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DISCOVERY OF A SHORT-PERIODIC PULSATING COMPONENT IN THE ALGOL-TYPE ECLIPSING BINARY SYSTEM AO Ser

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

Detector:	2K CCD camera

Filter(s):	Johnson B

Transformed to a standard system:	No

Availability of the data:
Upon request

Method of data reduction:
Standard CCD-frame reduction using the IRAF/DAOPHOT[1] package.

Table 1. Photometric parameters of observing stars from the Tycho-2 catalogue

ID	Name	RA (J2000)	DEC (J2000)	V_T	$(B_T - V_T)$
VAR	AO Ser	$15^h58^m18^s.41$	$+17°16'10''.0$	$11^m.064$	$0^m.242$
C1	GSC 01496-01071	$15^h58^m19^s.91$	$+17°19'45''.4$	$11^m.682$	$0^m.836$
C2	GSC 01496-00063	$15^h58^m13^s.00$	$+17°16'42''.5$	$11^m.864$	$0^m.516$

[1]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.

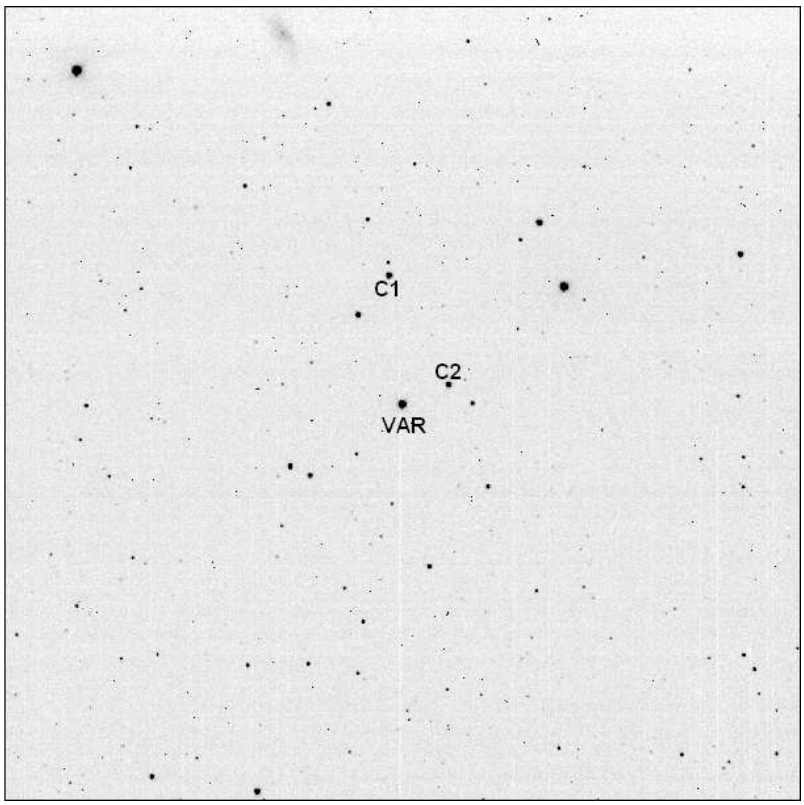

Figure 1. A B-band CCD image (22.′2×22.′2) near the eclipsing binary AO Ser (VAR) obtained with the LOAO 1.0m telescope and 2K CCD camera. The comparison (C1) and check stars (C2) are marked. North is up and east is to the left

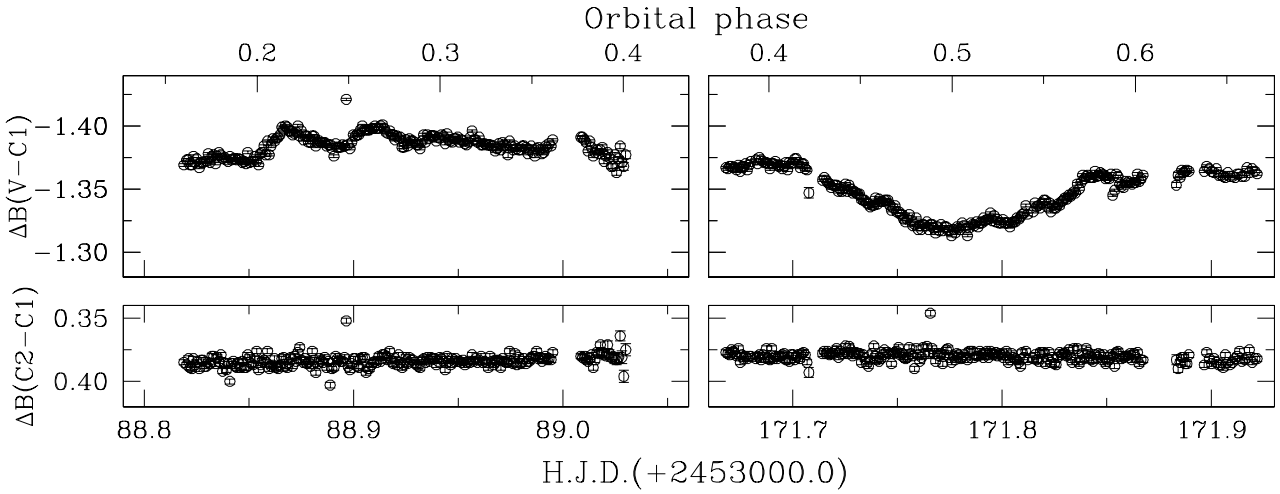

Figure 2. Differential magnitudes between the variable star AO Ser and the comparison star, ΔB(V−C1). Observation data of the check star, ΔB(C2−C1), are also displayed at lower panel for comparison.

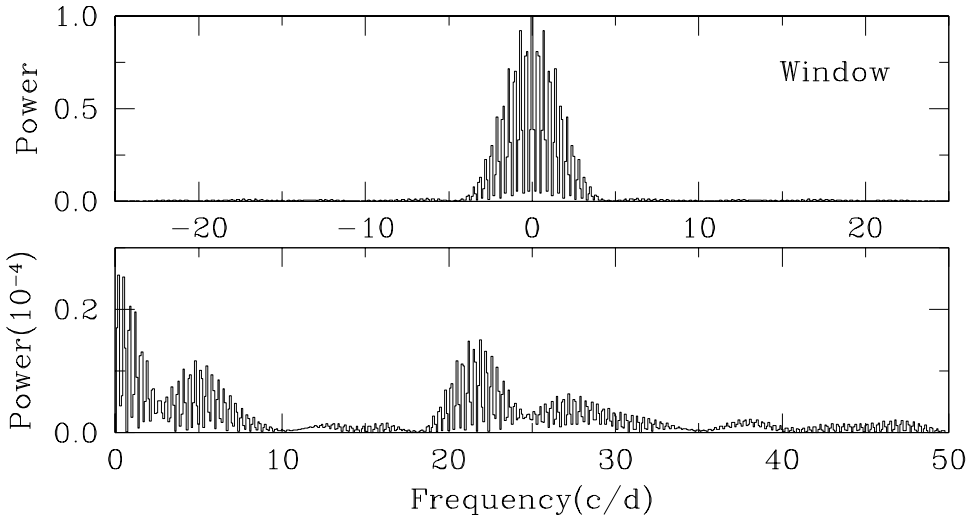

Figure 3. Power spectra of the residuals after subtracting a synthetic eclipsing light curve from the data. The window spectrum is displayed in the top panel. We could detect a peak near 21.5 cycles per day (c/d) in the lower panel. Low-frequency peaks less than 6.0 c/d might be originated from the incomplete 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 several observing targets in March 2004 using a 1.0m telescope at Mt. Lemmon Optical Astronomy Observatory (LOAO), Arizona, USA (Korea Astronomy Observatory has installed the telescope in September 2003). From these observations, we found small-amplitude short-periodic oscillations of AO Ser and then performed follow-up observations to confirm the variations in June 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. Figure 1 displays a sample CCD image of AO Ser. A comparison star, GSC 01496-01071, did not show any peculiar light variation during the runs, examining with several check stars in a CCD image. Differential magnitudes of AO Ser are shown in Figure 2. Orbital phases were calculated from the orbital period and epoch from the GCVS catalogue (Kholopov et al. 1988).

In addition to slow light variations caused by the eclipsing phenomenon, the data show oscillations with short-period less than 0.05 days and small-amplitude of maximum ΔB $\sim 0^{\rm m}.02$. The oscillations show amplitude modulation, implying to have multiple periods. We calculated residuals subtracting a synthetic eclipsing light curve from the data; the synthetic curve was derived from the 1998-version of Wilson & Devinney (1971) code. Power spectra of the residuals show clearly a peak near 21.5 cycles per day (=$1^{\rm h}.116$, Figure 3). Considering the δ Scuti-type pulsation characteristics (period, amplitude and spectral type of A2) and semi-detached configuration, we suggest that AO Ser is a new member of a recently formed group of mass-accreting pulsating components in Algol-type semi-detached eclipsing binary systems (oEA stars; Mkrtichian et al. 2004). Then the number of oEA stars has increased eleven, including our recent discovery of two oEA stars EF Her and CT Her (Kim et al. 2004).

Acknowledgements:
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Reference:

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