

13441 JANMERLIN, AN ASTEROID WITH AN EARTH COMMENSURATE ROTATION PERIOD

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(Received: 2024 October 15 Revised: 2024 November 8)

Photometric observations from two different longitudes of the asteroid 13441 Janmerlin were conducted in order to obtain its synodic rotation period, which resulted close to that of Earth. In fact, we obtained $P = 23.087 \pm 0.002$ h with an amplitude $A = 0.50 \pm 0.03$ mag.

CCD photometric observations of the asteroid 13441 Janmerlin were carried out in 2024 September-October from Italy by the Astronomical Observatory of the University of Siena (DSFTA, 2024) and from New Mexico (USA) by the Organ Mesa Observatory. Equipment details are on Table I. Observations from different longitudes became indispensable when, after the first sessions from Italy, we realized that the asteroid had a period close to 24 h.

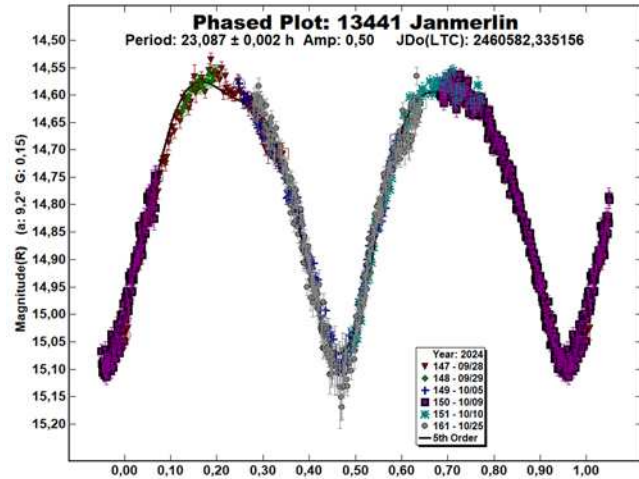
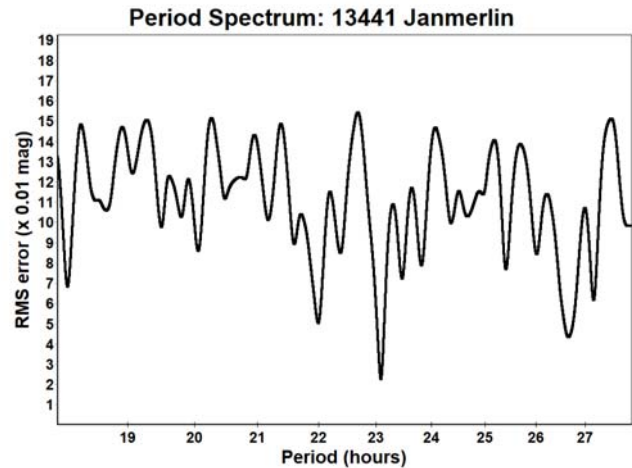
Data processing and analysis were done with *MPO Canopus* (Warner, 2018). All images were calibrated with dark and flat-field frames and the instrumental magnitudes converted to R magnitudes using solar-colored field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table II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

13441 Janmerlin (2098 P-L) was discovered on 1960 September 24 by C.J. Van Houten and I. Van Houten-Groeneveld on Palomar Schmidt plates taken by T. Gehrels. It was named for Jan Merlin (1925-2019), an actor who played cadet Roger Manning in the 1950 TV series Tom Corbett, Space Cadet. He was the astronaut on the rocket ship's radar deck and was always on the lookout for asteroids and comets. [Ref: *Minor Planet Circ.* 75548] It is a middle

main-belt asteroid with a semi-major axis of 2.630 AU, eccentricity 0.261, inclination 11.935° , and an orbital period of 4.27 years. Its absolute magnitude is $H = 13.06$ (JPL, 2024). The WISE/NEOWISE satellite infrared radiometry survey (Mainzer et al., 2019) found a diameter $D = 6.105 \pm 0.246$ km using an absolute magnitude $H = 12.5$.

Observations were conducted over five nights and collected 1032 data points. The period analysis, after discarding the unlikely monomodal solution, shows a clear bimodal solution for the rotational period of $P = 23.087 \pm 0.002$ h with an amplitude $A = 0.50 \pm 0.03$ mag.



Observatory	Telescope	CCD	Sessions (mm/dd)
Astronomical Observatory University of Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303E	09/28, 09/29, 10/05, 10/10
Organ Mesa Observatory (G50)	0.35-m SCT f/10.0	SBIG STL-1001E	10/09, 10/25

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

Number	Name	2024 mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
13441	Janmerlin	09/28-10/25	*9.3, 7.1	21	-2	23.087	0.002	0.50	0.03	MB-M

Table II. Observing circumstances and results. 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).

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LIGHTCURVE AND ROTATION PERIOD ANALYSIS OF (1685) TORO

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(Received: 2024 August 8)

Ten sets of photometric observations of the near-Earth asteroid 1685 Toro were obtained between 2024 January 26 and February 26. Using *Tycho Tracker* software, we plotted the lightcurve of 1685 Toro and measured its rotation period to be 10.1774 ± 0.012 h with a lightcurve amplitude of 0.51 ± 0.05 mag.

1685 Toro is a near-Earth Apollo asteroid that was discovered in 1948 July by C.A. Wirtanen at Mount Hamilton. A total of 1875 images were taken on ten nights between 2024 January 26 to February 26. We used an $f/4$ 0.2-m reflector and ASI6200MM CCD camera operating at -20 degrees C. Given Toro's large sky motion, exposure times were between 60 and 120 seconds. All of the frames were taken under L band (unfiltered).

Tycho Tracker was used for data analysis and measurement. Bias, flat, and dark frames were applied and the images aligned prior to measuring. The V magnitudes from APASS were used for the comparison stars. According to the asteroid lightcurve database (LCDB; Warner et al., 2009), the mean absolute magnitude is $H = 14.48 \pm 0.13$ if assuming a phase slope parameter $G = 0.24 \pm 0.11$. We used these values in our analysis. A fourth-order Fourier lightcurve was fit to $P = 10.1774 \pm 0.012$ h for a light-time corrected zero-point of JD = 2460336.0.

The rotation period of 1685 Toro is known (Ďurech et al., 2022) to be affected by YORP (Rubincam, 2000) based on data from 1972, 1988 (Hoffmann and Geyer, 1990), 2007 (Higgins, 2008, 2011) and (Higgins et al. 2008), 2013 (Warner, 2013). In the YORP model, a free parameter $\nu \equiv \frac{d\omega}{dt}$ is used to express rotational acceleration. Assuming a linear model, the period can be calculated as:

$$P(t) = \frac{2\pi P_0}{\nu P_0(t - T_0) + 2\pi}$$