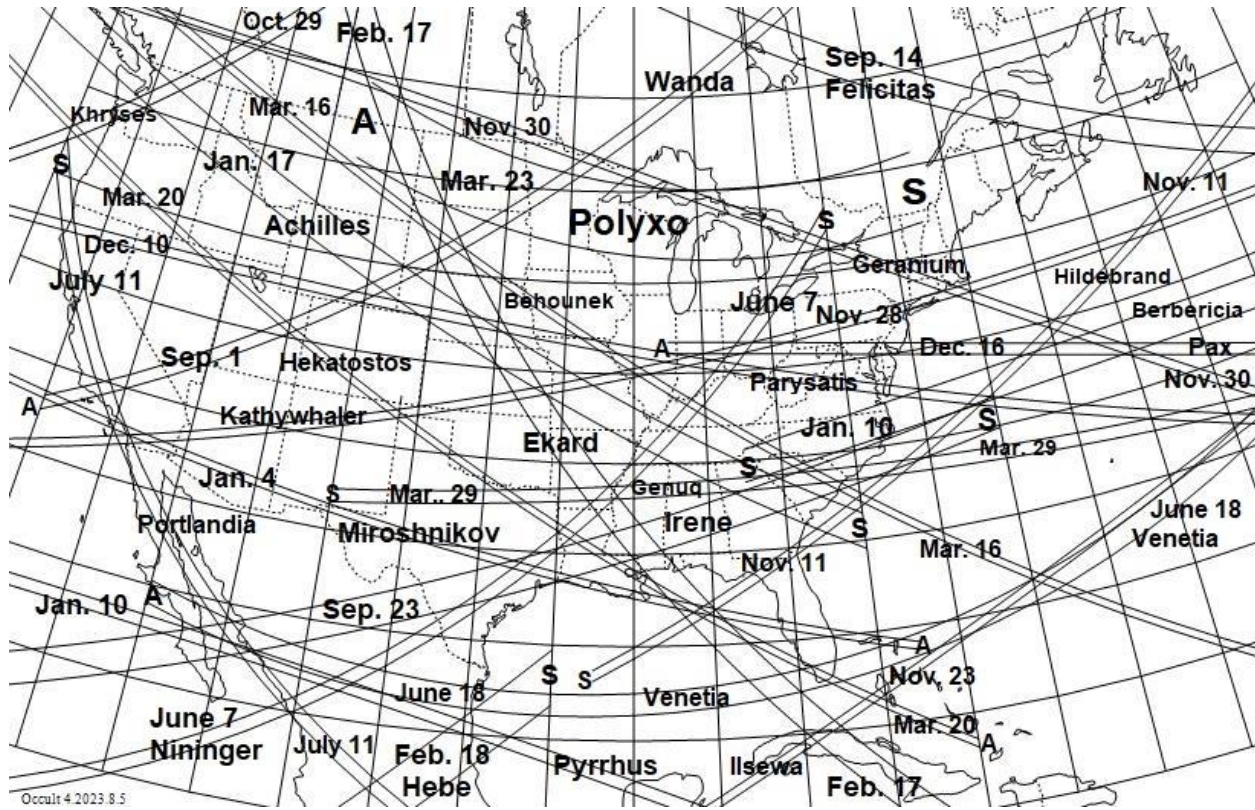


2024 Occultations of Bright Stars by Main-Belt Asteroids



Occult 4.2023.8.5

Date	UT	Occulting Body	Star	RA (2000)			Dec	Dur.		Path			
				Mag.	h	m	s	°	'		"	ΔMag.	s
Jan. 4	10:30	12214 Miroshnikov	UCAC4 525-028249	8.2	06	30	07.4	+14	58	52	9.1	2.1	FL-CA
Jan. 10	05:59	5283 Pyrrhus	HIP 39366	8.5	08	02	51.4	+36	05	08	7.8	3.3	Mex-Baja
Jan. 10	23:26	776 Berbericia	TYC 1860-00331-1	8.1	05	30	02.8	+29	49	43	3.7	15.3	NC-GA
Jan. 17	11:25	588 Achilles	TYC 1927-01883-1	10.4	08	13	34.4	+23	54	32	4.1	8.5	SC-BC
Feb. 17	05:12	694 Ekard	TYC 0155-01863-1	8.5	06	44	01.7	+03	45	12	5.8	13.2	Cuba-SK
Feb. 18	12:19	6 Hebe	HIP 72635	8.2	14	51	02.5	-00	01	36	2.8	20.2	Mex
Mar. 16	04:58	3278 Behounek	HIP 30200	6.4	06	21	11.9	+29	32	26	10.9	3.1	BC-SC
Mar. 20	09:38	2245 Hekatosotos	HIP 51823	10.1	10	35	14.8	+27	14	05	6.1	3.4	BS-OR
Mar. 23	09:49	308 Polyxo	TYC 6259-00194-1	9.6	18	00	00.1	-19	02	16	3.7	8.3	MT-VT
Mar. 29	02:08	485 Genua	TYC 0718-00942-1	9.6	05	37	49.6	+09	40	30	3.4	2.2	NM-NC
Jun. 7	08:26	2421 Nininger	TYC 6868-00164-1	9.1	18	53	20.9	-27	06	43	6.6	3.8	ON-Mex
Jun. 18	04:20	487 Venetia	TYC 6300-02115-1	8.9	19	12	25.2	-18	15	54	3.4	6.1	BS-Baja
Jul. 11	05:00	757 Portlandia	HIP 77896	8.1	15	54	27.0	-30	25	33	6.3	8.4	Mex-CA
Sep. 1	07:18	1057 Wanda	TYC 1814-00965-1	8.6	04	09	07.9	+23	42	22	6.8	2.8	CA-QC
Sep. 14	07:38	109 Felicitas	HIP 5406	8.0	01	09	11.1	+08	17	47	3.7	17.6	NS-ON
Sep. 23	09:41	14 Irene	TYC 1342-00182-1	9.4	06	45	25.6	+21	49	02	2.6	6.6	Baja-NC
Oct. 29	03:31	4707 Khryses	HIP 1364	8.1	00	17	05.2	+10	30	07	9.2	3.3	AB-OR
Nov. 11	23:59	5661 Hildebrand	HIP 105939	8.5	21	27	19.7	-09	01	56	8.4	2.2	GA-FL
Nov. 23	04:49	979 Ilsewa	HIP 13448	6.2	02	53	11.8	+16	28	59	7.8	3.3	BS-Cuba
Nov. 28	03:35	5914 Kathywhaler	HIP 21856	8.5	04	41	59.7	+21	30	32	7.7	2.6	MA-CA
Nov. 30	08:01	1227 Geranium	TYC 2907-00725-1	9.5	05	02	25.8	+44	39	27	6.7	2.9	MA-BC
Dec. 10	04:24	888 Parysatis	UCAC4 503-034756	8.4	06	55	54.1	+10	24	21	4.1	6.0	VA-CA
Dec. 16	00:53	679 Pax	TYC 0139-00850-1	9.0	06	11	00.9	+04	30	34	2.8	4.3	NJ-IL

Like 2023, we are presenting a map of the brightest occultations by main-belt asteroids in North America on the first page; 23 events involving stars brighter than mag. 9.2 are included, but also a few fainter stars, to mag. 10.4, for a good geographical distribution. This is not ALL of the occultations of bright stars by asteroids with good-enough orbits to predict them well. As the orbits of more smaller asteroids are improved with the ever-growing numbers of astrometric observations of them (especially high-accuracy data from occultation observations and from Gaia), more bright events are found that didn't have good-enough orbits when we generated the predictions for 2024 several months ago to meet the RASC Handbook publication deadline. For example, on Jan. 9, several minutes before 8h UT, the asteroid (7483) Sekitakakazu will occult 8.2-mag. TYC 1913-00495-1 in a narrow path crossing southern and west Texas, s.w. New Mex., southern Arizona, and southern California; details for it can be found at <https://cloud.occultwatcher.net/event/1103-7483-103200-649561-T00495-1> . You can find events like this, and many others visible from or near your location using IOTA's free Occult Watcher software, described near the end of this document. After the map is a table, similar to our tables given in the 2021 and earlier Handbooks, but without the long path descriptions we had before, since the path locations can easily be seen on the map. The predictions were generated by Edwin Goffin, Scott Donnell, Steve Preston, Derek Breit, and David Herald. Preston assisted Dunham in the selection for the map, and he prepared the basic tables. The maps were produced with IOTA's free *Occult* software; see <http://www.lunar-occultations.com/iota/occult4.htm>. The orbital elements are all from the NASA JPL Horizons Web site at <https://ssd.jpl.nasa.gov/horizons.cgi> and the stellar data are from the third release (DR3) of the European Space Agency's Gaia mission, as implemented with UCAC4, Tycho, and Hipparcos catalog identifiers with *Occult*. At the bottom of the first page is the shortened version of the table given in the *Handbook*. Below is the full original version of the table of the 23 events:

2024	U.T.		Occulting Body			Diameter			Star R.A. (J2000)				Dec.	Dur.		Elongation		Moon		Path
Date	day	h m	Number	Name	Mag	km	"	Star	Mag	h m s	° ' "	° ' "	Δmag.	s	Sun°	Moon°	%s			
Jan.	4	10:30	12214	Miroshnikov	17.3	21.9	0.011	UCAC4 525-028249	8.2	06 30 07.4	+14 58 52	9.1	2.1	170	98	48			FL-CA	
Jan.	10	05:59	5283	Pyrrhus	16.3	54.1	0.020	HIP 39366	8.5	08 02 51.4	+36 05 08	7.8	3.3	164	156	2			Mex-Baja	
Jan.	10	23:26	776	Berbericia	11.8	155.4	0.121	TYC 1860-00331-1	8.1	05 30 02.8	+29 49 43	3.7	15.3	153	161	1			NC-GA	
Jan.	17	11:25	588	Achilles	14.5	133.5	0.052	TYC 1927-01883-1	10.4	08 13 34.4	+23 54 32	4.1	8.5	175	102	43			SC-BC	
Feb.	17	05:12	694	Ekard	14.3	97.5	0.057	TYC 155-01863-1	8.5	06 44 01.7	+03 45 12	5.8	13.2	131	43	56			Cuba-SK	
Feb.	18	12:19	6	Hebe	10.9	199.3	0.112	HIP 72635	8.2	14 51 02.5	-00 01 36	2.8	20.2	108	134	70			Mex	
Mar.	16	04:58	3278	Behounek	17.3	32.2	0.015	HIP 30200	6.4	06 21 11.9	+29 32 26	10.9	3.1	99	21	40			BC-SC	
Mar.	20	09:38	2245	Hekatos	16.2	31	0.023	HIP 51823	10.1	10 35 14.8	+27 14 05	6.1	3.4	146	26	80			BS-OR	
Mar.	23	09:49	308	Polyxos	13.3	136.5	0.077	TYC 6259-00194-1	9.6	18 00 00.1	-19 02 16	3.7	8.3	93	107	97			MT-VT	
Mar.	29	02:08	485	Genua	13	59.8	0.037	TYC 718-00942-1	9.6	05 37 49.6	+09 40 30	3.4	2.2	76	143	87			NM-NC	
Jun.	7	08:26	2421	Nininger	15.8	41	0.025	TYC 6868-00164-1	9.1	18 53 20.9	-27 06 43	6.6	3.8	155	166	1			ON-Mex	
Jun.	18	04:20	487	Venetia	12.3	62.6	0.049	TYC 6300-02115-1	8.9	19 12 25.2	-18 15 54	3.4	6.1	159	68	84			BS-Baja	
Jul.	11	05:00	757	Portlandia	14.4	33.8	0.026	HIP 77896	8.1	15 54 27.0	-30 25 33	6.3	8.4	133	74	25			Mex-CA	
Sep.	1	07:18	1057	Wanda	15.4	43.7	0.032	TYC 1814-00965-1	8.6	04 09 07.9	+23 42 22	6.8	2.8	94	75	3			CA-QC	
Sep.	14	07:38	109	Felicitas	11.7	87.4	0.106	HIP 5406	8.0	01 09 11.1	+08 17 47	3.7	17.6	153	80	80			NS-ON	
Sep.	23	09:41	14	Irene	11.8	146.5	0.077	TYC 1342-00182-1	9.4	06 45 25.6	+21 49 02	2.6	6.6	80	29	66			Baja-NC	
Oct.	29	03:31	4707	Khryses	17.4	37.7	0.014	HIP 1364	8.1	00 17 05.2	+10 30 07	9.2	3.3	151	168	9			AB-OR	
Nov.	11	23:59	5661	Hildebrand	16.8	38	0.018	HIP 105939	8.5	21 27 19.7	-09 01 56	8.4	2.2	92	34	79			GA-FL	
Nov.	23	04:49	979	Ilsewa	14	37.8	0.027	HIP 13448	6.2	02 53 11.8	+16 28 59	7.8	3.3	165	107	48			BS-Cuba	
Nov.	28	03:35	5914	Kathywhaler	16.2	38.9	0.020	HIP 21856	8.5	04 41 59.7	+21 30 32	7.7	2.6	174	140	9			MA-CA	
Nov.	30	08:01	1227	Geranium	16.2	44	0.023	TYC 2907-00725-1	9.5	05 02 25.8	+44 39 27	6.7	2.9	156	153	1			MA-BC	
Dec.	10	04:24	888	Parysatis	12.5	45.3	0.048	UCAC4 503-034756	8.4	06 55 54.1	+10 24 21	4.1	6.0	152	96	67			VA-CA	
Dec.	16	00:53	679	Pax	11.7	55.9	0.068	TYC 139-00850-1	9.0	06 11 00.9	+04 30 34	2.8	4.3	159	24	99			NJ-IL	

Full Table (above) Description: The successive columns in the table list: (1) the date and map central time [UT] of the event; (2) the number and name of the occulting body; (3) its magnitude; (4) its diameter, in km and then in arc seconds; (5) the catalogue and number of the occulted star; (6) the star's apparent visual magnitude; (7) the star's right ascension and (8) declination; (9) the expected magnitude change from the combined brightness; (10) the predicted maximum duration of the occultation in seconds; (11) the elongation of the star from the Sun and (12) the Moon; (13) the percent of the Moon's disc that is sunlit; and, (14) the path location specified by the lands crossed by the eastern and western ends of the path shown on the map. The two-letter abbreviations for the US States and Canadian Provinces are given,

with the order indicating the direction of motion of the shadow. “LI” is used for Long Island (NY); “Baja” is Baja California, either Norte or Sur, while “Mex” denotes the rest of Mexico. DR is the Dominican Republic, and BS is the Bahamas. Due to uncertainties mainly in the ephemerides of the minor planets from which these predictions are derived (most star positions are now accurately determined from the European Space Agency’s Gaia mission), the region of visibility of an occultation is uncertain, but now by only a few tenths of a path-width for most of these events. Errors remain, so those near but outside the paths should try to observe. It’s also useful, especially for the brighter stars that produce high signal-to-noise recordings, to observe even if you are located up to about 10 path-widths from the predicted path, to check for the possibility of an occultation by a previously-unknown satellite of the asteroid.

We can only portray the brightest events here. Our searches have found many other occultations, including 649 visible from North America of stars brighter than mag. 11.1. Tables and interactive maps of them are available at http://www.poyntsource.com/New/RASC_Events.htm .

The “short” table in the Handbook, at the bottom of the first page of this document, doesn’t have as much information as the “long” version on the previous page; although the order of the columns that are there in the short version is the same. The “short” version does not include the “long” version columns 3, 4, 11, 12, and 13 that are described on the previous page.

Note that the times are for a point near the center of the path shown on the map; for any specific location in North America, the event time can be a few minutes earlier or later. A few weeks before each event, improved predictions and the latest path maps, as well as Aladin finder charts of different scales to locate the stars, may be obtained from “Occult Watcher (OW)”, which is highly recommended as it will list all of the asteroidal occultations, filtered to a magnitude limit that you specify, visible from your site or region during the next two months; it is a free download from <http://www.hristopavlov.net/OccultWatcher/publish.htm>. Since OW, and its companion OW Cloud, works from an interactive Web site, IOTA uses it to coordinate minor planet occultation observation plans. It is a valuable tool that all serious observers of these events should use.

Now that the prediction accuracy as improved for most asteroids, thanks to the Gaia mission, we give maps and tables in the next subsections for selected fainter but more scientifically valuable occultations that could be observed by many amateur astronomers; you are encouraged to visit those subsections, to try some of those events and contribute to occultation science.

Some other star designations

The star designations given in our table above, and in all of our predictions, are those from the version of the Gaia EDR3 catalog that Dave Herald generated for the Occult program. These include HIP and Tycho2 catalog numbers for the brighter stars, and UCAC4 numbers for most of the rest. The stellar data in the catalog are the best available, from Gaia DR3, but from the USNO Bright Star Catalog (UBSC) for most stars brighter than 4th mag. that are too bright for Gaia to observe. Other star catalog numbers, such as SAO given in the past, and spectral types, are generally not given now, but can be found from the Occult Watcher (OW) Cloud page for the event, which you can get either from Occult Watcher (if installed on your computer) or you can always find the event at <https://cloud.occultwatcher.net/events> where you can specify the asteroid’s number and the event date specified by clicking on the calendar symbol, to get the OW Cloud page for the event. On the OW Cloud page, click on the star number at the top to get the VizieR page for the star, and from the options listed near the top, click on “Simbad” and from that page, the SAO number and spectral type can be found, if the star has them; most stars brighter than 9th mag. have SAO numbers and spectral types, but not all of them.

Occult Input Files

You can download and use IOTA's free Occult program and use it to compute your own local lists and information about these and many other occultations. The information for doing this is at <http://www.lunar-occultations.com/iota/iotandx.htm> - on the right side of that page, under the "IOTA GOALS AND OBJECTIVES" section, is a "2024 Predictions" section. Near the top of that, click on the line "Concerning 2024 IOTA Predictions Must Read (pdf format)". In that, it describes a prediction input file for planetary and asteroidal occultations called **All2024.xml**. You can use that file to generate local predictions, but you can replace it with the other files listed below to generate predictions for more occultations, mainly of fainter stars than shown on the map and in the short table above:

Nam24toMag11.xml – This is the input for 649 occultations of stars of mag. 11.0 and brighter visible from North America. These may be posted on Derek Breit's RASC events page at http://www.poyntsource.com/New/RASC_Events.htm . It includes occultations by near-Earth asteroids (NEAs) as well as by main-belt (and Trojan) asteroids.

2024-events-NA.xml – This is the input file for all 1427 North American asteroidal occultations in Steve Preston's predictions for 2024 given at <https://www.asteroidoccultation.com/> including stars to 12th magnitude, and several fainter. For 2024, Preston includes input files for many more occultations, including many to 13th magnitude, and some fainter, that won't be in this file. You can get them from his predictions page at the link above, in .zip files for three categories (general asteroids, NEO asteroids, and TNOs and Centaurs) which when unzipped, give large files grouped by month, with worldwide coverage. But unlike in previous years, they will not be updated with improved orbits during the year; that is now done only with Occult Watcher.

For worldwide occultations for the whole year, use the **All2024.xml** file noted above, but even more occultations can be found with Occult Watcher (it is also limited to the next two months); links to it are given above.

For occultations by Near-Earth Asteroids (NEA's), see <https://occultations.org/publications/rasc/2024/nam24NEAoccs.htm>

For occultations by special Main-Belt asteroids, see <https://occultations.org/publications/rasc/2024/nam24MBspecialoccs.htm>

For occultations by Trojan asteroids, see <https://occultations.org/publications/rasc/2024/nam24Trojanoccs.htm>

For occultations by distant objects (SW1, Centaurs, and TNO's), see [but won't be ready until February] <https://occultations.org/publications/rasc/2024/nam24distantoccs.htm>

Most of the above pages are under construction, probably returning broken links, but they should be ready before the first event of them given in the Handbook occurs.

David Dunham, dunham@starpower.net, 2023 December 30