

Occultations of stars by major and minor planets in 2012

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The accompanying graphs contain the predicted occultations of catalogue stars by major and minor planets in the year 2012. They are a selection from a much larger number of events found by the computer programme. The selection was made taking into account the star's magnitude, the duration of the occultation, the distribution of potential observers and the altitude above the local horizon.

Star catalogues

The *first catalogue* is a merged catalogue consisting of the following star entries:

1. FK6, Part I (Wielen et al., 1999) and Part III (Wielen et al., 2000)
2. Hipparcos (ESA, 1997)
3. Tycho-2 catalogue (Høg et al., 2000), without the Hipparcos stars
4. UCAC2, the second USNO CCD Astrograph Catalog (Zacharias et al., 2004); only stars with magnitude ≤ 12.0 were used

The following table gives the total number of stars in each catalogue as well as the number retained after eliminating multiple entries, the order given being the order of precedence :

Star catalogue	Total stars	Stars retained
FK6 (Parts I and III)	4,150	4,150
Hipparcos	117,955	113,805
Tycho-2	2,420,173	2,420,122
UCAC2 (magn. ≤ 12.0)	2,747,834	841,986
Total	5,290,112	3,380,063

The *second catalogue* consists of the 9,909,805 stars of the UCAC2 with magnitudes: $12.0 < \text{magn.} \leq 14.0$.

Selection criteria for the planets

The merged star catalogue was used for comparison with the ephemerides of the 8 major planets and of 2593 minor planets: numbered ones larger than 25 km and also objects with multi-opposition orbits and semi-major axis larger than 5.40 AU (Centaur, Kuiper Belt objects, ...). For the major planets, only occultations of stars brighter than visual magnitude 10 were selected.

The second catalogue was used for a special search with 943 objects with semi-major axis larger than 5.40 AU.

Diameters have been taken from the Asteroids II data base (Binzel et al. 1989) to which some occultation diameters were added. In case no diameter was published an approximate value was computed from the formula:

$$\log D = 3.52 - 0.20M$$

where D is the diameter in km and M the absolute visual magnitude constant.

Explanation of the graphs

- The top line gives the name of the major or minor planet and the star designation. The latter is only used to identify the star.
- The second line gives the instant of closest geocentric approach (in U.T.).
- Under the heading "Planet" the following data are given:
 - a = semi-major axis, e = eccentricity of the orbit
 - V. mag. = visual magnitude of the planet
 - Diam. = absolute diameter in km and apparent diameter in seconds of arc.
 - μ = instantaneous motion at closest approach, in seconds of arc per hour.
 - π = horizontal equatorial parallax in seconds of arc.
 - Ref. = source for the orbital elements.
- Under the heading "Star" are given:
 - Source cat. = an abbreviation for the source catalogue from which the positional data for the star are taken:
 - * FK6 = FK6 Catalogue (Parts I and III)
 - * HIP = Hipparcos Catalogue
 - * TYC2 = Tycho-2 Catalogue; the following suffixes were added: p = Tycho data refer to the photocentre of two entries, x = no mean position and no proper motion given
 - * UCAC2 = USNO CCD Astrograph Catalog
 - α = right ascension (J2000.0) at the epoch of occultation
 - δ = declination (J2000.0) at the epoch of occultation
 - V. mag. = visual magnitude of the star
 - Ph. mag. = photographic magnitude

- The last line contains information about the occultation:
 - Δm = drop in magnitude
 - Max. dur. = maximum duration for an observer on the central line (in seconds of time)
 - Sun = elongation of the Sun (in degrees)
 - Moon = elongation (in degrees) and illuminated fraction (in %) of the Moon
- The small star chart shows a portion of the sky of about 15 by 15°. Only stars of visual magnitude 7.0 and brighter are included. The dashed rectangle indicates the part shown by the larger chart.
- The large star chart is based on the merged catalogue or on both catalogues. The star to be occulted is encircled and is always in the middle. A visual-magnitude scale is added to the right, mostly ranging from 1 to 10; for faint stars the range may be 2–11, 3–12, etc. The star chart also shows the path of the minor planet with crosses indicating the daily position at 0h UT.
- The world map shows the Earth as seen from the star, i.e. the centre of the disk is the point on the Earth's surface where the star is in the zenith. The night side is the part within the heavy lines. The shadow path is indicated by the central line and the northern and southern limits (including the effect of the Earth's rotation). The dashed lines show the position of the central line for a shift of 1'' perpendicular to the predicted shadow path (i.e. for a difference of $\pm 1''$ in the shortest geocentric distance planet-star). The times written at the bottom refer to the first and last cross lines; also the interval between two cross lines is given.

Close approaches

A by-product of these occultation predictions is a list of close approaches of minor planets to naked-eye stars. Also, the input ephemeris file is used by a separate programme to search for mutual minor-planet occultations, the by-product this time being a list of close mutual approaches.

Both lists are sent to the editor of the *Minor Planet Bulletin*.

Availability of the files

The PostScript and PDF files can be obtained from the FTP site of the "Vereniging voor Sterrenkunde" (VVS, the Flemish Astronomical Association).

The URL is: <ftp://ftp.ster.kuleuven.ac.be/dist/vvs/asteroids>

Distribution of the graphs

A selected number of predictions is sent to Mat Drummen (The Netherlands) for inclusion in the "Sterrengids".

Mailing Lists and Web Sites

European observers are strongly encouraged to subscribe to the PLANOCULT mailing list, maintained by Jan Van Gestel (Belgium):

- send a message to: `listserv@aula.com`
- subject not needed
- message text: `subscribe planocult [YourName], [Country]`

For more up-to-date information on predictions, finder charts and occultation news, consult the following home pages:

- <http://mpocc.astro.cz/2012> for European events.
- <http://www.asteroidoccultation.com/observations> that has links to asteroidal occultation resources in Europe, N. America, Australia/New Zealand, and Japan.

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References

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