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CALL FOR OBSERVATIONS

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Observers who have made visual, photographic, or CCD measurements of positions of minor planets in calendar year 2020 are encouraged to report them to this author on or before 2021 April 1. This will be the deadline for receipt of reports, for which results can be included in the "General Report of Position Observations for 2020," to be published in *MPB* Vol. 48, No. 3.

NEAR-EARTH ASTEROID LIGHTCURVE ANALYSIS AT THE CENTER FOR SOLAR SYSTEM STUDIES: 2020 SEPTEMBER TO 2021 JANUARY

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Lightcurves of 22 Near-Earth asteroids (NEAs) obtained at the Center for Solar System Studies (CS3) from 2020 October to early 2021 January were analyzed for rotation period, peak-to-peak amplitude, and signs of satellites or tumbling.

CCD photometric observations of 22 near-Earth asteroids (NEAs) were made at the Center for Solar System Studies (CS3) from 2020 September to early 2021 January. Table I lists the telescopes and CCD cameras that were combined to make observations.

Up to nine telescopes can be used for the campaign, although seven is more common. All the cameras use CCD chips from the KAF blue-enhanced family and so have essentially the same response. The pixel scales ranged from 1.24-1.60 arcsec/pixel.

Telescopes	Cameras
0.30-m *f*/6.3 Schmidt-Cass	FLI Microline 1001E
0.35-m *f*/9.1 Schmidt-Cass	FLI Proline 1001E
0.40-m *f*/10 Schmidt-Cass	SBIG STL-1001E
0.40-m *f*/10 Schmidt-Cass	
0.50-m *f*/8.1 Ritchey-Chrétien	

Table I. List of available telescopes and CCD cameras at CS3. The exact combination for each telescope/camera pair can vary due to maintenance or specific needs.

All lightcurve observations were unfiltered since a clear filter can cause a 0.1-0.3 mag loss. The exposure duration varied depending on the asteroid's brightness and sky motion. Guiding on a field star sometimes resulted in a trailed image for the asteroid.

Measurements were made using *MPO Canopus*. The Comp Star Selector utility in *MPO Canopus* found up to five comparison stars of near solar-color for differential photometry. To reduce the number of times and amounts of adjusting nightly zero points, we use the ATLAS catalog r′ (SR) magnitudes (Tonry et al., 2018). Those adjustments are usually ≤ ±0.03 mag. The rare greater corrections may have been related in part to using unfiltered observations, poor centroiding of the reference stars, and not correcting for second-order extinction. Another cause may be selecting what appears to be a single star but is actually an unresolved pair.

The Y-axis values are ATLAS SR "sky" (catalog) magnitudes. The two values in the parentheses are the phase angle (a) and the value of *G* used to normalize the data to the comparison stars used in the earliest session. This, in effect, had all the observations made at a single fixed date/time and phase angle, leaving any variations due only to the asteroid's rotation and/or albedo

2021MPBu...48..170W

2021MPBu...48..170W

2021MPBu...48..170W

2021MPBu...48..170W

2021MPBu...48..170W

2021MPBu...48..170W

2021MPBu...48..170W

> *My full 2-period Fourier series analysis shows [the] following three periods with the highest signal: 1.879, 2.879 and 5.407 h. Two of the three are real periods of the tumbler, while a third one is related to them; note that 1/2.879 = 1/1.879 - 1/5.407. However, we cannot resolve which two of the three are the real ones based just on this analysis. ... future physical modeling may reveal it.*

His plot shows the two stronger periods of 1.879 h and 5.407 h and how confused lightcurves can be with a tumbling asteroid since the lightcurve almost never repeats itself. It can come close, as on Nov 13 and 15, but those are unlikely solutions, even though they are each close to the period of 2.879 h found by Pravec.

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Number	Name	2020 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.
2212	Hephaistos	10/19-10/28	6.2,2.9	43	3	48	0.2	0.35	0.04
2368	Beltrovata	12/18-12/20	1.8,2.5	85	3	5.786	0.003	0.91	0.03
7753	1988 XB	11/29-12/12	60.5,18.2	96	1	42.2	0.2	0.65	0.05
10115	1992 SK	10/21-10/25	*18.0,15.8	36	9	7.342	0.004	0.58	0.04
16834	1997 WU22	11/16-11/20	6.4,6.9	53	10	9.32	0.01	0.31	0.03
21088	Chelyabinsk	12/15-12/19	22.8,21.1	124	5	11.23	0.01	0.34	0.03
66272	1999 JW6	11/14-12/20	*23.3,34.8	68	8	[T1]502	5	0.58	0.05
						[T2]401	5	0.4	0.1
						[3]15.99	0.01	0.07	0.02
68359	2001 OZ13	11/23-12/05	23.9,30.7	44	-13	18.07	0.02	0.27	0.04
69230	Hermes	10/08-10/15	12.5,22.1	4	-5	13.82	0.02	0.08	0.01
144411	2004 EW9	10/19-10/25	23.6,18.7	47	15	50	0.2	0.81	0.05
153201	2000 WO107	12/06-12/12	18.8,28.1	62	3	5.022	0.001	1.22	0.05
154302	2002 UQ3	10/14-10/19	17.7,14.5	36	13	4.328	0.002	0.22	0.03
159402	*1999 AP10*	*08/24-09/17*	**11.3,12.4*	*341*	*-5*	*[P]7.9219*	*0.0003*	*0.27*	*0.02*
						28.461	*0.006*	*0.06*	*0.01*
159402	*1999 AP10*	*10/02-10/07*	*26.3,32.9*	*356*	*9*	*[P]7.9186*	*0.0004*	*0.33*	*0.02*
						29.30	*0.01*	*0.04*	*0.01*
159402	1999 AP10	01/04-01/04	24.4	112	18	7.937	0.005	0.35	0.02
163902	2003 SW222	12/06-12/12	25.7,22.7	78	19	4.76	0.01	0.11	0.02
275714	2000 YH4	12/15-12/19	50.2,45.0	55	-10	4.438	0.003	0.29	0.03
465749	2009 WO6	11/19-11/29	36.1,34.4	97	4	86.2	0.5	1.19	0.06
474179	1999 VS6	10/27-11/03	24.0,32.9	49	10	15.88	0.02	0.33	0.04
	2000 TU28	10/07-10/18	*32.6,25.2	35	1	128.5	0.5	1.55	0.10
	2002 GZ8	12/06-12/19	43.4,61.3	110	19	25.448	0.005	1.06	0.03
	2003 YJ	12/15-12/22	34.1,39.0	66	-11	3.255	0.001	0.22	0.04
	2013 UX14	10/02-10/18	51.6,45.4	48	-8	33.119	0.006	0.46	0.03
	2020 ST1	11/13-11/15	*5.9,3.8	52	1	2.875	0.003	1.2	0.06

Table III. Observing circumstances. [P]Period of the primary in a binary system. [T1,2]Period associated with tumbling. [3]Third period in a solution. The phase angle (α) is given at the start and end of each date range. If there is an asterisk before the first phase value, the phase angle reached a maximum or minimum during the period. L_{PAB} and B_{PAB} are, respectively the average phase angle bisector longitude and latitude (see Harris et al.,1984). The results for 159402 in 2020 (in italics) are shown here for comparison (see Warner and Stephens, 2021).

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