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BV PHOTOMETRY OF THE DELTA SCUTI STAR IOTA BOOTIS

The light variation of Iota Bootis (= 21 Boo = NSV 06610 = HR 5350) was discovered by Albert (1980). Based on his data he concluded that Iota Bootis may be a Delta Scuti-type variable with a very short period (about 40 minutes). Szatmáry (1988) had similar result, which was confirmed by Gál et al. (1994). Unfortunately these measurements had very limited accuracy therefore only the existence of the variation with a period close to 40 min. was demonstrated.

We carried out photoelectric photometry (through B and V filters) on two nights, 24 and 26 May, 1995 with the 40 cm Cassegrain type telescope of Szeged Observatory using an SSP-5A photometer. The comparison star was HR 5360. The main aim of our measurements was to determine the exact period of variation and its amplitude in B and V. On these two nights we collected 155 points in two colors which cover about 10 cycles of the light curve (the individual observations are available through e-mail – see below).

In order to determine the exact period of variation we calculated the Fourier-transform (DFT) of B and V light curves separately and the phase dispersion spectra (PDM) too. The results in the different colors and with different methods are in agreement with each other (the variance is about 0.0002-0.0003 day). The correct value of the period is 0.0276 day (39.7 min) with an estimated error of $\pm$ 0.0003 day (0.4 min).

We plotted the averaged Fourier spectrum of B light curves in Figure 1. The period can be better determined with this averaging because the amplitude of noise decreases relatively to the highest peak (Gál et al., 1994). The phase diagram can be seen in Figure 2.

The Fourier amplitudes of the light variation are 0.007 and 0.005 magnitude in B and V, respectively. We fitted a sine function to the light curves in B (because of their regularity and higher S/N ratio) which are plotted in Figure 3.

The fitted function is

$$\Delta B = -1.291 + 0.007 \sin(2\pi \cdot 36.231884 \cdot T + 2.7),$$

where the frequency is in c/d, the phase is in radian and T means HJD$-$2440000.

We can conclude that the photometric period of Iota Bootis is 0.0276 $\pm$ 0.0003 day (=39.7 $\pm$ 0.4 min) which value confirms the results of previous studies. The full amplitudes are 0.015 and 0.010 magnitude in B and V, respectively, which show that this variation is very close to our limited accuracy. Therefore more accurate (0.001 magn. precision) photoelectric measurements are recommended.

The mode identification is difficult. In the case of double star Tau Cygni (Mkritichian et al., 1995) which has very similar light variation, the density determined from the orbital period gave a possibility to calculate the pulsational constant and comparing with the theory the excited mode could be estimated.

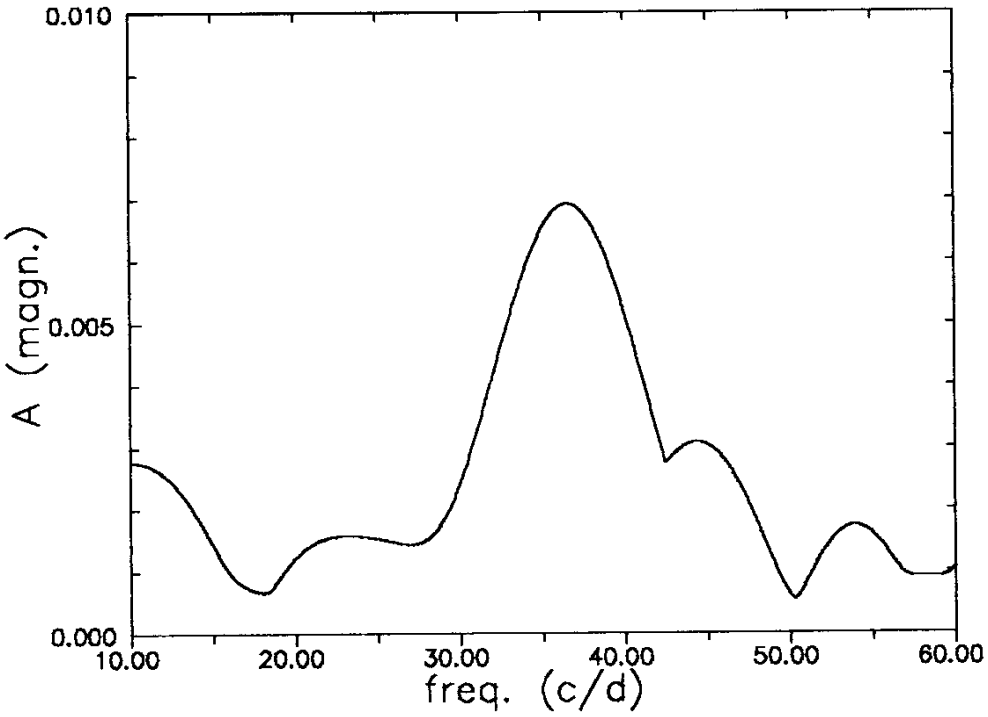

Figure 1. The mean Fourier spectrum of the B light curves

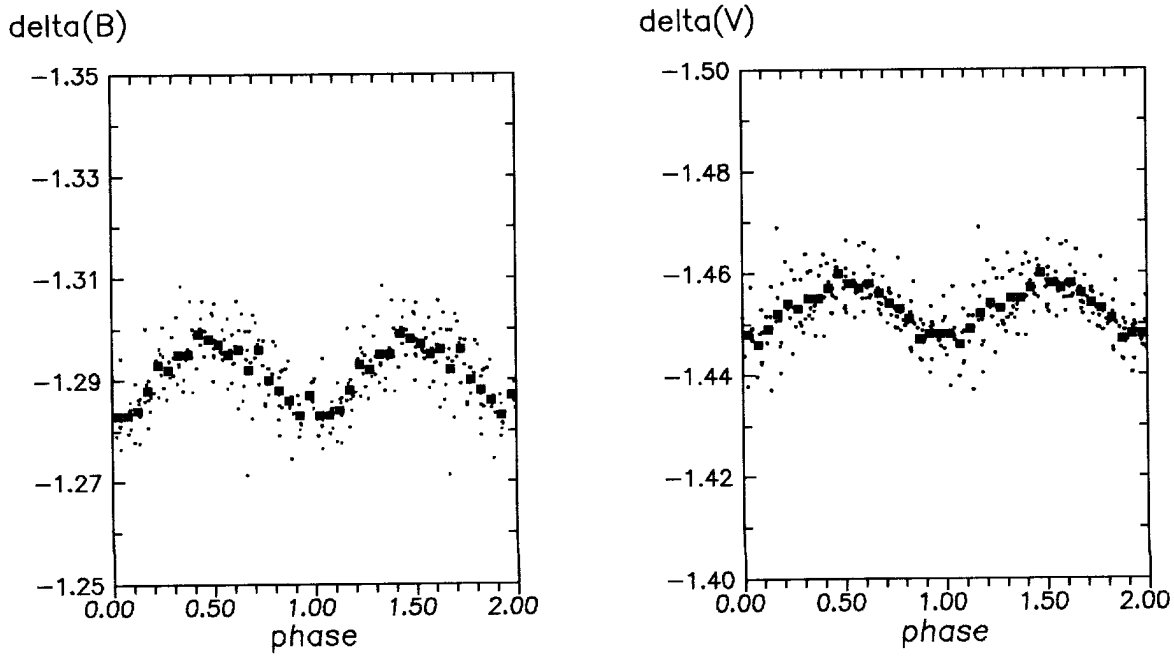

Figure 2. The phase diagram of Iota Bootis (P=0.0276 day, T_0= HJD 2449800.01)

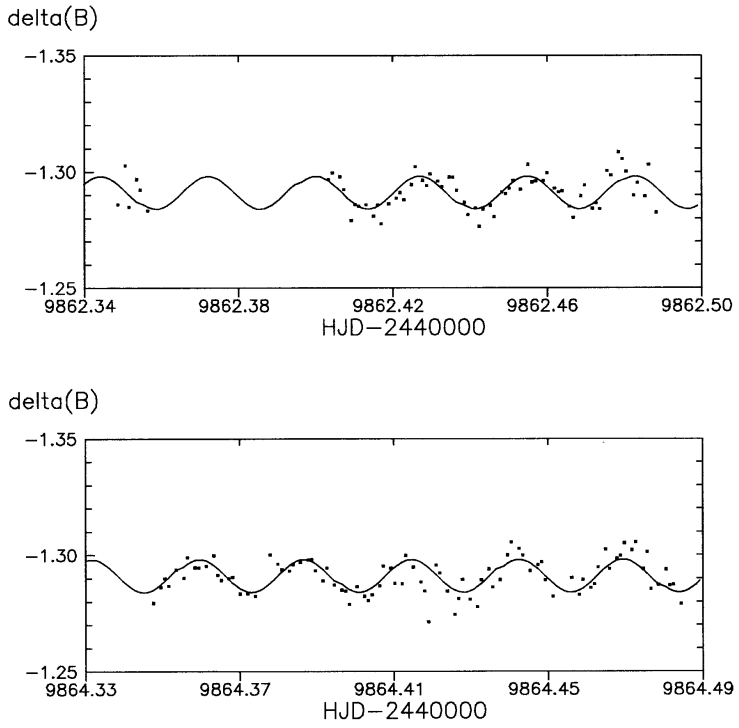

Figure 3. The 24 May (upper panel) and 26 May (lower panel) light curve with the fitted sine curve

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