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LIGHTCURVE PHOTOMETRY OPPORTUNITIES: 2020 OCTOBER-DECEMBER

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We present lists of asteroid photometry opportunities for objects reaching a favorable apparition and have no or poorly-defined lightcurve parameters. Additional data on these objects will help with shape and spin axis modeling using lightcurve inversion. We also include lists of objects that will or might be radar targets. Lightcurves for these objects can help constrain pole solutions and/or remove rotation period ambiguities that might come from using radar data alone.

We present several lists of asteroids that are prime targets for photometry during the period 2020 October-December.

In the first three sets of tables, "Dec" is the declination and "U" is the quality code of the lightcurve. See the latest asteroid lightcurve data base (LCDB from here on; Warner et al., 2009a) documentation for an explanation of the U code:

<http://www.minorplanet.info/lightcurvedatabase.html>

The ephemeris generator on the CALL web site allows you to create custom lists for objects reaching $V \leq 18.0$ during any month in the current year and up to five years in the future, e.g., limiting the results by magnitude and declination, family, and more.

http://www.minorplanet.info/PHP/call_OppLCDBQuery.php

We refer you to past articles, e.g., Warner et al. (2009b) for more detailed discussions about the individual lists and points of advice regarding observations for objects in each list.

Once you've obtained and analyzed your data, it's important to publish your results. Papers appearing in the *Minor Planet Bulletin* are indexed in the Astrophysical Data System (ADS) and so can be referenced by others in subsequent papers. It's also important to make the data available at least on a personal website or upon request. We urge you to consider submitting your raw data to the ALCDEF database. This can be accessed for uploading and downloading data at

<http://www.alcdef.org>

Containing almost 3.7 million observations for 14952 objects (2020 March 30), this makes the site one of the larger publicly available sources for raw asteroid time-series lightcurve data.

Now that many backyard astronomers and small colleges have access to larger telescopes, we have expanded the photometry opportunities and spin axis lists to include asteroids reaching $V = 15.5$ and brighter (sometimes 15.0 when the list has too many potential targets).

Lightcurve/Photometry Opportunities

Objects with $U = 3-$ or 3 are excluded from this list since they will likely appear in the list for shape and spin axis modeling. Those asteroids rated $U = 1$ should be given higher priority over those rated $U = 2$ or $2+$, but not necessarily over those with no period. On the other hand, *do not overlook asteroids with $U = 2/2+$ on the assumption that the period is sufficiently established.* Regardless, do not let the existing period influence your analysis since even highly-rated result have been proven wrong at times. Note that the lightcurve amplitude in the tables could be more or less than what's given. Use the listing only as a guide.

An entry in bold italics is a near-Earth asteroid (NEA).

Number	Name	Brightest			LCDB Data		U
		Date	Mag	Dec	Period	Amp	
2534	Houzeau	10 02.9	14.6	+3	53.237	0.22	2
3989	Odin	10 03.2	15.0	+9			
2252	CERGA	10 03.7	15.4	+6			
1024	Hale	10 04.3	13.7	-16	16.	0.10	1+
2819	Ensor	10 05.0	14.1	+4			
1654	Bojeva	10 05.4	14.3	+1	10.5559	0.27	2
842	Kerstin	10 05.9	14.5	+8			
21182	1994 EC2	10 09.0	14.5	+9			
8556	Jana	10 09.4	14.7	-4			
2300	Stebbins	10 10.8	15.0	+6			
1526	Mikkeli	10 12.3	14.9	+15		0.51	
6014	Chribrenmark	10 15.0	14.9	+8			
1935	Lucerna	10 16.1	14.8	+8			
1498	Lahti	10 16.6	15.0	+27	58.	0.8	1+
570	Kythera	10 16.8	12.7	+10	8.12	0.12-0.20	2
30717	1937 UD	10 17.8	14.7	+6			
2913	Horta	10 18.6	14.6	+7			
8651	Alineraynal	10 19.8	15.0	+15		0.32	
859	Bouzareah	10 27.6	13.5	+12	23.2	0.13	2-
4103	Chahine	10 28.4	13.7	+29		0.35	
2976	Lautaro	10 31.2	14.6	+11	17.41	0.12	2-
1351	Uzbekistania	11 05.1	14.1	+23	73.9	0.34-0.34	2
1578	Kirkwood	11 09.7	14.3	+16	12.518	0.05-0.22	2
1042	Amazone	11 18.8	14.1	+22	540.	0.10-0.25	2
21242	1995 WZ41	11 18.8	14.2	+20			
137311	1999 TX9	11 18.9	14.6	+30		0.46	
3398	Stattmayer	11 20.1	15.0	+12	8.28	0.13	2+
2191	Uppsala	11 21.5	14.8	+22			
838	Seraphina	11 22.2	13.4	+20	15.67	0.07-0.30	2
2312	Duboshin	11 22.6	14.5	+20	50.78	0.15	2+
2263	Shaanxi	11 22.7	14.9	+22	41.7	0.36	2-
12193	1979 EL	11 24.0	14.9	+7	7.5766	0.35-0.41	2+
748	Simeisa	11 25.4	13.4	+22	11.919	0.22-0.36	2
7288	1991 FE1	11 27.1	14.8	+27	4.89	0.47	2
8823	1987 WS3	11 29.4	14.4	+20			
1934	Jeffers	11 29.8	14.0	+4			
153201 2000 WO107		12 01.1	13.2	+25			
4493	Naitomitsu	12 04.2	15.0	+25	5.04	0.07	1+
2950	Rousseau	12 14.0	14.1	+14	18.228	0.30	2
1213	Algeria	12 22.1	15.0	+24	>16.	0.19	2
8532	1992 YW3	12 24.2	14.9	+25	>30.	0.35	2
931	Whitemora	12 26.3	12.4	+18	19.199	0.15-0.25	2+

Low Phase Angle Opportunities

The Low Phase Angle list includes asteroids that reach very low phase angles. The " α " column is the minimum solar phase angle for the asteroid. Getting accurate, calibrated measurements (usually V band) at or very near the day of opposition can provide important information for those studying the "opposition effect."

Use the on-line query form for the LCDB to get more details about a specific asteroid.

http://www.minorplanet.info/PHP/call_OppLCDBQuery.php

You will have the best chance of success working objects with low amplitude and periods that allow covering at least half a cycle every night. Objects with large amplitudes and/or long periods are much more difficult for phase angle studies since, for proper analysis, the data must be reduced to the average magnitude of the asteroid for each night. This reduction requires that you determine the period and the amplitude of the lightcurve; for long period objects that can be difficult. Refer to Harris et al. (1989) for the details of the analysis procedure.

As an aside, some use the maximum light to find the phase slope parameter (G). However, this can produce significantly different values for both H and G versus when using average light, which is the method used for values listed by the Minor Planet Center.

The International Astronomical Union (IAU) has adopted a new system, $H-G_{12}$, introduced by Muinonen et al. (2010). It will be some years before $H-G_{12}$ becomes widely used. Furthermore, it still needs refinement. That can be done mostly by having data for more asteroids, but only if at very low and moderate phase angles. We strongly encourage obtaining data every degree between 0° to 7° , the non-linear part of the curve that is due to the opposition effect. At angles $\alpha > 7^\circ$, well-calibrated data every 2° or so out to about $25-30^\circ$, if possible, should be sufficient. Coverage beyond about 50° is not generally helpful since the $H-G$ system is best defined with data from $0-30^\circ$.

Num	Name	Date	α	V	Dec	Period	Amp	U
3280	Gretry	09 04.6	0.84	14.5	-05	10.56	0.35-0.51	3-
573	Recha	09 06.3	0.18	12.8	-06	7.166	0.20-0.34	3
805	Hormuthia	09 06.7	0.37	13.3	-05	9.510	0.05	3-
147	Protogeneia	09 10.9	0.93	12.8	-02	7.853	0.25-0.28	3
586	Thekla	09 14.1	0.64	13.5	-02	13.670	0.24-0.30	3
399	Persephone	09 17.6	0.90	13.5	+01	9.136	0.40	3
434	Hungaria	09 19.1	0.56	12.3	-02	26.521	0.51-0.75	3
616	Elly	09 24.3	0.95	13.9	+03	5.297	0.34-0.44	3
91	Aegina	09 24.6	0.26	11.8	+00	6.025	0.12-0.27	3
1692	Subbotina	09 25.2	0.48	14.3	+02	9.246	0.30	3
1576	Fabiola	09 27.9	0.17	14.5	+02	6.889	0.2	-0.26 3-
2534	Houzeau	10 02.9	0.19	14.5	+03	53.237	0.22	2
2819	Ensor	10 05.1	0.22	14.1	+04			
331	Etheridgea	10 05.8	0.55	13.1	+04	25.315	0.12-0.13	3
644	Cosima	10 08.0	0.86	13.4	+04	7.556	0.20-0.28	3
518	Halawe	10 10.5	0.71	13.0	+08	14.310	0.50-0.55	3
1114	Lorraine	10 12.9	0.44	13.8	+07	20.71	0.15	3-
1059	Mussorgskia	10 15.0	0.17	14.0	+08	5.636	0.2	-0.21 3
570	Kythera	10 16.8	0.31	12.8	+10	8.120	0.12-0.20	2
158	Koronis	10 17.1	0.55	12.8	+11	14.218	0.28-0.43	3
189	Phthia	10 18.2	0.16	11.9	+09	22.346	0.18-0.28	3
439	Ohio	10 18.7	0.71	13.9	+08	37.46	0.20-0.24	3
326	Tamara	10 22.7	0.89	12.3	+09	14.445	0.10-0.27	3
180	Garumna	10 22.8	0.49	13.7	+13	23.866	0.27-0.6	3
67	Asia	10 24.6	0.74	10.7	+10	15.853	0.22-0.26	3
953	Painleva	10 26.4	0.31	13.6	+12	7.389	0.05-0.05	2-
859	Bouzareah	10 27.5	0.23	13.5	+12	23.2	0.13	2-
401	Ottilia	10 29.8	0.09	13.6	+14	6.049	0.11-0.24	3
761	Brendelia	11 02.5	0.36	14.5	+16	57.96	0.25	2+
499	Venusia	11 03.2	0.54	13.8	+17	13.48	0.33-0.36	3
268	Adorea	11 07.9	0.96	13.0	+13	7.80	0.15-0.20	3
1150	Achaia	11 09.4	0.92	14.0	+15	60.99	0.72	3
1578	Kirkwood	11 09.6	0.21	14.3	+16	12.518	0.05-0.22	2
82	Alkmene	11 10.6	0.68	11.6	+19	12.999	0.18-0.54	3
215	Oenone	11 13.0	0.42	12.9	+19	27.937	0.1	-0.20 3
379	Huenna	11 13.9	0.79	12.5	+16	14.141	0.07-0.12	3
528	Rezia	11 14.2	0.26	13.7	+19	7.337	0.36-0.39	3
235	Carolina	11 16.8	0.88	13.0	+16	17.610	0.25-0.38	3
21242	1995 WZ41	11 18.8	0.26	14.2	+20			
1042	Amazone	11 18.9	0.78	14.1	+22	540.	0.10-0.25	2
266	Aline	11 19.0	0.18	11.5	+19	13.018	0.05-0.10	3
157	Dejanira	11 21.2	0.54	13.3	+19	15.825	0.33-0.52	3
1810	Epimetheus	11 21.4	0.97	14.5	+22	28.61	0.04	2
838	Seraphina	11 22.2	0.13	13.4	+20	15.67	0.07-0.30	2
367	Amicitia	11 24.7	0.89	12.8	+19	5.055	0.25-0.90	3

Num	Name	Date	α	V	Dec	Period	Amp	U
748	Simeisa	11 25.4	0.38	13.4	+22	11.919	0.22-0.36	2
8823	1987 WS3	11 29.5	0.97	14.3	+20			
2215	Sichuan	11 30.1	0.51	13.6	+21	3.975	0.38-0.39	3
178	Belisana	12 01.2	0.38	12.5	+23	12.323	0.08-0.18	3
2617	Jiangxi	12 06.0	0.13	13.0	+23	11.77430	0.28-0.57	3
2112	Ulyanov	12 07.9	0.70	13.9	+21	3.041	0.32-0.36	3
171	Ophelia	12 09.3	0.49	12.3	+21	6.665	0.14-0.46	3
4729	Mikhailmil'	12 09.4	0.31	14.1	+22	17.74	0.36	2-
243	Ida	12 09.8	0.58	13.5	+24	4.634	0.45-0.86	3
2233	Kuznetsov	12 10.0	0.56	14.4	+22	5.031	0.23-0.25	3
423	Diotima	12 11.6	0.93	11.6	+26	4.775	0.05-0.20	3
940	Kordula	12 13.8	0.72	14.1	+26	15.57	0.36	3
2831	Stevin	12 14.2	0.13	14.5	+23			
1348	Michel	12 15.0	0.34	13.8	+22	8.095	0.43-0.47	3
2536	Kozyrev	12 17.6	0.71	14.5	+25	7.196	0.26-0.52	3
792	Metcalfia	12 22.8	0.67	13.0	+22	9.17	0.15-0.76	3
1137	Raissa	12 26.6	0.84	13.5	+25	142.79	0.56-0.56	3-
440	Theodora	12 27.2	0.46	13.1	+24	4.828	0.43-0.72	3
774	Armor	12 29.5	0.99	13.8	+20	25.107	0.11-0.34	2

Shape/Spin Modeling Opportunities

Those doing work for modeling should contact Josef Ďurech at the email address above. If looking to add lightcurves for objects with existing models, visit the Database of Asteroid Models from Inversion Techniques (DAMIT) web site

<https://astro.troja.mff.cuni.cz/projects/damit/>

Additional lightcurves could lead to the asteroid being added to or improving one in DAMIT, thus increasing the total number of asteroids with spin axis and shape models.

Included in the list below are objects that:

1. Are rated U = 3- or 3 in the LCDB.
2. Do not have reported pole in the LCDB Summary table.
3. Have at least three entries in the Details table of the LCDB where the lightcurve is rated U $\geq$ 2.

The caveat for condition #3 is that no check was made to see if the lightcurves are from the same apparition or if the phase angle bisector longitudes differ significantly from the upcoming apparition. The last check is often not possible because the LCDB does not list the approximate date of observations for all details records. Including that information is an on-going project.

Favorable apparitions are in bold text. NEAs are in italics.

Num	Name	Date	Brightest Mag	Dec	Period	LCDB Data Amp	U
8256	Shenzhou	10 03.5	14.9	-4	3.395	0.30-0.32	3
2189	Zaragoza	10 04.7	15.1	-17	4.9281	0.17-0.91	3
6265	1985 TW3	10 06.1	14.8	+1	2.7093	0.26-0.36	3
754	Malabar	10 06.5	13.4	-3	11.74	0.19-0.38	3
1590	Tsiolkovskaja	10 06.7	14.1	+9	6.731	0.10- 0.4	3
713	Luscinia	10 07.5	12.8	+11	9.9143	0.09-0.40	3
1115	Sabauda	10 08.4	14.5	-12	6.718	0.16-0.27	3
4132	Bartok	10 09.3	13.9	-12	3.297	0.32-0.44	3
194	Prokne	10 11.6	10.7	-11	15.679	0.08-0.27	3
102	Miriam	10 12.3	11.0	+9	23.613	0.04-0.14	3
1171	Rusthawelia	10 12.3	13.2	+3	10.98	0.26-0.31	3
2346	Lilio	10 17.3	14.3	+16	3.031	0.20-0.31	3
657	Gunlod	10 17.6	15.3	+24	15.6652	0.19-0.20	3
326	Tamara	10 22.5	12.3	+9	14.445	0.10-0.27	3
67	Asia	10 24.4	10.7	+10	15.853	0.22-0.26	3
618	Elfriede	10 29.1	12.9	-9	14.791	0.11-0.17	3
255	Oppavia	11 02.2	14.2	+21	19.499	0.14-0.16	3
635	Vundtia	11 02.7	13.2	+5	11.79	0.15-0.27	3
2074	Shoemaker	11 03.1	15.2	-5	2.5328	0.06-0.13	3
1520	Imatra	11 06.6	14.4	+27	18.635	0.27-0.35	3-
3028	Zhangguoxi	11 07.6	15.0	+9	4.826	0.12-0.25	3
252	Clementina	11 09.8	13.9	+11	10.864	0.32-0.44	3
3155	Lee	11 10.3	14.5	+22	8.31	0.22- 0.4	3
373	Melusina	11 11.0	13.3	+35	12.97	0.20-0.25	3
1453	Fennia	11 12.3	15.0	+52	4.4121	0.10-0.20	3
206	Hersilia	11 13.7	12.2	+12	11.122	0.13-0.20	3

Num	Name	Date	Brightest Mag	Dec	Period	LCDB Data Amp	U
1777	Gehrels	11 14.0	14.9	+23	2.8355	0.21-0.27	3
177	Irma	11 15.0	11.8	+21	13.856	0.24-0.37	3
235	Carolina	11 16.8	13.0	+16	17.61	0.25-0.38	3
1313	Berna	11 18.2	14.2	+39	25.46	0.20-0.58	3
266	Aline	11 19.0	11.4	+19	13.018	0.05-0.10	3
1342	Brabantia	11 25.7	15.0	+51	4.1754	0.17-0.21	3
305	Gordonia	11 26.7	12.1	+17	12.893	0.10-0.23	3
975	Perseverantia	11 27.0	14.1	+23	7.267	0.17-0.23	3
348	May	11 27.3	13.2	+15	7.3812	0.14-0.16	3
232	Russia	11 28.2	14.3	+12	21.905	0.14-0.31	3
53435	1999 VM40	11 28.7	15.0	+43	5.189	0.19-0.38	3
143	Adria	11 30.8	13.4	+38	22.005	0.07-0.10	3
9069	Hovland	12 01.2	14.9	+21	4.217	0.08-0.11	3
74	Galatea	12 04.2	11.5	+17	17.268	0.08-0.16	3
483	Seppina	12 08.0	13.6	-3	12.727	0.14-0.29	3
275	Sapientia	12 09.0	12.6	+17	14.931	0.05-0.12	3-
2448	Sholokhov	12 10.1	15.2	+1	10.059	0.21-0.63	3
26471	Tracybecker	12 12.1	15.2	+29	2.6868	0.18-0.24	3
522	Helga	12 12.5	13.9	+20	8.129	0.13-0.31	3
298	Baptistina	12 20.1	13.6	+35	16.23	0.10-0.25	3
333	Badenia	12 20.5	13.4	+29	9.862	0.20-0.33	3
533	Sara	12 21.2	14.0	+14	11.654	0.19-0.30	3
156	Xanthippe	12 23.6	12.9	+16	22.37	0.10-0.12	3
971	Alsatia	12 26.7	12.5	+29	9.614	0.17-0.29	3
1069	Planckia	12 27.7	13.8	+9	8.665	0.14-0.42	3
3712	Kraft	12 28.5	14.2	+40	9.341	0.27-1.20	3

Radar-Optical Opportunities

Past radar targets:

<http://echo.jpl.nasa.gov/~lance/radar.nea.periods.html>

Arecibo available targets:

<http://www.naic.edu/~pradar>

<http://www.naic.edu/~pradar/ephemfuture.txt>

Goldstone available targets:

http://echo.jpl.nasa.gov/asteroids/goldstone_asteroid_schedule.html

These are based on *known* targets at the time the list was prepared. It is very common for newly discovered objects to move up the list and become radar targets on short notice. We recommend that you keep up with the latest discoveries the Minor Planet Center observing tools.

In particular, monitor NEAs and be flexible with your observing program. In some cases, you may have only 1-3 days when the asteroid is within reach of your equipment. Be sure to keep in touch with the radar team (through Benner's email or their Facebook or Twitter accounts) if you get data. The team may not always be observing the target but your initial results may change their plans. In all cases, your efforts are greatly appreciated.

Use the ephemerides below as a guide to your best chances for observing, but remember that photometry may be possible before and/or after the ephemerides given below. Note that *geocentric* positions are given. Use these web sites to generate updated and *topocentric* positions:

MPC: <http://www.minorplanetcenter.net/iau/MPEph/MPEph.html>

JPL: <http://ssd.jpl.nasa.gov/?horizons>

In the ephemerides below, ED and SD are, respectively, the Earth and Sun distances (AU), V is the estimated Johnson V magnitude, and α is the phase angle. SE and ME are the great circle distances (in degrees) of the Sun and Moon from the asteroid. MP is the lunar phase and GB is the galactic latitude. "PHA" indicates that the object is a "potentially hazardous asteroid", meaning that at some (long distant) time, its orbit might take it very close to Earth.

About YORP Acceleration

Many, if not all, of the targets in this section are near-Earth asteroids. These objects are particularly sensitive to YORP acceleration. YORP (Yarkovsky–O’Keefe–Radzievskii–Paddack) is the asymmetric thermal re-radiation of sunlight that can cause an asteroid’s rotation period to increase or decrease. High precision lightcurves at multiple apparitions can be used to model the asteroid’s *sidereal* rotation period and see if it’s changing.

It usually takes four apparitions to have sufficient data to determine if the asteroid rotation rate is changing under the influence of YORP. This is why observing an asteroid that already has a well-known period remains a valuable use of telescope time. It is even more so when considering the BYORP (binary-YORP) effect among binary asteroids that has stabilized the spin so that acceleration of the primary body is not the same as if it would be if there were no satellite.

To help focus efforts in YORP detection, Table I gives a quick summary of this quarter’s radar-optical targets. The family or group for the asteroid is given under the number name. Also, under the name will be additional flags such as “PHA” for Potentially Hazardous Asteroid, NPAR for a tumbler, and/or “BIN” to indicate the asteroid is a binary (or multiple) system. “BIN?” means that the asteroid is a suspected but not confirmed binary. The period is in hours and, in the case of binary, for the primary. The Amp column gives the known range of lightcurve amplitudes. The App columns gives the number of different apparitions at which a lightcurve period was reported while the Last column gives the year for the last reported period. The R SNR column indicates the estimated radar SNR using the tool at

<http://www.naic.edu/~eriverav/scripts/index.php>

The SNRs were calculated using the current MPCORB absolute magnitude (H), a period of 4 hours (2 hours if $D \leq 200$ m) if it’s not known, and the approximate minimum Earth distance during the current quarter. These are estimates only and assume that the radars are fully functional.

If the SNR value is in bold text, the object was found on the radar planning pages listed above. Otherwise, the planning tool at

http://www.minorplanet.info/PHP/call_OppLCDBQuery.php

was used to find known NEAs that were $V < 18.0$ during the quarter. An object is usually placed on the list only if the estimated Arecibo SNR > 10 when using the SNR calculator mentioned above.

It’s rarely the case, especially when shape/spin axis modeling, that there are too many observations. Remember that the best set for modeling includes data not just from multiple apparitions but from as wide a range of phase angles during each apparition as well.

For potential radar targets “A” is Arecibo; “G” is Goldstone.

Asteroid	Period	Amp	App	Last	R SNR
(302830) 2003 FB NEA	-	-	-	-	10 A
(5645) 1990 SP NEA	30.39	0.70	1	2002	55 A 20 G
(511808) 2015 FH120 NEA	-	-	-	-	-
(159402) 1999 AP10 NEA	7.908	0.36	1	2009	525 A 175 G

Asteroid	Period	Amp	App	Last	R SNR
(474179) 1999 VS6 NEA	16.91	0.51	1	2017	15 A
(380929) 2006 HU30 NEA	49.0	0.17	1	2013	30 A 10 G
2015 WN1 NEA	-	-	-	-	100 A
2017 WJ16 NEA	-	-	-	-	??
162173 Ryugu NEA	7.627	0.10 0.16	2	2012	35 A
(153201) 2000 WO107 NEA	-	-	-	-	1800 A 600 G
(7753) 1988 XB NEA	-	-	-	-	150 A 50 G
(482505) 2012 TQ78 NEA	-	-	-	-	10 A
(501647) 2014 SD224 NEA	-	-	-	-	210 A 70 G

Table I. Summary of radar-optical opportunities for the current quarter. Period and amplitude data are from the asteroid lightcurve database (LCDB; Warner et al., 2009a). SNR values are estimates that are affected by radar power output along with rotation period, size, and distance. They are given for relative comparisons among the objects in the list.

(302830) 2003 FB (H = 18.8)

There are no entries in the LCDB for this NEA. The estimated diameter when assuming an albedo of 0.2 (Warner et al., 2009a) is about 500 meters. This makes it less likely that the period will be $P < 2$ hours. Note that the observing window is very short and starts in late September.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
09/25	04 44.0	-30 44	0.21	1.08	17.8	61.9	107	116	+0.60	-40
09/27	04 59.9	-30 12	0.20	1.07	17.7	64.5	105	104	+0.79	-36
09/29	05 17.7	-29 25	0.18	1.06	17.6	67.5	103	93	+0.92	-32
10/01	05 37.5	-28 20	0.17	1.04	17.5	70.9	100	82	+0.99	-28
10/03	05 59.5	-26 51	0.16	1.03	17.5	74.7	96	72	-0.99	-23
10/05	06 23.8	-24 55	0.15	1.02	17.5	79.0	93	63	-0.91	-17
10/07	06 50.2	-22 26	0.14	1.00	17.5	83.8	88	55	-0.78	-10

(5645) 1990 SP (H = 17.1)

The estimated diameter is 1.1 km. The sole entry in the LCDB is from Pravec et al. (2005), who reported a period of 30.39 h and amplitude of 0.7 mag. It is also a likely tumbler with the second period undetermined. Southern observers will have the advantage during the short window that is open the first ten days of October.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/01	05 15.6	-18 00	0.20	1.07	16.0	63.4	106	77	+0.99	-29
10/02	05 23.6	-17 37	0.19	1.07	15.9	64.7	105	70	-1.00	-27
10/03	05 32.0	-17 11	0.19	1.06	15.9	66.0	104	64	-0.99	-25
10/04	05 40.7	-16 43	0.18	1.06	15.9	67.5	103	58	-0.96	-23
10/05	05 49.9	-16 11	0.18	1.05	15.9	69.0	102	52	-0.91	-21
10/06	05 59.5	-15 35	0.17	1.04	15.8	70.6	100	47	-0.85	-18
10/07	06 09.4	-14 56	0.17	1.04	15.8	72.2	99	43	-0.78	-16
10/08	06 19.9	-14 13	0.16	1.03	15.8	74.0	97	40	-0.70	-13
10/09	06 30.7	-13 26	0.16	1.03	15.8	75.8	95	38	-0.60	-11
10/10	06 41.9	-12 35	0.16	1.02	15.8	77.8	93	38	-0.50	-8

(511808) 2015 FH120 (H = 18.6)

There is no lightcurve entry in the LCDB for this 600 meter NEA.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/01	02 51.3	-45 29	0.23	1.14	17.5	48.0	122	54	+0.99	-60
10/03	03 03.3	-47 38	0.22	1.12	17.4	51.0	119	56	-0.99	-57
10/05	03 17.7	-49 54	0.20	1.11	17.4	54.4	116	64	-0.91	-54
10/07	03 35.5	-52 17	0.19	1.09	17.3	58.1	113	74	-0.78	-51
10/09	03 57.7	-54 43	0.18	1.07	17.2	62.3	109	85	-0.60	-47
10/11	04 25.7	-57 06	0.17	1.05	17.2	66.9	104	93	-0.40	-42
10/13	05 01.1	-59 13	0.16	1.04	17.2	72.1	99	97	-0.20	-37
10/15	05 45.3	-60 47	0.15	1.02	17.2	77.8	94	96	-0.05	-31
10/17	06 37.6	-61 22	0.14	1.00	17.3	84.0	88	92	+0.00	-25
10/19	07 34.3	-60 33	0.14	0.99	17.5	90.6	82	89	+0.07	-18

(159402) 1999 AP10 (H = 16.1)

Franco et al. (2010) first reported a period 7.9 h. This was confirmed during the same apparition (2009) by Hasegawa et al. (2018). Given the near Earth-day commensurability, it's good that the 1.8 km NEA will be observable for several months. Still, a coordinated campaign with observers well separated in longitude will make for quicker results.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/01	22 38.1	+02 18	0.12	1.11	12.9	24.8	152	22	+0.99	-46
10/11	22 24.7	+22 56	0.09	1.07	12.6	38.6	138	123	-0.40	-29
10/21	22 06.8	+54 06	0.08	1.04	12.8	56.9	119	96	+0.24	-1
10/31	21 01.3	+82 14	0.10	1.02	13.5	69.5	105	80	+1.00	+23
11/10	10 58.2	+79 32	0.12	1.02	14.1	71.4	102	66	-0.35	+36
11/20	10 21.7	+69 25	0.16	1.04	14.5	66.6	105	130	+0.28	+42
11/30	10 01.2	+62 59	0.19	1.07	14.7	58.7	112	72	+1.00	+45
12/10	09 39.6	+58 24	0.22	1.12	14.9	49.3	121	71	-0.28	+44
12/20	09 14.6	+54 36	0.26	1.17	15.0	39.1	131	136	+0.31	+42
12/30	08 48.5	+50 51	0.30	1.23	15.2	29.1	142	37	+1.00	+39

(474179) 1999 VS6 (H = 19.0)

Warner (2017) found a period of 16.9 h based on observations obtained in 2017. The estimated diameter is about 500 meters. Those able to observe at high declinations will have a decided advantage and opportunity.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/20	04 08.4	+10 12	0.19	1.15	17.0	31.1	143	166	+0.15	-29
10/23	04 01.2	+16 35	0.17	1.14	16.6	27.5	148	128	+0.45	-27
10/26	03 50.8	+24 26	0.15	1.13	16.3	24.7	152	90	+0.74	-23
10/29	03 35.7	+33 44	0.14	1.12	16.1	24.2	152	55	+0.94	-18
11/01	03 13.2	+44 03	0.13	1.11	16.1	27.7	149	32	-1.00	-12
11/04	02 38.8	+54 22	0.13	1.10	16.2	34.6	141	43	-0.90	-5
11/07	01 45.2	+63 14	0.14	1.09	16.5	42.9	132	70	-0.66	+1
11/10	00 25.6	+69 13	0.15	1.08	16.9	50.8	123	95	-0.35	+6
11/13	22 49.8	+71 30	0.16	1.07	17.2	57.6	115	108	-0.07	+11
11/16	21 26.3	+70 48	0.18	1.06	17.6	63.1	108	105	+0.01	+14

(380929) 2006 HU30 (H = 19.6)

The estimated diameter for this NEA is about 350 meters. Warner (2014) reported a period of 49 h. Here's another case when a coordinated campaign of observers is warranted and recommended.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/15	06 50.5	-65 33	0.17	1.00	18.7	85.0	85	90	-0.05	-25
10/19	05 24.5	-61 05	0.14	1.02	18.1	75.8	96	99	+0.07	-34
10/23	04 08.0	-51 18	0.13	1.05	17.4	62.9	111	91	+0.45	-46
10/27	03 11.4	-36 26	0.12	1.07	16.9	46.6	128	60	+0.82	-59
10/31	02 32.5	-19 39	0.12	1.10	16.5	30.3	146	29	+1.00	-66
11/04	02 06.0	-04 55	0.14	1.12	16.5	19.1	158	53	-0.90	-62
11/08	01 47.7	+06 08	0.17	1.15	16.9	16.4	161	102	-0.56	-54
11/12	01 35.1	+13 56	0.20	1.17	17.4	19.2	157	156	-0.15	-48
11/16	01 26.4	+19 26	0.23	1.20	17.9	22.9	152	141	+0.01	-43
11/20	01 20.8	+23 24	0.27	1.23	18.4	26.0	147	86	+0.28	-39

2015 WN1 (H = 26.5)

The estimated diameter is only 15 meters, which is why the asteroid remains faint despite an Earth distance of only 0.01 au. The asteroid's sky motion and the possibility of being a super-fast rotator call for short exposures at the start (see Pravec et al., 2000). Access to a 1-meter scope or larger is recommended.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
11/12	21 25.0	-12 18	0.01	0.99	19.5	89.3	90	135	-0.15	-40
11/13	23 28.6	-01 26	0.01	0.99	18.4	57.9	122	152	-0.07	-58
11/14	01 06.8	+07 46	0.01	1.00	18.2	33.0	147	163	-0.02	-55
11/15	02 05.6	+12 34	0.02	1.00	18.4	18.9	161	163	+0.00	-46
11/16	02 40.5	+14 59	0.02	1.01	18.7	11.2	169	157	+0.01	-40
11/17	03 02.6	+16 19	0.03	1.01	19.0	6.8	173	148	+0.05	-36

2017 WJ16 (H = 24.3)

There are no entries for this NEA in the LCDB. The estimated diameter is only 40 meters, making it another candidate for being a super-fast rotator ($P < 2$ h). As pointed out by Pravec et al., (2000), exposures must be kept to no longer than $0.187 \times P$ to avoid "rotational smearing," which can lead to too small a lightcurve amplitude or, worse, completely hide any rotational indicators.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
11/18	08 21.3	+07 41	0.02	1.00	18.2	69.2	110	146	+0.11	+23
11/20	07 50.5	+17 58	0.02	1.00	17.4	57.5	122	171	+0.28	+21
11/22	06 56.2	+32 37	0.01	1.00	16.6	42.4	137	134	+0.48	+15
11/24	05 17.1	+47 59	0.01	1.00	16.2	31.1	149	92	+0.68	+6
11/26	02 59.0	+54 37	0.01	1.00	16.5	35.5	144	57	+0.84	-4
11/28	01 12.8	+52 22	0.02	1.00	17.3	46.0	133	44	+0.95	-10
11/30	00 14.1	+48 01	0.02	1.00	18.0	54.8	124	55	+1.00	-14
12/02	23 41.3	+44 15	0.03	1.00	18.6	61.5	117	75	-0.97	-17

162173 Ryugu (H = 19.3)

Ryugu is the target of the Hayabusa 2 sample return mission. It visited the asteroid in mid-2018 and, if all goes well, should land on Earth in December of this year. The rotation period is 7.63 h (e.g., Muller et al., 2017).

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
10/01	23 38.2	+34 58	0.19	1.17	17.3	28.7	146	41	+0.99	-26
10/11	23 15.9	+34 11	0.17	1.13	17.0	32.1	143	108	-0.40	-25
10/21	22 55.4	+31 22	0.14	1.10	16.9	38.7	136	93	+0.24	-25
10/31	22 41.5	+26 44	0.13	1.07	16.8	47.3	127	51	+1.00	-28
11/10	22 35.9	+20 38	0.11	1.05	16.7	57.0	118	145	-0.35	-32
11/20	22 38.9	+13 03	0.10	1.02	16.7	67.2	107	50	+0.28	-39
11/30	22 49.9	+03 34	0.09	1.00	16.7	78.0	97	79	+1.00	-48
12/10	23 08.2	-09 01	0.07	0.98	16.7	89.2	87	150	-0.28	-60

(153201) 2000 WO107 (H = 19.3)

There is no lightcurve entry in the LCDB for this 400-m NEA. As fate often provides, the asteroid is at its brightest when close in the sky to a nearly full moon. Even so, the very large swing in phase angles make it a good target for finding the H and G values.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
11/27	11 36.6	-04 03	0.04	0.97	16.5	108.8	69	146	+0.90	+54
11/29	09 02.5	+13 09	0.03	1.00	13.9	65.7	113	82	+0.98	+35
12/01	05 43.6	+24 47	0.04	1.02	13.2	16.7	163	10	-1.00	-3
12/03	04 13.7	+24 39	0.06	1.05	13.8	5.7	174	35	-0.93	-19
12/05	03 35.9	+23 34	0.09	1.07	15.0	14.9	164	68	-0.80	-26
12/07	03 16.4	+22 47	0.12	1.09	15.8	20.4	157	99	-0.61	-29
12/09	03 04.8	+22 13	0.15	1.12	16.5	24.0	153	129	-0.39	-31
12/11	02 57.3	+21 50	0.18	1.14	17.0	26.6	149	159	-0.18	-32
12/13	02 52.3	+21 33	0.20	1.16	17.4	28.7	146	167	-0.04	-33
12/15	02 48.9	+21 20	0.23	1.18	17.8	30.4	143	138	+0.00	-34

(7753) 1988 XB (H = 18.6)

Most NEAs are in the S taxonomic complex. However, this 575 m asteroid is type Cb (Binzel et al., 2019), meaning it is particularly dark (low albedo). This is another good chance to find the H and G values.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
11/25	10 09.3	+05 49	0.07	0.99	15.7	85.4	91	146	+0.76	+46
11/30	08 45.0	+17 03	0.08	1.03	15.3	57.1	119	65	+1.00	+33
12/05	07 44.8	+23 09	0.10	1.07	15.3	37.3	139	12	-0.80	+22
12/10	07 03.6	+26 11	0.13	1.11	15.5	23.3	154	90	-0.28	+14
12/15	06 35.0	+27 41	0.17	1.14	15.7	13.1	165	169	+0.00	+9
12/20	06 14.8	+28 25	0.20	1.18	15.9	5.9	173	117	+0.31	+5
12/25	06 00.5	+28 44	0.24	1.22	16.4	5.0	174	54	+0.77	+3
12/30	05 50.5	+28 51	0.28	1.26	17.0	9.2	168	10	+1.00	+1
01/04	05 43.7	+28 50	0.33	1.30	17.5	13.5	162	76	-0.76	+0

(482505) 2012 TQ78 (H = 19.5)

There are no entries in the LCDB for this 375-m NEA. The rotation period will *likely* be $P > 2$ h, but assume nothing.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
11/10	05 42.6	+26 53	0.28	1.22	18.5	30.3	142	70	-0.35	-2
11/15	05 48.2	+30 48	0.24	1.19	18.0	28.7	145	141	+0.00	+1
11/20	05 54.1	+36 08	0.20	1.16	17.6	27.8	147	146	+0.28	+5
11/25	06 01.4	+43 34	0.17	1.13	17.1	28.8	146	88	+0.76	+10
11/30	06 12.8	+54 01	0.14	1.10	16.8	33.8	142	42	+1.00	+16
12/05	06 40.1	+68 20	0.12	1.07	16.7	44.4	131	49	-0.80	+24
12/10	10 10.4	+83 57	0.11	1.03	16.9	60.3	114	87	-0.28	+32
12/15	16 35.7	+71 50	0.11	1.00	17.4	78.3	96	97	+0.00	+36

(501647) 2014 SD224 (H = 22.3)

The estimated size is 100 m, which makes NEA a potential super-fast rotator. Use as short exposures as possible to start and then adjust for a higher SNR (longer exposures) as able and needed.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
12/10	06 49.1	+46 40	0.10	1.07	18.6	28.6	149	93	-0.28	+19
12/12	06 45.5	+48 24	0.08	1.06	18.3	28.5	149	120	-0.10	+19
12/14	06 40.0	+50 36	0.07	1.05	18.0	28.9	149	144	-0.01	+19
12/16	06 31.0	+53 31	0.06	1.04	17.6	30.2	148	151	+0.02	+19
12/18	06 15.3	+57 32	0.05	1.03	17.2	33.0	145	134	+0.14	+18
12/20	05 43.0	+63 19	0.04	1.01	16.8	38.4	140	110	+0.31	+17
12/22	04 12.9	+71 01	0.03	1.00	16.5	48.7	130	85	+0.51	+14
12/24	23 55.4	+70 55	0.02	0.99	16.5	67.8	111	67	+0.69	+9
12/26	21 18.0	+46 52	0.02	0.98	17.3	97.7	81	77	+0.85	-2

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