

Research Note

Rotation periods and light curves of the large asteroids 409 Aspasia and 423 Diotima

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Summary. The asteroids 409 Aspasia and 423 Diotima were observed in the V band in November and December 1982 at the Torino Observatory. For 409 Aspasia a synodic rotational period of $9^h03 \pm 0^h03$ and an amplitude of $0^m10 \pm 0^m01$ were obtained. For 423 Diotima we have obtained a rotational period of $4^h62 \pm 0^h03$ and a maximum amplitude of $0^m18 \pm 0^m01$.

Both objects are in the diameter range 100–300 km, where equilibrium “piles of rubble” could be frequent, and at least for 423 Diotima the rotational properties are consistent with those of asteroids belonging to the LASPA (Large Amplitude Short Period Asteroid) class (Farinella et al., 1981).

Key words: asteroid – photoelectric photometry – light curve – 409 Aspasia – 423 Diotima

Introduction

Part of the Torino photoelectric observation program is devoted to improve the physical and statistical data of intermediate size range asteroids.

The diameter interval 100–300 km is very interesting for studying the physical evolution of the main belt minor planets. In this range they are small enough for undergoing collisional catastrophic disruptions, but, because the large masses involved, their self-gravitation could cause a reconstruction (rubble piles) in some equilibrium form, depending on the angular momentum of the reconstituted object (Farinella et al., 1981).

202 asteroids, listed by Bowell et al. (1979), have been found with diameters in this range. The rotation period of 96 of these asteroids have been measured accurately; for another 40 they are known only approximately.

409 Aspasia and 423 Diotima are two dark C-type objects with diameters, of respectively, 194 and 209 km (Bowell et al., 1979); no information on their rotational properties is available.

Observations and results

Both asteroids were observed in the V band, using a photoelectric photometer, equipped by a refrigerated EMI 6256S photomultiplier, attached to the 45 cm reflector telescope of the Torino Observatory. The reductions and UBV transformations were made in the standard way.

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Aspect data, reported in Table 1, were obtained by a computer program utilizing the osculating orbital elements drawn from *Ephemerides of Minor Planets* for 1982. The columns present the asteroid number, the date, the equatorial and the ecliptic coordinates for 1950.0, the geocentric and heliocentric distances, the phase angles, the absolute magnitudes at maximum brightness $V_0(1, \alpha)$ and the comparison stars used.

409 Aspasia

This asteroid was observed for the first time by Lagerkvist (1981) in March 1980, but it was not possible to draw any information on its rotational properties because of the shortness of the run ($< 2^h$). We observed it for two nights (December 21–22 and 22–23, 1982), and the resulting composite lightcurve is shown in Fig. 1.

The best fit was found for a rotational period of $P_{\text{syn}} = 9^h03 \pm 0^h03$. The maximum amplitude of the lightcurve is $0^m10 \pm 0^m01$. The lightcurve shape appears very asymmetric; it presents two equally deep minima and two maxima of very different level and shape. Therefore we deduce that the surface of the object could be very irregular and/or with possible albedo spots.

423 Diotima

The observation of this object, never previously observed, was performed in a single night (November 22–23, 1982), and a synodic period of $4^h62 \pm 0^h03$ was deduced. The maximum amplitude is $0^m18 \pm 0^m01$. The lightcurve is shown in Fig. 2 and presents four well defined extrema and a regular trend. Because of the short period and of the possibility to observe higher amplitudes in future oppositions 423 Diotima may be a good candidate to the LASPA class.

Concluding remarks

This importance of a better knowledge of the physical properties of asteroids of intermediate sizes is emphasized, for instance, from the theoretical work by Farinella et al. (1982). In particular, triaxial equilibrium ellipsoids, if real, are one of the most interesting outcomes of collisional events among minor planets. In the diameter range 100–300 km, at present, 18 asteroids with characteristics of the LASPA class (rotational period less than 6 h, maximum amplitude greater than about 0^m30) are known.

Therefore, to have a more complete scenario and an experimental strengthening of the theory, observations of asteroids belonging to this range with unknown or uncertain rotational properties are strongly needed.

Table 1. Aspect data for the observed asteroids

Asteroid	Date (O ^h UT)	R.A.	Decl.	Long.	Lat.	Δ	r	Phase	$V_0(1, \alpha)$	Comparison stars BD number
		(1950)				(AU)				
409	1982, Dec. 22	5 ^h 35 ^m 7	+16°08'	84°1	−7°2	1.751	2.727	3°19	7 ^m 870	+16° 830
	Dec. 23	5 34.7	+16 05	83.8	−7.2	1.752	2.727	3.49	7.856	^a
423	1982, Nov. 22	3 15.2	+13 17	50.0	−4.6	2.156	3.131	3.44	7.551	^b

^a Star not catalogued: $\alpha_{1950}=5^h34^m7$ $\delta_{1950}=+15^\circ57'$
^b Star not catalogued: $\alpha_{1950}=3^h17^m0$ $\delta_{1950}=+13^\circ25'$

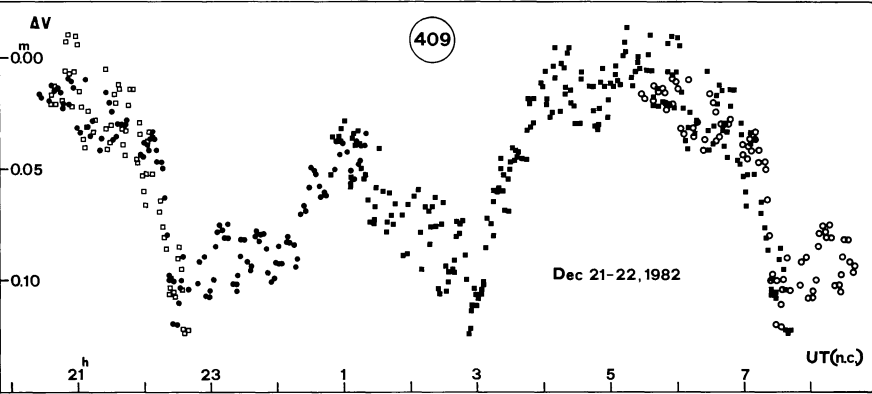


Fig. 1. Composite lightcurve of 409 Aspasia. (●○, December 21–22, 1982; ■□, December 22–23). n.c. means that the hours are not corrected for light time

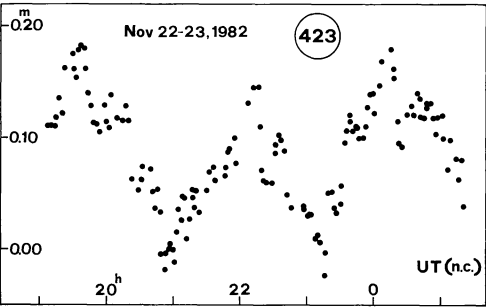


Fig. 2. Single-night lightcurve of 423 Diotima. n.c. means that the hours are not corrected for light time

We note that of the 62 asteroids of this size-class, which have not been observed in detail, 53 belong to the range 100–150 km. Therefore the first easy step of future work should be to complete the data for the range 150–300 km. For this reason we list in Table 2 all the asteroids larger than 150 km and not yet observed together with the objects having periods shorter than about 6 h, but whose lightcurve has a low amplitude. These asteroids, observed in only one or two oppositions, could reach higher amplitudes in different apparitions and therefore belong to the LASPA group.

The columns of Table 2 present: the asteroid number, the diameter and taxonomic type according to Bowell et al.(1979), the rotational period and the maximum amplitude, when observed.

Probably some other asteroids could be included in this list, because the real number of objects larger than 150 km is probably not known yet. Let us say that a particular priority should be given in future observations to the asteroids listed in Table 2.

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Table 2. List of possible LASPA asteroids

Asteroid	Diameter (km)	Taxonomic type	Rotation period	Maximum amplitude
52	291	C	11 ^h 258 ?	0 ^m 16
55	185	CMEU	4.804	0.24
88	214	C	6.042	0.19
93	170	C	5.979	0.09
117	156	C	—	—
165	228	C	6.000 ?	0.10
168	156	C	—	—
173	169	C	5.930	0.11
241	187	C	—	—
259	169	CMEU	—	—
334	199	C	6.100	0.16
375	200	C	—	—
381	150	C	—	—
423	209	C	4.620	0.18
444	167	C	6.218	0.15
536	152	C	—	—
617	159	U	—	—
690	175	CEU	—	—

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