

LIGHTCURVE FOR KORONIS FAMILY MEMBER 2498 TSESEVICH

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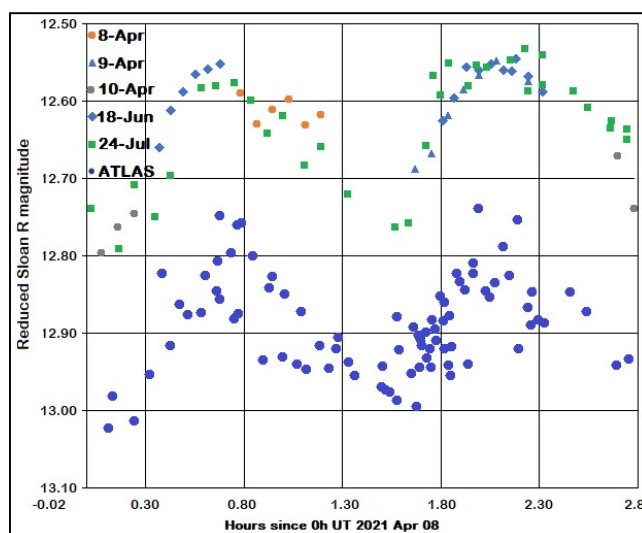
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Observations of the Koronis-family asteroid 2498 Tsesevich were obtained on five nights in 2021 at the 0.61m Chi-1 telescope of El Sauce Observatory. We obtained a doubly-periodic lightcurve with period 2.8737 ± 0.0002 h and an amplitude in Sloan r' (SR) of 0.26 ± 0.04 mag.

Observations were performed from 2021 April-July in Sloan r' filter on the Chi-1 (0.61 m) telescope at El Sauce Observatory in the Rio Hurtado Valley, Chile, operated by Telescope Live. Target selection and ephemeris were based upon the Koronis family asteroids web tool (Slivan 2003). The FLI PL9000 CCD camera was cooled to -25°C and the $12\ \mu\text{m}$ pixels with 1×1 binning yielded an image scale of 0.62 arcsec/pix. Images were processed for bias, dark and flat field corrections. Photometry was performed using *AstrolImageJ* using on-chip comparison stars of solar color ($B-V = 0.63$) to red ($0.6 < B-V < 1.0$) stars.

For the three consecutive nights in April, target motion was sufficiently small to use the same on-chip comparison stars. Using NASA Horizons ephemeris, all photometry was corrected for light travel time, unit distances, and solar phase angle using $G = 0.15$. The absolute calibration is based on catalog magnitudes from the APASS10 survey tied to the April observations. Small shifts in scale were subsequently applied to the June 18 and July 24 magnitudes to obtain a consistent, composited lightcurve. We derived an amplitude, in magnitudes, from trough to peak, $A = 0.26 \pm 0.04$ mag and synodic period $P = 2.8737 \pm 0.0002$ h, which is consistent within the uncertainties with that of Fauerbach and Brown (2019) from the 2017 apparition, who obtained $P = 2.864 \pm 0.019$ h. A singly-periodic fit with one-half this period was strongly disfavored by the July 24 dataset when examined alone because one and a half periods were observed. Our data covered the full rotation curve and yield a considerably more precise period due to the nearly 3-month observation span.

We checked our results by comparing to publicly available data from the Minor Planet Center from the Asteroid Terrestrial-impact Last Alert System (ATLAS; Tonry et al., 2018) program during 2021 in the o filter (orange, 560-820 nm). Corrections for light travel time, unit distance, and solar phase angle were performed and the data were shifted for clarity. The two resulting lightcurves show substantial similarity. The ATLAS data allowed us to consider other values of G . The lightcurve becomes noticeably more scattered for G values outside the range 0.15 ± 0.03 .



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References

- Fauerbach, M.; Brown, A. (2019). "Rotational Period Determination for Asteroids 2498 Tsesevich, (16024) 1999 CT101, (46304) 2001 OZ62." *Minor Planet Bulletin* **46**, 19-20.
- Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gytis." *Icarus* **57**, 251-258.
- Slivan, S. (2003). "A Web-based tool to calculate observability of Koronis program asteroids." *Minor Planet Bulletin* **30**, 71.
- Tonry, J.L.; Denneau, L.; Heinze, A.N.; Stalder, B.; Smith, K.W.; Smartt, S.J.; Stubbs, C.W.; Weiland, H.J.; Rest, A. (2018). "ATLAS: A High-cadence All-sky Survey System." *PASP* **130**, 064505.
- Warner, B.D.; Harris, A.W.; Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2016 Sep. <http://www.minorplanet.info/lightcurvedatabase.html>

Number	Name	yyyy mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
2498	Tsesevich	2021 04/8-7/24	*17.5, 17.1	253	-2	2.8737	0.0002	0.26	0.04	MB-Kor

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 extremum 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).