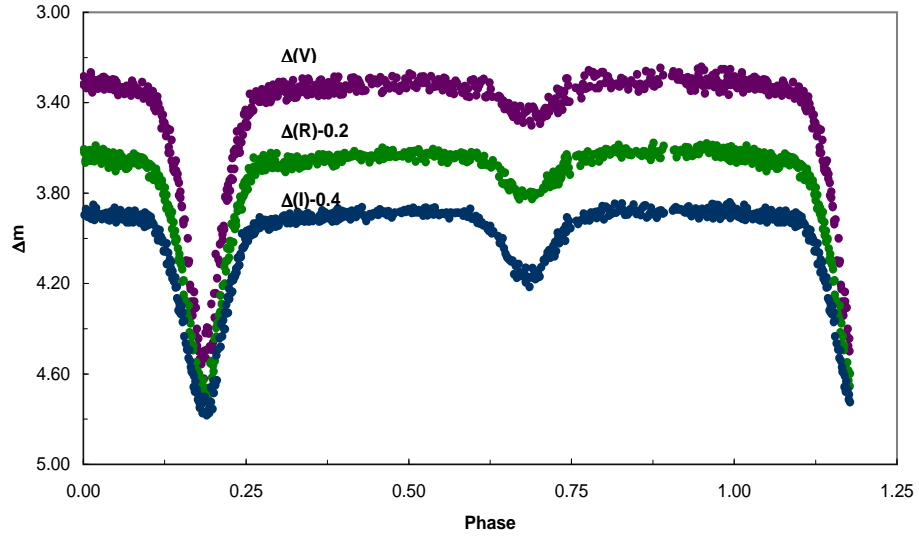


Figure 2: Observed light curves in V, R and I passbands, phased by using light elements taken from IBVS No:5600

3. RESULTS AND DISCUSSION

In this study, first filtered observations were made for V1001 Cas system. Light curves in Johnson VRI passbands were obtained and presented. Light elements of the system were updated by using these new filtered observations. As light curves were phased by using light elements taken from IBVS 5600, a significant phase shift was determined. The value of the phase shift is around 0.19. This significant difference among calculated light elements in 2004 and 2009 should be the indicator of a period variation. In order to confirm that period variation and come up with a result, more minima times obtained in a wide range time interval are required. On the other hand these new minima times are important to provide a basis for following O-C studies.

Since there is no any spectroscopic data or temperature information for the system, light curve analysis done by using only the photometric observations can not give reliable results. For this reason, as a future work, radial velocity curve is planning to be obtained by spectroscopic observations of the system. Also it is planning that these spectral data and photometric data will be solved in Wilson-Devinney light curve analysis program simultaneously. Thus, physical parameters of the system will be extracted for the first time.

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References

- Hardie, R. H.: 1962, *Astronomical Techniques*, ed. W. A. Hiltner, Chicago Univ. Press.
Kwee, K. K., van Woerden, H.: 1956, *BAN*, **12**, 327.
The editors of IBVS: 2006, *IBVS*, 5600.
Wilson, R. E., Devinney, E. J.: 1971, *journalApJ*, **166**, 605.