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ON A SHORT-PERIODIC PULSATING COMPONENT IN THE ALGOL-TYPE ECLIPSING BINARY SYSTEM VV UMa

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Name of the object:
VV UMa

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

Detector:	a) 1K CCD camera and b) 2K CCD camera

Filter(s):	Johnson B, exp. time $\sim$ 30 sec

Date(s) of the observation(s):
a) March 24, 2003; b) November 27, 2004; November 29, 2004; December 26, 2004

Comparison star(s):	GSC 03810-01503

Check star(s):	GSC 03810-00988

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. Aperture photometry was applied to get instrumental magnitudes with an aperture radius of 10 pixels (=6.″4); seeing size was about 2.″9 during the observing runs.

[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.

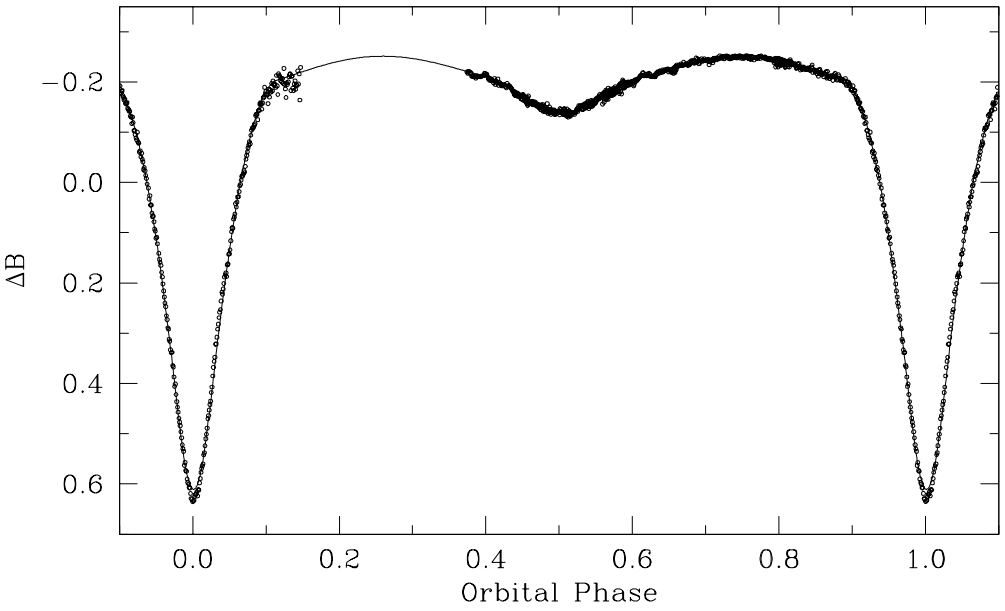

Figure 1. Phase diagram of VV UMa in B-passband. Open circles are the data obtained in the 2003-2004 observing runs. The line is a synthetic eclipsing light curve which was derived from the 1998-version of Wilson & Devinney (1971) code, taking into consideration the light curve solution by Lázaro et al. (2002).

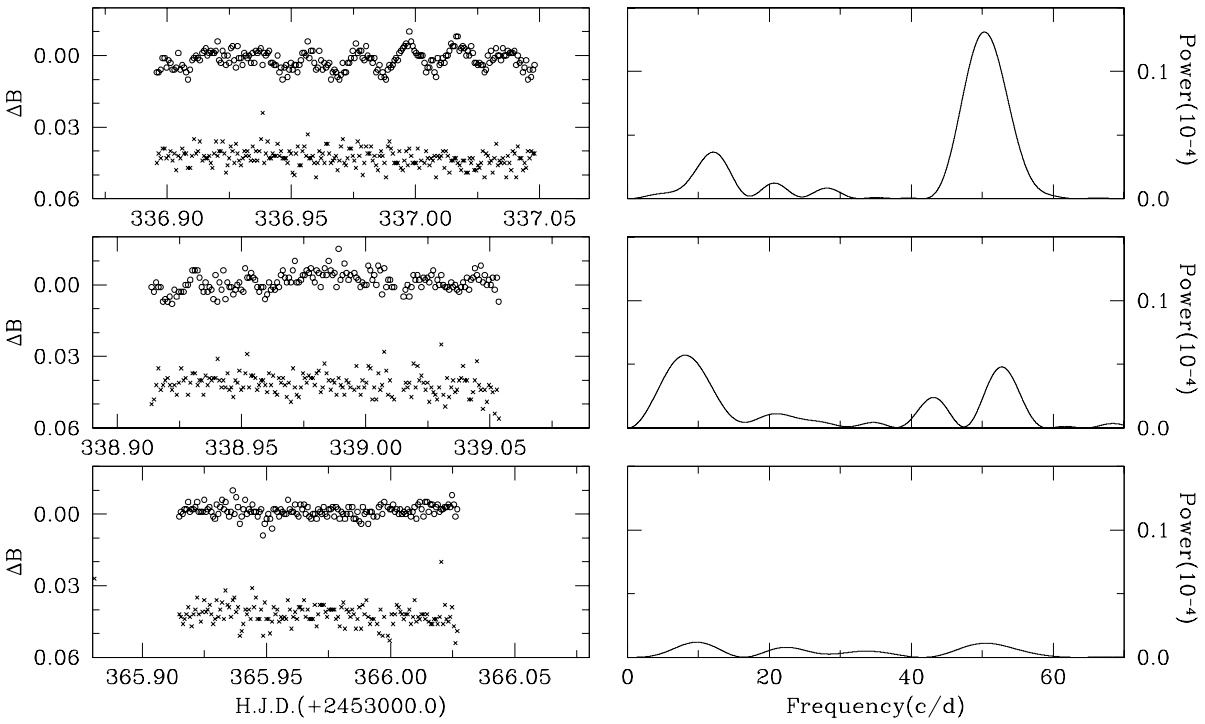

Figure 2. Light variations of the residuals after subtracting the synthetic curve from the data (left) and their power spectra (right) for each night, except for the data around the primary eclipsing phase. The residuals are represented by open circles. Note that the power at a high frequency around 50 cycles per day (c/d) varies greatly from night to night. Differential magnitudes of a check star are also displayed in arbitrary scale for comparison (crosses in left panels).

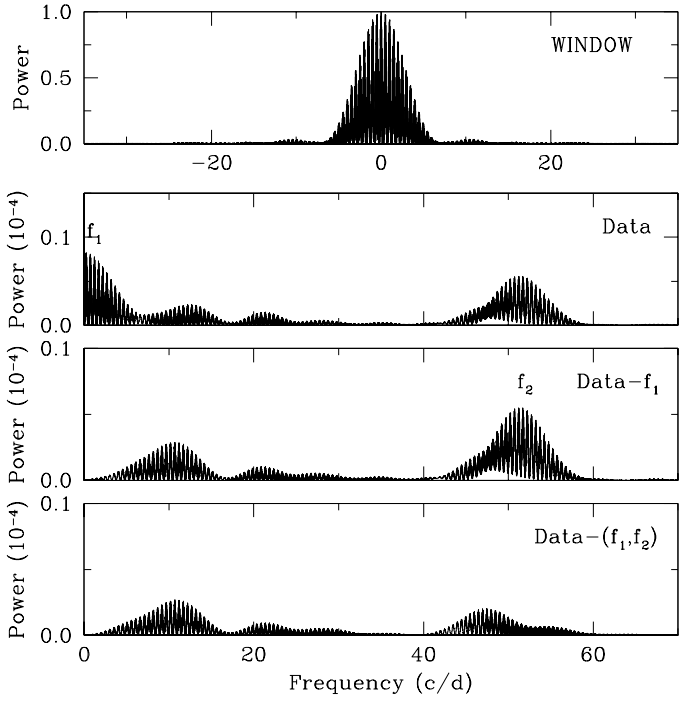

Figure 3. Power spectra of the residuals (combined), except for the data around the primary eclipsing phase. The window spectrum is displayed in the top panel. We can detect a peak of $f_2 = 51.239$ c/d in the third panel. f_1 and peaks at frequencies less than 15.0 c/d may be originated from the incomplete fit of the synthetic curve.

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 semi-detached Algol-type eclipsing binary VV UMa. Our observations showed undoubtedly a short-period small-amplitude pulsation of VV UMa, which had been reported firstly by Lázaro et al. (2001, 2002).

Phase diagram of VV UMa is shown in Figure 1, where orbital phases were calculated with the orbital period of 0.6873801 day and the primary minimum epoch of *H.J.D.*2452500.0528 (Kreiner 2004). We obtained residuals after subtracting a synthetic eclipsing light curve from the data. Figure 2 displays the residuals and their power spectra for each night. We can detect sinusoidal light variations with a short period of about 0.02 day and maximum amplitude of about $0\overset{m}{.}015$, see the top left panel, where the power spectrum shows a definite peak at 50.3 cycles per day (c/d). Amplitudes of the variations vary from cycle to cycle, consequently the power at the frequency around 50 c/d changes greatly from night to night, implying that the variable star may have multiple periods.

Power spectra of the combined residuals show a peak at high-frequency of $f_2 = 51.239$ c/d (=0.0195 day), see Figure 3. If we accept that the variable star has multiple periods, another peak at high-frequency of 47.460 c/d (=0.0211 day) at the bottom panel in Figure 3 is reliable; this is the same as the dominant period detected by Lázaro et al. (2001, 2002).

Remarks:

Considering the δ Scuti-type pulsation characteristics (multiple periods and small-amplitude), spectral type of A1.5-2V (Lázaro et al. 2002) for the primary component, and the semi-detached binary configuration, we suggest that VV UMa is also the 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). Then the number of the oEA stars has increased to sixteen (see Table 1 in Mkrtichian et al. 2005).

Acknowledgements:

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