DATE	RA	DEC	Δ	r	V	PH	Elong
02/20	22 24	-50 54	0.04	0.95	17.0	138	40
03/02	08 21	-33 49	0.05	1.02	12.8	52	125
03/12	08 54	-11 25	0.11	1.08	14.2	37	138
03/22	09 07	-04 48	0.18	1.13	15.4	38	135
04/01	09 18	-01 47	0.26	1.18	16.3	41	129

(143404) 2003 BD44 (a=1.97 AU, e=0.61, i=2.7°, H = 16.8)
Little is known about 2003 BD44 other than its Apollo type orbit that takes it from 0.77 to 3.16 AU from the Sun. On March 20, it passes through opposition and reaches a very low phase angle of 0.3°. It will remain bright for a few weeks after opposition as it peaks at V = 13.3 on April 12 and passes within 0.056 AU of Earth on April 18. The asteroid finally fades below V = 17 on April 22 when it phase angle will reach over 130°. Time series lightcurve and color photometry across a range of phase angles are requested.

DATE	RA	DEC	Δ	r	V	PH	Elong
01/31	12 02	-02 42	0.87	1.68	18.9	26	129
02/10	12 07	-03 17	0.72	1.60	18.3	24	138
02/20	12 11	-03 31	0.58	1.51	17.5	20	147
03/02	12 11	-03 12	0.45	1.42	16.7	15	157
03/12	12 06	-02 05	0.34	1.33	15.7	8	169
03/22	11 55	+00 25	0.24	1.23	14.4	2	177
04/01	11 30	+05 54	0.15	1.14	14.0	17	159

References

Behrend, R. (2014) Observatoire de Geneve website, *http://obswww.unige.ch/~behrend/page_cou.html*

Belskaya, I., Shevchenko, V. (2000). “The Opposition Effect of Asteroids.” *Icarus* 147, 94-105.

Bembrick, C., Pereghy, B. (2003). “A period determination for the Aten asteroid (5604) 1992 FE”. *Minor Planet Bulletin* **30**, 43-44.

Binzel, R.P. et al. (2004). “Observed Spectral Properties of Near-Earth Objects: Results for Population Distribution, Source Regions, and Space Weathering Processes”. *Icarus* **170**, 259-294.

Campins, H., Hargrove, K., Pinilla-Alonso, N., Howell, E.S., Kelley, M.S., Licandro, J., Mothé-Diniz, T., Fernández, Y., Ziffer, J. (2010). "Water Ice and Organics on the Surface of the Asteroid 24 Themis". *Nature* **464**, 1320–1321.

Hanus, J., Durech, J., Broz, M., Warner, B.D., Pilcher, F., Stephens, R., Oey, J., Bernasconi, L., Casulli, S., Behrend, R., Polishook, D., Henych, T., Lehky, M., Yoshida, F., Ito. T. (2011). “A Study of Asteroid Pole-Latitude Distribution Based on an Extended Set of Shape Models Derived by the Lightcurve Inversion Method”. *Astron. Astrophys.* **530**, A134.

Harris, A.W., Warner, B.D., Pravec, P. (2015). “Asteroid Lightcurve Derived Data V15.0”. EAR-A-5-DDR-DERIVED-LIGHTCURVE-V15.0. NASA Planetary Data System.

Hergenrother, C., Hill, D. (2013). “The OSIRIS-REx *Target Asteroids!* Project: A Small Telescope Initiative to Characterize Potential Spacecraft Mission Target Asteroids.” *Minor Planet Bulletin* **40**, 164-166.

Higgins D., Warner, B.D. (2009). “Lightcurve Analysis at Hunters Hill Observatory and Collaborating Stations - Autumn 2009”. *Minor Planet Bulletin* **36**, 159-160.

Koehn, B.W., Bowell, E.G., Skiff, B.A, Sanborn, J.J., McLelland, K.P., Pravec, P., Warner, B.D. (2014). “Lowell Observatory Near-Earth Asteroid Photometric Survey (NEAPS) – 2009 January through 2009 June”. *Minor Planet Bulletin* **41**, 286-300.

Neese, C. (2010). “Asteroid Taxonomy V6.0”. EAR-A-5-DDR-TAXONOMY-V6.0”. NASA Planetary Data System.

Nesvorny, D. (2015). “Nesvorny HCM Asteroid Families V3.0”. EAR-A-VARGBDET-5-NESVORNYFAM-V3.0. NASA Planetary Data System.

Rivkin, A.S., Emery, J.P. (2010). "Detection of ice and organics on an asteroidal surface". *Nature* **464**, 1322–1323.

Thomas, C.A. et al. (2014). “Physical characterization of Warm Spitzer-observed near-Earth objects”. *Icarus* **228**, 217-246.

Warner, B.D. (2010). “Asteroid Lightcurve Analysis at the Palmer Divide Observatory: 2009 December – 2010 March”. *Minor Planet Bul.* **37**, 112-118.

Ye, Q. (2011). “BVRI photometry of 53 unusual asteroids”. *Astron. J.* **141**, 32.

LIGHTCURVE PHOTOMETRY OPPORTUNITIES: 2017 JANUARY-MARCH

Brian D. Warner
Center for Solar System Studies / MoreData!
446 Sycamore Ave.
Eaton, CO 80615 USA
brian@MinorPlanetObserver.com

Alan W. Harris
MoreData!
La Cañada, CA 91011-3364 USA

Josef Ďurech
Astronomical Institute
Charles University in Prague
18000 Prague, CZECH REPUBLIC
durech@sirrah.troja.mff.cuni.cz

Lance A.M. Benner
Jet Propulsion Laboratory
Pasadena, CA 91109-8099 USA
lance.benner@jpl.nasa.gov

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 via lightcurve inversion. We also include lists of objects that will be the target of radar observations. Lightcurves for these objects can help constrain pole solutions and/or remove rotation period ambiguities that might not come from using radar data alone.

We present several lists of asteroids that are prime targets for photometry during the period 2017 January-March.

In the first three sets of tables, “Dec” is the declination and “U” is the quality code of the lightcurve. See the asteroid lightcurve data base (LCDB; Warner *et al.*, 2009) 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 ≤ 18.5 during any month in the current year, *e.g.*, limiting the results by magnitude and declination.

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

We refer you to past articles, e.g., *Minor Planet Bulletin* **36**, 188, 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 page on the Minor Planet Center web site:

http://www.minorplanetcenter.net/light_curve

We believe this to be the largest publicly available database of raw lightcurve data that contains 2.5 million observations for more than 11500 objects.

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 or brighter.

In both of those lists, a line in *italics text* indicates a near-Earth asteroid (NEA). In the spin axis list, a line in **bold text** indicates a particularly favorable apparition. To keep the number of objects manageable, the opportunities list includes only those objects reaching a particularly favorable apparition, meaning they could all be set in bold text.

Lightcurve/Photometry Opportunities

Objects with U = 3– or 3 are excluded from this list since they will likely appear in the list below 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, d*o 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 high quality ratings 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.

		Brightest			LCDB Data		
Number	Name	Date	Mag	Dec	Period	Amp	U
13244	Dannymeyer	01 03.0	16.0	+24			
88500	2001 QZ138	01 03.7	15.9	+25			
12193	1979 EL	01 04.1	14.9	+29	8.9918	0.35	2
3931	Batten	01 04.3	16.0	+28			
5399	Awa	01 05.1	14.9	+21			
6117	1985 CZ1	01 06.8	15.6	+26			
1674	Groeneveld	01 09.0	14.7	+23	8.1	0.19	2
2886	Tinkaping	01 09.0	14.8	+22	12.	0.13	1
1558	Jarnefelt	01 10.9	14.6	+22	18.22	0.40	2
106589	*2000 WN107*	*01 14.2*	*15.0*	*-63*			
47223	1999 VW10	01 14.6	15.7	+22			
45878	2000 WX29	01 15.8	15.4	+22	16.07	0.05	2
5693	*1993 EA*	*01 16.3*	*15.4*	*+24*	*2.497*	*0.10*	*2*
1477	Bonsdorffia	01 16.7	14.9	+31	7.8	0.32	2
4052	Crovisier	01 17.1	15.7	+23			
31782	1999 KM6	01 20.2	15.6	+23			
27675	1981 CH	01 20.4	15.4	+38			
33349	1998 XF72	01 20.4	15.9	+30			
13628	1995 WE	01 21.7	15.7	+31			
2405	Welch	01 22.0	15.6	+19			
12352	Jepejacobsen	01 22.6	15.4	+22	13.3954	0.42	2
8126	Chanwainam	01 22.9	15.6	+19			
18429	1994 AO1	01 23.0	15.3	+14			
1218	Aster	01 23.1	15.0	+25			
5761	Andreivanov	01 24.1	15.5	+31	11.68	0.82-0.85	2
739	Mandeville	01 26.4	11.7	+12	11.931	0.14	2
27185	1999 CH37	01 26.9	16.0	+16	3.1546	0.25	2
4283	Stoffler	01 27.9	14.8	+38	136.	0.1-0.65	2-
2928	Epstein	01 29.4	15.2	+18	8.5088	0.37	2
3569	Kumon	01 29.5	15.1	+5			
17065	1999 GK17	01 29.7	15.9	+17			
5267	1966 CF	01 29.9	15.6	+22			
22092	2000 AQ199	02 02.2	15.9	+15	18.8544	0.35	2
4099	Wiggins	02 06.1	15.5	+16			
5641	McCleese	02 09.2	15.1	+4	418.	0.06- 1.3	2
17591	1995 DG	02 12.0	15.9	+11	6.5577	0.37	2
7811	Zhaojiuzhang	02 15.2	16.0	+22	3.3539	0.62-0.67	2
2916	Voronveliya	02 16.3	15.4	+10			
10263	Vadimsimona	02 17.2	15.5	-3			
26421	1999 XP113	02 21.8	15.9	+7			
8212	Naoshigetani	02 23.6	15.4	+15			
3983	Sakiko	03 01.6	15.0	+7	10.5103	0.69	2
2546	Libitina	03 06.3	14.1	-3	132.71	0.35	2+
18889	2000 CC28	03 07.0	16.0	+18			
1910	Mikhailov	03 08.7	15.4	-3	8.88	0.25	2
3316	Herzberg	03 12.7	15.6	-2	9.6	0.1	1
4404	Enirac	03 15.6	15.0	+32	2.998	0.27	2+
9148	Boriszaitsev	03 16.4	15.5	+2			
3580	Avery	03 21.2	15.0	-2	24.2257	0.17-0.33	2
7421	Kusaka	03 22.4	16.0	-3	96.5	0.58-0.70	2
56116	1999 CZ7	03 22.5	15.3	-12			
138404	*2000 HA24*	*03 25.8*	*15.6*	*-38*			
1969	Alain	03 26.3	15.1	-4			
3748	Tatum	03 26.3	14.9	+2	58.21	0.54	2+
6349	Acapulco	03 27.8	15.1	-14	4.3755	0.18	2
2504	Gaviola	03 28.4	14.9	-3	8.7508	0.28	2
2142	Landau	03 29.2	15.5	-3			
19743	2000 AF164	03 29.2	15.8	+15			

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

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

to get more details about a specific asteroid.

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; *Icarus* **81**, 365-374) 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 a significantly different value 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; *Icarus* **209**, 542-555). However it will be some years before it becomes the general standard and, furthermore, it is still in need of refinement. That can be done mostly through having more data for more asteroids, but only if there are data at very low and moderate phase angles. Therefore, we strongly encourage observers to obtain data for these objects not only at very low phase angles, but to follow them well before and/or after opposition, *i.e.*, out to phase angles of 15-30 degrees.

Num	Name	Date	α	V	Dec	Period	Amp	U
500	Selinur	01 01.0	0.99	12.5	+26	8.011	0.10-0.16	3
514	Armida	01 02.3	0.43	13.1	+22	21.851	0.16-0.42	3
5399	Awa	01 05.1	0.67	15.0	+21			
586	Thekla	01 06.0	0.71	13.0	+20	13.670	0.22-0.30	3
846	Lipperta	01 06.5	0.16	14.0	+22	1641.	0.30	2
861	Aida	01 07.2	0.46	14.4	+21	10.95	0.32	3
561	Ingwelde	01 08.9	0.65	14.9	+20	12.012	0.38	3
2886	Tinkaping	01 09.0	0.03	14.8	+22	12.	0.13	1
662	Newtonia	01 09.1	0.81	14.5	+20	21.095	0.42	3-
2410	Morrison	01 10.1	0.57	14.9	+21			
215	Oenone	01 10.4	0.90	13.1	+24	27.937	0.18-0.20	3
1558	Jarnefelt	01 10.9	0.08	14.6	+22	18.22	0.40	2
1847	Stobbe	01 11.3	0.50	14.4	+23	5.617	0.27-0.35	3
21	Lutetia	01 11.9	0.89	10.9	+24	8.166	0.06-0.25	3
158	Koronis	01 14.7	0.20	12.8	+21	14.218	0.28-0.43	3
1623	Vivian	01 14.8	0.13	14.8	+21	20.521	0.85	3-
415	Palatia	01 21.3	0.69	11.4	+18	20.73	0.33	3
1398	Donnera	01 23.4	0.57	14.7	+18	7.231	0.15-0.26	3
212	Medea	01 25.7	0.30	12.2	+20	10.283	0.03-0.16	3
299	Thora	01 26.9	0.99	14.2	+16	274.	0.39	2+
54	Alexandra	01 30.8	0.25	12.0	+18	7.024	0.10-0.31	3
472	Roma	01 30.9	0.75	11.8	+19	9.801	0.27-0.45	3
406	Erna	02 03.1	0.07	14.8	+17	8.789	0.35	3
177	Irma	02 04.0	0.40	13.2	+17	13.856	0.24-0.37	3
1128	Astrid	02 04.0	0.51	14.7	+18	10.228	0.29	2+
1334	Lundmarka	02 07.0	0.48	14.4	+17	6.250	0.70	3-
13276	1998 QP40	02 07.3	0.24	15.7	+16			
634	Ute	02 08.2	0.52	14.6	+17	11.755	0.14-0.17	3
103	Hera	02 10.3	0.28	11.5	+15	23.740	0.35-0.45	3
203	Pompeja	02 10.5	0.79	12.3	+16	24.052	0.10	3
1252	Celestia	02 11.1	0.79	13.5	+16	10.636	0.26	3
2892	Filipenko	02 12.2	0.49	14.3	+15	14.00	0.21	3
924	Toni	02 13.8	0.39	13.7	+12	19.437	0.1 -0.24	3
2911	Miahelena	02 18.1	0.08	15.0	+12	4.201	0.56-0.66	3
1999	Hirayama	02 18.9	0.27	14.5	+12	15.63	0.45-0.57	3-
1641	Tana	02 23.6	0.25	15.0	+09	7.95	0.32-0.33	3-
62	Erato	02 28.7	0.54	13.3	+09	9.221	0.12-0.17	3
379	Huenna	03 01.4	0.16	13.9	+07	14.141	0.07-0.12	3
243	Ida	03 02.8	0.21	13.6	+07	4.634	0.40-0.86	3
269	Justitia	03 02.9	0.30	13.2	+08	33.128	0.14-0.25	3
16	Psyche	03 03.2	0.30	10.3	+08	4.196	0.03-0.42	3
1242	Zambesia	03 03.2	0.69	14.3	+09	15.72	0.15-1.36	2
808	Merxia	03 08.3	0.68	13.0	+03	30.631	0.59-0.70	3
723	Hammonia	03 09.1	0.22	14.1	+05	5.436	0.18	3
1162	Larissa	03 10.9	0.51	14.7	+06	6.516	0.1 -0.20	3
289	Nenetta	03 11.2	0.56	14.2	+02	6.902	0.11-0.19	3
672	Astarte	03 12.5	0.92	15.0	+01	22.572	0.10-0.17	3
1636	Porter	03 12.9	0.22	14.9	+04	2.966	0.22-0.24	3
109	Felicitas	03 15.1	0.66	12.4	+04	13.191	0.06-0.12	3
635	Vundtia	03 16.1	0.65	13.5	+00	11.790	0.15-0.27	3
589	Croatia	03 16.9	0.12	13.4	+01	24.821	0.16-0.25	2+
192	Nausikaa	03 18.3	0.86	11.1	-01	13.625	0.15-0.40	3
356	Liguria	03 20.1	0.37	11.8	-01	31.82	0.22	3-
150	Nuwa	03 20.8	0.41	12.8	-01	8.135	0.08-0.31	3
450	Brigitta	03 23.5	0.90	14.7	+02	10.766	0.18-0.30	3
2002	Euler	03 24.2	0.57	14.9	+00	5.993	0.18-0.31	3
253	Mathilde	03 25.4	0.29	14.6	-01	417.7	0.45-0.50	3
1990	Pilcher	03 25.9	0.44	15.0	-03			
1462	Zamenhof	03 26.3	0.21	14.8	-02	10.4	0.15-0.30	2
570	Kythera	03 26.8	0.39	14.1	-04	8.120	0.15-0.20	2
119	Althaea	03 27.5	0.94	12.1	-05	11.484	0.23-0.36	3
952	Caia	03 27.8	0.75	14.5	+00	7.51	0.03-0.13	2
2504	Gaviola	03 28.4	0.20	14.9	-03	8.751	0.28	2
77	Frigga	03 28.5	0.21	12.2	-03	9.012	0.07-0.20	3
1512	Oulu	03 29.6	0.13	14.6	-03	132.3	0.33	2+
1029	La Plata	03 30.1	0.47	14.5	-02	15.310	0.26-0.58	3
533	Sara	03 31.6	0.65	13.4	-03	11.654	0.19-0.30	3
5405	Neverland	03 31.8	0.57	15.0	-03	3.181	0.20	2
5605	Kushida	03 31.9	0.09	15.0	-05			

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

http://astro.troja.mff.cuni.cz/projects/asteroids3D

An additional dense lightcurve, along with sparse data, 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 ≥ 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.

		Brightest			LCDB Data		
Num	Name	Date	Mag	Dec	Period	Amp	U
514	Armida	01 02.3	13.1	+22	21.851	0.16-0.27	3
586	Thekla	01 06.0	13.0	+20	13.67	0.24-0.30	3
4179	Toutatis	01 06.4	14.9	+11	176.	0.16-1.46	3
530	Turandot	01 08.6	14.4	+18	19.96	0.10-0.16	3-
2241	Alcathous	01 08.9	15.5	+15	7.689	0.20-0.34	3
1806	**Derice**	**01 10.6**	**13.7**	**+19**	**3.224**	**0.07-0.19**	**3**
206	Hersilia	01 11.9	12.1	+18	11.122	0.13-0.20	3
1313	Berna	01 11.9	14.4	+24	25.46	0.20-0.28	3
855	Newcombia	01 14.4	15.5	+38	3.003	0.33-0.41	3
1117	Reginita	01 17.5	15.2	+17	2.946	0.10-0.33	3
2006	Polonskaya	01 17.5	15.5	+28	3.1183	0.08-0.16	3
1866	Sisyphus	01 17.9	14.5	-33	2.4	0.01-0.14	3
4440	**Tchantches**	**01 17.9**	**15.0**	**+7**	**2.7883**	**0.21-0.34**	**3**
5143	Heracles	01 17.9	14.5	-27	2.7063	0.05-0.20	3
143	Adria	01 22.2	13.0	+29	22.005	0.07-0.10	3
759	Vinifera	01 23.4	15.0	+27	14.229	0.36-0.40	3
1152	Pawona	01 24.5	13.8	+23	3.4154	0.16-0.26	3
235	Carolina	01 25.4	13.1	+30	17.61	0.30-0.38	3
3986	**Rozhkovskij**	**01 26.1**	**14.6**	**+15**	**3.548**	**0.25-0.35**	**3**
754	Malabar	01 27.5	13.6	-11	11.74	0.19-0.38	3
1867	Deiphobus	01 28.9	15.4	+3	58.66	0.10-0.27	3-
472	**Roma**	**01 30.8**	**11.8**	**+19**	**9.8007**	**0.27-0.45**	**3**
380	Fiducia	02 02.1	13.5	+22	13.69	0.04-0.32	3
266	Aline	02 03.5	13.1	-3	13.018	0.07-0.10	3
177	Irma	02 03.9	13.2	+17	13.856	0.24-0.37	3
929	Algunde	02 04.5	14.4	+10	3.3102	0.13-0.19	3
785	Zwetana	02 06.4	12.4	+35	8.8882	0.13-0.20	3
2448	**Sholokhov**	**02 06.6**	**14.2**	**+19**	**10.061**	**0.21-0.63**	**3-**
74	Galatea	02 07.5	12.9	+10	17.268	0.08-0.16	3
971	Alsatia	02 08.6	13.2	+33	9.614	0.17-0.29	3
5407	1992 AX	02 10.3	14.7	+25	2.5488	0.10-0.12	3
6602	Gilclark	02 10.7	15.5	+32	4.5686	0.21-0.54	3
156	Xanthippe	02 11.8	12.0	+0	22.37	0.10-0.12	3
3332	**Raksha**	**02 14.0**	**14.5**	**+16**	**4.8065**	**0.25-0.36**	**3**
1602	**Indiana**	**02 15.3**	**14.4**	**+20**	**2.601**	**0.12-0.19**	**3**
40267	***1999 GJ4***	***02 17.5***	***15.3***	***+14***	***4.9567***	***0.67-1.11***	***3***
1257	Mora	02 17.8	15.0	+6	5.2948	0.23-0.43	3
504	Cora	02 18.1	14.7	+24	7.588	0.15-0.27	3-
2911	**Miahelena**	**02 18.1**	**14.9**	**+12**	**4.201**	**0.56-0.69**	**3**
1999	**Hirayama**	**02 18.9**	**14.4**	**+12**	**15.63**	**0.45-0.57**	**3-**
3028	Zhangguoxi	02 19.6	14.8	+3	4.826	0.12-0.25	3
275	**Sapientia**	**02 21.7**	**11.5**	**+13**	**14.931**	**0.05-0.12**	**3-**
2478	Tokai	02 23.4	14.5	+3	25.885	0.41-0.90	3
1829	Dawson	02 24.2	14.8	+2	4.254	0.05-0.28	3
618	Elfriede	02 24.6	13.3	+25	14.795	0.12-0.17	3-
517	Edith	02 24.7	13.7	+5	9.2747	0.08-0.18	3
947	Monterosa	02 25.8	14.2	+17	5.164	0.15-0.23	3-
5604	1992 FE	02 27.9	12.5	-47	5.3375	0.10-0.15	3
204	Kallisto	03 01.1	12.5	-1	19.489	0.09-0.26	3
1520	Imatra	03 02.4	15.3	-13	18.635	0.27-0.35	3-
373	Melusina	03 02.5	14.2	+15	12.97	0.20-0.25	3
1115	Sabauda	03 04.3	13.5	+28	6.75	0.16-0.27	3-
5448	**Siebold**	**03 04.3**	**14.2**	**+3**	**2.9546**	**0.31-0.53**	**3**
1425	**Tuorla**	**03 07.4**	**14.1**	**-2**	**7.75**	**0.17-0.40**	**3**
713	Luscinia	03 07.8	14.6	-5	9.9143	0.09-0.40	3

		Brightest			LCDB Data		
Num	Name	Date	Mag	Dec	Period	Amp	U
33	Polyhymnia	03 10.1	13.8	+5	18.608	0.13-0.21	3
252	Clementina	03 10.6	14.5	-3	10.864	0.32-0.44	3
6170	**Levasseur**	**03 11.0**	**14.7**	**+22**	**2.6529**	**0.09-0.14**	**3**
289	Nenetta	03 11.2	14.2	+2	6.902	0.11-0.19	3
2577	**Litva**	**03 13.6**	**14.3**	**-5**	**2.8126**	**0.14-0.36**	**3**
635	Vundtia	03 16.1	13.5	+0	11.79	0.15-0.27	3
348	May	03 16.9	13.6	+15	7.3812	0.14-0.16	3
3712	Kraft	03 17.3	15.2	-51	9.341	0.27-1.20	3
1052	Belgica	03 18.3	15.1	+8	2.7097	0.08-0.10	3
70	Panopaea	03 19.0	12.1	+14	15.808	0.07-0.14	3-
309	Fraternitas	03 19.7	14.2	+0	22.398	0.10-0.35	3
5333	**Kanaya**	**03 21.8**	**14.9**	**-10**	**3.8022**	**0.15-0.22**	**3**
1171	Rusthawelia	03 23.7	14.8	+2	10.98	0.26-0.31	3
4374	Tadamori	03 23.8	14.9	+3	4.5047	0.77-0.94	3
198	Ampella	03 25.9	12.7	-14	10.379	0.03-0.22	3
811	Nauheima	03 26.4	14.8	+1	4.0011	0.08-0.20	3
240	Vanadis	03 30.1	13.0	-1	10.64	0.13-0.34	3
1029	**La Plata**	**03 30.1**	**14.5**	**-2**	**15.31**	**0.26-0.58**	**3**
782	Montefiore	03 30.3	13.5	+5	4.0728	0.42-0.54	3
533	**Sara**	**03 31.6**	**13.3**	**-3**	**11.654**	**0.19-0.30**	**3**

Radar-Optical Opportunities

There are several resources to help plan observations in support of radar.

Future radar targets:
http://echo.jpl.nasa.gov/~lance/future.radar.nea.periods.html

Past radar targets:
http://echo.jpl.nasa.gov/~lance/radar.nea.periods.html

Arecibo targets:
http://www.naic.edu/~pradar/sched.shtml
http://www.naic.edu/~pradar

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

However, 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 Dr. Benner's email listed above) 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 circles 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. So, while obtaining a lightcurve at the current apparition may not result in immediately seeing a change, the data are still critical in reaching a final determination. This is why observing asteroids that already have well-known periods can still be a valuable use of telescope time. It is even more so when considering BYORP (binary-YORP) among binary asteroids where that effect 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.

Name	Grp	Period	App	Last	Bin	R SNR
2003 UX34	NEA	-	-	-	-	**71 G**
Tantalus	NEA	2.384	2	2014	?	**10 G**
1999 JV6	NEA	6.838	3	2016	-	**394 A**
1998 XB	NEA	500.	1	2005	-	**335 G**
2010 LN14	NEA	-	-	-	-	**291 A**
2005 EE	NEA	-	-	-	-	**155 A**
1999 VG22	NEA	-	-	-	-	**35 A**
Toutatis	NEA	176	6	2013	-	**3000 G**
2003 BD44	NEA	-	-	-	-	**2000 A**
1991 VK	NEA	4.21	2	2016	-	**37 G**
2013 WT67	NEA	135.	1	2014	-	**1140 A**
1998 QK56	NEA	9.84	1	2016	-	**192 A**
1992 FE	NEA	5.338	2	2009	-	**2500 G**
2000 HA24	NEA	-	-	-	-	**42 G**
2003 HF2	NEA	-	-	-	-	**3400 A**

Table I. Summary of radar-optical opportunities in 2017 Jan-Mar. Data from the asteroid lightcurve database (Warner *et al.,* 2009; *Icarus* **202**, 134-146).

To help focus efforts in YORP detection, Table I gives a quick summary of this quarter's radar-optical targets. The Grp column gives the family or group for the asteroid. The period is in hours and, in the case of binary, for the primary. 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 Bin column is 'Y' if the asteroid has one or more satellites (a '?' indicates a suspected binary). The last column indicates the estimated radar SNR using the tool at

http://www.naic.edu/~eriverav/scripts/radarscript.php

The estimate in Table I is based on using the Arecibo (A) or Goldstone (G) radar. Goldstone is the default if a close approach is outside the declination range of Arecibo. The estimate uses the current MPCORB absolute magnitude (*H*), a period of 3.0 hours if it's not known, and the approximate minimum Earth distance during the three-month period covered by this paper.

If the SNR value is in bold text, the object was found on the radar planning pages listed above. Otherwise, the search 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 was placed on the list only if the estimated radar SNR > 10. This would produce a very marginal signal, not enough for imaging, but might allow improving orbital parameters

(226514) 2003 UX34 (Dec-Jan, *H* = 20.0)

This NEA has an estimated diameter of about 300 meters. The rotation period has not yet been determined. Early January will provided the best opportunity for smaller backyard telescopes.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/01	02 21.7	+22 03	0.37	1.21	16.2	45.0	120	88	+0.07	-36
01/11	02 27.1	+25 06	0.45	1.22	16.7	48.5	111	50	+0.97	-33
01/21	02 37.4	+27 36	0.53	1.23	17.1	51.0	104	163	-0.40	-30
01/31	02 51.4	+29 45	0.60	1.22	17.5	52.8	98	63	+0.10	-26
02/10	03 08.4	+31 39	0.67	1.22	17.7	54.2	92	76	+0.99	-23
02/20	03 27.9	+33 22	0.74	1.20	17.9	55.4	87	155	-0.39	-19
03/02	03 49.5	+34 52	0.79	1.18	18.1	56.5	82	42	+0.14	-15
03/12	04 13.2	+36 10	0.84	1.15	18.2	57.6	77	96	+1.00	-11

2102 Tantalus (Dec-Jan, Binary?, *H* = 16.5)

Pravec *et al*. (1997) reported a period of 2.391 h. Warner (2015) reported a possible satellite based on a second period of about 16 hours in addition to a "primary" period of 2.384 h. High-quality data (< 0.03 mag precision) will be needed to help confirm the satellite.

On the other hand, the lack of evidence (negative observations) will not automatically mean that the earlier analysis observations and analysis were incorrect. Favoring confirmation is that the phase angle bisector longitude will be about 180° from the time Warner observed the NEA. This means that the viewing geometry of the purported satellite orbit will be about the same, the difference being, e.g., a view favoring the south pole of primary instead of its north pole.

January is the best time to catch this. While still bright enough to work into February and March, the galactic latitude is near 0°, put the asteroid in rich star fields.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/01	02 11.4	-01 54	0.14	1.04	14.1	63.8	109	79	+0.07	-58
01/05	01 06.8	+18 19	0.17	1.02	14.8	72.7	98	22	+0.41	-44
01/09	00 20.8	+30 06	0.22	1.00	15.5	78.2	89	52	+0.84	-32
01/13	23 48.6	+36 36	0.28	0.99	16.1	80.6	83	105	-1.00	-25
01/17	23 25.2	+40 26	0.35	0.97	16.5	81.2	78	135	-0.77	-20
01/21	23 07.7	+42 51	0.42	0.96	16.8	80.7	75	123	-0.40	-16
01/25	22 53.9	+44 28	0.48	0.95	17.1	79.7	72	91	-0.09	-14
01/29	22 42.8	+45 35	0.54	0.94	17.3	78.3	69	61	+0.01	-12

(85990) 1999 JV6 (Jan, *H* = 20.2)

Warner (2014, 2015, and 2016) has reported a period of about 6.54 hours for this NEA. The primary goals for observations are for lightcurve inversion modeling and building a longer time frame to look for YORP influence in the coming years.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/10	02 21.3	-11 39	0.07	1.00	17.2	77.6	98	49	+0.91	-64
01/11	02 37.0	-08 19	0.07	1.00	17.1	73.6	102	58	+0.97	-59
01/12	02 51.5	-05 09	0.08	1.01	17.1	69.9	106	67	+1.00	-54
01/13	03 04.9	-02 10	0.08	1.01	17.1	66.5	109	76	-1.00	-49
01/14	03 17.3	+00 35	0.08	1.02	17.1	63.5	112	87	-0.97	-45
01/15	03 28.7	+03 07	0.09	1.02	17.1	60.8	115	97	-0.92	-41
01/16	03 39.2	+05 26	0.09	1.03	17.1	58.4	117	107	-0.85	-38
01/17	03 48.9	+07 31	0.09	1.03	17.2	56.3	119	117	-0.77	-35

(96590) 1998 XB (Jan-Feb, *H* = 16.2)

This asteroid has reported a period between 500-520 hours (Pravec *et al*., 2005). Given the somewhat large phase angle, the lightcurve may have some unusual features. A campaign of determined and well-coordinated observers is in order. The low galactic latitudes could make this a difficult target. Remember to get a prolonged run of data throughout each night and not just a few random data points. This helps assure correctly finding the nightly trends as well as to look for a short period component (see Warner, *MPB* **43**, 306-309).

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/01	02 21.7	+22 03	0.37	1.21	16.2	45.0	120	88	+0.07	-36
01/11	02 27.1	+25 06	0.45	1.22	16.7	48.5	111	50	+0.97	-33
01/21	02 37.4	+27 36	0.53	1.23	17.1	51.0	104	163	-0.40	-30
01/31	02 51.4	+29 45	0.60	1.22	17.5	52.8	98	63	+0.10	-26
02/10	03 08.4	+31 39	0.67	1.22	17.7	54.2	92	76	+0.99	-23
02/20	03 27.9	+33 22	0.74	1.20	17.9	55.4	87	155	-0.39	-19
03/02	03 49.5	+34 52	0.79	1.18	18.1	56.5	82	42	+0.14	-15
03/12	04 13.2	+36 10	0.84	1.15	18.2	57.6	77	96	+1.00	-11

(438955) 2010 LN14 (Jan-Feb, *H* = 21.1)

The rotation period for this 180-meter NEA has not been determined. The size is on the edge of making this a likely super-fast rotator. Keep exposures as short as possible until preliminary analysis indicates a period.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/15	13 38.2	+08 41	0.06	0.99	17.8	81.4	95	54	-0.92	+69
01/18	12 19.4	+15 21	0.06	1.02	17.3	58.4	118	16	-0.68	+76
01/21	11 12.9	+19 26	0.08	1.04	17.1	39.5	138	61	-0.40	+66
01/24	10 23.5	+21 25	0.09	1.07	17.2	25.5	152	107	-0.15	+56
01/27	09 48.3	+22 14	0.11	1.09	17.3	15.3	163	151	-0.01	+48
01/30	09 23.2	+22 30	0.13	1.11	17.5	8.1	171	161	+0.04	+43
02/02	09 04.9	+22 31	0.15	1.14	17.7	4.9	174	117	+0.27	+39
02/05	08 51.4	+22 25	0.18	1.16	18.2	7.1	172	73	+0.60	+36

(265482) 2005 EE (Jan-Feb, *H* = 21.3)

2005 EE is an NEA with an estimated diameter of 160 meters. This makes it another candidate for being a super-fast rotator. Because of the need for short exposures means larger scopes (0.5-m or more) are preferred.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/20	13 45.6	+10 08	0.07	1.00	18.3	77.2	99	18	-0.49	+69
01/23	13 14.2	+16 56	0.08	1.01	18.1	65.1	111	57	-0.23	+79
01/26	12 45.0	+22 29	0.08	1.03	18.0	54.5	121	99	-0.04	+85
01/29	12 18.4	+26 50	0.09	1.05	18.0	45.7	130	139	+0.01	+83
02/01	11 54.3	+30 07	0.10	1.06	18.0	38.3	138	151	+0.17	+77
02/04	11 32.8	+32 32	0.12	1.08	18.1	32.4	144	116	+0.48	+72
02/07	11 13.8	+34 14	0.13	1.10	18.3	27.9	149	74	+0.81	+68
02/10	10 57.2	+35 24	0.14	1.11	18.4	24.6	152	36	+0.99	+64

(413002) 1999 VG22 (Jan-Mar, *H* = 18.7)

For radar observations, the relatively large size of 0.55 km for this NEA is countered by its Earth distance of more than 0.1 AU. The result is a low SNR. Still, photometric and astrometric observations will be helpful, especially the former. Expect a period greater than 2 hours.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/01	09 48.1	+08 27	0.20	1.13	17.0	38.6	134	165	+0.07	+43
01/11	10 21.3	+01 56	0.18	1.12	16.8	39.5	134	65	+0.97	+46
01/21	10 52.8	-04 49	0.17	1.11	16.6	40.2	133	58	-0.40	+47
01/31	11 20.3	-10 57	0.16	1.10	16.5	39.9	134	163	+0.10	+46
02/10	11 42.2	-15 44	0.16	1.11	16.5	37.9	136	55	+0.99	+44
02/20	11 57.4	-18 50	0.17	1.12	16.5	33.9	141	70	-0.39	+42
03/02	12 05.9	-20 09	0.18	1.15	16.5	28.1	147	153	+0.14	+41
03/12	12 09.1	-19 54	0.19	1.17	16.5	21.3	155	32	+1.00	+42
03/22	12 09.5	-18 30	0.22	1.21	16.6	14.8	162	97	-0.37	+43
04/01	12 09.5	-16 29	0.25	1.24	16.9	11.5	166	122	+0.20	+45

4179 Toutatis (Jan-Mar, NPAR (tumbler), *H* = 15.3)

This well-studied asteroid is in non-principal axis rotation (NPAR), commonly known as *tumbling*. The periods of rotation and precession are 176 and 130 h (Pravec *et al*., 2005). There are several radar generated “movies” showing the rotation of the asteroid, *e.g.*, *http://www.jpl.nasa.gov/video/details.php?id=1175*.

Period analysis of a tumbler requires specialized software such as that developed by Petr Pravec. Even so, because of the long periods involved, consideration should be given to a prolonged campaign involving several observers at widely-spaced locations and a standardized method so that all data can be put onto a common system (zero point), even if it’s only internal and not one such as the Johnson-Cousins system.

Try to catch this as soon into the New Year as possible. The galactic latitude decreases to near 0° while the magnitude increases, making the asteroid a more difficult target by Ground Hog Day.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
01/01	01 13.4	+06 33	0.25	1.05	14.9	67.4	99	68	+0.07	-56
01/06	01 58.1	+11 01	0.26	1.08	14.9	60.8	106	14	+0.52	-49
01/11	02 40.8	+14 48	0.28	1.12	14.9	54.8	112	48	+0.97	-40
01/16	03 19.7	+17 42	0.31	1.15	15.0	49.7	116	109	-0.85	-33
01/21	03 54.1	+19 49	0.34	1.19	15.2	45.8	120	162	-0.40	-26
01/26	04 23.9	+21 16	0.39	1.23	15.5	42.8	122	145	-0.04	-19
01/31	04 49.7	+22 14	0.43	1.27	15.7	40.6	123	86	+0.10	-14
02/05	05 12.3	+22 51	0.49	1.32	16.0	39.0	123	22	+0.60	-10

(143404) 2003 BD44 (Feb-Apr, *H* = 16.6, PHA)

No rotation period has been reported for this 1.3 km NEA. Follow this across as wide a range of phase angles as possible (e.g., once every 7-10 days), getting a complete lightcurve at every interval. This will allow finding more accurate values for H (absolute magnitude) and G (phase slope parameter). Be careful, however, of trying to merge the lightcurves into a single solution: the synodic period and especially the shape of the lightcurve may evolve dramatically during the apparition.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
02/01	12 02.6	-02 46	0.87	1.68	18.8	26.5	130	175	+0.17	+58
02/11	12 08.2	-03 20	0.71	1.60	18.2	24.0	139	41	+1.00	+58
02/21	12 11.3	-03 31	0.57	1.51	17.5	20.2	148	83	-0.30	+58
03/03	12 10.9	-03 10	0.45	1.42	16.6	14.8	159	144	+0.23	+58
03/13	12 06.0	-01 57	0.33	1.32	15.6	7.4	170	6	-1.00	+59
03/23	11 54.0	+00 42	0.24	1.23	14.4	3.2	176	120	-0.28	+60
04/02	11 28.0	+06 33	0.15	1.14	13.9	19.5	158	91	+0.30	+61
04/12	10 10.9	+22 43	0.08	1.05	13.3	52.6	124	64	-0.99	+54

(7341) 1991 VK (Feb-Apr, *H* = 17.0)

Pravec *et al.* (1998, *A* = 0.70 mag) and Warner (2016, *A* = 0.21 mag) each found a period of about 4.2 hours for this 1.4 km NEA. Warner observed at a phase angle bisector longitude of about 10°, or almost 180° from the longitude for this apparition. Expect, but don’t assume, an amplitude closer to 0.2 mag than 0.7 mag, keeping in mind that amplitude increases with phase angle.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
02/01	12 02.6	-02 46	0.87	1.68	18.8	26.5	130	175	+0.17	+58
02/11	12 08.2	-03 20	0.71	1.60	18.2	24.0	139	41	+1.00	+58
02/21	12 11.3	-03 31	0.57	1.51	17.5	20.2	148	83	-0.30	+58
03/03	12 10.9	-03 10	0.45	1.42	16.6	14.8	159	144	+0.23	+58
03/13	12 06.0	-01 57	0.33	1.32	15.6	7.4	170	6	-1.00	+59
03/23	11 54.0	+00 42	0.24	1.23	14.4	3.2	176	120	-0.28	+60
04/02	11 28.0	+06 33	0.15	1.14	13.9	19.5	158	91	+0.30	+61
04/12	10 10.9	+22 43	0.08	1.05	13.3	52.6	124	64	-0.99	+54

(443103) 2013 WT67 (Feb-Mar, *H* = 18.0)

Warner (2015) found a period of 135 h with a possibility of tumbling. A well-coordinated campaign involving observers from widely separated longitudes will be required to give this 750-m NEA the attention it needs.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
02/20	03 19.3	+11 47	0.11	0.97	16.6	94.0	79	156	-0.39	-37
02/25	04 18.4	+00 21	0.13	0.99	16.5	86.0	87	106	-0.03	-33
03/02	05 03.2	-08 25	0.15	1.01	16.7	79.6	92	53	+0.14	-28
03/07	05 36.9	-14 30	0.18	1.02	16.9	74.9	95	36	+0.67	-23
03/12	06 02.9	-18 39	0.21	1.04	17.2	71.5	97	78	+1.00	-19
03/17	06 23.9	-21 33	0.24	1.06	17.4	68.9	98	120	-0.82	-15
03/22	06 41.4	-23 37	0.27	1.07	17.7	66.8	99	137	-0.37	-13
03/27	06 56.8	-25 07	0.31	1.09	17.9	65.2	99	107	-0.02	-10

(10636) 1998 QK56 (Feb-Mar, *H* = 17.6)

Warner (2016) found a period 9.84 hours for 1998 QK56, an NEA with an estimated diameter of 900 meters. Taking moon elongation and galactic latitude into account, early February and late March appear to provide the best opportunities.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
02/01	02 24.6	-38 11	0.23	0.94	17.6	93.7	73	48	+0.17	-68
02/09	03 27.0	-37 01	0.18	0.97	17.0	88.8	81	81	+0.95	-56
02/17	04 54.1	-31 45	0.15	1.01	16.2	77.0	95	126	-0.67	-38
02/25	06 36.1	-19 20	0.14	1.06	15.5	58.1	115	129	-0.03	-12
03/05	08 04.2	-03 54	0.15	1.10	15.3	39.9	134	57	+0.45	+14
03/13	09 05.6	+07 13	0.20	1.16	15.7	30.8	143	42	-1.00	+33
03/21	09 46.6	+13 27	0.26	1.22	16.4	28.8	144	130	-0.47	+45
03/29	10 15.3	+16 40	0.33	1.27	17.0	29.5	141	129	+0.01	+52

(5604) 1992 FE (Mar, *H* = 17.2)

Bembrick *et al*. (2003) found a period of 6.02 h while Higgins *et al.* (2009) and Koehn *et al*. (2014) found a period of about 5.3 hours. Southern Hemisphere observers will have the best chance to help remove any remaining uncertainties about the period. The estimated size for this NEA is 1.1 km.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
03/01	08 09.5	-40 22	0.05	1.01	12.6	58.0	120	107	+0.07	-4
03/06	08 40.3	-21 15	0.07	1.05	13.3	41.9	135	61	+0.56	+12
03/11	08 52.1	-12 49	0.11	1.08	14.0	37.6	139	31	+0.97	+20
03/16	08 59.6	-08 13	0.14	1.10	14.7	37.0	138	78	-0.89	+24
03/21	09 05.7	-05 22	0.18	1.13	15.2	37.9	136	132	-0.47	+27
03/26	09 11.4	-03 26	0.21	1.15	15.7	39.2	133	155	-0.06	+29
03/31	09 17.1	-02 04	0.25	1.18	16.2	40.6	130	91	+0.12	+31
04/05	09 23.1	-01 06	0.29	1.20	16.5	42.1	127	26	+0.64	+33

(138404) 2000 HA24 (Mar-Apr, *H* = 19.1)

The rotation period for 2000 HA24, a 500-meter NEA, has apparently not been reported. Late March and later will be the better time to observe the asteroid. It will still be relatively bright and farther away from the galactic plane.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
03/15	16 56.7	-47 10	0.07	1.00	16.1	80.5	96	61	-0.94	-2
03/20	15 30.7	-44 04	0.08	1.03	15.7	60.9	115	36	-0.56	+10
03/25	14 30.3	-38 53	0.09	1.06	15.6	44.6	132	96	-0.12	+20
03/30	13 50.0	-33 34	0.10	1.08	15.7	31.7	145	155	+0.05	+28
04/04	13 23.0	-28 52	0.12	1.11	15.8	21.8	156	101	+0.53	+34
04/09	13 04.6	-24 57	0.14	1.14	16.0	15.4	162	36	+0.95	+38
04/14	12 52.0	-21 45	0.16	1.16	16.3	13.1	165	39	-0.93	+41
04/19	12 43.5	-19 11	0.19	1.19	16.7	14.7	163	97	-0.54	+44
04/24	12 38.1	-17 08	0.22	1.21	17.1	17.9	158	159	-0.09	+46
04/29	12 35.2	-15 31	0.25	1.23	17.6	21.4	153	118	+0.09	+47

(215588) 2003 HF2 (Mar-Apr, *H* = 19.4)

This NEA has an estimated effective diameter of 390 meters, so its rotation period is very likely more than 2 hours. The first few days of April will provide the best opportunity to find a rotation period. Because of the large phase angle, be careful about assuming a bimodal shape for the lightcurve, even the amplitude exceeds 0.5 mag.

DATE	RA	Dec	ED	SD	V	α	SE	ME	MP	GB
03/30	06 41.7	+19 09	0.05	1.00	15.7	86.7	91	65	+0.05	+7
03/31	07 40.8	+18 40	0.05	1.01	15.6	73.6	104	64	+0.12	+19
04/01	08 25.1	+17 32	0.06	1.02	15.6	63.8	113	60	+0.20	+28
04/02	08 57.3	+16 18	0.07	1.04	15.7	56.7	120	53	+0.30	+35
04/03	09 21.0	+15 11	0.08	1.05	15.9	51.6	125	45	+0.42	+40
04/04	09 38.8	+14 14	0.09	1.06	16.1	47.9	128	35	+0.53	+43
04/05	09 52.6	+13 26	0.10	1.07	16.4	45.2	131	25	+0.64	+46
04/06	10 03.6	+12 46	0.12	1.08	16.6	43.1	132	14	+0.74	+48
04/07	10 12.4	+12 11	0.13	1.09	16.8	41.6	134	3	+0.83	+50
04/08	10 19.8	+11 42	0.14	1.10	17.0	40.3	134	8	+0.90	+51