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PHOTOMETRIC OBSERVATIONS AND LIGHTCURVE ANALYSIS OF (25450) 1999 XQ7

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In this paper we report the results of our photometric observation campaign and lightcurve analysis of an asteroid (25450) 1999 XQ7 during its favorable opposition in 2024.

(25450) 1999 XQ7 is an inner main-belt asteroid with no record of a synodic period in LCDB database (Warner et al., 2009). The CALL webpage (Warner, 2016) listed this asteroid as a potential target for photometric observation due to the favorable opposition on 2024 November 7 and relatively high brightness of $V \sim 15.6$.

Photometric observations were carried out from three observatories located in Slovakia, Malta and Canada. A total of 23 sessions were obtained from 2024 November 1 to December 14, totaling 688 individual observations. Table I provides the complete equipment list and the observer's total runs. Initial sessions were all-night observations (approximately 9 hours) and then they were adapted to batch observations plan of approximately one hour duration. Exposure times varied from 180 s (Luckystar Observatory) to 240/300 s (Flarestar and A la belle étoile Observatory).

All images were taken through a clear filter (unfiltered) with an SR (SLOAN r') bandpass zero point and were calibrated using dark and flat-field master frames subtraction. All brightness measurements were based on the Asteroid Terrestrial-impact Last Alert System (ATLAS) catalogue (Tonry et al., 2018).

We remotely-controlled all our equipment over the Internet or from a nearby location for each telescope. *NINA* software (Berg, 2023) was used for image acquisition by A la belle étoile and Luckystar Observatories. Flarestar Observatory used *Sequence Generator Pro* software (Binary Star Software). We used *MPO Canopus* software versions 10 and 12 (Warner, 2017) for our image analysis, to obtain differential aperture photometry, and to create the final lightcurve. We selected near-solar color comparison stars ($0.5 \leq B-V \leq 0.9$) using the Comparison Star Selector (CSS) feature of *MPO Canopus*.

We estimate the synodic rotation period of (25450) 1999 XQ7 to be 299.68 ± 0.37 h, with an amplitude of 0.92 ± 0.05 mag. The suggested, and most probable solution, has the lowest RMS value. Another solution, proposed by Fourier algorithm, has a very similar RMS value close to a double-period length (719 h). Based on the fact that asteroids with amplitudes greater than 0.2 magnitudes typically exhibit a bimodal solution, we preferred the solution with nearly 300-hour period.

Number	Name	Family	H	Dkm	a (au)	e	i (deg)	P(ys)	Discovered by	yyyy/mm
25450	1999 XQ7	9104	14.39	3.94	2.35	0.228	5.87	3.61	C.W. Jue1s	1999/12

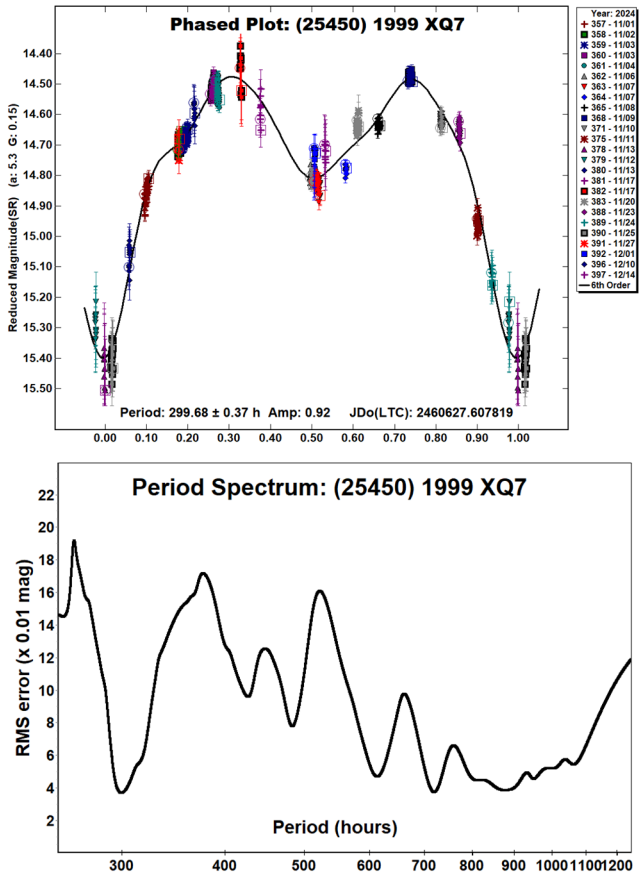
Table II. Orbital and discovery information. Fam is the group or family using the LCDB values. An asterisk indicates a generic group, otherwise, the numbers are from Nesvorný et al. (2015). Web Sources: JPL: https://ssd.jpl.nasa.gov/tools/sbdb_lookup.html# MPInfo: <https://minorplanet.info/php/oneasteroidinfo.php>

Number	Name	yyyy mm/dd	Phase	LPAB	BPAB	Period(h)	P.E.	Amp	A.E.	Grp
25450	1999 XQ7	2024 11/01-12/14	5.3, 21.2	47	6	299.68	0.37	0.92	0.05	MBI

Table III. Observing circumstances and results. The phase angle is given for the first and last date. LPAB and BPAB are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

Observatory/ Country	Scope	Camera	Obs. Runs
A la belle étoile Obs. CANADA	0.2-m MK	Moravian G2-1600	2
Flarestar Obs. (MPC: 171) MALTA	0.25-m SCT	Moravian G2-1600	8
Luckystar Obs. (MPC: M55)/ SLOVAKIA	0.25-m SCT	Atik 460EX	13

Table I. Instrumentation and Observation Runs. SCT: Schmidt-Cassegrain Telescope, MK: Maksutov-Cassegrain.



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