CCD photometry of the cataclysmic variable star V425 Cas in 2006-2007

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Abstract. We studied the photometric behavior of the cataclysmic variable V425 Cas using CCD observations with the telescopes at Rozhen NAO and Belogradchik AO. The changes of the star magnitude were determined during the period of observations from June 2006 to September 2007 in the bands B and V. Two respective light curves are presented. There were two nights with simultaneous observations in the bands B and I and the corresponding light curves are plotted too. We found correlation between the colours (B-I) and B and the corresponding fluxes.
Key words: stars: cataclysmic: close

CCD-фотометрия на катаклизмичната променлива звезда V425 Cas през 2006-2007 г

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Изследвано е фотометричното поведение на катаклизмичната променлива V425 Cas чрез CCD наблюдения с телескопите в НАО - Рожен и АО - Белоградчик. Определено е изменението на звездната величина за периода на наблюдения от юни 2006 г до септември 2007 г в системите B и V. Представени са съответните криви на блясъка. Направени са синхронни наблюдения в две нощи в системите B и I. Съответните синхронните криви на блясъка са също представени. Намерена е корелация между цвета (B-I) и звездната величина B. Определени са съответните светлинни потоци.

1 Introduction

V425 Cassiopeia is a cataclysmic system which is classified as Nova-like variable. This star belongs to the subclass VY Scl-type stars. Its variability was detected by Hoffmeister (1967). The system's magnitude lies within the interval 14.5^m - 18^m at V. It is a close binary system with orbital period of 0.14964 days (Shafter, 1982), consisting of a white dwarf and a red dwarf secondary. The red star fills its Roche lobe and transfers matter to the primary white dwarf through the inner Lagrange point forming an accretion disc. The more massive component has a mass $M_1 = 0.86 \pm 0.32$ $M_\odot$and the mass of the secondary is $M_2 = 0.31 \pm 0.02$ $M_\odot$(Shafter & Ulrich, 1982). The distance to the system is estimated to be about 700 pc (Ak et al, 2007). Most of the time the system spends with hot disc and high mass-transfer from the secondary. Rarely the mass-transfer drops away or completely stops and then the system's luminosity decreases considerably.

2 Observations

The observational data was received with the telescopes at Rozhen NAO and Belogradchik AO, using the following equipment:

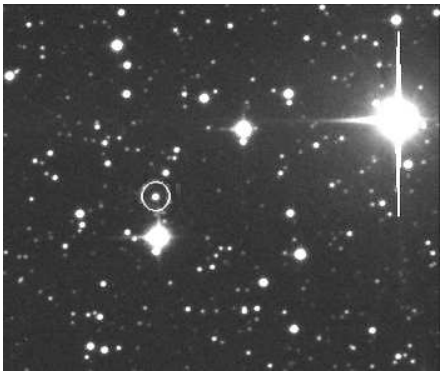

Fig. 1. A CCD image of V425 Cas obtained from 2m RCC telescope at Rozhen NAO, 25.08.2006.

A. 2m reflector with optical system Ritchey-Chretien-Coude at Rozhen NAO. The telescope equipment includes:
- A dual channel focal reducer FoReRo2 with a CCD camera Photometrics 1024x1024 for the blue channel and a camera VersArray 512x512 for the red channel.
- A CCD camera VersArray 1300B - 1340x1300, px = 20 microm at the direct telescope's focus.
B. 50/70 Schmidt telescope at Rozhen NAO with a CCD camera SBIG ST8.
C. 60 cm telescope Cassegrain at Belogradchik AO with an similary CCD camera SBIG ST8.
We studied the photometric behaviour of V425 Cas in B, V, and I bands.

Table 1. The magnitudes of the standards according to Henden & Honeycutt, 1995 and Zombeck, 1990.

	V	**B**	**I**
10	14.807	15.227	
8	14.019	14.678	13.129
7	14.391	15.206	13.331
TYC	11.07	11.24	
6	13.937	15.113	

Frames were obtained with exposure times from 10s to 300s. The standards' magnitudes for B and V bands, which we used to estimate the variable's light of V425 Cas, were taken from the catalogue of Henden & Honeycutt, 1995. For estimating the stars' light for I band we used the normal colours for MS stars from Zombeck (1990). In Table 1 we show all magnitudes of

used standards. A CCD image of the region of V425 Cas is shown in Fig.3.2.

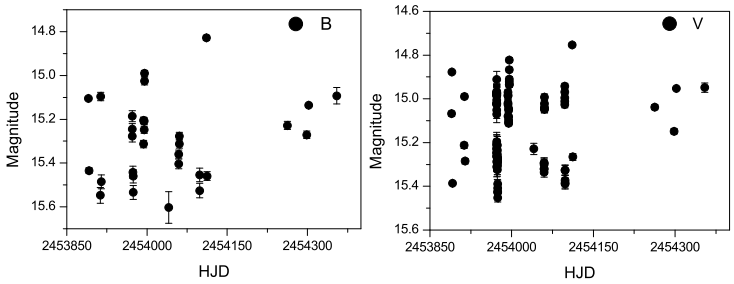

Fig. 2. Light curves for B and V band

3 Results

The results from the aperture photometry of V425 Cas in B and V bands for the period from June 2006 to September 2007 are shown in Fig.**??** During totally 23 observation nights we obtained 31 images for B band and 103 images for V band. The average accuracy for every measurement is several hundreds of the magnitude. We concluded that during this period the variable was at high state, reaching sometimes the maximum of the system magnitude, about 14.5^m. Also, for this period the magnitude of V425 Cas changes in the interval 14.83^m - 15.60^m in B band and 14.75^m - 15.45^m in V band. The variable reached maximum magnitude of 14.75^m on January 10th, 2007, which magnitude was only 0.25^m less from the ever observed maximum of 14.5^m.

3.1 Simultaneous observations in B and I bands

Using the focal reducer FoReRo2 at 2m RCC telescope we obtained simultaneous observations in B and I bands. Exposure times for the blue channel were 60s or 90s and for the red channel were 10s or 40s. At Fig.3 are shown the simultaneous light curves from the observations on 25.08.2006 and 16.09.2006. The exposure times for the two bands differ, so we averaged the magnitude for some frames at I filter obtained at the same interval equal to exposure time at B. In this way we obtained the exact relation between the color (B-I) and the system light in B band (See Fig.4, left panel). We concluded that there is reddening while the B flux of the star decreases.

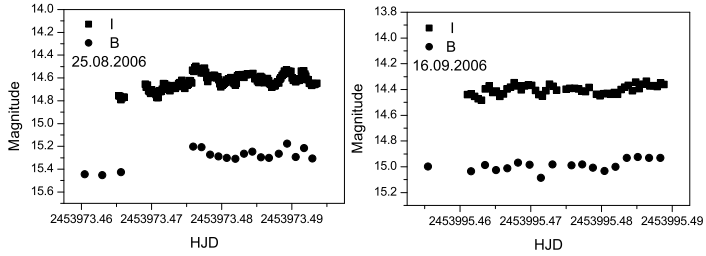

Fig. 3. Simultaneous observations for V425 Cas from 25.08.2006 and from 16.09.2006.

3.2 A correlation between the logarithm of a system fluxes in B and I bands

Figure 4(left panel) shows the tendency for reddening when magnitudes getting fainter, but there is a good linear correlation between the logarithm of the B and I fluxes for V425 Cas.

$$logF_I = -5.96 + 0.74\ logF_B, \tag{1}$$

This correlation is shown on Fig.4(right panel). For calculating fluxes we used transformation coefficients for magnitudes published by Bessell (1979). The correlation shows that the changing of the fluxes and the colors of the

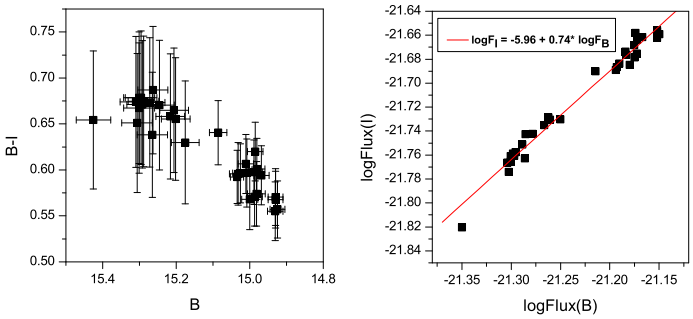

Fig. 4. The correlation between the color (B-I) and the system light at B (left panel) and between the logarithm of a system fluxes at B and I bands using simultaneous observations (right panel)

system are not casual and they are strictly connected to the energy state of the system. The two values during the two observational nights in V band differed with about 0.30^m and the average values in B and I bands were 15.29^m and 14.99^m respectively. In spite of the difference of about 0.3^m, there is a general correlation between the data of the two night observations.

Future simultaneous observations in more bands would show us whether this correlation is a constant in time and whether the inclination of fluxes curve will keep its value.

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