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.

References

DSFTA (2021). Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente – Astronomical Observatory. *https://www.dsfta.unisi.it/en/research/labs/astronomical-observatory*

Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gyptis." *Icarus* **57**, 251-258.

JPL (2021). Small-Body Database Browser. *http://ssd.jpl.nasa.gov/sbdb.cgi#top*

NEODyS-2 (2021). Near Earth Objects - Dynamic Site 2 web site. *https://newton.spacedys.com/neodys/index.php*

UAI (2021). "Unione Astrofili Italiani" web site. *https://www.uai.it*

Warner, B.D.; Harris, A.W.; Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2020 Oct. *http://www.minorplanet.info/lightcurvedatabase.html*

Warner, B.D. (2018). MPO Software, MPO Canopus v10.7.7.0. Bdw Publishing. *http://minorplanetobserver.com*

WISE (2021). Wide-field Infrared Survey Explorer web site. *https://www.jpl.nasa.gov/missions/wide-field-infrared-survey-explorer-wise/*

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

Ernesto Guido
AstroCampania ETS, Naples, Italy
Osservatorio Salvatore Di Giacomo (L07)
Via Salvatore Di Giacomo 7b
Agerola (Na) Italy
comets77@astrocampania.it

Antonio Catapano, Alfonso Noschese, Antonio Vecchione
AstroCampania ETS, Naples, Italy
Osservatorio Salvatore Di Giacomo (L07)
Via Salvatore Di Giacomo 7b, 80051
Agerola (Na) Italy

(Received: 2020 Nov 3)

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 (2048×2048array 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).

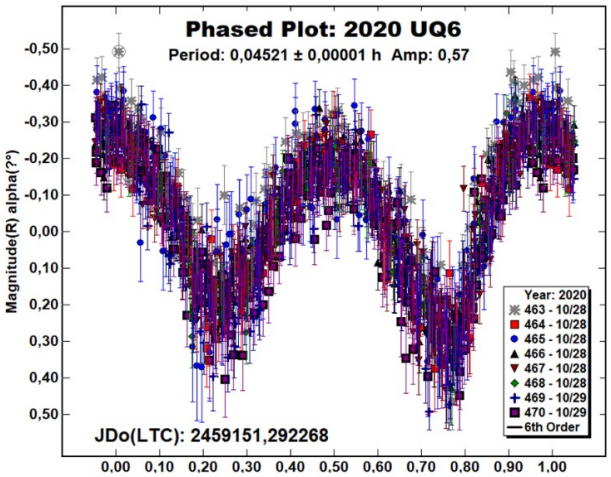
Number	Name	2020 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
	2020 UQ6	10/28-10/29	15.39,13.25	43	-1	0.04521	0.0001	0.57	0.02	NEA

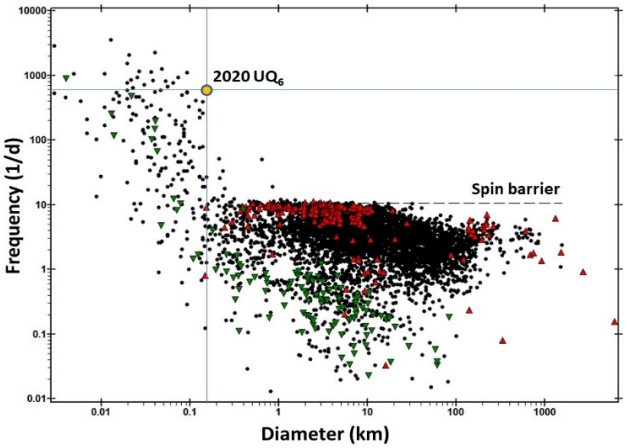
Table I. Observing circumstances and results. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

2020 UQ6 proved to be challenging since the rate of sky motion and potentially fast rotation required using short exposures and dealing with the subsequent low (but useful) SNR values. In order to take in account both the high speed of the object (ranging from 21.48 arcec/min to 17.46 arcsec/min during the measurements) and to avoid rotational smearing (Pravec, 2000), which typically leading to a loss of rotation information or to an amplitude significantly underestimated, exposure times were kept to 4 s for all sessions.

Eight observation sessions collected 1373 data points for lightcurve analysis. This led to a bimodal lightcurve with a period of 0.04521 h (162.76 s), or a frequency of 530.84 rev/d, and an amplitude of 0.57 magnitudes. This finding identifies this object as a super-fast rotator asteroid (P << 2 h). This puts it beyond the rotation rate barrier of 11 rev/d for rubble piles.

It can be speculated that the asteroid is most likely strength-bound rather than gravity-bound. Moreover, from the absolute magnitude value of H = 22.6 and assuming the asteroid to be a spherical object with a uniform surface and albedo ranging from 0.05 and 0.30, one can gets an estimated diameter ranging from 80 and 180 m. From this, it is possible to add the average value of the estimated diameter, D = 130 m, to the frequency vs diameter plot from LCDB. As it can be observed, 2020 UQ6 is located in an uncrowded region of the graph (identified by a yellow point), making this object particularly noteworthy.





Acknowledgements

The authors gratefully acknowledge Lorenzo Franco for his valuable discussions and suggestions.

References

JPL (2020). Small-Body Database Browser. *https://ssd.jpl.nasa.gov/sbdb.cgi*

Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gyptis." *Icarus* **57**, 251-258.

Harris, A.W.; Young, J.W.; Bowell, E.; Martin, L.J.; Millis, R.L.; Poutanen, M.; Scaltriti, F.; Zappala, V.; Schober, H.J.; Debehogne, H.; Zeigler, K.W. (1989). "Photoelectric Observations of Asteroids" 3, 24, 60, 261, and 863." *Icarus* **77**, 171-186.

Pravec, P.; Hergenrother, C.; Whiteley, R.; Sarounova, L.; Kusnirak, P. (2000). "Fast Rotating Asteroids 1999 TY2, 1999 SF10, and 1998 WB2." *Icarus* **147**, 477-486.

Tonry, J.L.; Denneau, L.; Flewelling, H.; Heinze, A.N.; Onken, C.A.; Smartt, S.J.; Stalder, B.; Weiland, H.J.; Wolf, C. (2018). "The ATLAS All-Sky Stellar Reference Catalog." *Astrophys. J.* **867**, A105.

Warner, B.D.; Harris, A.W.; Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2020 Aug. *http://www.minorplanet.info/lightcurvedatabase.html*

Warner, B.D. (2017). MPO Software, *MPO Canopus* version 10.7.11.1 Bdw Publishing. *http://minorplanetobserver.com*