

CCD PHOTOMETRY OF NOVA V 2362 CYG

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Abstract: Results of CCD photometry of V 2362 Cyg nova are published in this work. They were achieved at the Observatory in Valašské Meziříčí on 24th November – 14th December 2006, which was in the period of its second brightness maximum. During 4 hours lasting photometry on 8th December 2006 nova brighten about 0.1 mag for a short time. According to L. Hric (2008) it could be a flickering activity. Theoretical model correspond with turbulent streams of mass in accretion disk around compact element. Similar phenomenon could be seen at recurrent novae (RS Oph)

INTRODUCTION:

V 2362 Cyg was discovered by Hideo Nishimura on the 2nd April 2006 and the discovery was proved by Richard Miles on 4th April 2006 (Nakano 2006) when the star reached the brightness of $V = 8.5$ mag. This object was classified as the nova category and the above mentioned name was given (assigned) to it.

Yamaoka (2006) and Steeghs (2006) found the exact position and identified the progenitor as an emission line star in the IPHAS $H\alpha$ survey (coordinates ICRS 2000.0 21 11 32,46 +44 48 03,7). Brightness of progenitor was $R = (20.3 \pm 0.05)$ mag and $I = (19.76 \pm 0.07)$ mag. The outburst amplitude was about 12 mag.

Siviero et al. (2006) classified the nova as “Fe-II” type. Classification was based on spectra obtained on April 13, 2006. Spectra had very broad Balmer emission lines with structured profile with FWZI of $3750 \text{ km}\cdot\text{s}^{-1}$ and FWHM of $1800 \text{ km}\cdot\text{s}^{-1}$.

At the beginning of July 2006 Mazuk et al. (2006) announced first signs of unusual behavior. Second maximum was observed from August 2006 until beginning of December 2006 (Munari et al. 2006a). Goranskij et al. (2006) found a period of short optical variations of nova $P=0.2070$ d. in visible light. During second maximum an increase of the emission line width was observed as well. They also pointed out similarities to the lightcurve of V1493 Aql (Nova Aql 1999a) where the second maximum with amplitude of 0.75 mag became 2 weeks after first outburst. In case of nova V2362 Cyg the second maximum became 6 months after first outburst with amplitude of 2.1 mag.

Assumption of dropping brightness after second maximum was right. In the December 2006 the brightness dropped by 2.5 mag over a period of two weeks and returned back to a theoretical light curve values. At the beginning of December 2006 Kimeswenger et al. (2006) announced rapid spectral changes. At the end of the year nova reached a typical nebular phase (Munari et al. 2006b). For the description of the nova light curve model by Hachisu & Kato (2006, 2007) was used. First 60 days after first maximum (t_2/t_3) correspond with the theoretical model. First anomaly appears about 100 days after maximum and it is uncertain if it is this theoretical model suitable for such a nova.

Mass of the both elements was specified for the proposed orbital period. The mass of the accreting white dwarf is $1.2 M_{\text{SOL}}$ and the secondary has to be less than $0.75 M_{\text{SOL}}$ K to M star (S. Kimeswenger et al. 2008). The distance of V2362 Cyg was found to be $7.5_{-2.5}^{+3.0}$ kpc.

OBSERVATION AND DATA REDUCTION:

The photometry at the Observatory in Valašské Meziříčí was carried out in the period of 24th November – 14th December 2006.

During eight nights (time span 21 days) I have obtained a total of 352 measurements by with use of Schmidt - Cassegrain 0,28-m $f/6,3$ reflector and SBIG ST-7 CCD camera + V,R and I band filter.

24th November 2006 - JD 2454064,201 - 263 (16:50 - 18:19 UT) - 20 measurement – filter V
 28th November 2006 - JD 2454068,270 - 368 (18:29 - 20:50 UT) - 88 measurement – filter V
 3rd December 2006 - JD 2454073,225 - 232 (17:24 - 17:35 UT) - 9 measurement – filter V
 5th December 2006 - JD 2454075,381 - 385 (21:09 - 21:15 UT) - 6 measurement – filter V
 8th December 2006 - JD 2454078,202 - 384 (16:51 - 21:13 UT) - 146 measurement – filter V
 11th December 2006 - JD 2454081,201 - 263 (16:50 - 18:19 UT) - 23 measurement – filter V

11th December 2006 - JD 2454081,202 - 237 (16:51 - 17:41 UT) - 15 measurement — filter R
 11th December 2006 - JD 2454081,205 - 257 (16:55 - 18:10 UT) - 19 measurement — filter I
 14th December 2006 - JD 2454084,205 - 243 (16:55 - 17:50 UT) - 11 measurement — filter V
 14th December 2006 - JD 2454084,205 - 223 (16:55 - 17:21 UT) - 4 measurement — filter R
 14th December 2006 - JD 2454084,203 - 245 (16:52 - 17:53 UT) - 11 measurement — filter I

Comparison stars are comp. GSC 3181:1401 (designated with the letter „b“ in Frigo’s work,2006)

	U	NU	B	NB	V	NV	V-R _c	Nvr	R _c -I _c	Nri
„b“	11,44 (0,04)	3	11,52 (0,01)	9	11,23 (0,01)	9	0,167 (0,01)	6	0,212 (0,018)	6

ch1 - GSC 3181:1159 and ch2 - GSC 3181:1727.

Images were processed using C-Munipack (Motl, 2006). Because only one-filter observation was made during first five nights, the data cannot be transformed to Johnson-Cousins standard photometric system. So data are given in instrumental photometric system. Our instrumental system and standard Johnson-Cousins photometric system difference is given by equations:

$$dV = dv + 0.044*(dv - dr_c)$$

$$dR_c = dv - 0.816*(dv - dr_c)$$

$$dI_c = dv - 0.983*(dv - di_c)$$

where “vr_c” are instrumental values and “VR_cI_c” are Johnson-Cousins magnitudes.

OBSERVATIONAL RESULTS :

The aim of the observation was a survey of nova V 2362 Cyg variation after first maximum and during the second maximum and comparison to visual observers (fig. 1, fig. 2). A fast variation on brightness was registered on 8th December 2008 during 4 hours lasting photometry (fig. 4). Range of the variation was 0.1 mag. Possible cause of changes can be an activity of accretion disc.

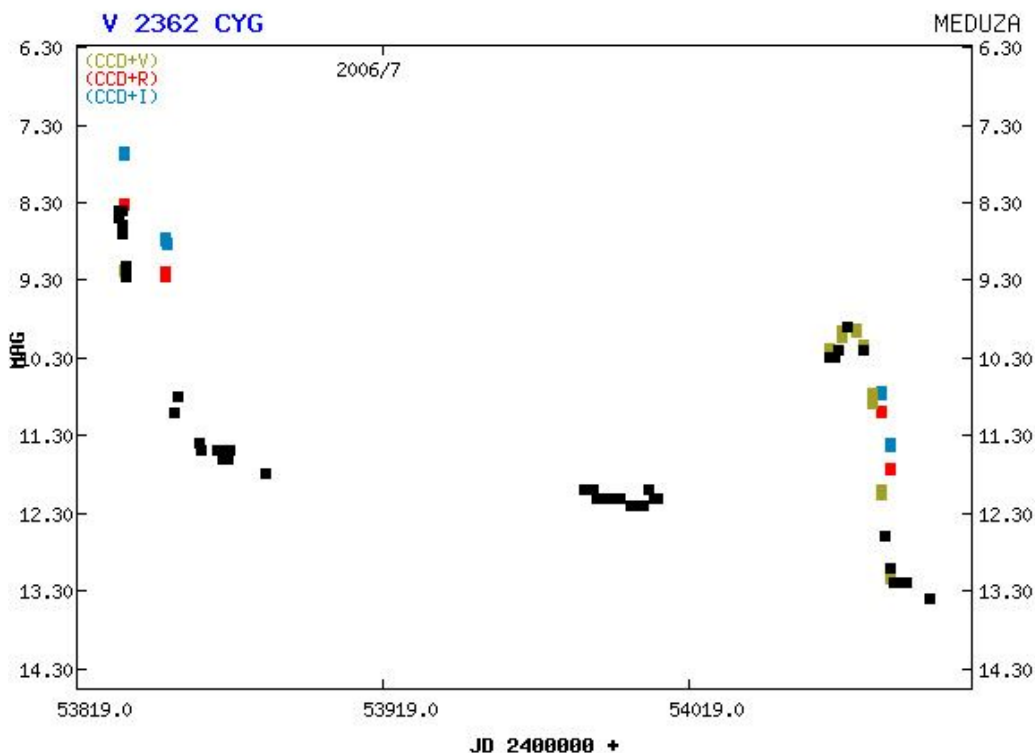


Figure 1. Overall light curve composed of visual data of MEDUZA observers and comparison to CCD data (black point visual data, green point CCD filter V, red point CCD filter R, blue point CCD filter I). All CCD data of the nova obtained at Valasske Mezirici observatory.

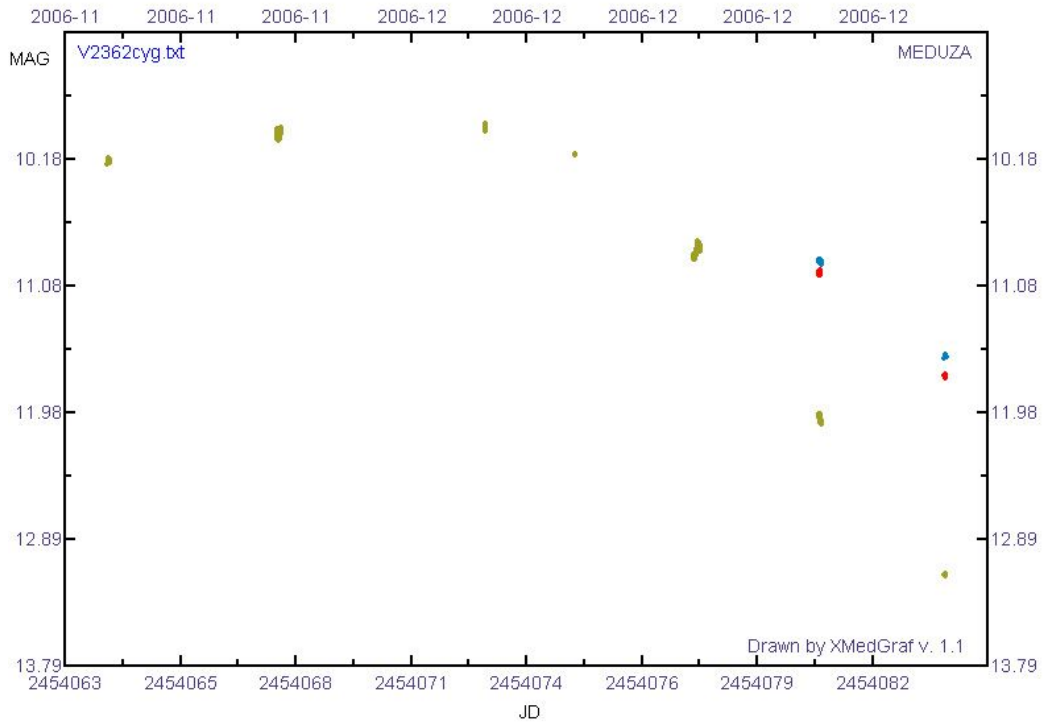


Figure 2. Detail CCD light curve V 2362 Cyg from 24th November – 14th December 2006 (green point filter V, red point filter R, blue point filter I).

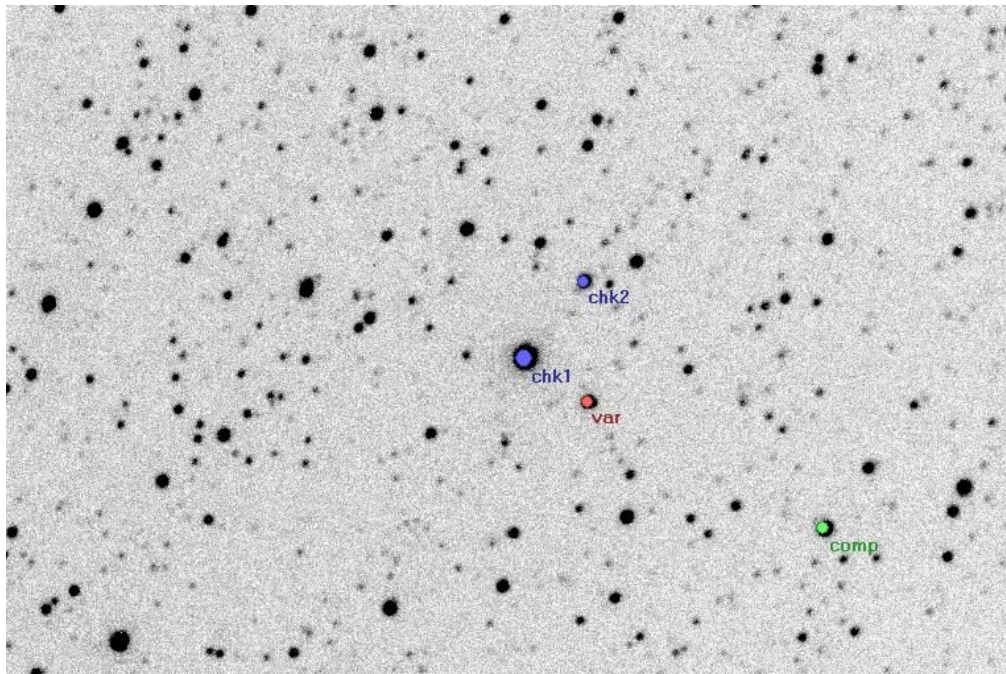


Figure 3. Close vicinity of V 2362 Cyg (field of view is 13' x 8', north is to the top, east to the left).

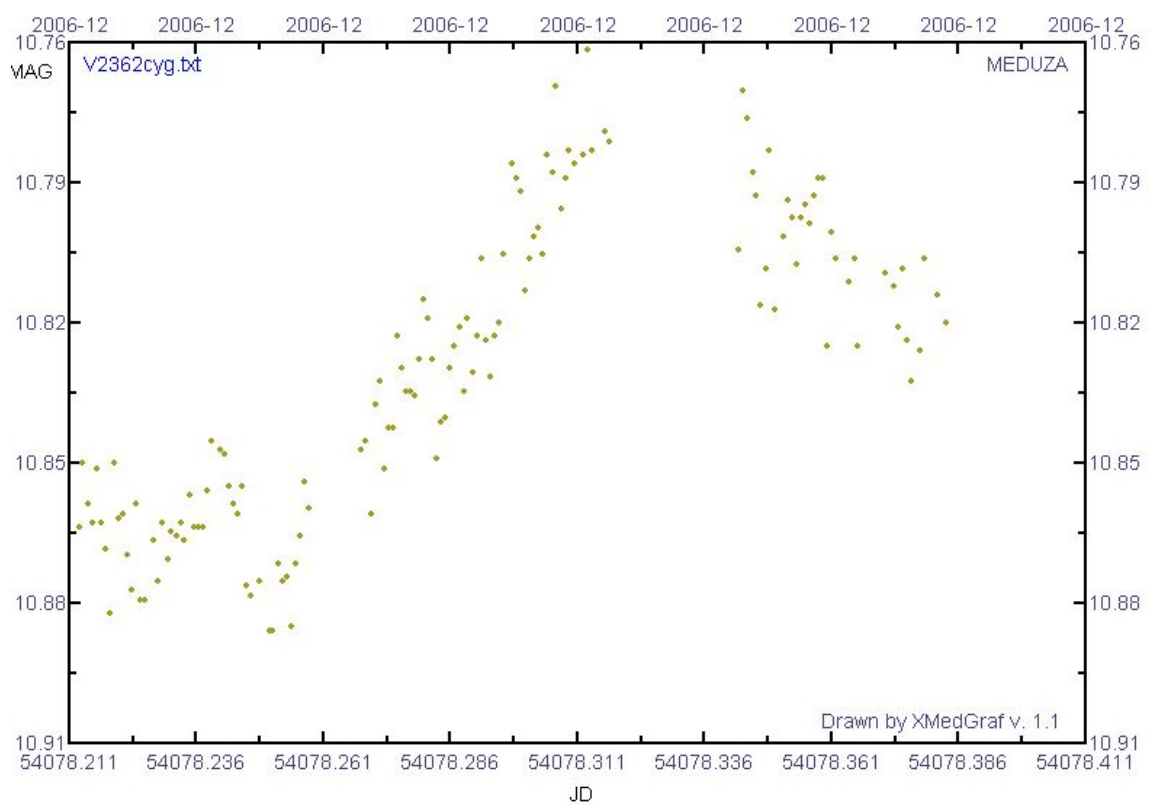


Figure 4. CCD V band light curve V 2362 Cyg from 8th December 2006.

During 4 hours lasting photometry on 8th December 2006 nova brighten about 0.1 mag for a short time. According to L. Hric (2008) it could be a flickering activity. Theoretical model correspond with turbulent streams of mass in accretion disk around compact element. Similar phenomenon could be seen at recurrent novae (RS Oph) (L. Hric, 2008, Munari et al. 2008, A&A, 492, 145).

CONCLUSION:

The aim of this paper is to document the second maximum of nova V 2362 Cyg. Seven night-long observations were made from 24th November – 14th December 2006. Data acquired describes the second maximum. Assumption of dropping brightness after second maximum was confirmed. The same drop have been seen at nova V1493 Aql (Nova Aql 1999a). During 4 hours lasting photometry on 8.12.2006 nova brighten about 0.1 mag for a short time. According to L. Hric (2008) it could be a flickering activity. Theoretical model correspond with turbulent streams of mass in accretion disk around compact element. Similar phenomenon could be seen at recurrent novae (RS Oph) (L. Hric, 2008, Munari et al. 2008, A&A, 492, 145). Long-term photometry of this phenomenon was not possible due to the cloudy weather.

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