CCD photometry of V425 Cas in 2006 - 2007

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Abstract. We studied the photometric behavior of the cataclysmic variable V425 Cas using CCD observations received with the telescopes at NAO-Rozhen and AO-Belogradchik. 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 and as a result the two light curves are presented. There were two nights with simultaneous observations for the bands B and I and the corresponding light curves are plotted here. We received the correlation between the colours (B-I) and B and the corresponding fluxes at the two colors.

Key words: stars: cataclysmic: close

1 Introduction

V425 Cassiopeia is a cataclysmic variable which is classified as Novalike variable. The star belongs to the subclass VY Scl-type stars. Its variability was detected by Hoffmeister (1967). The system’s magnitude is within the interval 14.5$^m$ - 15$^m$ 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 rates coming 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 is received with the telescopes at NAO-Rozhen and AO-Belogradchik using the following equipment:
A. 2m reflector with optical system Ritchey-Chretien-Coude at NAO-Rozhen. 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 NAO-Rozhen with a CCD camera SBIG ST8.
C. 60 cm telescope Cassegrain at AO-Belogradchik with an analogous CCD camera SBIG ST8.

For estimating the light we used BVI bands. Frames were made with time exposures from 10s to 300s. The standards’ magnitudes for B and V bands, which we used to estimate the variable’s light were taken from the catalogue of Henden & Honeycutt, 1995. For estimating the stars’ light for I band we used

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the normal colours for stars from MS according to Zombeck, 1990. At table 1 are shown all magnitudes of used standards. At Fig.1 is shown a CCD image of V425 Cas.

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

<table>
<thead>
<tr>
<th>V</th>
<th>B</th>
<th>I</th>
</tr>
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<tbody>
<tr>
<td>10</td>
<td>14.807</td>
<td>15.227</td>
</tr>
<tr>
<td>8</td>
<td>14.019</td>
<td>14.678</td>
</tr>
<tr>
<td>7</td>
<td>14.391</td>
<td>15.206</td>
</tr>
<tr>
<td>TYC</td>
<td>11.07</td>
<td>11.24</td>
</tr>
<tr>
<td>6</td>
<td>13.937</td>
<td>15.113</td>
</tr>
</tbody>
</table>

3 Results

At Fig.2 are shown results from the aperture photometry of V425 Cas for the period from June 2006 to September 2007. 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 about several hundreds of the magnitude. We concluded that during this period the variable was at high state, almost reaching sometimes the system maximum of the magnitude of 14.5. Also for this period the magnitude of V425 Cas changes in the interval 14.83 - 15.60 for color B and 14.75 - 15.45 for color V. The variable reached a maximum magnitude of 14.75 on January 10th, 2007, which magnitude was only 0.25 less from the ever observed maximum of 14.5.
3.1 Simultaneous observations in B and I

Using the focal reducer FoReRo2 at 2m RCC telescope we obtained simultaneous observations in 2 filters - B and I. 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 25.08.2006 and 16.09.2006 observations. The exposure times for the two colors 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 (See Fig. 4 left panel). We concluded that there is reddening while the B flux of the star decreases.
3.2 A correlation between the logarithm of a system fluxes at B and I filters

There is a tendency for reddening with magnitudes and the color (B-I) getting fainter but there is a good linear correlation between the logarithm of the fluxes for V425 Cas

\[ \log F_I = -5.96 + 0.74 \log F_B, \]  

This correlation is shown at 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 system are not casual and they are strictly connected to the energy state of the system. The two values during the two observational nights for the light in V band differed with about 0.40\( m \) and the average values of the light in B band were 15.29\( m \) and 14.99\( m \) respectively. In spite of the difference of about 0.3\( m \), there is a general correlation for 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.

References

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