ROTATION PERIOD DETERMINATION FOR (9659) 1996 EJ

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(Received: 2022 April 14 Revised: 2022 June 1)

Photometric observations of the main-belt asteroid (9659) 1996 EJ were conducted in order to determine its synodic rotation period. We found $P = 6.527 \pm 0.001$ h, $A = 0.09 \pm 0.03$ mag.

CCD photometric observations of the main-belt asteroid (9659) 1996 EJ were carried out in March 2022 at the Astronomical Observatory of the University of Siena (K54), a facility inside the Department of Physical Sciences, Earth and Environment (DSFTA, 2022). We used a 0.30-m *f*/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter; the pixel scale was 2.30 arcsec when binned at 2×2 pixels and all exposures were 300 seconds.

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 I 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.

(9659) 1996 EJ was discovered on 1996 March 10 at Kushiro by S. Ueda and H. Kaneda. It is a main-belt asteroid with a semi-major axis of 2.660 AU, eccentricity 0.090, inclination 13.461°, and an orbital period of 4.34 years. Its absolute magnitude is $H = 12.36$ (JPL, 2022). The NEOWISE satellite infrared radiometry survey (Masiero et al., 2011) found a diameter $D = 8.883 \pm 0.141$ km using an absolute magnitude $H = 12.1$.

Observations were conducted over four nights and collected 223 data points. The period analysis shows two possible solutions for the rotational period of this asteroid: $P = 3.243$ h and $P = 6.527$ h (Fig. 1). As noted by Harris et al. (2014), given the low amplitude, either solution was plausible and so we used a split-halves plot to see which period to favor. The "split-halves" test (Fig. 2) shows a significant mismatch between the two halves of the half-period lightcurve, well beyond the data scatter level. This favors the longer period of $P = 6.527 \pm 0.001$ h (Fig. 3) with an amplitude $A = 0.09 \pm 0.03$ mag that is formally adopted as a solution in this paper (Fig. 4), but further observations are highly recommended in future apparitions to verify the result.

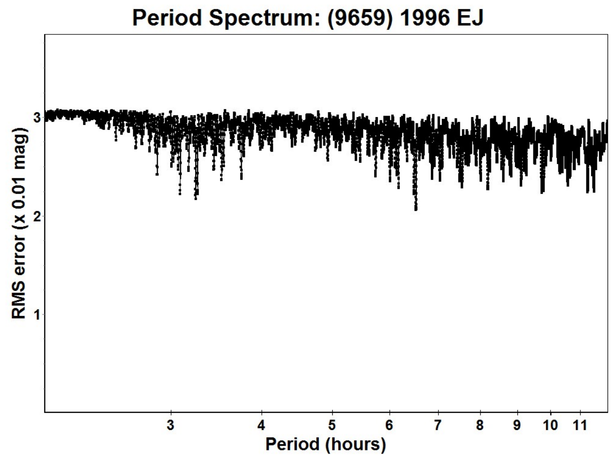

Figure 1: Period spectrum with two possible solutions at 3.243 h and 6.527 h.

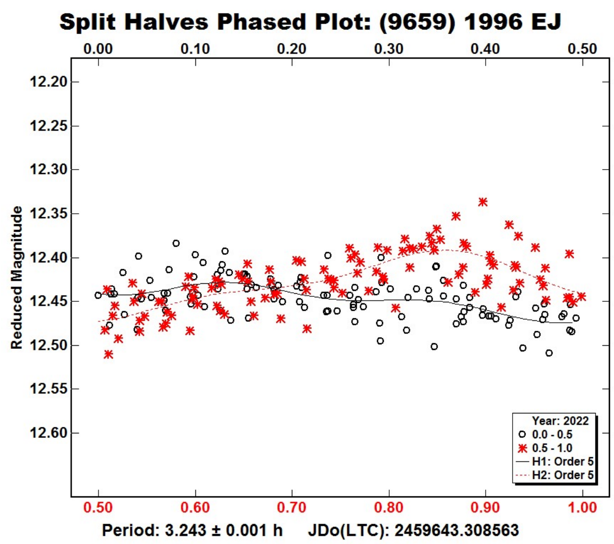

Figure 2: Split halves plot for the period of 3.243 h.

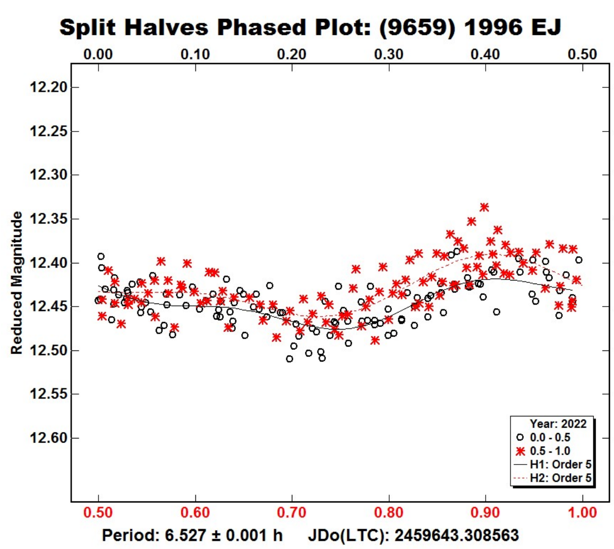

Figure 3: Split halves plot for the period of 6.527 h.

Number	Name	2022/mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
9659	1996 EJ	03/04-03/29	*3.6,10.2	168	6	6.527	0.001	0.09	0.03	MB

Table I. 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).

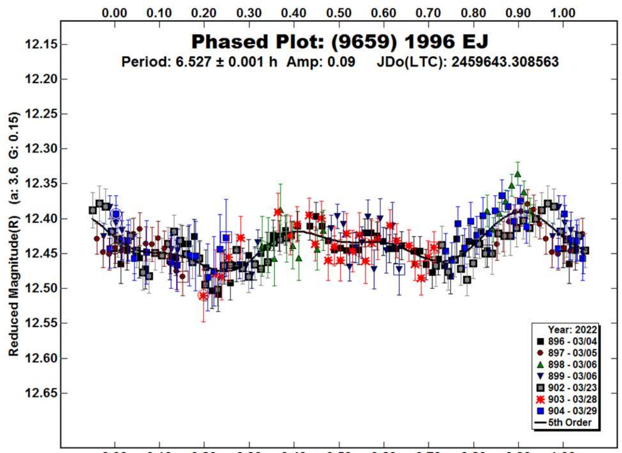

Figure 4: Lightcurve for (9659) 1996 EJ with the preferred period of 6.527 h.

Acknowledgements

The authors want to thank a group of high school students involved in an interesting vocational guidance project about astrophysics; they attended some observing sessions and participated in data analysis. From Liceo “Poliziano” (Montepulciano): G. Accursi, B. Belelli, F. Casanova, S. Corazza, M. Di Bernardini, C. Di Renzone, G. Fascetti, F. Gavagni, S. Lionelli, F. Materazzi, S. Mazzetti, A. Meacci, G. Meocci, S. Nicorescu, F. Pepi, C. Rachini, M. Rosignoli, F. Sabatino, B. Socea; from Liceo “Alessandro Volta (Colle Val d’Elsa): M. Calabrò, G. Cortonesi, M. Fedele, A. Giurleo, A. Guidi, A. Lazemataj, P. Lupini, A. Sciarrotta, F. Vanni.

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