

JHKs Photometry of V523 Cassiopeiae

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Abstract

The first light curves in the J, H, Ks bands of W UMa system V523 Cas are presented. The preliminary result of light curve analysis is also extended.

Key words: JHKs photometry – Eclipsing Binary – Close Binary – Contact Binary – W UMa type – : Individual(V523 Cas)

V523 Cas is one of the shortest period W UMa type eclipsing binary systems ($P=0.2337$ day, K_2-K_3 V, $J=9.3$, $H=8.6$, $K=8.5$). Many optical observations and light curve analysis have been carried out (e.g. Lister et al. 2000, Samec et al. 2004, Zboril & Djurašević 2006, Latković et al. 2009). They revealed that this binary is in a W-type overcontact configuration. This system is also known for its light curve variability and hence existence of starspots is indicated. However there has been no infrared photometry of V523 Cas to our knowledge, then we report *JHKs* photometric study in this paper.

On eight nights in January and February 2012, *JHKs* photometric observations were carried out using the NIC (Nishi-harima Infrared Camera) attached to the Cassegrain focus of the 2 m NAYUTA telescope at Nishi-Harima Astronomical Observatory, University of Hyogo. NIC employs three HAWAII (1024×1024 pixel, HgCdTe) arrays. The pixel scale is 0.16 arc-seconds and FOV is 2.7×2.7 arc-minutes. We can obtain three band images simultaneously with NIC. Other details of NIC are described in Ishiguro et al. (2011). 2MASS J00400429+5014320 and 2MASS J00400727+5015178 were selected as a comparison and a check star respectively.

We conducted dithering observations. A set of dithering observation provides 10 images taken on a circular dither pattern of 10 arcseconds radius. Total 62 sets were obtained for aperture photometry using the IRAF software package. Photometric errors are 0.019 mag., 0.006 mag., and 0.014 mag. for *J*, *H*, and *Ks* filters respectively. The observed light curves are shown in Fig. 1. Each light curve presents an asymmetry with Max I brighter than Max II (0.02 - 0.03 mag.). It may be due to the so-called O’Connell effect.

We observed a primary and a secondary minimum for one time each. Table 1 contains the heliocentric times of minima. The O-C values were derived from the ephemeris given in Kreiner (2004).

Since the photometric error of *H*-band was the smallest, the light curve analysis was performed for this band with the Binary Maker 3. We adopted the values of the mass ratio, effective temperature of cooler

Table 1. Minima times of V523 Cas.

Min (Hel.JD)	Error	Type	O-C (days)
2455944.0775	0.0005	I	0.0002
2455953.07503	0.00008	II	0.00013

Table 2. Synthetic Curve Parameters for V523 Cas.

Parameter	Simultaneous Solution
q	0.52
T_c (K)	4762
T_h (K)	4930 ± 20
i (deg.)	84.8 ± 0.4
f	0.20 ± 0.05
g	0.08
A	0.5
u	0.5

(primary) component, gravity exponent, albedo and limb-darkening coefficients from Latković et al. (2009). The obtained parameter values and the spot parameters are given in Table 2 and Table 3 respectively. The observed and the synthetic light curves of H -band are shown in Fig. 2. Fig. 3 shows the derived configurations of V523 Cas.

Starspot information derived from various studies is summarized in Table 4. This suggests a magnetic activity of both components.

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Table 3. Starspot Parameters of V523 Cas.

Component	Co-Latitude	Longitude	Spot Radius	Temp. Factor
Cooler (primary)	90	30	30	0.98
Hotter (secondary)	90	30	30	1.05

Table 4. Starspot information derived from various studies.

Observational period	Component	Spot type	Reference
Sep. 1998	hotter (secondary)	hot spot	Samec et al. (2004)
2005/2006	hotter (secondary)	hot spot	Zboril & Djurašević (2006)
Sep. 2006	cooler (primary)	hot spot	Latković et al. (2009)
Jan. - Feb. 2012	hotter (secondary)	hot spot	this study
Jan. - Feb. 2012	cooler (primary)	cool spot	this study

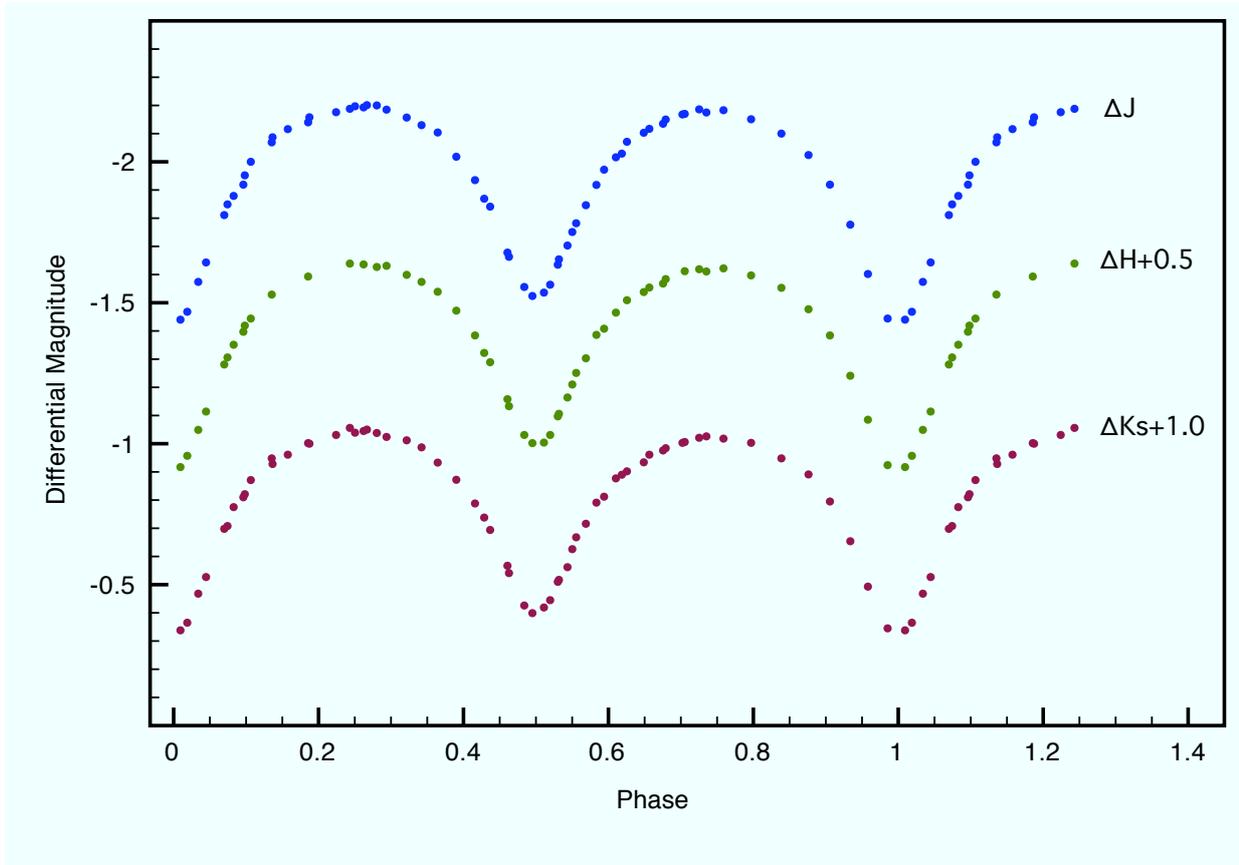


Fig. 1. Light curves of V523 Cas

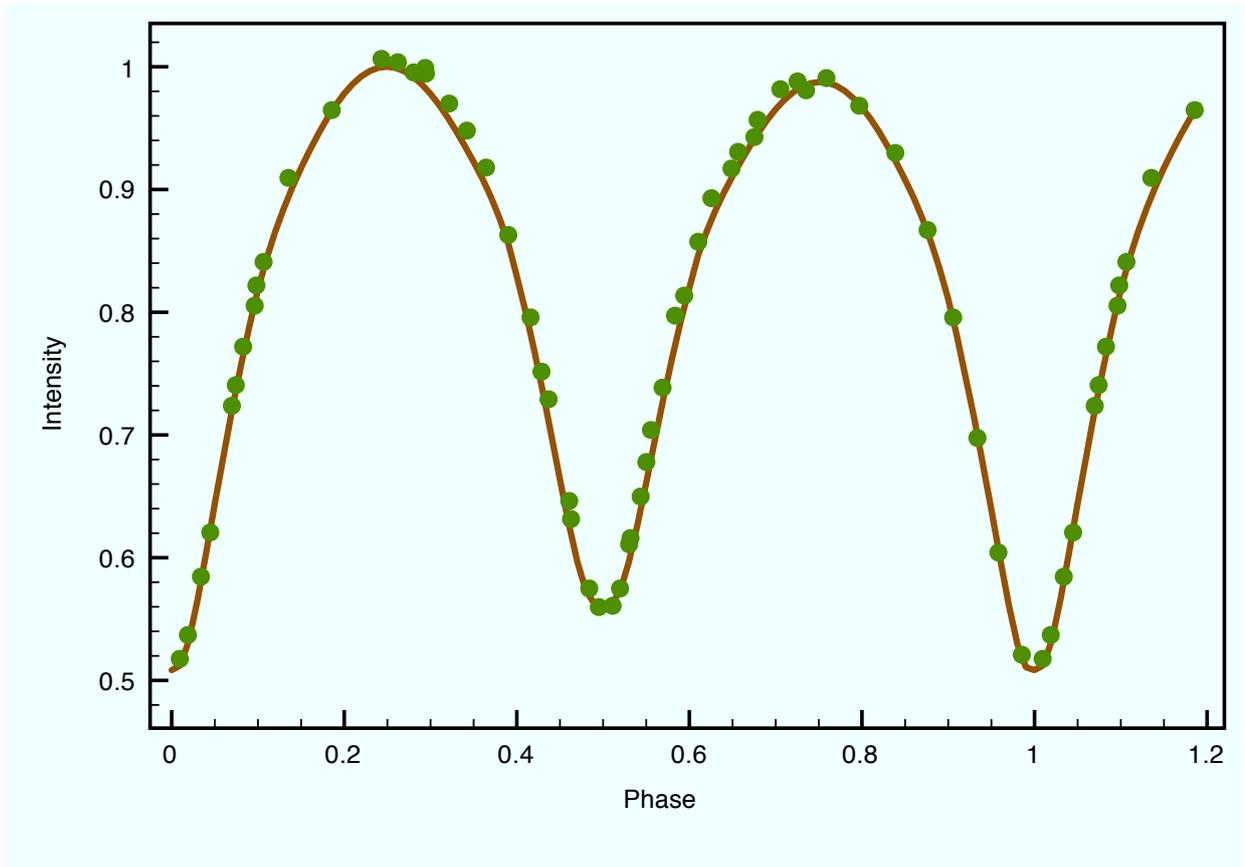


Fig. 2. *H*-light curve of V523 Cas. Dots are observed data.

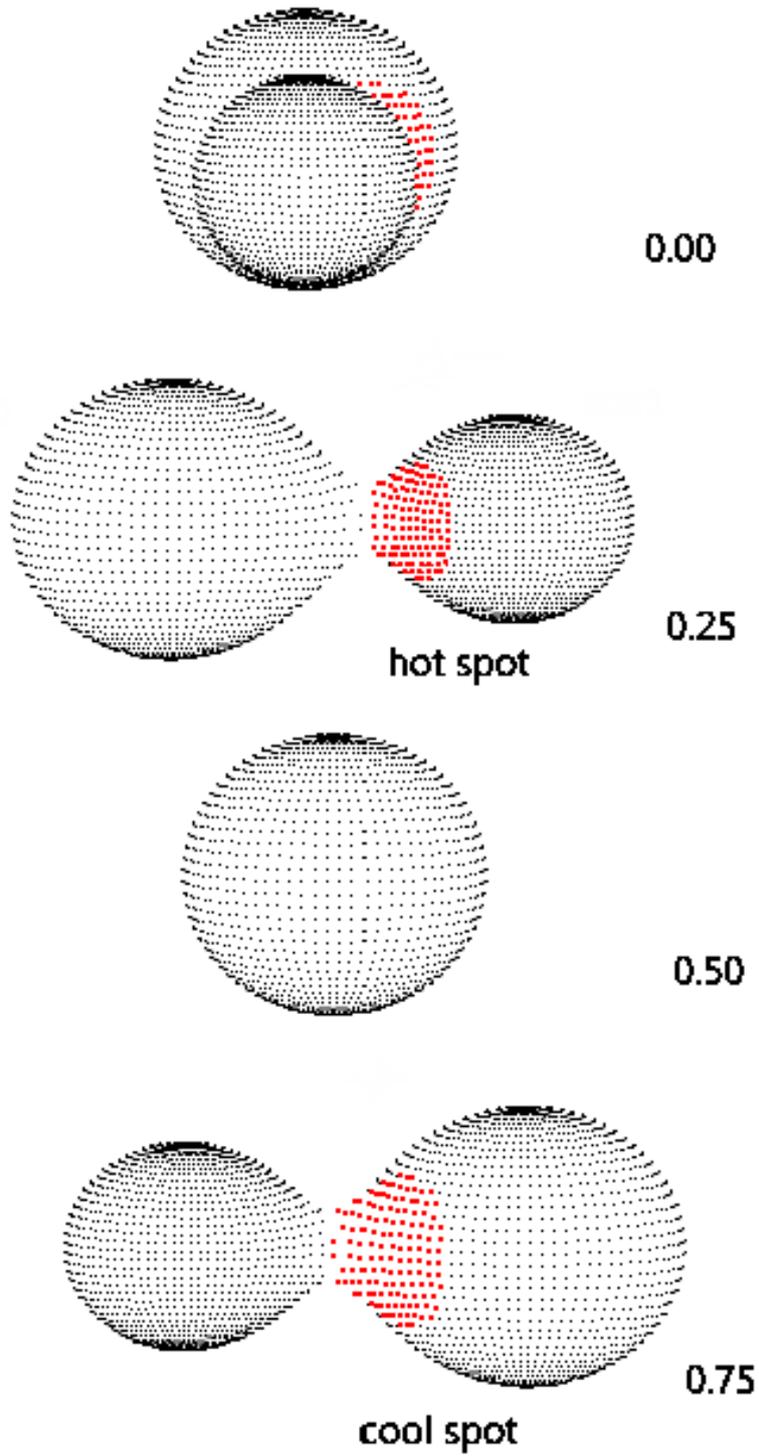


Fig. 3. The model with the obtained parameters at orbital phase 0.00, 0.25, 0.50, and 0.75.