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SHORT PERIOD VARIABILITY OF THE ALGOL SYSTEM AI Dra

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We performed photometric observations of AI Dra on two nights and detected short period variability. AI Dra (A0V+F9; Brancewicz and Dworak 1980) is one of the well-known Algol-type eclipsing binary systems. As this system is bright ($m_v = 7.05 - 8.09$) and of short orbital period (P=1.988day), many reports of photometric observations have been presented.

Recently, photoelectric photometry covering the whole phase of AI Dra was carried out by Değirmenci et al. (2000) at B and V bands. They found "collapses" at both shoulders of the primary minima in both colors and they pointed out that these anomalies would be due to the gas stream flowing from the secondary to the primary component. The Wilson-Devinney analysis of the light curves yielded a semi-detached configuration.

We performed photoelectric observations of AI Dra with the 60cm reflector of Nishi-Harima Astronomical Observatory in the B and V band-passes similar to the standard Johnson system. The telescope is equipped with the photon-counting photometer (AES PCPA2) at its Cassegrain focus. The photomultiplier tube R647p of HAMAMATSU Photonics was used. The star HD 154199 was chosen as the comparison. This star was also used by Değirmenci et al. (2000).

We have detected periodic oscillations with an amplitude of about $0.03 - 0.05$ mag outside eclipses. The light curves obtained on 5 Aug. 2000 in the B- and V-bands are shown in Fig. 1. The heliocentric phase calculated according the ephemeris by Değirmenci et al. (2000) were from 0.688 to 0.782. On 7 Sep. 2000 (heliocentric phase $0.152 - 0.186$), we have also detected the light variations which covered less than one period (Fig. 2). We adapted the PDM analysis (Widjaya, 1996) to these data, and a periodicity of $0\overset{\mathrm{d}}{.}034$ was found in both passbands.

To study the correlation between brightness and color, we use the difference from the mean B magnitude of each night, ΔB, and the difference from the mean color, $\Delta(B-V)$. We plot $\Delta(B-V)$ versus ΔB in Fig. 3. The data fit to the relation $\Delta(B-V) = 0\overset{\mathrm{m}}{.}384\ \Delta B$, with a correlation coefficient of 0.784. The star is bluer in its brighter phase. This corresponds to the property of stellar pulsation.

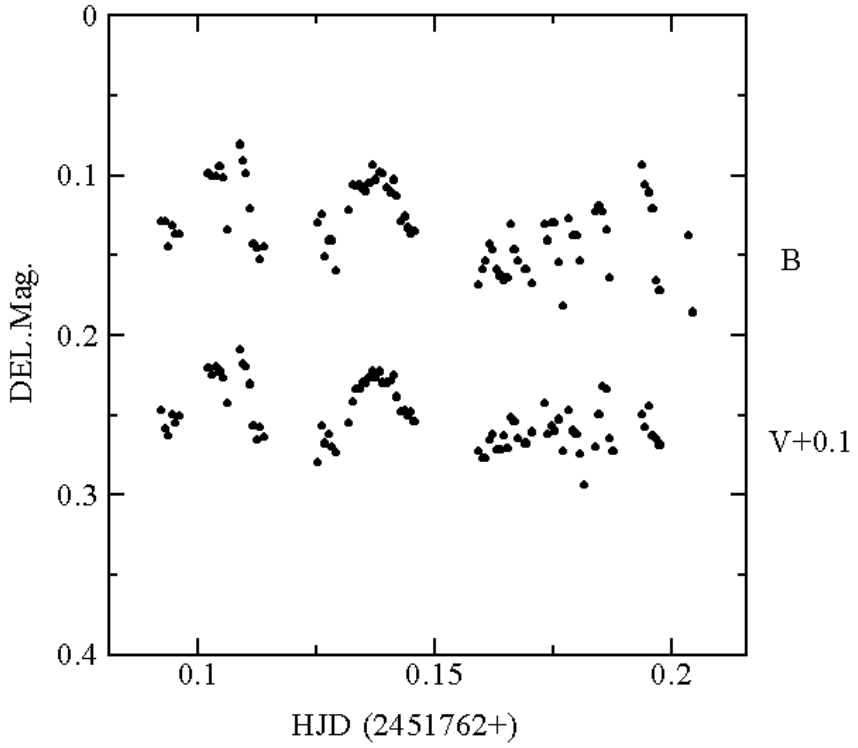

Figure 1. Observed oscillations on 5 Aug. 2000.

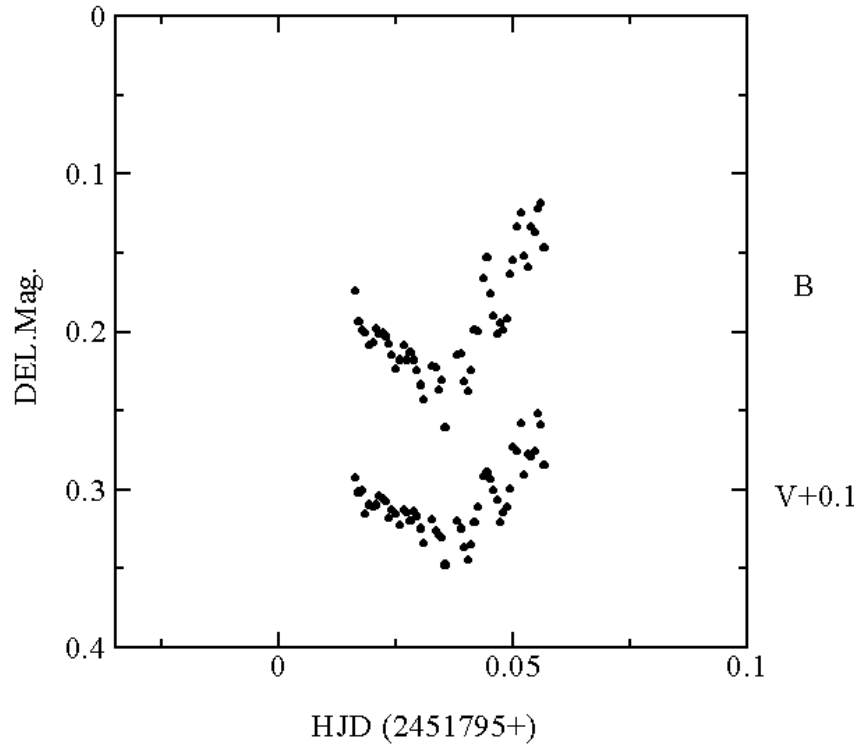

Figure 2. Observed oscillations on 7 Sep. 2000.

Adapting the M = 3.40 $M_\odot$ and R = 2.39 $R_\odot$ (Değirmenci et al. 2000) we determined the mean density of the primary $\rho = 0.25\ \rho_\odot$. that gives the pulsation constant Q $\simeq$ 0.02. This value and the observed amplitude suggest lower mode of non-radial oscillation.

The spectral type A0 of AI Dra is in the range of the δ Sct type stars listed by Rodriguez (2000). Five A0 stars are found in the list. Bolometric magnitude and bolometric correction of primary component of AI Dra is 0.60 and -0.25, respectively (Değirmenci et al. 2000). That gives Mv = 0.85. This value almost corresponds with the period-luminosity relation of δ Sct stars (Breger 1979). Based on these characteristics, we suggest that AI Dra is a δ Sct star.

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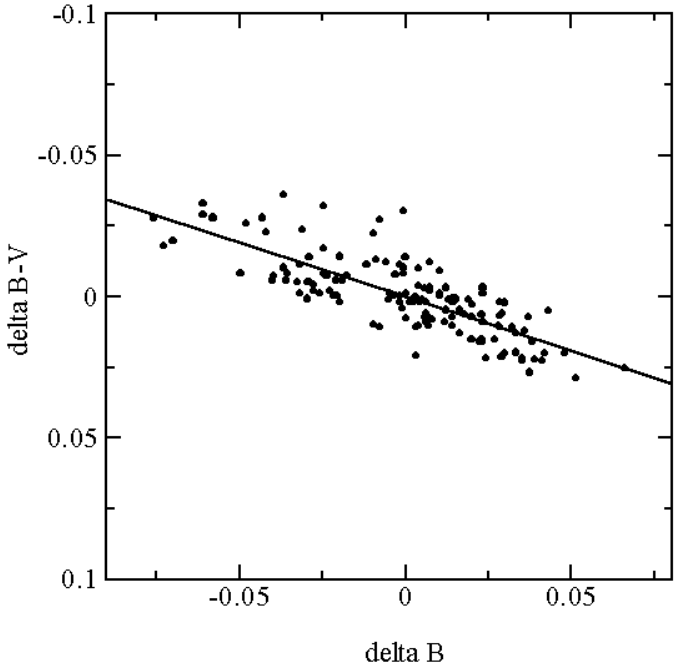

Figure 3. Color-magnitude diagram of the short-period variability on the two nights. The horizontal axis indicates ΔB, and the vertical axis indicates $\Delta(B-V)$.

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