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DISCOVERY OF A SHORT-PERIODIC PULSATING COMPONENT IN THE ALGOL-TYPE ECLIPSING BINARY SYSTEM IV Cas

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Name of the object:
IV Cas

Observatory and telescope:
Mt. Lemmon Optical Astronomy Observatory in USA, 1.0m telescope[1]

Detector:	2K CCD camera (Field of view is 22.2×22.2 arcmin^2)

Filter(s):	Johnson B

Date(s) of the observation(s):
November 27, 29, 30 and December 15, 2004

Comparison star(s):	GSC 04001-00080 ($B = 10\overset{\mathrm{m}}{.}987$, $V = 10\overset{\mathrm{m}}{.}881$; Kharchenko 2001)

Check star(s):	GSC 04001-01028 ($B = 12\overset{\mathrm{m}}{.}787$, $V = 11\overset{\mathrm{m}}{.}723$; Kharchenko 2001)

Transformed to a standard system:	No

Availability of the data:
Upon request

Method of data reduction:
Standard CCD-frame reduction using the IRAF/DAOPHOT[2] package

[1]Korea Astronomy & Space science Institute (*KASI*) had installed the telescope and has been operating it by remote control from Korea via a network connection.

[2]IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

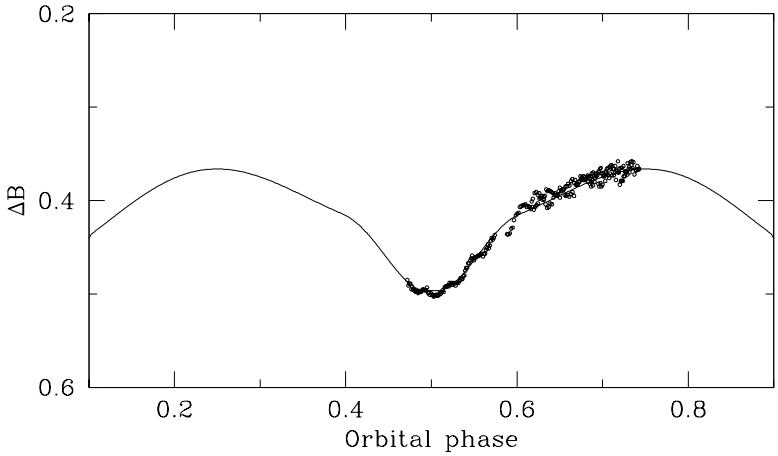

Figure 1. Phase diagram of IV Cas in B-passband. The line is a synthetic eclipsing light curve which is roughly derived from the 1998-version of Wilson & Devinney (1971) code, taking into consideration of observing parameters by Kreiner et al. (2001) and orbital ephemeris by Kreiner (2004).

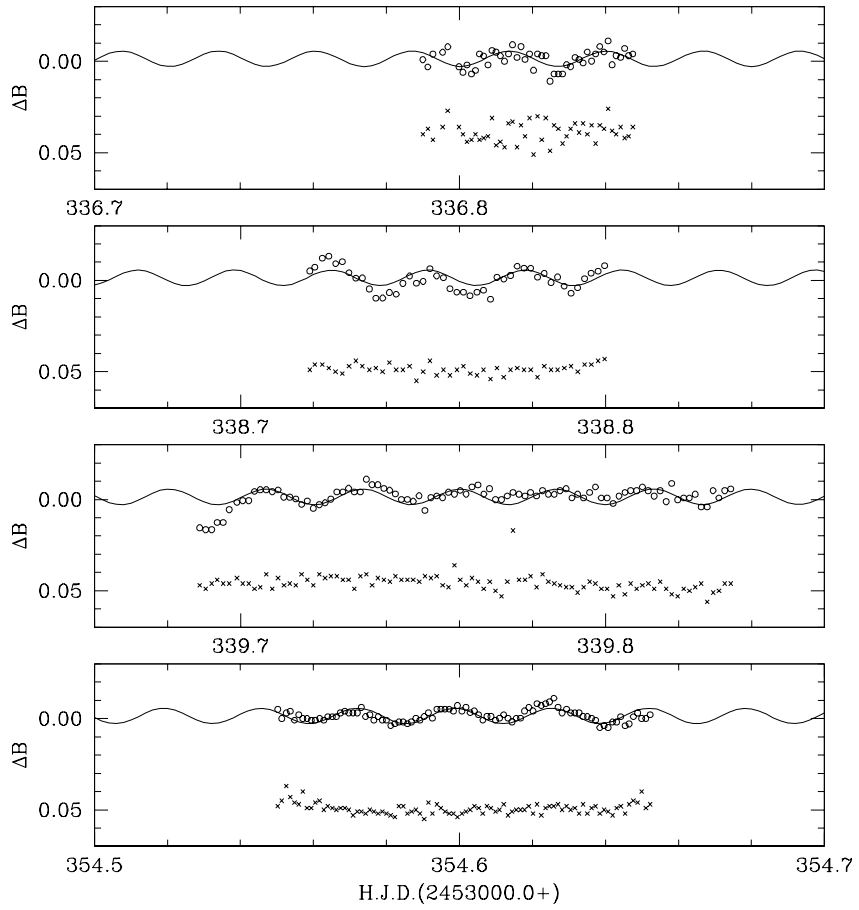

Figure 2. Light variations of the residuals after subtracting the synthetic curve from the data (open circles). The lines are sinusoidal fits with $f_1 = 37.672$ c/d obtained from the multiple frequency analysis. The residuals and the sinusoidal curves were corrected for the low frequency term (see Figure 3). Differential magnitudes of a check star, ΔB(Check−Comparison), are also displayed in arbitrary scale for comparison (crosses).

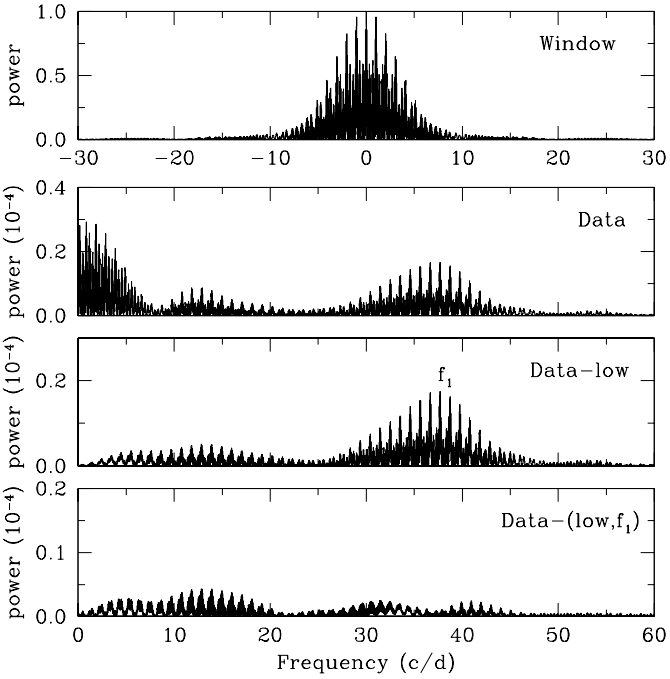

Figure 3. Power spectra of the residuals. The window spectrum is displayed in the top panel. Low frequency peaks in the second panel may be originated from nightly variations of the data and/or the incomplete fit of the synthetic curve. After prewhitening the low frequency, we can detect $f_1 = 37.672$ c/d in the third panel.

Remarks:

As a part of our photometric survey project to search for A-type pulsating components in eclipsing binary systems (Kim et al. 2003), we monitored the Algol-type semi-detached eclipsing binary IV Cas. The observations were performed for four nights between November and December 2004. Simple aperture photometry was applied to get instrumental magnitudes with an aperture radius of 10 pixels (=6.″4); seeing size was about 3.″0 during the observing runs. We examined differential magnitudes of tens of stars in the observing field to check their variations. Phase diagram of IV Cas is shown in Figure 1, where orbital phases were calculated with the orbital period of 0.9985132 day and the primary minimum epoch of *H.J.D.* 2452500.3502 (Kreiner 2004). We obtained residuals after subtracting a synthetic eclipsing light curve from the data (Figure 2). The multiple frequency analysis (Kim & Lee 1996) was applied to examine periodicity of the residuals, displayed in Figure 3. We detected a frequency of $f_1 = 37.672$ c/d (cycles per day). The signal to noise (S/N) ratio of its amplitude is larger than 4.0 which is proposed as a criterion of a real frequency by Breger et al. (1993).

Our observations show that the primary component of IV Cas has δ Scuti-type pulsational characteristics such as the short period of about 38 minutes, peak-to-peak amplitudes of about $0.^{\mathrm{m}}01$ in B-passband, and spectral type of A4 (Kreiner et al. 2001). Considering these pulsational characteristics and the semi-detached binary configuration (Kreiner et al. 2001), we suggest that IV Cas is a new member of the oscillating EA (oEA) stars, a group of mass-accreting pulsating components in Algol-type semi-detached eclipsing binary systems (Mkrtichian et al. 2004, 2005; Kim et al. 2005).

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