A COMPREHENSIVE PHOTOMETRIC STUDY OF 630 EUPHEMIA

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Based on 86 sessions 2026 Jan. 30 - March 26, we find for 630 Euphemia a synodic rotation period 387.2 ± 0.2 hours, amplitude 0.45 ± 0.05 magnitudes. The period, amplitude, and epoch of lightcurve maximum all agree with a posting on the DAMIT website. Data obtained on 2026 Feb. 18 show that B-V=0.83 ± 0.03 and V-R = 0.46 ± 0.03. At mid-light, H=11.25 ± 0.03 in the V band, G=0.25 ± 0.03.

As a summary of previous studies for 630 Euphemia, Warner (2005) published a period of 79.18 hours, amplitude 0.22 magnitudes, based on only 5 nights 2005 Apr. 1-9. A re-examination made in the year 2011 and including 7 nights of data 2005 April 1-12 suggested a period of 350 ± 50 hours, amplitude 0.4 magnitudes. Durech (2019) posted to the DAMIT website a lightcurve inversion model based entirely on sparse data from the Gaia DR2 and Lowell Observatory photometric databases. These show a sidereal rotational period of 386.98 hours, rotational pole at either longitude 2°, latitude 54°, or longitude 125°, latitude 71°.

Here we present new photometric lightcurves from 2026 Jan. 30 to March 26, many of them 7 to more than 10 hours. These provide a good fit (Fig. 1) to a slightly unsymmetric bimodal lightcurve with synodic period 387.2 ± 0.2 hours, amplitude 0.45 ± 0.05 magnitudes. This result is very close to the sidereal period published by Durech (2019) and within Warner's stated ± 50 hours error to his 350-hour period (Warner, 2011).

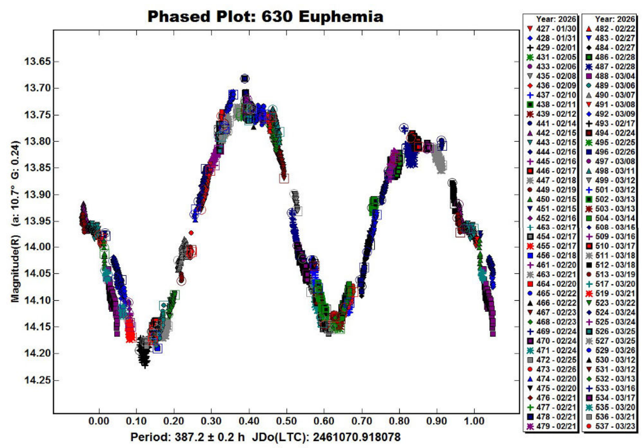

Figure 1. The lightcurve of 630 Euphemia phased to a period of 387.2 hours.

The DAMIT website has a provision that the *LI* model can be projected to any JD specified by the user. On 2026 Feb. 1, JD 2461073.0, the narrow side of the model is toward the Earth and the asteroid is observed at minimum light, as the model predicts. On 2006 Feb. 5, JD 2461077.0, the broad side of the model is toward the Earth and the asteroid is observed at brightest light, again as predicted. Furthermore, the difference between the maximum and minimum areas would predict a rotational amplitude close to the observed 0.45 magnitudes. The compatibility of rotation period, amplitude near 0.45 magnitudes predicted by the elongated shape model, and epochs of lightcurve extrema increase our confidence in the *LI* model including the two decimal places in its 386.98-hour period.

Here we also report multiband photometry, acquired by P. Bacci and M. Maestriprieri (104) on 2026 Feb. 18, allowing us to determine the color indices B-V = 0.83 ± 0.03 and V-R = 0.46 ± 0.03 (Fig. 2), consistent with a medium albedo asteroid (Shevchenko and Lupishko, 1998).

Number	Name	2026 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
630	Euphemia	01/30-03/26	*10.4-18.2	148	14	387.2	0.2	0.45	0.05	MB-M

Table I. 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).

Observatory (MPC code)	Telescope	CCD	Filter
Organ Mesa Observatory (G50)	0.35-m SCT f/10	SBIG STL-1001E	C
Observatorio Nuevos Horizontes (Z73)	0.28-m SCT f/10	ATIK 414	C
Astronomical Observatory, University of Siena (K54)	0.30-m MCT f/5.6	SBIG STL-6303e(bin 2x2)	C
GAMP (104)	0.60-m NRT f/4	Apogee Alta	B,V,R
Castelmartini Observatory (160)	0.25-m SCT f/6.3	CMOS ASI2600MM (bin 3x3)	C
Iota Scorpii(K78)	0.40-m RCT f/6.1	Player One 455M Pro (bin 4x4)	R
GiaGa Observatory (203)	0.36-m SCT f/5.8	Moravian G2-3200	R
Zen Observatory (M26)	0.30-m RCT f/7.4	Atik 383L+ (bin 2x2)	R
45th Parallel Observatory (D43)	0.25-m RCT f/5.6	IMX533 (bin 2x2)	C
ALMO Observatory (G18)	0.30-m NRT f/4.0	ZWO ASI533MM PRO	R
Monte Viseggi Observatory (126)	0.41-m RCT f/7.5	CMOS ZWO ASI 6200MM (bin 4x4)	R
HOB Astronomical Observatory (L63)	0.20-m SCT f/6	ATIK 383L+	C
Beppe Forti Astronomical Observatory (K83)	0.40-m RCT f/8	SBIG ALUMA (bin 2x2)	C

Table II. Observing Instrumentations. MCT: Maksutov-Cassegrain, NRT: Newtonian Reflector, RCT: Ritchey-Chretien, SCT: Schmidt-Cassegrain.

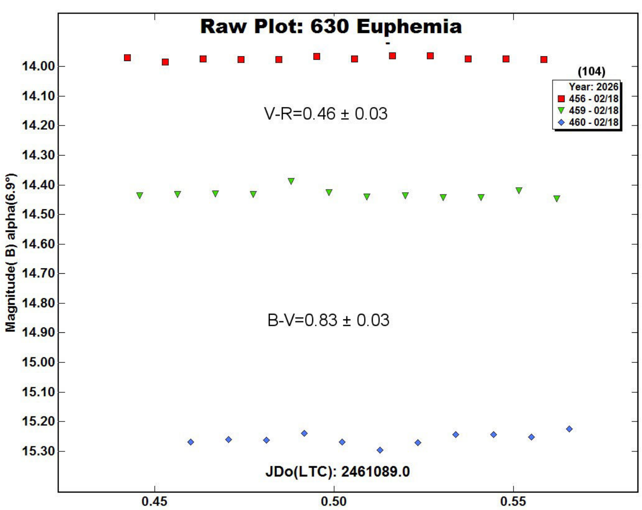

Figure 2. The magnitudes of 630 Euphemia in B, V, R filters with B-V and V-R color indices.

We also present a reflectance spectrum of 630 Euphemia (Fig. 3), retrieved from the Gaia ESA Archive (2025) and corrected for z-i parameter (Franco, 2025), is consistent with an S-type classification within the Bus-DeMeo taxonomy (DeMeo et al., 2009). This result aligns with the taxonomic attribution proposed by Franco (2025). Furthermore, the observed color indices agree with the reference values for S-type asteroids (Shevchenko and Lupishko, 1998, B-V = 0.86 ± 0.04, V-R = 0.49 ± 0.05).

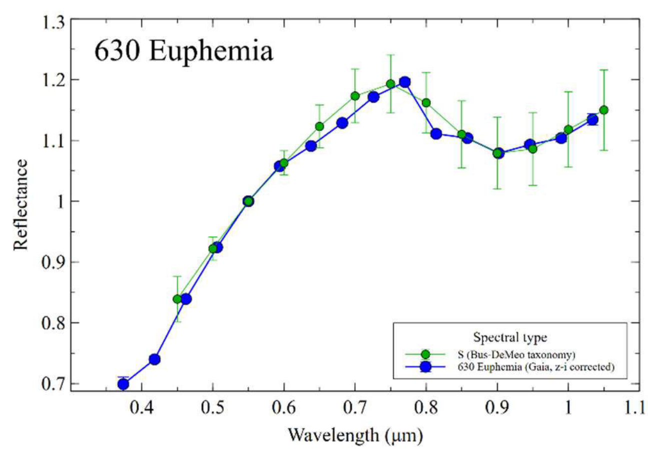

Figure 3. The reflectance spectrum for 630 Euphemia from Gaia DR3, corrected for z-i parameter (Franco, 2025), and compared with S-type taxonomy (DeMeo et al., 2009).

We further derived H-G parameters using the specific function implemented in *MPO Canopus*. For each session, the mean Julian Date (JD) and R-band magnitude were calculated; subsequently, the half peak-to-peak magnitude was evaluated using a 3rd-order Fourier model (Buchheim, 2011). Finally, magnitudes were converted to the V band by adding the V-R color index. We obtained (Fig. 4) H = 11.25 ± 0.03 and G = 0.25 ± 0.04, where the G value is consistent with an S-type asteroid (Shevchenko and Lupishko, 1998; G = 0.24 ± 0.01).

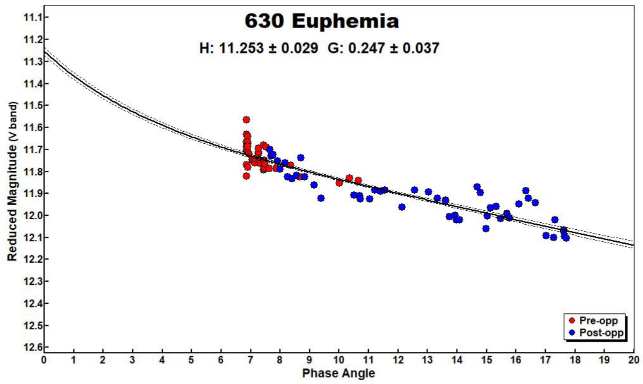

Figure 4. The H-G plot for 630 Euphemia at mid-light.

In conclusion, we find for 630 Euphemia at its early 2026 opposition a synodic rotation period of 387.2 ± 0.2 hours, amplitude 0.45 ± 0.05 magnitudes. The observed period, dates of lightcurve maxima and minima, and amplitude are all predicted by the *LI* inversion model (Durech, 2019) which finds a sidereal rotation period 386.98 hours, and provides confidence that the *LI* model is correct.

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PHOTOMETRIC OBSERVATIONS OF ASTEROIDS 1090 SUMIDA, 1825 KLARE AND 1884 SKIP

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Photometric observations of three main-belt asteroids were conducted to verify or determine their synodic rotation periods. For 1090 Sumida, we found P = 2.720 ± 0.001 h with A = 0.16 ± 0.02 mag. For 1825 Klare, we found P = 4.742 ± 0.001 h with A = 0.64 ± 0.02 mag. For 1884 Skip, we found P = 2.894 ± 0.001 h with A = 0.19 ± 0.03 mag.

CCD photometric observations of three main-belt asteroids were carried out in 2026 January-March at the Astronomical Observatory of the University of Siena (K54). We used a 0.30-m *f*/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera; the pixel scale was 2.30 arcsec when binned at 2×2 pixels. We used a Clear filter and 300 seconds of exposure time.

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-coloured field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table I shows the observing circumstances and results.

1090 Sumida (1928 DG) was discovered on 1928 February 20 by O. Oikawa at Tokyo. It is an inner main-belt asteroid of the Phocaea class with a semi-major axis of 2.359 AU, eccentricity 0.221, inclination 21.543°, and an orbital period of 3.62 years. Its absolute magnitude is H = 12.44 (JPL, 2026). The NEOWISE satellite infrared radiometry survey (Mainzer et al., 2016) found a diameter D = 12.977 ± 0.438 km using an absolute magnitude H = 12.49 and a geometric albedo of p_V = 0.106. Based on the reflectance spectra available in GAIA DR3 (Franco, 2025; 2026), Lorenzo Franco derived the taxonomic class C for 1090 Sumida, and found a diameter D = 19.9 km using an absolute magnitude H = 12.22 and a geometric albedo of p_V = 0.058.

Observations were conducted over four nights and collected 188 data points. The period analysis shows a rotational period of P = 2.720 ± 0.001 h with an amplitude A = 0.16 ± 0.02 mag, in good agreement with the previously results published in the asteroid lightcurve database (LCDB; Warner et al., 2009; Behrend, 2004web; 2015web; 2022web; Blake and Himeno, 2018; Farfan et al., 2022; Lang, 2017; Pravec et al., 2012web; Skiff et al., 2019; Warner and Megna, 2012; Wisniewski, 1991).