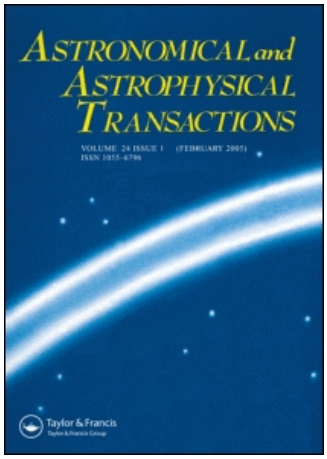

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PHOTOMETRIC EVIDENCES FOR THE BINARY ASTEROIDS 87 SYLVIA AND 423 DIOTIMA

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The frequency analysis of the photometrical observations of the asteroids 87 Sylvia and 423 Diotima shows several different periods for each of them. We suppose that these periods may be the precession, orbital and rotation periods of the components of the binary asteroids.

KEY WORDS Photometry, binary asteroids

INTRODUCTION

The problem of binary asteroids is very important for their evolution and the role of catastrophic collisions (Farinella *et al.*, 1982). Equilibrium models and light curves of binary asteroids were described by Leone *et al.* (1984) and by Cellino *et al.* (1985).

We use frequency analysis of photometric series obtained during short time intervals. It is supposed that a binary asteroid may have several different light variation periods (Binzel, 1985; Prokof'eva, 1993): the precession, orbital and component's rotation ones.

OBSERVATIONS

Photometric observations of two large asteroids 87 Sylvia (6 nights in 1989) and 423 Diotima (7 nights in 1990) were carried out with the digital TV complex of the 0.5-meter telescope at the Crimean Astrophysical Observatory (Abramenko *et al.*, 1988). The duration of the observations was 2–7 h for each night. The exposures were 1–2 min. The accuracy of a single photometric measurement varied

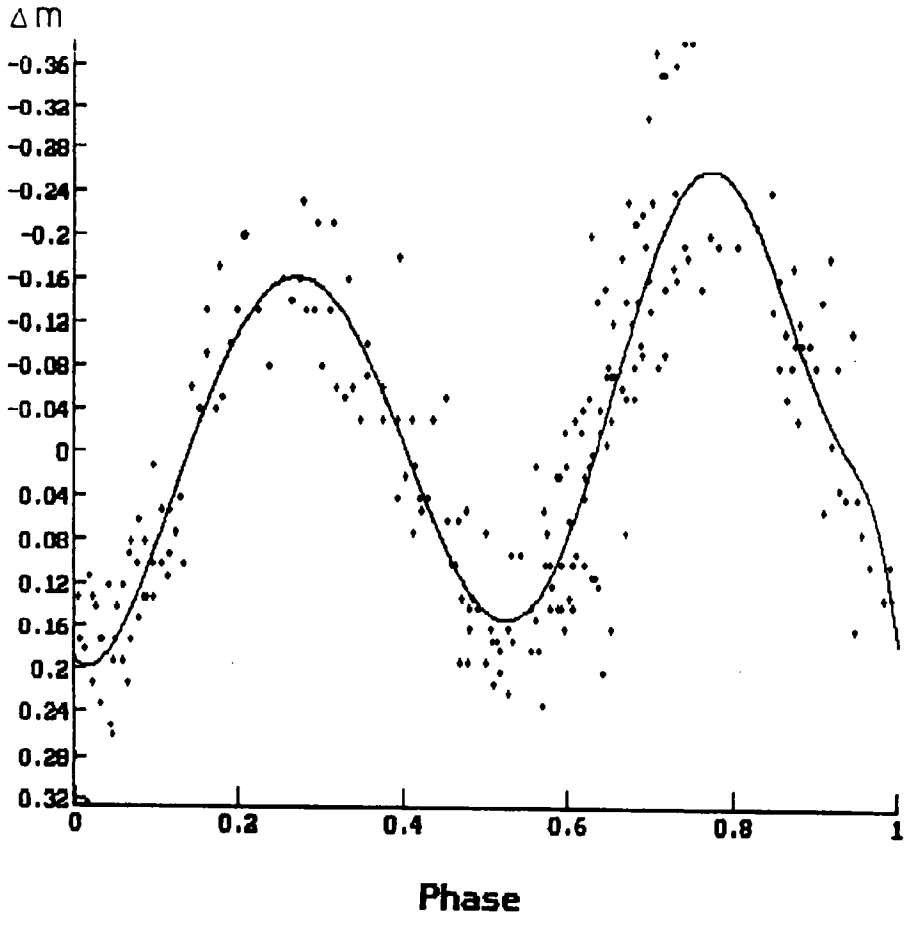

Figure 1 The light curve of Sylvia constructed with the period $5^h.18364$ after whitening the B-data for the precessing period. The curve is a 10-order polynomial. The zero phase is J.D. $2447643^d.324$.

from $0^m.015$ up to $0^m.03$ in accordance with the weather conditions. All observations were calibrated using an artificial standard, reference stars and stellar standards (Prokof'eva *et al.*, 1992). The aspect angles of 87 Sylvia were $\varphi_1 = 85°$ and $\varphi_2 = 99°$. The full duration of the observations was $16^h.8$ for Sylvia and $41^h.6$ for Diotima.

ANALYSIS

We use different methods to search for the periodicity described by Deeming (1975), Lafler and Kinman (1965) and Jurkevich (1971). Frequency analysis of the 239 photometric measurements of 87 Sylvia in the spectral band B and in the integral

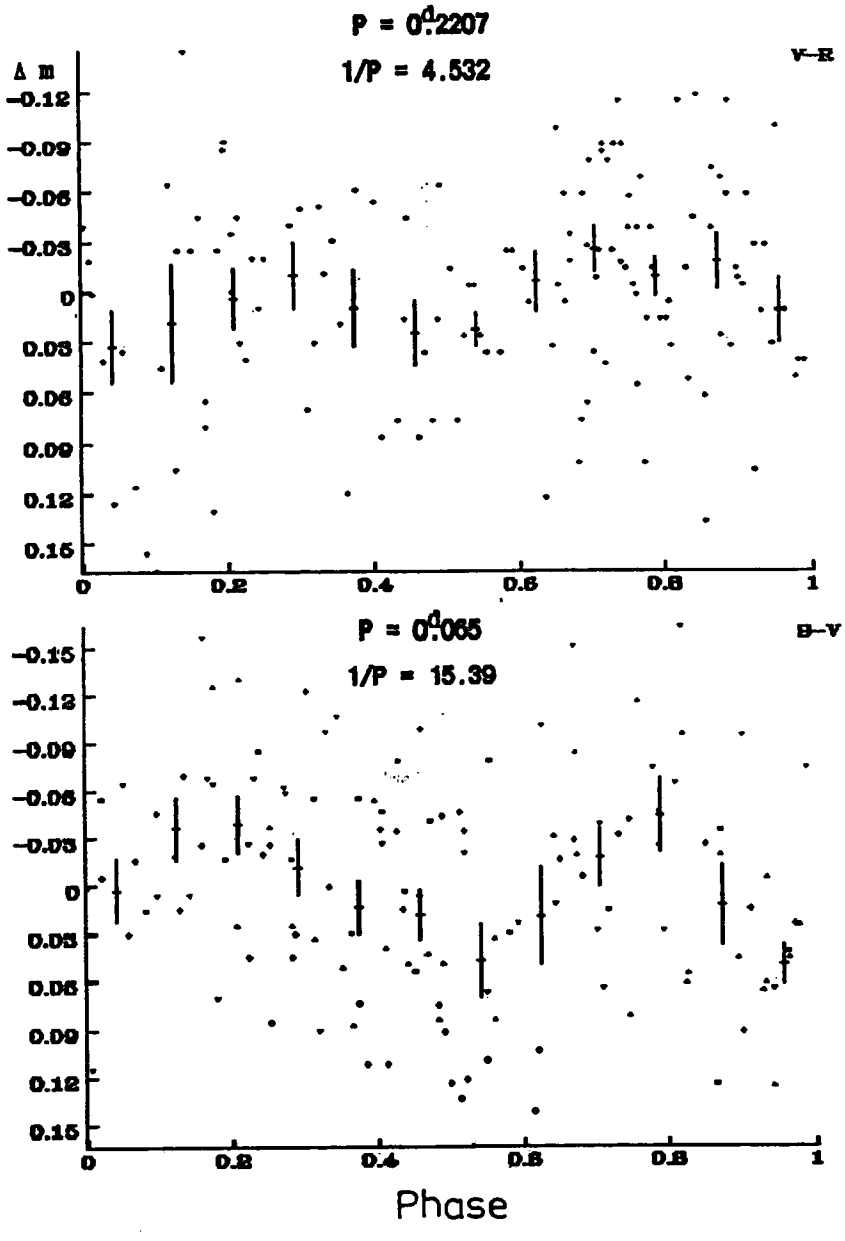

Figure 2 The color-index curves of Sylvia, V–R (top) and B–V (bottom), constructed with the periods $5^h.30$ and $1^h.56$. The zero phase is J.D. $2447643^d.324$.

light shows the periods of about 30^d, $0^d.215985$ ($5^h.18364$) (see Figure 1) and $0^d.2207$ ($5^h.30$). The amplitudes of the light variations were $0^m.4$, $0^m.6$–$0^m.4$ and $0^m.1$, respectively (Prokof'eva and Demchik, 1992). The analysis of 132 B–V and V–R

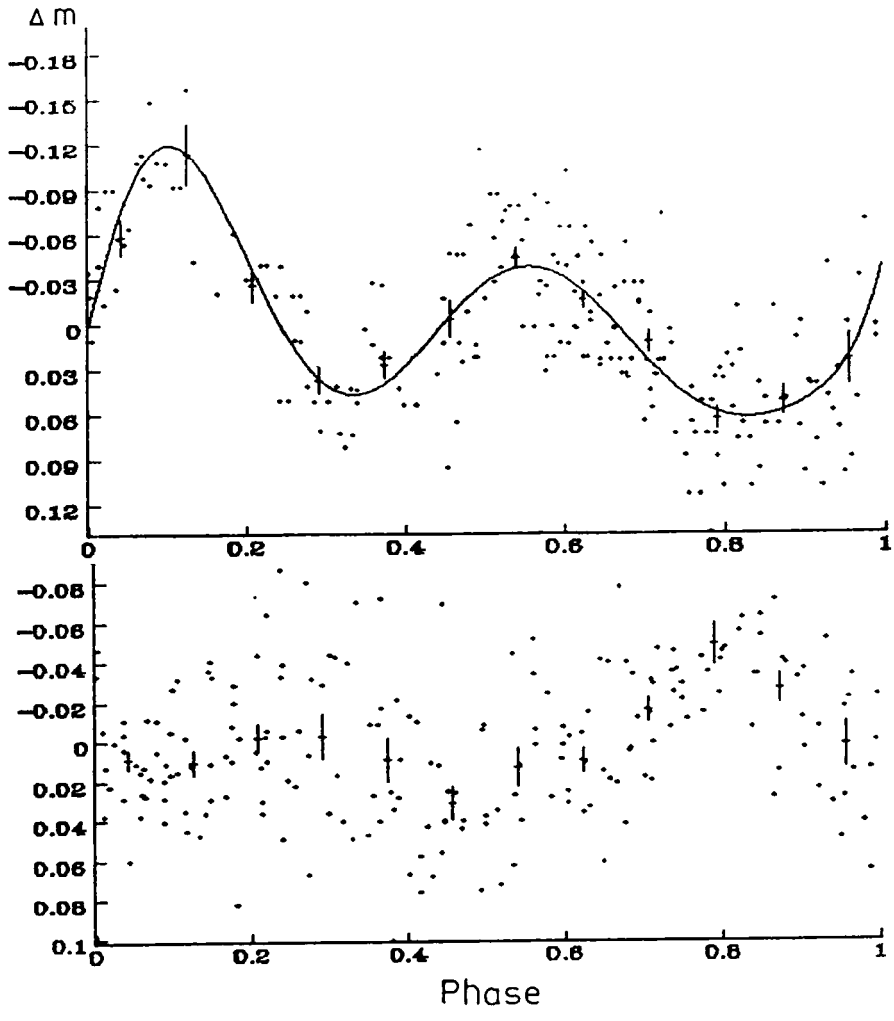

Figure 3 The light curves of Diotima constructed with the period $14^h.88$ after whitening the V-data for the precession period (top) and with the period $4^h.56$ after whitening the V-data for two periods – precession and orbital (bottom). The curve is a 10-order polynomial. The zero phase is J.D. $2447967^d.357$.

measurements shows the absence of the period $0^d.215985$ and the presence of two periods, $0^d.2207$ ($5^h.30$) and $0^d.065$ ($1^h.56$) (see Figure 2).

Frequency analysis of V-data for 423 Diotima was made using 216 average data for neighboring 4 original measurements. Two periods were found: 0.620 ($14^h.88$) and 0.190 ($4^h.56$). The latter is in agreement with the period $4^h.62$ published by Zappalá *et al.* (1985). The light curves are shown in Figure 3. The period of about 200^d is assumed.

DISCUSSION

We suppose that the multiple light variation periodicity is a criterion to assume the binarity of the asteroids. We suggest the following interpretation: the periods 30^d, $5^h.18364$, $5^h.29$ and $1^h.5$ of the asteroid 87 Sylvia are the precession, orbital and component rotation ones. We suppose that the periods $14^h.9$ and $4^h.6$ of the 423 Diotima are the orbital and rotation ones of one of the components. The binarity of Diotima is confirmed by the presence of a 200^d period with the amplitude of about $0^m.8$ to be likely the precession one.

In terms of our hypothesis, we can make some speculations. According to similar arguments, the asteroid 87 Sylvia has M1/M2=3.4, $\rho = 4.5$ g/cm^3 (Leone *et al.*, 1984), D1=228 km, D2=150 km, the distance between surfaces of the components is about 60 km, $M1 = 2 \times 10^{22}$ g and $M2 = 6 \times 10^{21}$ g.

The asteroid 423 Diotima seems to have more separations than Sylvia. The orbital period may be equal to the rotation period of the primary component. The ambiguity of the observed light curves of this asteroid seems to be explained by the motion and rotation of its satellite.

It is noteworthy that the periods mentioned above may be harmonic or multiple of the real periods. Our estimations may be corrected in future when the periods will be obtained more precisely.

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