

LIGHTCURVE ANALYSIS OF TWO NEAR-EARTH ASTEROIDS

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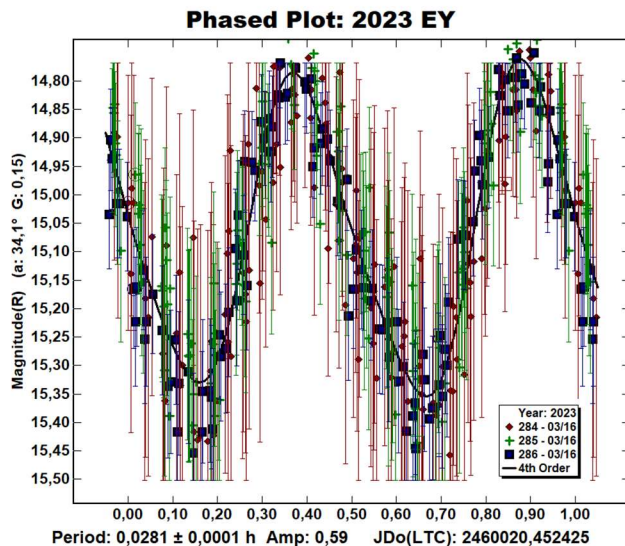
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We report photometric analysis of two near-Earth asteroids observed during close approaches in 2023 March. For 2023 EY we found $P=0.0281 \pm 0.0001$ h, amplitude of 0.59 mag; Results for 2023 DZ2 are $P=0.1050 \pm 0.0001$ h, amplitude of 0.48 mag.

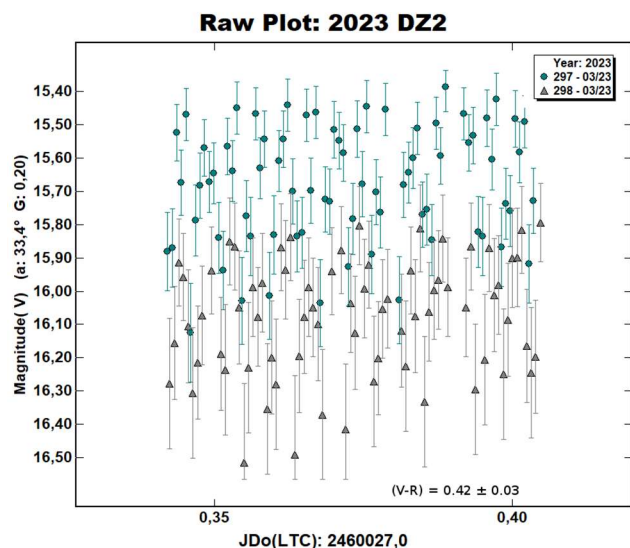
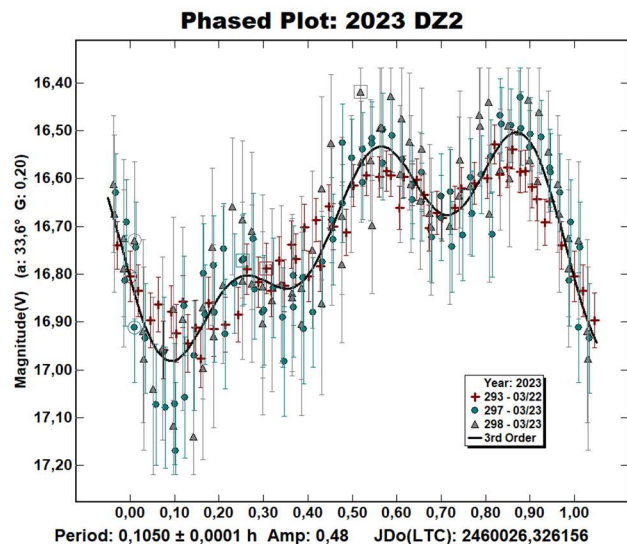
The CCD observations were made in 2023 March using the instrumentation described in the Table I. Lightcurve analysis was performed with *MPO Canopus* (Warner, 2016). All the images were calibrated with dark and flat frames and converted to R magnitudes using solar colored field stars from CMC15 catalogue distributed with *MPO Canopus*. Table II shows the observing circumstances and results.

No previously reported results have been found in the Asteroid Lightcurve Database (LCDB) (Warner et al., 2009). The size estimates are calculated using H values from the Small-Body Database Lookup (JPL, 2023a). Both asteroids are small in size and have a rotation period below the spin-barrier, they are probably monolithic objects.

2023 EY is an Apollo orbit class, discovered by ATLAS South Africa, Sutherland in 2023 March 13 (Cromer et al., 2023), with $H = 26.81$ and a Minimum Orbit Intersection Distance (MOID) from Earth of 0.00167 au. It was observed for 47 minutes starting at 2023 March 16, 22:56 UT when it was at magnitude 15.4 and motion 121 arcsec/min, at range 0.0028 au. We found a synodic period of $P = 0.0281 \pm 0.0001$ h with amplitude $A = 0.59 \pm 0.10$ mag. and ratio $a/b=1.7 \pm 0.1$ based on the amplitude, for an assumed triaxial ellipsoid viewed equatorially (Zappala et al. 1990).



2023 DZ2 is an Apollo asteroid, discovered 2023 February 27 at La Palma (Vaduvescu et al., 2023b), with $H = 24.23$ and a Minimum Orbit Intersection Distance (MOID) from Earth of 4.776E-5 au. It was originally listed as a Virtual Impactor with a 1/621 probability of hitting Earth on March 27, 2026. Subsequently with a 66-day observation span, it was removed from the Sentry Risk Table (JPL, 2023b) on March 21, 2023. It was observed for 96 minutes starting at 2023 March 22, 19:55 UT, when it was at magnitude 17.0 and motion 2.45 arcsec/min, at range 0.013 au, with unfiltered exposures 120 second. A second observation starting at 2023 March 23 20:18 UT, of 90 minutes, when it was at magnitude 16.1 and motion 7.06 arcsec/min, at range 0.0086 au, with exposures 120 second, using alternating photometric filters V-Rc. We found a synodic period of $P = 0.1050 \pm 0.0001$ h with amplitude $A = 0.48 \pm 0.10$ mag. and ratio $a/b=1.6 \pm 0.1$ based on the amplitude, for an assumed triaxial ellipsoid viewed equatorially (Zappala et al., 1990). We found the color index $(V-R) = 0.42 \pm 0.03$, consistent with a M-type asteroid (Shevchenko and Lupishko, 1998). The period and spectral class are close to the previously published results Goldstone Radar Observations of Asteroid 2023 DZ2 (Benner, 2023).



Observatory (MPC code)	Telescope	CCD	Filter	Observed asteroid
GAMP (104)	0.60-m NRT f/4.0	Apogee Alta	C, V, Rc	2023 EY, 2023 DZ2

Table I. Observing Instrumentations. CDK: Corrected Dall-Kirkham, MCT: Maksutov-Cassegrain, NRT: Newtonian Reflector, RCT: Ritchey-Chretien, SCT: Schmidt-Cassegrain.

Number	Name	2023 mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	H
	2023 EY	16/03	34.1	157	7.5	0.0281	0.0001	0.59	0.1	26.81
	2023 DZ2	22-23/03	33.6/33.4	150/152	-0.5/-0.6	0.1050	0.0001	0.48	0.1	24.23

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). H is the absolute magnitude at 1 au from Sun and Earth taken from the Small-Body Database Lookup (JPL, 2022).

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