

ROTATION PERIOD DETERMINATION FOR 1511 DALERA AND 2271 KISO

Fabio Salvaggio
21047 – Saronno, ITALY
fsalvaggio@gmail.com

Alessandro Marchini
Astronomical Observatory, University of Siena (K54)
Via Roma, 53100 – Siena, ITALY

Lorenzo Franco
Balzaretto Observatory (A81), Rome, ITALY

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Photometric observations of the main-belt asteroids 1511 Dalera and 2271 Kiso were performed by the authors from Italy in 2015 February and March. Analysis of the data revealed a bimodal lightcurve for 1511 Dalera with a synodic period 3.880 ± 0.001 hours. A period of 17.14 ± 0.01 h, also with a bimodal lightcurve, was found for 2271 Kiso.

Asteroids 1511 Dalera and 2271 Kiso were observed by a group of amateur astronomers at the Astronomical Observatory of the University of Siena and at the Balzaretto Observatory, both located in Italy. This paper presents the results of these campaigns.

At the Astronomical Observatory of the University of Siena, data were obtained with a 0.30-m $f/5.6$ Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter. The pixel scale was 2.20 arcsec when binning 2x2 and the exposure times were 300 or 420 seconds. At the Balzaretto Observatory, data were obtained with a 0.20-m Schmidt-Cassegrain (SCT), reduced to $f/5.5$, equipped with an SBIG ST7-XME CCD camera. The pixel scale was 1.65 arcsec and the exposure times were 420 sec.

For both asteroids, images were calibrated with bias, flats, and darks. Data processing, including reduction to R band, and period analysis were performed using *MPO Canopus* (BDW Publishing, 2012). Differential photometry measurements were performed using the Comp Star Selector (CSS) procedure in *MPO Canopus* that allows selecting of up to five comparison stars of near solar color. Subsequently, additional adjustments of the magnitude zero-points for the particular data sets were carried out in order to achieve the best alignment among them, i.e., to reach the minimum RMS value from the Fourier analysis.

1511 Dalera (1939 FB). This main-belt asteroid was discovered on 1939 March 22 by Louis Boyer. It orbits with a semi-major axis of about 2.36 AU, eccentricity 0.10, and a period of 3.62 years. Observations were made on four nights from 2015 February 27 to March 09 with a total of 252 data points collected. During the interval of ten days, the phase angle ranged from 4.1° to 4.9° after opposition.

The period analysis yielded a few possible solutions that clearly stand out in the period spectrum (Fig. 1) with nearly comparable RMS errors. We concluded that the most likely value of the synodic period for 1511 Dalera is associated with a bimodal lightcurve phased to 3.880 ± 0.0001 hours with an amplitude of 0.18 ± 0.03 mag (Fig. 2).

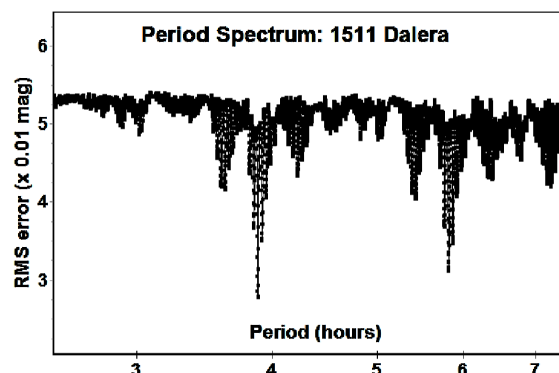


Figure 1. The period spectrum for 1511 Dalera.

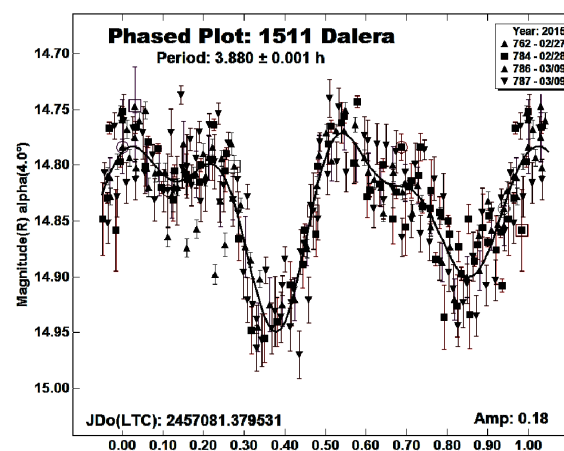


Figure 2. The lightcurve for 1511 Dalera phased to the adopted period of 3.880 h.

2271 Kiso (1976 UV5) is a main-belt asteroid discovered on 1976 October 22 by Hiroki Kosai and Kiichiro Furukawa at the Tokyo Observatory's Kiso Station and is named after the observatory. It orbits with a semi-major axis of about 2.79 AU, eccentricity 0.06, and a period of 4.6 years. According to the WISE satellite infrared radiometry, the diameter is 34.42 ± 0.43 km based on an absolute magnitude $H = 10.9$ (Masiero *et al.*, 2012).

Observations were made on eight nights from 2015 February 19 to March 20 with a total of 408 data points collected. During an interval of about one month, the phase angle ranged from 0.4° to 11.3° after opposition.

The period analysis yielded several possible solutions that clearly stand out in the period spectrum (Fig. 3) with nearly comparable RMS errors: 8.67 h (monomodal), 17.14 h (bimodal), and 26.01 h (trimodal). We concluded that the most likely value of the synodic period for 2271 Kiso is associated with the bimodal lightcurve phased to 17.14 ± 0.01 hours with an amplitude of 0.14 ± 0.03 mag (Fig. 4). This is based on the presumption that large amplitudes would be improbable for monomodal or trimodal lightcurves at lower phase angles, as explained in the *MPO Users Guide* (Warner, 2012).

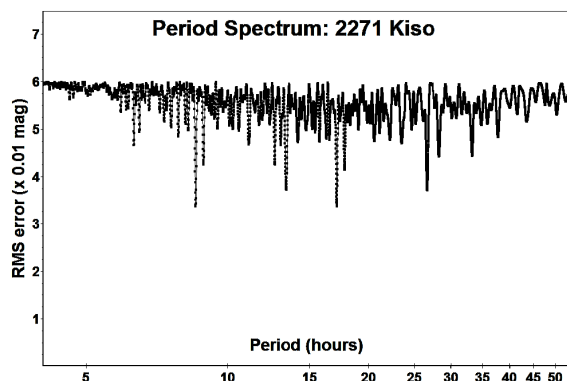


Figure 3. The period spectrum for 2271 Kiso.

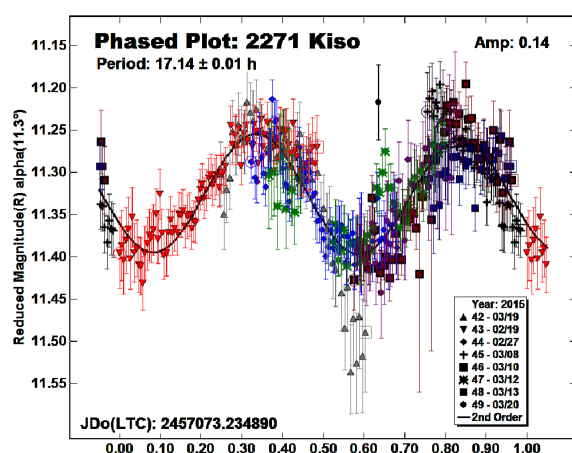


Figure 4. The lightcurve for 2271 phased to the adopted period of 17.14 h.

A search of the asteroid lightcurve database (LCDB; Warner *et al.*, 2009) indicates that these are the first observations and results for these objects. Both asteroids were reported as a lightcurve photometry opportunity in the *Minor Planet Bulletin* (Warner *et al.*, 2015).

Acknowledgments

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