# Occultations by Major Planets and their Satellites

The text from the Handbook is repeated below. Following that is the Occult program input file with instructions for using the program to generate your own local predictions for many more occultations, for wherever you are in the world. This Web page concentrates on occultations by the major planets and their satellites, while other pages give similar information, and Occult input files, for occultations by main-belt asteroids, and by other classes of asteroids, including Near-Earth Asteroids (NEA's), Jupiter Trojan asteroids, and more distant objects, the Centaur asteroids and Kuiper-Belt Objects (KBO's) or Trans-Neptunian Objects (TNO's).

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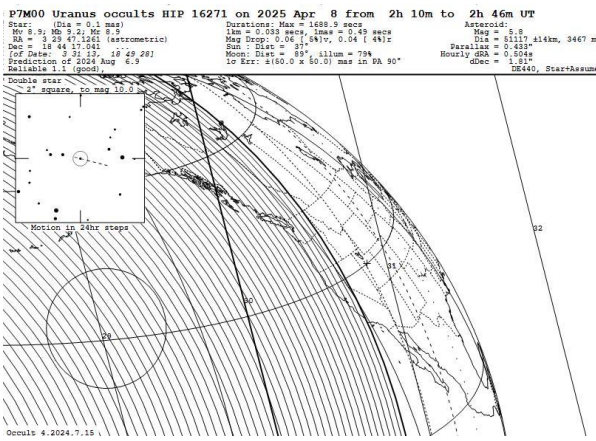
**Handbook Text**

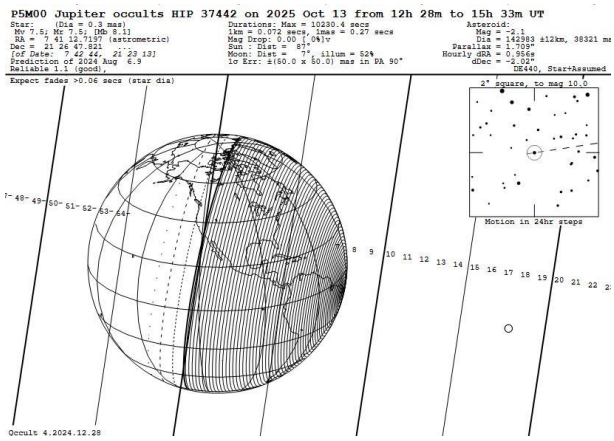
As major, dwarf, and minor planets, and their moons, move across the sky, they occasionally pass directly between an observer and a distant star, producing an *occultation*. Astronomers have learned much about solar system bodies by carefully monitoring the changing apparent brightness of stars during the immersion and emersion phases of occultations. If the occulting body does not have an atmosphere, the occultation is virtually instantaneous; if there is an atmosphere, it causes the star's disappearance and reappearance to occur gradually. If a planet has rings or other debris in its environs, the extent and degree of transparency of this material can be precisely mapped. The rings of Uranus, the ring arcs of Neptune, and the atmosphere of Pluto were all discovered by occultation observations. If an occultation is observed at several distributed sites, the size and shape of the occulting body can be determined more accurately than by other Earth-based techniques.

**2025 Occultations by Major Planets**

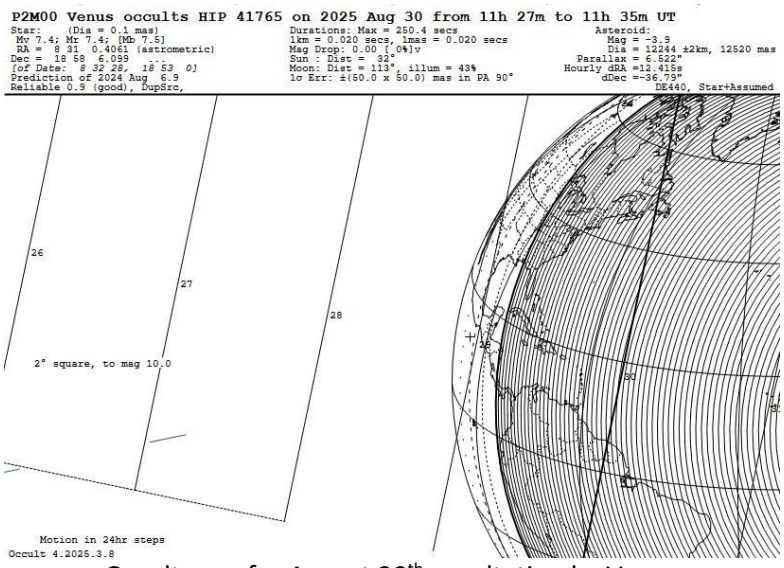
Occultations by the major planets are difficult to observe due to the brightness of the occulting body; events involving stars bright enough to observe next to a dazzling planet are rare. In 2025, the brightest star occulted by a major planet in North America is 7.4-mag. SAO 97869 = HIP 41765 by Venus on August 30$^{th}$ around 11:30 UT, visible best from central N. America. But Venus is much brighter than the star, so high magnification with a large telescope will be needed to see it; only the dark-side reappearance might be seen. Venus will be 12" across and 84% sunlit, so the greatest distance of Venus' dark edge will be only 2.0" from its terminator. Better will be an occultation of 8.9-mag. SAO 93455 = HIP 16271 by Uranus on Apr. 8, around 2.5h UT, visible best again from central N. America. With Uranus at mag. 5.8, effective observations of the event by Uranus' atmosphere could be made with large telescopes and methane-band filters that darken the methane-rich planet. The occultation will last up to 28 minutes, while brief occultations by the ε ring will occur about 12 min. before the D and 12 min. after the R. Predictions of these contacts are posted on IOTA's page for 2025 occultations by the major planets and their moons at **https://occultations.org/publications/rasc/2025/nam25Planetoccs.htm**. Also with a methane-band filter, an occultation of 7.5-msg. SAO 79613 = HIP 37442 by Jupiter lasting almost 3h might be recorded from Hawaii the morning of Oct. 13; only the D might be observed from the Pacific Time Zone around 13:25 UT. R. French and D. Souami published a paper on occultations by the outer planets, and by Titan and Triton, through 2050 available at **https://arxiv.org/abs/2307.13530**.




Occult map for the 2025 April 8th occultation by Uranus

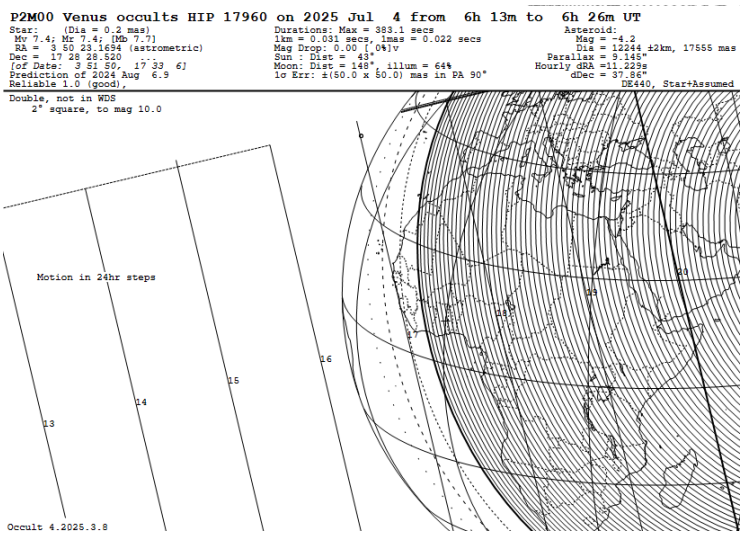



Occult map for the 2025 October 13th occultation by Jupiter



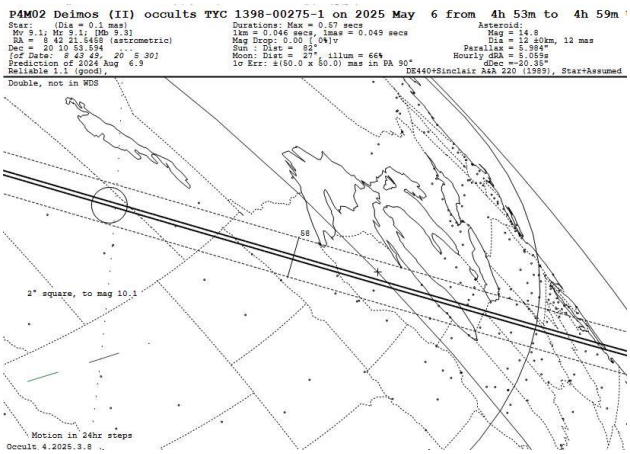

Occult map for August 30th occultation by Venus

The Aug. 30th Venus and the Jupiter occultations noted above also involve the brightest stars occulted by any planet in the world over land in 2025, although equally bright will be 7.4-mag. SAO 93630 = HIP 17960, spec. type G0 by Venus on July 4th from eastern Brazil¸ n.w. Africa and the Cape Verde Islands; see the Occult map for it below.

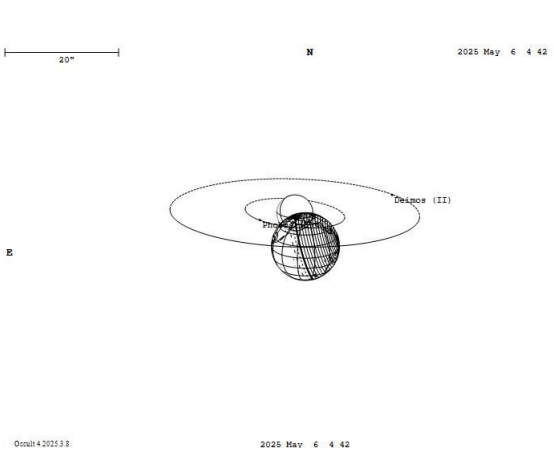


**2025 Occultations by Satellites of Major Planets**

Easier to observe are occultations by moons of the planets, but they are not common. There are several occultations by the small Martian moons, with the brightest being an occultation of 9.1-mag. SAO 80372 = TYC 1398-00275-1, spectral type F0, near M44 by Deimos on May 6 around 4:58 UT. The error bars of the May 6th occultation can probably be improved with the help of radiometric tracking of the UAE's Amal spacecraft that is orbiting Mars and imaged Deimos during a series of close flybys in 2025.

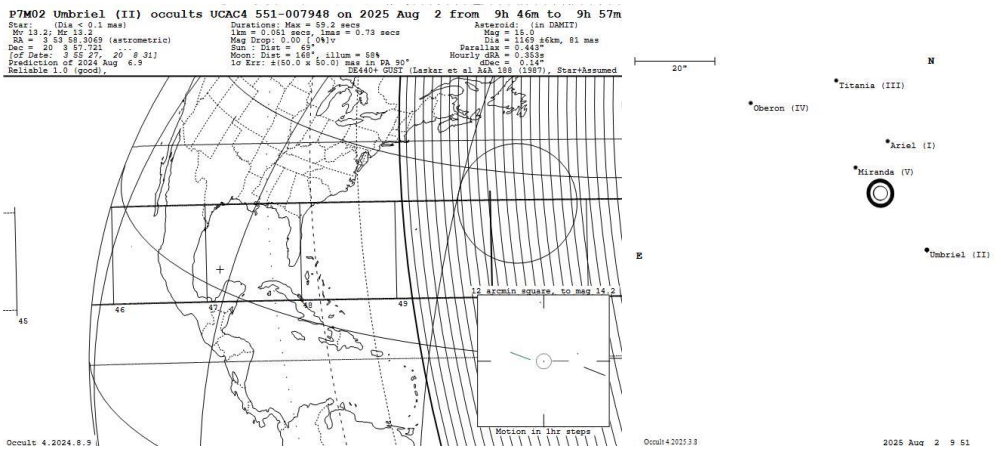



2025 May 6th Deimos Occult Map



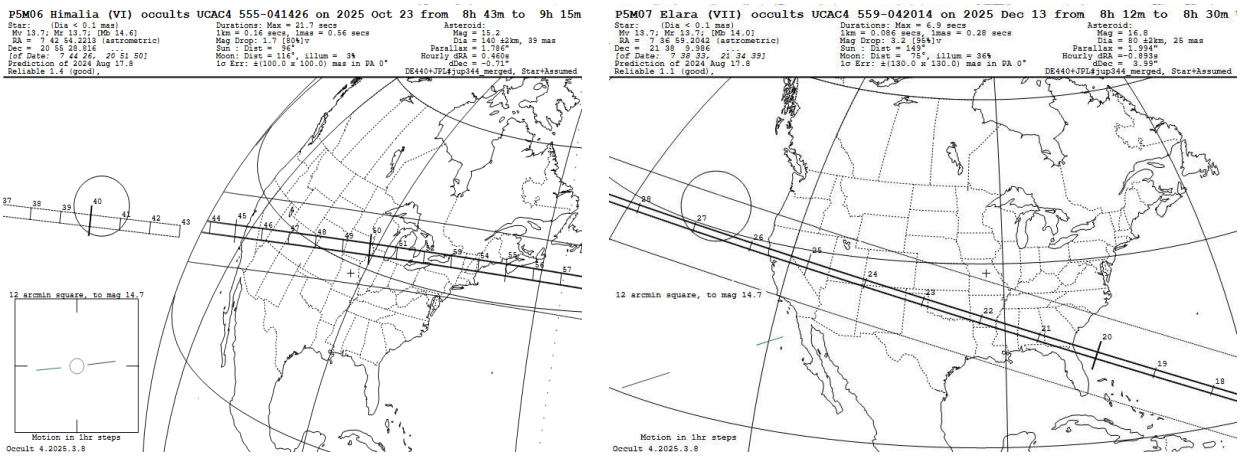

2025 May 6th Mars and Satellites Configuration

More valuable is an occultation by Uranus' 1169-km moon Umbriel on Aug. 2 at 4:47 UT across central Mexico, s. Texas and Florida, but the path may be as far north as Oklahoma or Kentucky; the Occult map for it is below. The path error bars can probably be decreased by using the results of another occultation by Umbriel that was well-observed on 2020 Sept. 21; see https://www.asteroidoccultation.com/observations/Results/Reviewed/Data2020/20200921_Umbriel_PROFILE_ALL_REPORTED.gif . The Umbriel northern limit is also shown on the 2025 distant objects occultation map and table on p. 251 of the RASC Observer's Handbook and also on slides 11 and 12 of a 2025 events document at http://iota.jhuapl.edu/Dunham2025occs.pdf but without the large bars. Since Umbriel will be 20" from Uranus as shown below (right), Uranus should not interfere significantly.




Occult map for Aug. 2nd Umbriel event. Uranus & sats. sky view for Aug. 2nd

Occultations by the irregular outer moons of Jupiter are predicted by astronomers working for the Lucky Star project, but usually only a few weeks in advance, based on special astrometric updates; IOTA's Occult program found 2 such events by the larger ones during 2025 shown on the distant objects map and table shown in the .pdf document with link above but without error bars; their Occult maps are below. The large path errors will probably be reduced with the Lucky Star updates.




Occult map for the 2025 Oct. 23 occultation by P5M06 Himalia Occult map for the 2025 Dec. 13th occultation by P5M07 Elara

The maps given above 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 Early third release (EDR3) of the European Space Agency's Gaia mission, as implemented with UCAC4, Tycho, and Hipparcos catalog identifiers with *Occult*.

Note that the times are for the geocentric time of closest approach; for any specific location in North America, the event time can be several minutes earlier or later.

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/2025iotapredictions.pdf . This describes a prediction input file for planetary and asteroidal files called **All2025.xml**. Besides the occultations by major planets and their main moons, it also includes all of the occultations, generally down to about 12$^{th}$ magnitude, found by Edwin Goffin and Steve Preston, and some other IOTA members working with them. You can use that file to generate local predictions, but you can replace it with the other files listed below and on the pages for other types of occultations:

**Planets2025.xml** – This is the input for 341 occultations of stars by the major planets, including Pluto, and by Jupiter's Galilean Satellites, and by the major satellites of Saturn and Uranus. Included are several unobservable occultations of very faint stars, especially by the Galilean satellites; a few of those can be observed if the satellite is in total eclipse by Jupiter's shadow; in that case, Occult detects that fact, and replaces the magnitude of the satellite with 16.0, to calculate a more realistic magnitude drop for the situation. Several of the shadows for these events narrowly miss the Earth, or are visible only from oceans. Also included, as has been the case for some previous years, are some occultations by the Martian satellites Phobos and Deimos, but not by the satellites of Neptune and Pluto; predictions for them are given by Occult Watcher, if you select its feed for occultations by planetary satellites. A list of all of these events is at **https://occultations.org/publications/rasc/2025/Planets2025.txt .**

For worldwide occultations for the whole year, use the **All2025.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.

**Links to other 2025 RASC asteroidal occultation pages**

First versions of the below pages will be posted in a few weeks, except for the already-posted brighter main-belt (MB) occultations. That page has most of the Occult input files for the year for these other occultations.

**https://occultations.org/publications/rasc/2025/nam25MBoccs.htm** - Occultations of the brighter stars by main-belt asteroids.

The pages below are not ready; they will be posted later. The text associated with them for the Handbook, written in August 2024, is at https://occultations.org/publications/rasc/2025/mpocc25.pdf . The maps and tables mentioned there are at https://occultations.org/publications/rasc/2025/Dunham2025occs.pdf.

**https://occultations.org/publications/rasc/2025/nam25NEAoccs.htm** - Occultations by Near-Earth Asteroids (NEA's)
**https://occultations.org/publications/rasc/2025/nam25MBspecialoccs.htm** - Occultations by some special main-belt objects
**https://occultations.org/publications/rasc/2025/nam25Trojanoccs.htm** - Occultations by Troan asteroids
**https://occultations.org/publications/rasc/2025/nam25distantoccs.htm** - Occultations by more distant objects
**https://occultations.org/observing/software/ow/** - Occult Watcher information

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