

4376 SHIGEMORI: AN ASTEROID WITH AN EARTH COMMENSURATE ROTATION PERIOD

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Multi-site photometric observations of the asteroid 4376 Shigemori were conducted in order to discern its synodic rotation period, which presented a challenge in being very close to that of Earth. In fact, we obtained $P = 23.984 \pm 0.004$ h with an amplitude $A = 0.21 \pm 0.03$ mag.

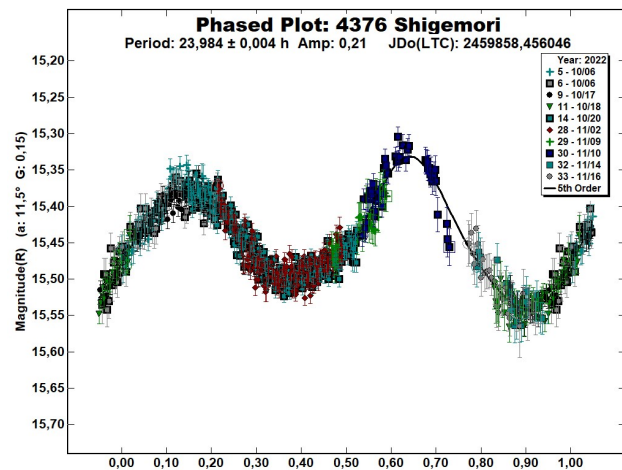
CCD photometric observations of the asteroid 4376 Shigemori were carried out in 2022 October–November from Italy by the Astronomical Observatory of the University of Siena (DSFTA, 2022), from New Mexico (USA) by the Organ Mesa Observatory, from Australia by the Blue Mountains Observatory. Equipment details are on Table I. Observations from different longitudes became indispensable when, after the first sessions from Italy, it was realized that the asteroid had a period very close to 24 h.

Data processing and analysis were done with *MPO Canopus* (Warner, 2018). All images were calibrated with dark and flat-field frames and the instrumental magnitudes converted to R magnitudes using solar-colored field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table II shows the observing circumstances and results.

A search through the asteroid lightcurve database (LCDB; Warner et al., 2009) indicates that our result may be the first reported lightcurve observations and results for this asteroid.

4376 Shigemori (1987 FA) was discovered on 1987 March 20 at Ojima by T. Nijima and T. Urata and named for a Japanese military commander, Taira-no Shigemori (1138–1179), the eldest son of Taira-no Kiyomori. [Ref: Minor Planet Circ. 19696] It is an inner main-belt asteroid with a semi-major axis of 2.231 AU, eccentricity 0.158, inclination 0.876° , and an orbital period of 3.33 years. Its absolute magnitude is $H = 13.69$ (JPL, 2022). The WISE/NEOWISE satellite infrared radiometry survey (Masiero et al., 2014) found a diameter $D = 4.967 \pm 0.290$ km using an absolute magnitude $H = 13.6$.

Observations were conducted over eight nights and collected 747 data points. The period analysis shows a bimodal solution for the rotational period of $P = 23.984 \pm 0.004$ h with an amplitude $A = 0.21 \pm 0.03$ mag.



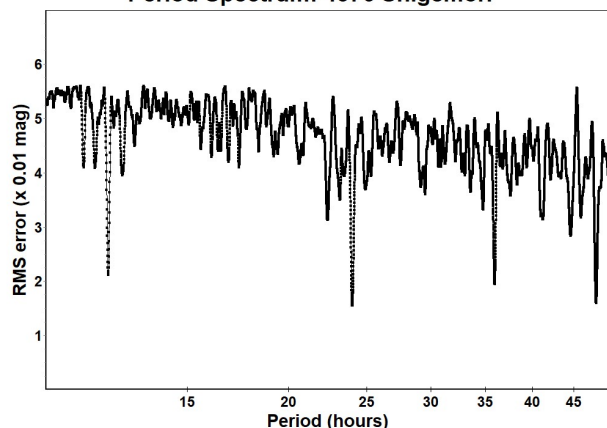
Observer Observatory	Telescope	CCD	Sessions (mm/dd)
Alessandro Marchini Astronomical Observatory University of Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303E	10/05, 10/06, 10/17, 10/18, 11/14, 11/16
Frederick Pilcher Organ Mesa Observatory (G50)	0.35-m SCT f/10.0	SBIG STL-1001E	10/20, 11/02
Julian Oey Blue Mountains Observatory (Q68)	0.35-m SCT f/5.9	SBIG ST-8XME	11/09, 11/10

Table I. Observing equipment. MCT: Maksutov-Cassegrain, SCT: Schmidt-Cassegrain.

Number	Name	2022/mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
4376	Shigemori	10/05–11/16	*11.6,14.3	31	0	23.984	0.004	0.21	0.03	MB-I

Table II. Observing circumstances and results. The first line gives the results for the primary of a binary system. The second line gives the orbital period of the satellite and the maximum attenuation. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

Period Spectrum: 4376 Shigemori



Acknowledgements

Minor Planet Circulars (MPCs) are published by the International Astronomical Union's Minor Planet Center.

https://www.minorplanetcenter.net/iau/ECS/MPCArchive/MPCArchive_TBL.html

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A COMPREHENSIVE PHOTOMETRIC STUDY OF 603 TIMANDRA

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Based on 65 sessions 2022 Sept. 24 - Dec. 28, we find for 603 Timandra a synodic rotation period of 330.1 ± 0.5 hours and amplitude 0.80 ± 0.05 magnitudes. There is also low-level tumbling with a possible second period of 273 hours, PAR -2. The period, amplitude, and epoch of lightcurve maximum all agree with a recent posting on the DAMIT website. Data obtained on 2022 Oct. 15 show that $(B-V) = 0.80 \pm 0.04$ and $(V-R) = 0.51 \pm 0.02$. At mid-light, $H = 12.18 \pm 0.14$ in the V band, $G = 0.20 \pm 0.17$.

The first author of this paper (Pilcher, 2011) obtained twelve photometric sessions of 9 to 11 hours each on 603 Timandra 2010 Nov. 13 - Dec. 24. These data were measured with uncalibrated comparison stars, that is, instrumental magnitudes only. The zero points of the individual lightcurves were adjusted up to several $\times 0.1$ magnitudes to provide a fit to a rotation period of 41.79 hours, amplitude 0.1 magnitudes. The uncalibrated data have been posted onto www.ALCDEF.org with sharing allowed. The reader is invited to download them and perform his own investigation.