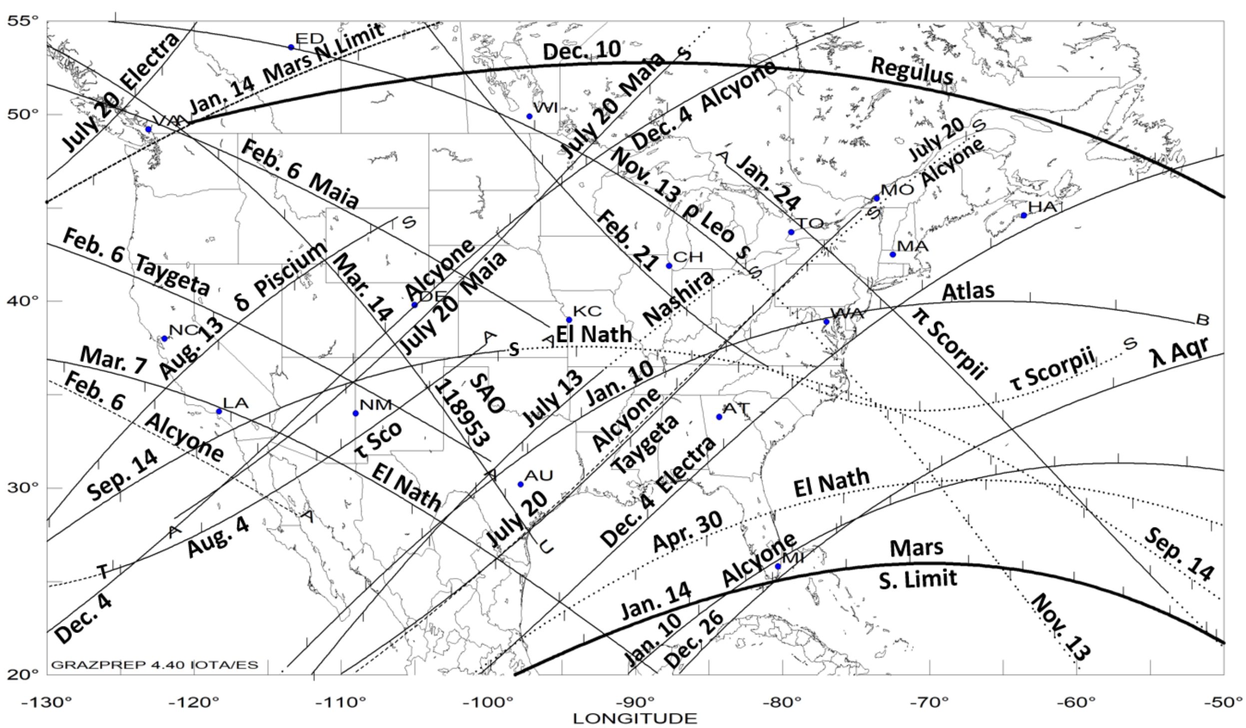
The Best Lunar Grazing Occultations in North America during 2025

The map below shows the paths of lunar grazing occultations for the 25 brighter stars and planets visible from much of North America in 2025. The events are limited to stars of magnitude 4.4 or brighter (except for a 9.1-mag. star during a lunar eclipse) that will graze the limb of the Moon when it is at a favorable elongation from the Sun and at least as high above the horizon in degrees as the star's magnitude (e.g., a third-magnitude star is included only if its altitude is at least 3°). The map is a "false" projection, since the latitude and longitude scales are both linear. This makes it much easier for measuring coordinates or plotting locations with known coordinates than is possible with any other type of projection. The longitude scale is compressed by a factor of cos 50°. The maps are not detailed enough for locating oneself in the 2- or 3-km-wide zone where multiple disappearances of the star may occur. You can compute your own detailed predictions for grazing occultations using IOTA's free Occult4 program; for information on how to obtain and use it, see **http://www.lunar-occultations.com/iota/2025iotapredictions.pdf**. If you have trouble calculating your own predictions, detailed predictions of any graze for plotting on larger-scale maps of your region can be obtained by writing to IOTA at PO Box 20313, Fountain Hills, AZ 85268-0313 or better, send an email to **business@occultations.org.** For some grazes, IOTA overlays the predicted limit line on the very detailed maps and imagery of maps.google.com, but further corrections are needed based on the predicted lunar profile and the observer's height above sea level. A Web .htm file for this is generated by IOTA's Occult4 program, see above. The height above sea level in the area of the graze needs to be specified when generating the .htm file. Even better are Google Earth files generated with **GRAZPREP** described at the top of p. 4 of this document; when used with Google Earth, the files show the predicted lunar profile projected on the landscape.

The 2025 month and day of month, and the star or planet's name or number are given along each track on the map. Conditions are represented by three different types of lines:
solid line = dark limb, night; dashed line = bright limb, night; and dotted line, dark or bright limb, day.

The best lunar grazing occultations in North America during 2025



Thicker lines are drawn for first-magnitude stars and planets. Many tracks begin and/or end with the letter A, B, or S: A denotes that the Moon is at a low altitude, B that the bright limb interferes, and S that sunlight or twilight interferes. The tick marks along the tracks indicate multiples of 10 min of every hour. For example, if the time for the west end of the track is 3:16.2, the tick marks proceeding eastward correspond to 3:20, 3:30, etc. Time always increases from west to east along the path. *The time ticks are on the side of the limit <u>with</u> an occultation,* that is north of southern limits and south of northern limits. The locations for the North American standard stations for lunar total occultation predictions given on pages 163-170 of the 2025 *Handbook* are indicated by asterisks on the graze map. 116 grazes are shown on four maps and tables, similar to what we published in the Handbook for previous years. For those maps, and extensive tables of them, see the Web page accompanying this document at **https://occultations.org/publications/rasc/2025/nam25grz.htm** .

Table of the best lunar grazing occultations in North America during 2025

Date	Object Name	ZC/SAO	d	m_v	%sl	L	W.U.T. h	m	Lo.	La.
Jan. 10	Alcyone	ZC 552	K	2.9	82+	S	0	55.5	-90	20
Jan. 10	Atlas	ZC 560	U	3.6	82+	S	1	6.0	-114	20
Jan. 14	Mars			-1.4	100-	S	2	14.8	-98	20
Jan. 14	Mars			-1.4	100-	N	2	28.9	-130	45
Jan. 24	π Scorpii	ZC 2287	W	2.9	27-	S	9	45.8	-84	47
Feb. 6	Alcyone	ZC 552	K	2.9	61+	S	8	52.6	-130	36
Feb. 6	Taygeta	ZC 539	X	4.3	60+	N	7	51.8	-130	43
Feb. 6	Maia	ZC 541	X	3.9	61+	N	7	57.1	-130	52
Feb. 21	τ Scorpii	ZC 2383		2.8	43-	S	11	33.8	-104	55
Mar. 7	El Nath	ZC 810	K	1.6	55+	N	4	27.9	-130	37
Mar. 14*		SAO 118953		9.1	0E	S	6	51.9	-130	54
Apr. 30	El Nath	ZC 810	K	1.6	13+	N	18	37.9	-101	20
July 13	Nashira	ZC 3171	V	3.7	93-	N	10	30.3	-112	20
July 20	Taygeta	ZC 539	X	4.3	24-	N	8	54.7	-110	20
July 20	Electra	ZC 537	U	3.7	24-	N	9	14.6	-130	47
July 20	Maia	ZC 541	X	3.9	24-	N	9	15.9	-121	28
July 20	Alcyone	ZC 552	K	2.9	24-	S	9	26.1	-109	20
Aug. 4	τ Scorpii	ZC 2383		2.8	74+	S	6	1.3	-130	25
Aug. 13	δ Piscium	ZC 105		4.4	80-	N	11	19.7	-130	28
Sep. 14	El Nath	ZC 810	K	1.6	50-	N	11	21.1	-130	27
Nov. 13	ρ Leonis	ZC 1547	X	3.8	38-	S	11	19.7	-126	55
Dec. 4	Electra	ZC 537	U	3.7	98+	S	1	3.1	-100	20
Dec. 4	Alcyone	ZC 552	K	2.9	99+	S	1	56.9	-130	22
Dec. 10	Regulus	ZC 1487	S	1.4	66-	S	6	10.8	-120	50
Dec. 26	λ Aqr	ZC 3353		3.7	30+	S	0	6.0	-87	20

The columns of the table above are explained below:

Date …………... The 2025 date
Object name …. Planet name, or star's proper name, Bayer Greek letter or Flamsteed number
ZC/SAO ……… The star's ZC or Smithsonian Astrophysical Observatory (SAO) catalogue number
d ……………… Double star code (if the star is double or triple) – see below
m ……………... The star's visual magnitude
%sl …………… the percent of the Moon sunlit (+ for waxing, - for waning, E for lunar eclipse*)
L ……………… whether the track is a northern (N) or southern (S) limit
W.U.T. ………. the Universal Time at the west end of the track
Lo., La. ………. the longitude and latitude of the west end of the track

*In this case, the number is the % of the Moon's disk that is NOT in the umbral shadow

The map and table on the previous pages were generated with **GRAZPREP** that you can read about, and obtain from links given in, the Web page accompanying this document at **https://occultations.org/publications/rasc/2025/nam25grz.htm ,**

Occulted stars known to be double

The table below gives data for double stars for which graze predictions are given, either on the map and table above, or on the maps and tables of the 116 grazes portrayed elsewhere on this Web page. The information is from DSFILE, a comprehensive file of zodiacal double-star data compiled by Don Stockbauer, Henk Bulder, Mitsuru Sôma, David Herald, and David Dunham; most of the data for the ZC stars are in the Sato ZC catalogue. The successive columns give the ZC number of the star, the 2025 graze date, the double star code (d), the magnitudes of the brighter (A) and fainter (B) components, the separation in arcseconds, and the position angle (PA) of B from A measured eastward from north. If the star is triple, the third component's magnitude is given under C, and its separation and PA from A are given in the last columns.

The parameters are given for the epoch of the occultation, computed from orbital elements when available or from extrapolations from a long series of observations. If there is little change in the available observations, the last-observed separation and PA are used. Most components fainter than magnitude 12.0 are not listed, and some very close doubles whose parameters are not known, generally with separations less than 0.2", are also not listed. The latter include spectroscopic binaries (code U, or sometimes V) and visual occultation doubles (most codes K and X, and many Vs).

The codes have the following meanings:

A .... Double listed by Aitken and/or Burnham (ADS, BDS)
B .... Triple, with possible close pair discovered by occultation and more distant star visual (A or C)
C .... Double listed by Innes, Couteau, or other visual observers
D .... primary of wide pair; secondary has separate catalogue entry
H .... triple, with close occultation pair and third visual component; prediction uses a mean position (U,orV & M)
J .... Single-line spectroscopic binary
K .... U or V, but duplicity doubtful, only reported "gradual" from a past visual occultation observation
L............ close triple star (only two stars often listed because inner pair is often spectroscopic; J or U, & V; all V; or all J)
M .... mean position (centre of light) of a close pair is used by the ZC and/or XZ catalogue
O .... orbital elements available and used to calculate the separation and PA
T .... visual triple star (V and A or C; or all A and/or C)
U .... Double, separation 0.05" or less, usually a 2-line spectroscopic binary
V .... Close double discovered by occultation or by interferometry
W .... Triple, J or U, and A or C
X .... probable double from occultation (not certain)
Y .... triple, K or X (visual A component) and A or C (C component)

Some close pairs have rapid orbital motion such that the current PA is unknown.

ZC#	2025 Date(s)	d	A	B	Sep. ″	PA °	C	Sep. ″	PA °
399	Feb. 5	O	6.3	6.8	0.03	221			
399	Oct. 9	O	6.3	6.8	0.03	272			
440	Apr. 1, Oct. 9	M	5.2	5.6	1.5	208			
501	Feb. 5	Y	6.3	7.7	0.01	120	10.4	0.8	65
518	Aug. 16	O	6.6	6.7	0.7	344			
771	Apr. 3, Sep. 14	T	6.1	9.1	0.2		8.6	11.8	27
885	Jan. 12, Jul. 22	Y	5.9	7.2	0.01	270	12.0	15.0	232
1208	Nov. 10	M	6.5	9.8	2.1	326			
1211	Apr. 6	C	6.2	11.0	45.5	23			
1663	Oct. 18	D	4.9	7.4	88.1	182			
1949	Jan. 21	O	6.5	6.9	0.5	65			
2045	Nov. 18	M	6.4	10.5	0.7	99			
2287	**Jan. 24**	**W**	**3.4**	**4.6**	**.0003**		**12.2**	**50.4**	**132**
2609	Mar. 22, Sep. 2	V	5.1	5.1	0.1	153			
2848	May 17	A	5.6	8.6	7.8	142			
3388	Feb. 1	O	6.2	6.3	0.1	220			
3430	Jul. 15	A	5.7	10.6	11.3	17			

The line in the double star table on the previous page in bold type is for a graze shown on the map on the first page of this document.

Names of occulted stars

The stars that are occulted by the Moon are stars that lie along the zodiac; hence they are known by their number in the Zodiacal Catalogue (ZC) compiled by James Robertson and published in the *Astronomical Papers Prepared for the Use of the American Ephemeris and Nautical Almanac, Vol. 10*, Part 2 (U.S. Government Printing Office, Washington, 1940). Robertson's ZC has been out of print for many years. In 1986, Isao Sato, a member of the Lunar Occultation Observers Group in Japan, republished the ZC. This new edition is based on the epoch J2000 and includes much new data, particularly on double stars. Since stars are not usually recognized by their ZC numbers, the Bayer designations or Flamsteed numbers of the stars occulted during 2025 are given in the table below. The ZC and larger XZ (now version XZ80Q) catalogues, updated in 2018 by D. Herald using Gaia data, are available through IOTA's website.

ZC	Name	ZC	Name	ZC/XZ	Name
98	60 Psc	771	V1156 Tau	2263	1 Sco
103	62 Psc	810	β Tau (El Nath)	2268	2 Sco
105	δ Psc	890	136 Tau	2287	π Sco
146	ε Psc	1008	49 Aur	2383	τ Sco (Alniyat)
180	ζ Psc	1088	47 Gem	2609	W Sgr
240	π Psc	1169	76 Gem	2784	τ Sgr
399	μ Ari	1088	47 Gem	2914	60 Sgr
435	47 Ari	1169	76 Gem	3031	17 Cap
440	ε Ari	1211	4 Cnc	3078	η Cap (Chow)
501	66 Ari	1251	λ Cnc	3089	χ Cap
518	7 Tau	1308	γ Cnc (Asellus Borealis)	3092	27 Cap
536	16 Tau (Celaeno)	1418	8 Leo	3113	30 Cap
537	17 Tau (Electra)	1487	α Leo (Regulus)	3171	γ Cap (Nashira)
539	19 Tau (Taygeta)	1547	ρ Leo	3190	δ Cap (Deneb Algedi)
541	20 Tau (Maia)	1589	56 Leo	3268	42 Aqr
542	21 Tau (Asterope)	1600	59 Leo	3353	λ Aqr
543	22 Tau (Sterope II)	1658	80 Leo	3360	78 Aqr
545	23 Tau (Merope)	1663	τ Leo	3383	82 Aqr
549	24 Tau	1787	FT Vir	3388	83 Aqr
552	η Tau (Alcyone)	1807	25 Vir	3412	φ Aqr
559	26 Tau	1888	50 Vir	3430	96 Aqr
560	27 Tau (Atlas)	2051	CS Vir	3520	XZ Psc
561	28 Tau (Pleione)				

General Lunar Occultations, especially Total Lunar Events

General information about lunar occultations, and aboiut predictions of total occultations, from the Handbook not included above, are given in lunar25short.pdf [xx need posted lint xx]

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