

**CCD PHOTOMETRIC OBSERVATIONS OF ASTEROIDS
4493 NAITOMITSU, (21242) 1995 WZ41,
(68130) 2001 AO17, AND (183230) 2002 TC58**

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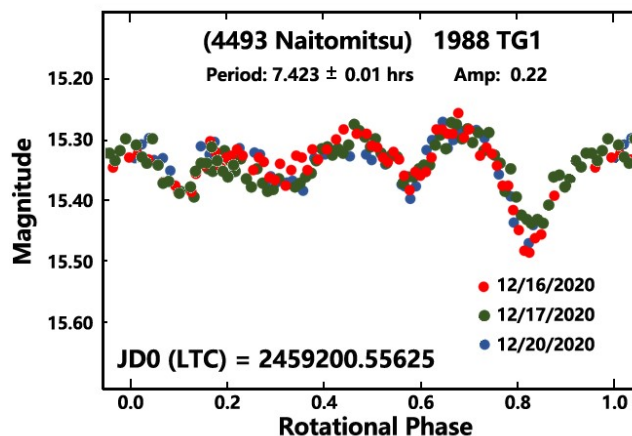
CCD Photometric observations of asteroids 4493 Naitomitsu, (21242) 1995 WZ41, (68130) 2001 AO17, and (183230) 2002 TC58 were conducted from the Star Z Research Ranch in South Texas. The results found are 4493 Naitomitsu 7.423 ± 0.01 hr, amplitude 0.22 mag.; 1995 WZ41 5.456 ± 0.01 hr, amplitude 0.47 mag.; 2001 AO17 10.515 ± 0.01 hr, amplitude 0.34 mag.; 2002 TC58 3.616 ± 0.01 hr, amplitude 0.14 mag.

The photometric observations described in this paper were conducted from the Star Z Research Ranch, which is located at a dark sky site, 19 kilometers south of the Town of George West, Texas. Throughout this research program, a Meade 0.35-m LX600 Schmidt Cassegrain telescope was used. The telescope is housed within a converted eight by sixteen-foot Wells Cargo trailer with a hinged roof, which in turn sets upon four steel jacks resting on a concrete slab. The telescope pier itself rests upon a heavy steel tripod, independent of the trailer, to minimize vibrations. An SBIG STXL 6303 camera thermoelectrically cooled to -35°C was used to make the photometric observations. The photometric exposures were all 120 seconds in length and were dark subtracted and flat-fielded. To preserve the maximum light intensity of the objects observed, no filters were placed in the optical path during the observations.

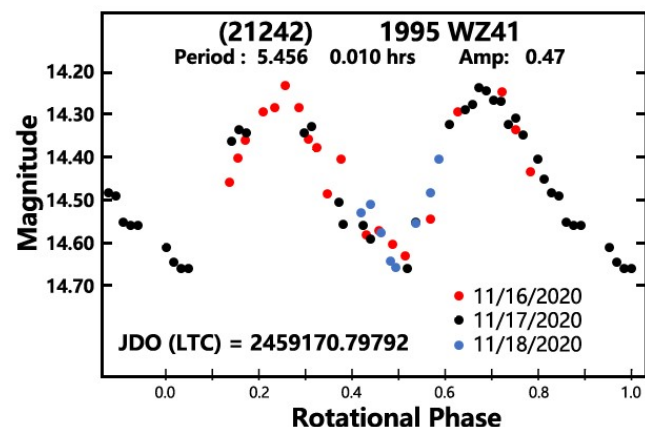
The brightness of the asteroid was compared to that of three comparison stars in the same CCD frame. The average instrumental magnitude of the three stars was determined and this average was subtracted from the instrumental magnitude of the asteroid. A constant was then added to approximate the visual magnitude. The instrumental magnitude of the three comparison stars with respect to one another was continuously monitored in the event that one of them was determined to be a short period variable star. The target brightness was determined by measuring a 121-pixel (11×11 pixel) sample surrounding the asteroid or star in question. This corresponds to a 7.15×7.15 arcsec box. When possible, the same comparison stars were used during consecutive nights of observation. The coordinates of the asteroid and its approximate visual magnitude on any specific night were obtained from the online Lowell Minor Planet Services. This information was also used to compensate for the effect of the asteroid's changing distance from the sun and earth on its visual magnitude when vertically aligning the photometric data points from different nights in the construction of a composite lightcurve.

4493 Naitomitsu was discovered on October 14, 1988 by T. Kojima in Chiyoda, Japan. It was named for is the mother of the first female Japanese astronaut, Chiaki Mukai. The orbit of the asteroid has a semi-major axis of 3.22 astronomical units with an orbital period of 5.25 years. This asteroid was observed by Behrend (2009web), who determined a 5.04-hour rotational period

based upon a partial lightcurve. This asteroid was observed from the Star Z Research Ranch on three separate nights between December 16 and December 20, 2020. On two of these nights, the asteroid was observed long enough to obtain a complete rotational cycle. On each of these nights, measurements were taken once every 5 minutes. The lightcurve of the asteroid is very atypical, displaying four distinct maxima and minima per rotational cycle. One of the minima is twice as deep as any of the others. This characteristic was observed on each of the three nights of observation. A composite lightcurve with a period of 7.423 ± 0.01 hours best fits the available data. The lightcurve has an amplitude of 0.22 magnitudes, as shown in the accompanying figure.



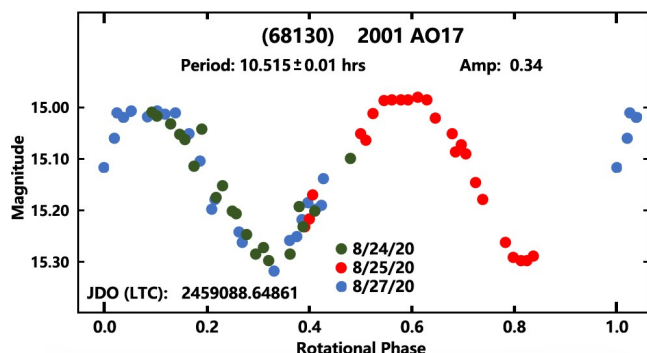
(21242) 1995 WZ41 was discovered by S. Uedav and H. Kaneda, at Kushiro, Japan on November 25, 1995. With a semi-major axis of 2.34 astronomical units, and an eccentricity of 0.281, it is located in the inner region of the main belt and at perihelion, approaches the orbit of Mars. According to the Lightcurve Data Base (Warner et al. 2009), as of October 2020, a rotational period for this asteroid has not yet been determined. This asteroid was observed from the Star Z Research Ranch on the nights of November 16, 17, and 18, 2020. The asteroid was determined to have a rotational period of 5.456 ± 0.01 hours, with a lightcurve amplitude of 0.47 magnitudes. The lightcurve is characterized by two maxima and two minima per rotational cycle. The two maxima are virtually identical in shape, and are of equal brightness. The minima are also very similar to each other.



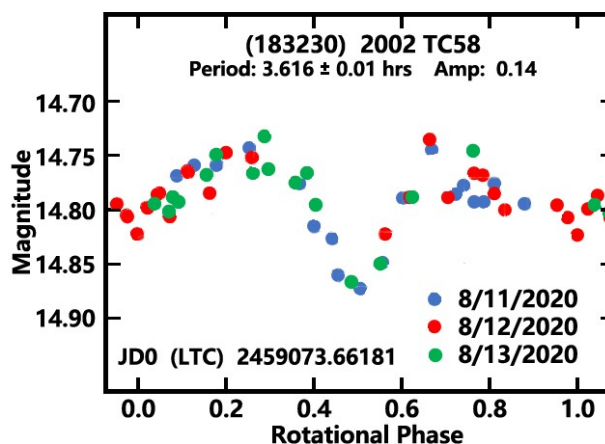
Number	Name	yyyy mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
4493	Naitomitsu	2020 12/16-12/20	5.1, 6.4	--	--	7.423	0.010	0.22	0.02	
21242	1995 WZ41	2020 11/16-11/18	-2.2, 1.0	--	--	5.456	0.010	0.47	0.02	
68130	2001 AO17	2020 08/24-8/27	-2.7, 2.8	--	--	10.515	0.010	0.34	0.02	
183230	2002 TC58	2020 08/11-8/13	-7.5, -7.8	--	--	3.616	0.010	0.14	0.02	

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).

(68130) 2001 AO17 was discovered on January 2, 2001 by the LINEAR Survey at Socorro, New Mexico. Its orbit has a semi-major axis of 2.67 astronomical units, placing it at about the middle of the main belt. This asteroid was observed from the Star Z Research Ranch on the nights of August 24, 25, and 27, 2020. The composite lightcurve displays two symmetrical maxima and minima per rotational cycle. A rotational period of 10.515 ± 0.01 hours, with a lightcurve amplitude of 0.34 magnitudes best fits the observations. According to the October 2020 update of the LCDB, Asteroid 68130 had been previously observed by Pál et al. (2020), who determined a rotational period of 10.479 hours. This is close to the value presented here.



(183230) 2002 TC58 was discovered on January 21, 1990 by T Hioki and S. Hayakawa. It orbits the sun at a distance between 1.81 and 2.90 astronomical units, making it an inner main belt asteroid. This asteroid was observed on August 11, 12, and 13, 2020. A rotational period of 3.616 ± 0.01 hours was determined. The asteroid displays two maxima and minima per rotational cycle. Although the maxima have approximately the same brightness, one minimum is only about 0.05 magnitudes fainter than the two maxima, while the second minimum is about 0.14 magnitudes fainter than the maxima. An examination of the October 2020 update of the Asteroid Lightcurve Database reveals that this asteroid currently has no published lightcurves.



References

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