

PHOTOMETRIC ANALYSIS AND ROTATION PERIOD DETERMINATION OF THE POTENTIALLY HAZARDOUS ASTEROID 2020 WU5

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Photometric observations of 2020 WU5 were conducted in 2021 January in order to determine its synodic rotation period and revealed a bimodal solution with $P = 5.574 \pm 0.002$ h and an amplitude $A = 0.84 \pm 0.08$ mag.

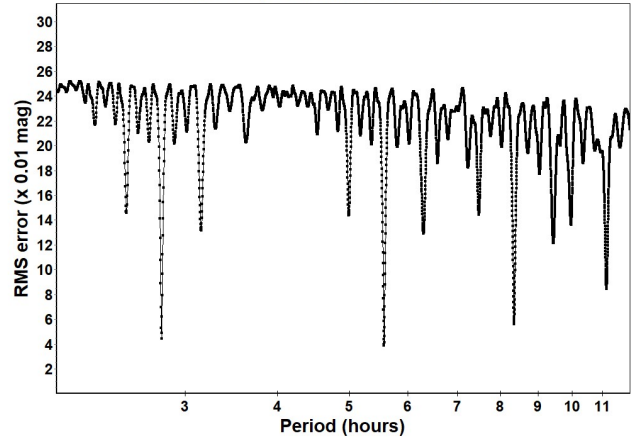
CCD photometric observations of the Potentially Hazardous Asteroid (PHA) 2020 WU5 were carried out in 2021 January 12-19 at the Astronomical Observatory of the University of Siena (K54), a facility inside the Department of Physical Sciences, Earth and Environment (DSFTA, 2021), and at three other Italian observatories inside the Italian Amateur Astronomers Union (UAI, 2021) group. Table I shows the observing circumstances and results, Table II describes the instrumentation used in each observatory.

Data processing and lightcurve analysis were performed 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 the catalogues distributed with *MPO Canopus*.

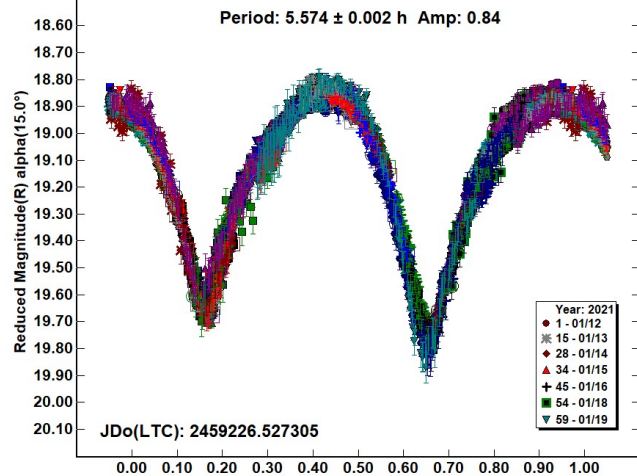
2020 WU5 was observed for the first time on 2020 November 29 by WISE (WISE, 2021). It belongs to the Apollo family and is a PHA with a semi-major axis of 1.059 AU, eccentricity 0.102, inclination 41.484° , an orbital period of 1.09 years and an absolute magnitude $H = 18.651$ (JPL, 2021). Its Earth MOID (Minimum Orbit Intersection Distance) is of 0.041 AU (NEODyS-2, 2021).

Observations were intensively conducted over six nights and collected 4,560 data points. The asteroid moved across the sky very quickly (about 27 arcmin per hour on January 15) challenging the observers who had to re-point their telescopes every 30-60 minutes to keep it in the frame. The period analysis shows a bimodal solution for the rotational period of $P = 5.574 \pm 0.002$ h with an amplitude $A = 0.84 \pm 0.08$ mag. The large amplitude suggests that the shape is quite elongated. The large dispersion and subtle variations in the light curve are likely effects of the large variation of the phase angle, which changed more than 40 degrees during the observations (see table I for details).

Period Spectrum: 2020 WU5



Phased Plot: 2020 WU5



Number	Name	2021/mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
2000	WU5	01/12-01/19	*14.9, 56.6	105	13	5.574	0.002	0.84	0.08	PHA

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).

Observatory (IAU code)	Instrumentation
Astronomical Observatory, University of Siena (K54)	0.30-m MCT f/5.6 telescope, SBIG STL-6303e CCD, Clear filter
M57 Observatory (K38)	0.30-m RCT f/5.5 telescope, SBIG STT-1603 CCD camera, Clear filter
GiaGa Observatory (203)	0.36-m SCT f/5.8 telescope, Moravian G2-3200 CCD, Clear filter
GAMP – San Marcello Pistoiese (104)	0.60-m NRT f/4.0 telescope, Apogee Alta CCD, Clear filter

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

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ROTATIONAL PERIOD AND LIGHTCURVE DETERMINATION OF 2020 UQ6: A SUPER FAST ROTATOR

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The lightcurve and rotation period determination for 2020 UQ6 are reported based on observations made in late October 2020. 2020 UQ6 is a super-fast rotator with a period of 0.04521 +/- 0.000001 h.

The aim of this research was to find the rotational period and lightcurve of 2020 UQ6. This asteroid is a Near-Earth object belonging to the Apollo group discovered at Tokyo-Kiso Observatory (MPC code 381) on 2020 October 27. Based on the latest orbit computations performed by the Jet Propulsion Laboratory (JPL, 2020), it is confirmed that 2020 UQ6 is not going to impact Earth in the near future (it is not a potentially hazardous asteroid).

It has a semi-major axis of 2.352 AU, orbital period of 3.62 years, eccentricity of 0.760°, and inclination of 4.516°. JPL Small-Body Database Browser reports an absolute magnitude $H = 22.6$, with an estimated diameter of 80 to 180 meters, respectively for medium and low albedo object type (JPL, 2020).

CCD photometric observation of 2020 UQ6 were carried out in 2×2 binned format during the night between 2020 October 28 and 29 by using the main telescope of the Osservatorio Salvatore di Giacomo, Agerola (MPC code L07). It is a 0.50-m Ritchey-Chretien operating at f/8 equipped with an unfiltered FLI-PL4240 CCD camera (2048×2048 array of 13.5-micron pixels).

All images were astrometrically aligned, dark and flat-field corrected using *Maxim DL* software. *MPO Canopus* (Warner, 2017) was used to measure the magnitudes, perform Fourier analysis, and produce the final lightcurve. In particular, data were reduced in *MPO Canopus* using differential photometry. Night-to-night zero-point calibration was accomplished by selecting up to five comparison stars with near-solar colors using the “comp star selector” feature.

To analyze the data points, the ATLAS star catalog (Torny 2018) was used for determining the comparison star magnitudes. The “StarBGone” routine within *MPO Canopus* was used to subtract stars that occasionally merged with the asteroid during the observations. *MPO Canopus* was also used for rotation period analysis. The software employs a FALC Fourier analysis algorithm developed by Harris (Harris et al., 1989).