

LIGHTCURVE PHOTOMETRY OPPORTUNITIES: 2025 JANUARY - APRIL

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We present lists of asteroid photometry opportunities for 2025 Jan-April. The extended four-month listing continues the changes announced in MPB 51-4 (Warner et al., 2024). Extending to the month beyond the usual quarter-year allows better observation planning, especially for those working in wide-spread collaborations. With the massive input of survey photometry, even if mostly sparse data, the small telescope researcher's role is moving away generic studies to those concentrating on specific needs and targets and so, we hope, leading to even more fulfilling and fruitful efforts.

We refer the reader to the lightcurve photometry opportunities article in *Minor Planet Bulletin* 51-4 (Warner et al., 2024) for a detailed discussion on the evolution of the lists presented here and the purpose behind each one. In addition, we refer the reader to other prior releases of this paper (e.g., Warner et al., 2023) for more detailed discussions about the requirements and considerations for the targets in the lists and to Warner et al. (2021a; 2021b).

An Improved Planning Tool

The ephemeris generator on the <https://MinorPlanet.info> web site allows creating custom lists for numbered objects reaching $V \leq 18.0$ during a given month from 2020 through 2035 by setting search parameters based on a number of parameters.

<https://www.minorplanet.info/php/callopplcdbquery.php>

The updated page added data for the minimum phase angle of any object included in the search: the date (0.001 d), the minimum phase angle (0.1°), and the declination. Searches can limit results to a phase angle range between $0-120^\circ$. Also new is limiting the results to a range of rotation periods and so, for example, one can look for only long, or especially short, period objects.

Important and Useful Web Sites

The dates and values given on the MinorPlanet.info site are very good estimates in most cases. NEAs are sometimes an important exception. Use the site for preliminary planning for objects and then confirm those plans using the Minor Planet Center or JPL Horizons web sites.

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

JPL: <https://ssd.jpl.nasa.gov/sb/orbits.html>

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/>

to see what, if any, information it has on a chosen target.

For near-Earth asteroids in particular, check the list found on the Goldstone planned targets schedule at

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

and keep in touch with Lance Benner at the email above. The radar team often needs updated astrometry and photometry (rotation period) prior to observing. Keep in mind as well that the *MinorPlanet.info* site opposition database includes only numbered objects. Keep a close eye on the MPC NEA pages.

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>

The database contains about 10.69 million observations for 24,454 objects (as of 2024 May 27), making it one of the more useful sources for raw data of *dense* time-series asteroid photometry.

The Planning Lists

The lists, excluding the one for NEAs, are usually restricted to objects reaching $V \leq 15.5$ during the covered months. To include every object within a list that met this criterium alone resulted in far too many targets than the known community of asteroid photometrists could possibly handle, so only the "better" candidates are included. This is entirely subjective and the reader is encouraged to visit the <https://MinorPlanet.info> web site and use all the planning tools available there should our preferences not match yours.

Don't presume that something rated $U \geq 3$ — doesn't need more work nor, at the other end, that something not rated at all or $1 < U < 2+$ or has a long period should be skipped in lieu of an "easier" project. The often-heard saying, "Past performance is not a guarantee of future results" should be part of your work ethic. Someone's "certain" result may not be so certain after all, especially if it's based on data that are minimal in quantity and/or quality.

Favorable Apparitions includes objects reaching one of the five brighter (favorable) apparitions from 1995 and 2050 and rated $U < 3$ – in the LCDB (Warner et al., 2009).

No Pole Solutions includes objects rated $U > 2$ + but do not have a pole indicated on the LCDB summary line. This list is the most likely needing further confirmation by checking the DAMIT web site, which grows in spurts large and small quite frequently and so the LCDB can lag considerably.

Poor Pole Solutions includes objects rated $U < 3$ – that have a pole solution on the summary line. In this case, the period is often based on using sparse survey data, with or without support of dense lightcurve data. An additional set of dense data may help elevate both the U rating and the quality of the pole solution.

Low Phase Angles includes objects, regardless of U rating or even having a period, that reach a solar phase angle $< 1^\circ$. You should refer to Warner et al. (2023) to review important information about low solar phase angle work.

Long Periods includes objects with $P \approx 24$ hours. These are often overlooked because they are very difficult for a single-station campaign. However, they are ideal for collaborations, especially those with stations well-separated in longitude.

NEAs (aka Radar Target) is limited to *known* near-Earth asteroids that might be on the radar team's radar (pun intended). It is common for newly discovered objects to move into or out of the list. We recommend that you keep up with the latest discoveries by using the Minor Planet Center observing tools.

The List Data

If the list includes the “Fam” column, this is the orbital group (> 9000) using criteria from the LCDB or the collisional family (< 9000) based on Nesvorný et al. (2015) and Nesvorný (2015). To convert the number to a name, see the LCDB documentation on the LCDB web site or use the One Asteroid Lookup page on the site:

<https://www.minorplanet.info/php/lcdb.php>

<https://minorplanet.info/php/oneasteroidinfo.php>

Table Columns

Num	Asteroid number, if any.
Name	Name (or designation) assigned by the MPC.
Fam	Orbital group or collisional family.
BMD	Date of maximum brightness (to 0.1 d precision).
BMg	Approximate V magnitude at brightest.
BDC	Approximate declination at brightest.
PD	Date of minimum phase angle (to 0.001 d precision).
PMn	Phase angle at minimum (solar elongation $> 90^\circ$).
PDC	Approximate declination at minimum phase angle.
P (h)	Synodic rotation period from summary line in the LCDB summary table. An * indicates a sidereal period.
U	LCDB solution quality (U) from 1 (probably wrong) to 3 (secure).
Notes	Comments about the object.

Some asteroids may appear in more than one list. The reader is referred to the latest LCDB release and, where and when necessary, the original reference source should be used. The Notes column is rarely used, for now, except for the NEAs list.

Favorable Apparitions (U < 3-)											
Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
18513	1996 TS5	701	01 12.6	15.5	+27	01 12.226	2.8	27	9.749	2	
7186	Tomiooka	9104	01 14.5	15.2	+22	01 14.017	0.2	22	7.309	2	
4176	Sudek	602	01 17.5	15.4	+21	01 18.356	0.2	21	8.164	2	
4683	Veratar	602	01 20.4	15.5	+19	01 21.076	0.5	19	29.391	2	
2843	Yeti	9104	01 25.4	15.2	+11	01 25.063	3.9	11	156.718	2	
4107	Rufino	9104	02 08.3	14.4	+10	02 08.728	2.7	10	22.371	2	
4133	Heureka	502	02 12.5	15.3	+15	02 11.148	0.3	15	3.726	2–	
2020	Ukko	606	02 15.5	15.1	+12	02 16.637	0.2	12	25.478	2+	
5438	Lorre	527	03 14.0	14.7	–40	03 13.600	20.1	–40	25.30	2+	
2030	Belyaev	9104	03 16.5	15.4	+3	03 15.282	0.3	2	2.738	2+	
5802	Casteldelpiano	9104	03 21.4	14.9	+1	03 21.914	0.8	1	2.970	2+	
2045	Peking	401	03 21.5	14.7	+2	03 21.506	1.0	2	158.7	2	
9369	1993 DB1	410	03 25.5	15.3	–1	03 24.795	0.3	–1	54.335	2	
4350	Shibechea	9105	03 30.8	15.1	+5	03 31.734	4.2	5	2.890	2+	
1287	Lorcia	606	04 02.4	15.0	–7	04 02.576	0.9	–7	8.878	2	
1841	Masaryk	9106	04 04.4	15.0	–5	04 05.675	0.6	–4	7.53	2+	
85953	1999 FK21	9101	04 05.0	14.6	+34	03 31.001	30.1	11	28.08	2	
1512	Oulu	9107	04 08.5	14.3	–8	04 06.829	0.3	–8	132.3	2+	
1101	Clematis	2012	04 15.5	14.9	–8	04 13.453	0.3	–8	34.3	2	
1155	Aenna	9104	04 16.1	14.0	–7	04 15.971	1.4	–7	8.07	2+	
992	Swasey	9106	04 17.4	14.0	–12	04 16.987	0.6	–12	13.305	2+	
3815	Konig	517	04 22.0	15.1	–8	04 22.053	1.7	–8	6.239	2	
9871	Jeon	9104	04 25.0	15.4	–21	04 24.821	4.0	–21	94	2	
3857	Cellino	2004	04 30.5	15.1	–14	04 29.850	0.5	–14	3.657	2	Sidereal

Table I. A partial list of numbered asteroids reaching a favorable apparition and with an LCDB rating $U < 3$ –. Objects in bold text are near-Earth asteroids.

Spin Axis and Modeling (Favorable Apparition, $U > 2+$, No LCDB pole, not in DAMIT)

Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
1302	Werra	602	01 02.4	14.1	+24	01 03.961	0.4	+24	8.183	3-	
3335	Quanzhou	502	01 13.1	15.0	+15	01 13.284	2.7	+15	6.1564	3	
3048	Guangzhou	2004	01 14.0	15.2	+18	01 14.054	1.8	+18	3.811	3-	
862	Franzia	9106	01 17.4	13.2	+21	01 18.685	0.3	+21	7.523	3	
4440	Tchanchches	9102	01 20.3	15.3	+4	01 19.827	8.6	+04	2.7883	3	
1342	Brabantia	9104	02 13.3	12.8	+4	02 12.375	5.0	+04	4.1754	3	
469	Argentina	9106	02 14.5	12.1	+15	02 14.019	0.9	+15	17.5727	3	
1318	Nerina	701	03 09.5	13.9	+16	03 08.507	6.1	+16	2.5280	3	
75079	1999 VN24	701	03 11.1	15.3	-1	03 12.020	2.6	-00	6.632	3-	
137170	1999 HF1	9101	03 22.6	14.6	+44	05 15.366	57.3	+63	2.3192	3	
298	Baptistina	403	04 10.2	13.3	-10	04 10.347	1.2	-10	16.23	3	

Table II. A partial list of numbered asteroids reaching a favorable apparition that have high-quality periods solutions but do not have a pole solution in the LCDB or DAMIT databases.

Spin Axis and Modeling (Any Apparition, $U < 3-$, Pole in LCDB/DAMIT)

Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
3140	Stellafane	606	01 23.5	15.4	+25	01 23.818	2.00	+25	33.07	2	
1684	Iguassu	602	01 30.5	15.5	+20	01 29.406	0.64	+20	6.416	2	
2045	Peking*	401	03 21.5	14.7	+2	03 21.506	0.98	+2	158.7	2	Favorable
1055	Tynka	402	03 30.9	15.0	+2	03 30.340	2.44	+2	11.893	2+	
2345	Fucik	606	04 23.5	15.5	-25	04 23.860	4.21	-25	17.12	2	

Table III. A partial list of numbered asteroids reaching brightest magnitude that have a reported pole position but the LCDB rating is $U < 3-$.**Low Phase Angle ($V \leq 15.0$, phase angle $\alpha \leq 1.0^\circ$)**

Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
140	Siwa	9106	01 04.4	12.9	+22	01 05.870	0.1	+22	34.445	3	
1254	Erfordia	9106	01 05.0	14.8	+24	01 03.864	0.3	+24	12.287	3	
1067	Lunaria	633	01 10.4	13.9	+21	01 11.688	0.3	+21	6.057	3	
240	Vanadis	9105	01 14.4	11.6	+21	01 15.023	0.0	+21	10.565	3	
862	Franzia	9106	01 17.4	13.2	+21	01 18.685	0.3	+21	7.523	3	
1076	Viola	9104	02 05.4	14.4	+15	02 06.119	0.3	+15	7.336	3	
2258	Viipuri	9105	02 05.9	14.9	+15	02 06.830	0.2	+15	3.834	3	
300	Geraldina	9106	02 07.6	14.2	+16	02 09.197	0.3	+16	6.8423	3	
987	Wallia	9106	02 09.4	14.9	+14	02 11.295	0.1	+14	10.0813	3	
282	Clorinde	9104	02 14.4	13.4	+13	02 14.967	0.2	+13	49.350	3-	
526	Jena	602	02 18.0	13.6	+12	02 19.054	0.3	+12	11.877	2	
271	Penthesilea	9106	02 27.4	14.1	+7	03 01.244	0.2	+07	18.787	3	
2159	Kukkamaki	9104	03 02.7	14.7	+7	03 03.864	0.3	+07	3.867	3	
1079	Mimosa	605	03 08.4	14.8	+4	03 09.912	0.2	+04	64.6	2-	
108	Hecuba	601	03 10.5	12.0	+5	03 09.150	0.1	+05	14.256	3	
491	Carina	9106	03 15.4	13.5	+2	03 17.040	0.2	+02	14.836	3	
313	Chaldaea	415	03 16.4	10.8	+1	03 17.251	0.2	+01	8.392	3	
358	Apollonia	9106	03 17.4	13.0	+1	03 19.125	0.2	+01	50.6	3-	
954	Li	602	03 18.5	14.9	+2	03 16.065	0.1	+02	7.207	3	
1409	Isko	9105	03 19.0	14.7	+1	03 19.366	0.2	+01	11.639	2+	
48	Doris	9106	03 19.4	11.3	-1	03 20.742	0.2	-00	11.89	3	
139	Juewa	9106	03 20.4	10.5	+0	03 21.188	0.2	+00	20.991	3	
160	Una	9106	03 22.4	12.6	-1	03 24.040	0.2	-01	11.033	3	
497	Iva	9106	03 23.4	14.8	-1	03 24.357	0.1	-01	4.620	3	
229	Adelinda	9106	03 24.5	14.5	+1	03 22.189	0.3	+01	6.60	3	
60	Echo	9104	03 28.4	11.0	-4	03 28.921	0.2	-04	25.208	3	
3394	Banno	9104	03 31.4	14.4	-5	03 31.972	0.2	-05	7.321	3	
175	Andromache	9106	04 03.5	13.7	-3	03 31.940	0.2	-04	8.324	3	
1512	Oulu	9107	04 08.5	14.3	-8	04 06.829	0.3	-08	132.3	2+	
1101	Clematis	2012	04 15.5	14.9	-8	04 13.453	0.3	-08	34.3	2	
510	Mabella	9105	04 16.5	12.6	-9	04 15.233	0.3	-09	19.4	3	
2052	Tamriko	606	04 18.5	14.9	-12	04 19.714	0.3	-12	7.469	3	
1675	Simonida	402	04 23.4	14.6	-14	04 24.056	0.3	-14	5.2885	3	
468	Lina	602	04 26.5	14.6	-13	04 24.059	0.1	-13	16.33	3	
1060	Magnolia	402	04 28.5	14.5	-15	04 28.055	0.3	-15	2.911	3	

Table IV. A partial list of numbered asteroids reaching a minimum phase angle $\alpha \leq 1.0^\circ$.

Long Period (Favorable Apparition, $P \geq 24$ h, $U < 3$)											
Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
887	Alinda	9101	01 12.1	9.3	+24	01 13.416	8.5	+26	28.41	3-	
4683	Veratar	602	01 20.4	15.5	+19	01 21.076	0.5	+19	29.391	2	
2843	Yeti	9104	01 25.4	15.2	+11	01 25.063	3.9	+11	156.718	2	
741	Botolphia	9106	01 29.7	13.4	+24	01 29.551	2.6	+24	23.9101	3	
282	Clorinde	9104	02 14.4	13.4	+13	02 14.967	0.2	+13	49.350	3-	
2020	Ukko	606	02 15.5	15.1	+12	02 16.637	0.2	+12	25.478	2+	
7564	Gokumenon	9106	03 01.4	15.1	+9	03 01.677	0.7	+09	30.58	3	
5438	Lorre	527	03 14.0	14.7	-40	03 13.600	20.1	-40	25.30	2+	
2045	Peking	401	03 21.5	14.7	+2	03 21.506	1.0	+02	158.7	2	
9369	1993 DB1	410	03 25.5	15.3	-1	03 24.795	0.3	-01	54.335	2	
85953	1999 FK21	9101	04 05.0	14.6	+34	03 31.001	30.1	+11	28.08	2	
1512	Oulu	9107	04 08.5	14.3	-8	04 06.829	0.3	-08	132.3	2+	
1101	Clematis	2012	04 15.5	14.9	-8	04 13.453	0.3	-08	34.3	2	
2014	Vasilevskis	701	04 19.3	14.4	-8	04 18.685	1.8	-08	32.16	3-	
9871	Jeon	9104	04 25.0	15.4	-21	04 24.821	4.0	-21	94	2	

Table V. A partial list of numbered asteroids reaching a favorable apparition and with a reported period $P \geq 24$ hours.

NEAs (aka Radar) Reaching Brightest for Year (Any Apparition, $V \leq 17.0$, $\alpha \leq 90^\circ$)											
Num	Name	Fam	BMD	BMg	BDC	PD	PMn	PDC	P (h)	U	Notes
459462	2013 AY52	9101	01 07.0	17.0	-16	01 17.514	26.4	+17			
	2020 BC6	9101	01 07.4	15.4	-46	01 19.925	20.3	+06			PHA
887	Alinda	9101	01 12.1	9.3	+24	01 13.416	8.5	+26	28.41	3-	
137805	1999 YK5	9101	01 19.9	16.7	+73	01 10.837	36.9	+70	3.930	3-	
103067	1999 XA143	9101	01 20.6	15.9	+31	01 17.633	5.5	+26	9.8490	3	
6239	Minos	9101	01 22.7	15.9	+48	11 01.189	5.0	+22	3.5558	3	
265196	2004 BW58	9101	01 28.4	15.3	-4	02 20.648	27.6	+39	6.479	3	PHA
1627	Ivar	9101	01 29.5	15.9	+17	01 28.900	0.4	+17	4.795	3	
5332	Davidaguilar	9101	02 01.1	14.3	-8	02 10.604	25.4	+07	5.803	3	
16834	1997 WU22	9101	02 05.9	15.9	-22	10 05.186	21.8	+32	9.345	3	
496869	2000 QU7	9101	02 16.7	16.6	+22	02 26.349	3.1	+13			
	2015 BK509	9101	02 23.0	16.8	-21	12 04.899	8.8	+37	0.0741	3	Pravec (2020)
535844	2015 BY310	9101	03 02.3	16.0	-18	07 23.488	5.3	-28	0.09267	3	NHATS
66008	1998 QH2	9101	03 02.7	15.9	-68	09 19.536	31.4	+22	7.09	2+	
137126	1999 CF9	9101	03 05.0	14.1	+1	10 20.958	3.9	+03			PHA
143678	2003 SA224	9101	03 16.7	16.4	+41	12 31.	9.0	-29	35.	2	
137170	1999 HF1	9101	03 22.6	14.6	+44	05 15.366	57.3	+63	2.3192	3	
85709	1998 SG36	9101	03 28.1	16.0	-2	01 01.848	33.6	-32	3.573	3-	
	2014 TN17	9101	03 28.5	17.1	-21	-	-	-			
85953	1999 FK21	9101	04 05.0	14.6	+34	03 31.001	30.1	+11	28.08	2	
152754	1999 GS6	9101	04 09.6	16.9	-32	04 24.276	8.3	-22	8.021	2	
223456	2003 UB10	9101	04 10.2	16.8	+8	08 11.472	2.1	-18			
462959	2011 DU	9101	04 21.2	16.0	+35	12 29.403	5.4	+15	10.290	3	PHA
436030	2009 JO2	9101	04 25.8	16.7	+67	06 04.872	50.0	+29			
9058	1992 JB	9101	04 26.3	14.8	-15	05 05.449	30.5	+01			
85818	1998 XM4	9101	04 28.1	17.0	+13	12 31.	22.4	+33	19.451	3	

Table VI. A list of near-Earth asteroids known as of 2024 Oct 10. Green bar lines are on the Goldstone list of planned targets. PHA: Potentially Hazardous Asteroid. NHATS: Near-Earth Object Human Space Flight Accessible Targets Study. BA: Binary asteroid. This is not necessarily a complete list of Goldstone targets. Check their web site.

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