

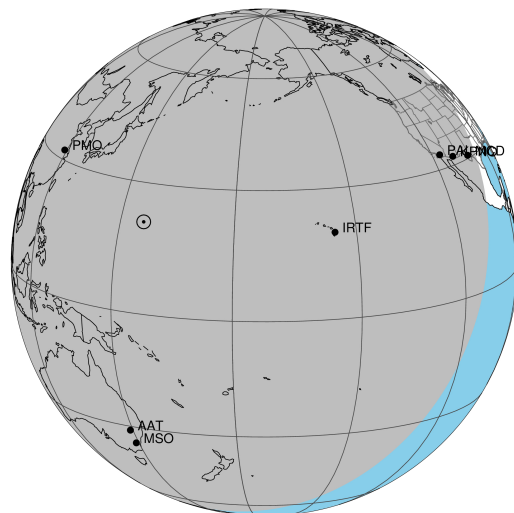
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2045-01-15T13:42:57.130
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 615909000420713856
 2Mass ID (if available) : 09514060+1346253

Uranus 2045-01-15T13:42:57 K13.62 G14.88 XRgt

ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s

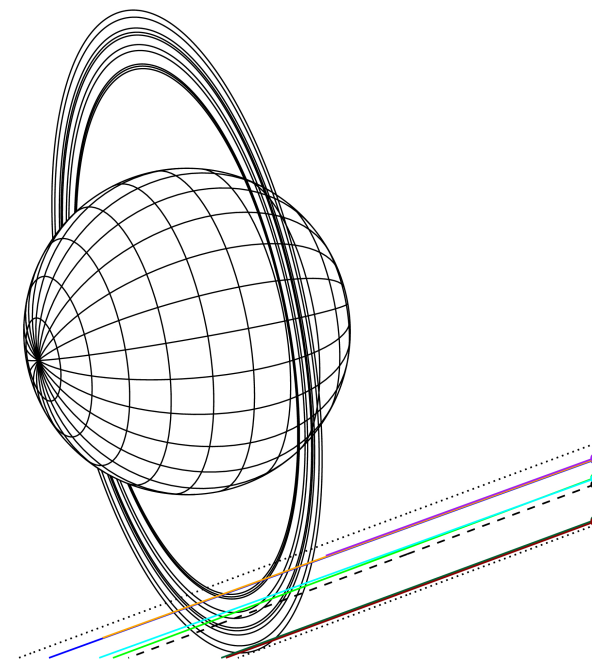
RUWE (>1.4 is poor) : 1.06
 K magnitude : 13.624
 G magnitude : 14.880
 RP magnitude : 14.440
 BP magnitude : 15.150
 DUPflag : 0
 Distance (au) : 17.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.03
 Sun-Target sep (deg) : 149.79
 Sun-Moon sep (deg) : 121.43
 B (ring opening deg) : 21.94
 PA of pole (deg) : 101.06

Uranus 2045-01-15T13:42:57 K13.62 G14.88 XRgt



2045-01-15T13:42:57.1300 α: 09 51 40.61775 s: +13 46 25.476 C/A 3.509° PA 20.40 deg v_sky -19.03 km/s D 17.51 AU
 Credit: Styled after SORA/Lucky Star

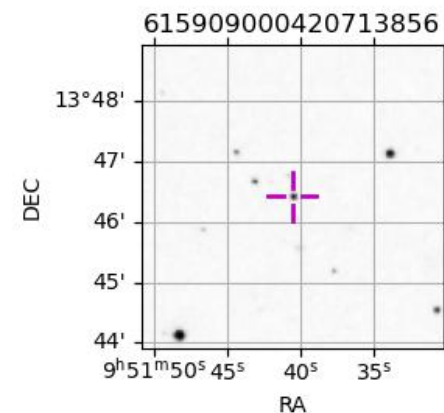
Earth
 PAL
 PMO
 KPNO
 MCD
 IRTF
 AAT
 MSO



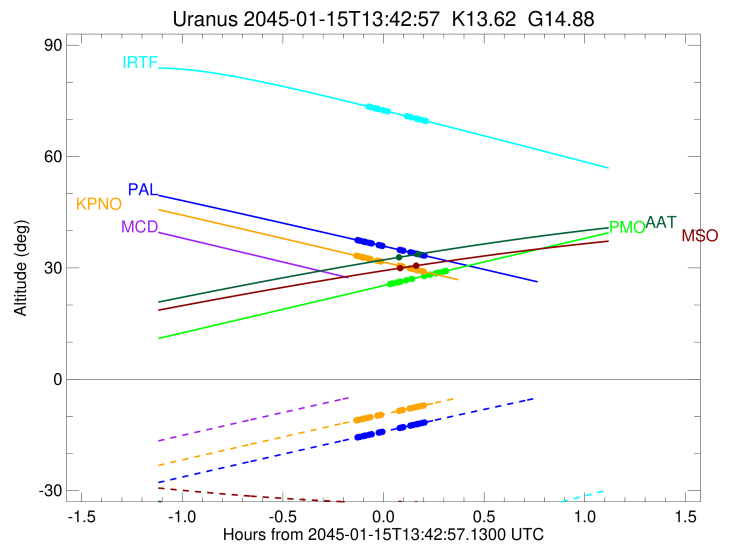
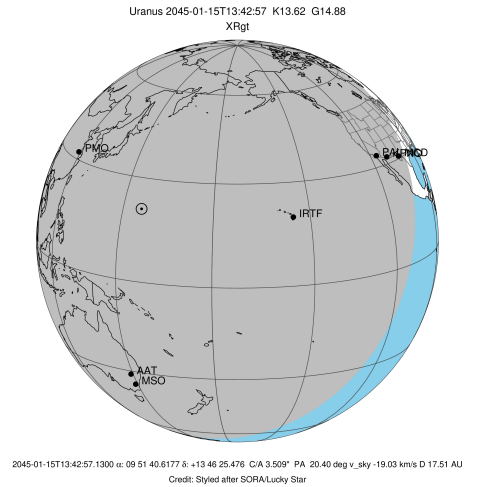
| # | a(km) | ring |
|----|---------|---------|
| 1 | 41837.2 | 6 |
| 2 | 42235.0 | 5 |
| 3 | 42571.2 | 4 |
| 4 | 44718.5 | alpha |
| 5 | 45661.1 | beta |
| 6 | 47176.1 | eta |
| 7 | 47626.3 | gamma |
| 8 | 48300.3 | delta |
| 9 | 50026.7 | lambda |
| 10 | 51149.4 | epsilon |

Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| Obs | Location | lat | Elon | Rings I | Planet | Rings E | Observed Events Interval | OEcode |
|------|-----------------------|-------|-------|---------|--------|---------|-----------------------------|--------|
| PIC | Pic du Midi | 42.9 | 0.1 | | | | | PnnRnn |
| PAL | Palomar Mt (200") | 33.4 | 243.1 | +++++ | | +++++ | JAN 15 13:35 - JAN 15 13:55 | PnnRie |
| PMO | Purple Mtn Obs. Nanki | 32.1 | 118.8 | +++++ | | +++++ | JAN 15 13:44 - JAN 15 14:01 | PnnRie |
| KPNO | Kitt Peak Natl Obs | 32.0 | 248.4 | +++++ | | +++++ | JAN 15 13:34 - JAN 15 13:54 | PnnRie |
| MCD | McDonald Obs. 2.7m | 30.7 | 256.0 | | | | | PnnRnn |
| TEN | Teide Obs./Tenerife | 28.3 | 343.5 | | | | | PnnRnn |
| IRTF | Mauna Kea/IRTF | 19.8 | 204.5 | +++++ | | +++++ | JAN 15 13:38 - JAN 15 13:55 | PnnRie |
| KAV | Kavalur Observatory | 12.6 | 78.8 | | | | | PnnRnn |
| RIO | Rio de Janeiro | -22.9 | 316.8 | | | | | PnnRnn |
| ESO | European Southern Obs | -29.3 | 289.3 | | | | | PnnRnn |
| AAT | Siding Spring (AAT) | -31.3 | 149.1 | | + | | JAN 15 13:47 - JAN 15 13:53 | PnnRie |
| SAAO | So. Afr. Astro. Obs. | -32.4 | 20.8 | | | | | PnnRnn |
| MSO | Mt. Stromlo Observato | -35.3 | 149.0 | | + | | JAN 15 13:47 - JAN 15 13:52 | PnnRie |



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2045-01-15T13:40:27.510
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 615909000420713856
 2Mass ID (if available) : 09514060+1346253
 ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 13.624
 G magnitude : 14.880
 RP magnitude : 14.440
 BP magnitude : 15.150
 DUPflag : 0
 Distance (au) : 17.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.03
 Sun-Target sep (deg) : 149.79
 Sun-Moon sep (deg) : 122.09
 B (ring opening deg) : 21.94
 PA of pole (deg) : 101.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.202
 C/A sky separation (km) : 40659.0
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

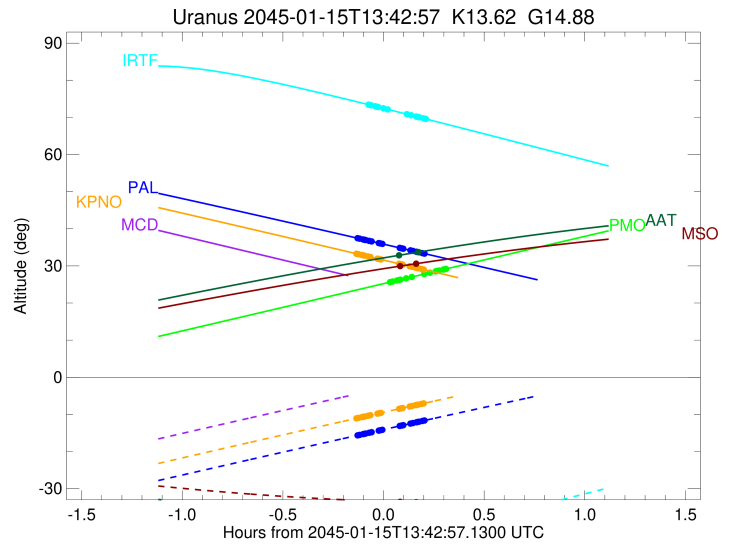
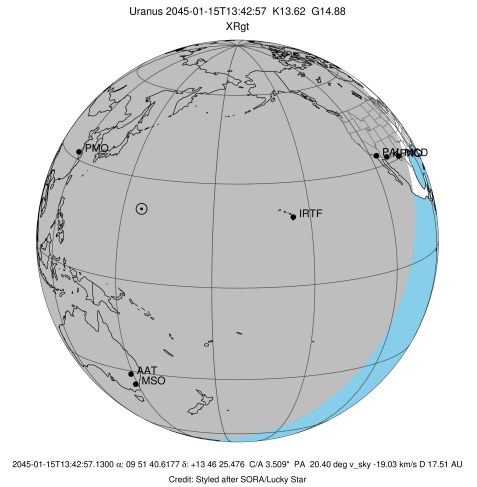


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I | 2045-01-15T13:35:03.951 | | 37.50 | -15.68 | 51449.38 | -30.43 | | |
| lambda | I | 2045-01-15T13:35:51.603 | | 37.33 | -15.52 | 50026.71 | -29.04 | | |
| delta | I | 2045-01-15T13:36:53.435 | | 37.12 | -15.31 | 48300.35 | -26.76 | | |
| gamma | I | 2045-01-15T13:37:19.249 | | 37.03 | -15.23 | 47622.80 | -25.73 | | |
| eta | I | 2045-01-15T13:37:36.856 | | 36.97 | -15.17 | 47176.12 | -25.00 | | |
| beta | I | 2045-01-15T13:38:40.321 | | 36.75 | -14.95 | 45675.77 | -22.20 | | |
| alpha | I | 2045-01-15T13:39:23.382 | | 36.60 | -14.81 | 44749.82 | -20.13 | | |
| 4 | I | 2045-01-15T13:41:31.061 | | 36.16 | -14.38 | 42612.18 | -13.48 | | |
| 5 | I | 2045-01-15T13:41:55.020 | | 36.08 | -14.30 | 42295.85 | -11.93 | | |
| 6 | I | 2045-01-15T13:42:42.563 | | 35.91 | -14.14 | 41796.55 | -9.23 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| 6 | E | 2045-01-15T13:47:42.139 | | 34.87 | -13.14 | 41803.62 | 9.23 | | |
| 5 | E | 2045-01-15T13:48:25.537 | | 34.72 | -12.99 | 42265.26 | 11.93 | | |
| 4 | E | 2045-01-15T13:48:52.631 | | 34.63 | -12.90 | 42616.38 | 13.48 | | |
| alpha | E | 2045-01-15T13:50:57.908 | | 34.19 | -12.48 | 44730.54 | 20.12 | | |
| beta | E | 2045-01-15T13:51:42.421 | | 34.04 | -12.34 | 45659.40 | 22.18 | | |
| eta | E | 2045-01-15T13:52:46.574 | | 33.81 | -12.12 | 47176.12 | 24.98 | | |
| gamma | E | 2045-01-15T13:53:04.405 | | 33.75 | -12.06 | 47628.08 | 25.71 | | |
| delta | E | 2045-01-15T13:53:30.041 | | 33.66 | -11.98 | 48300.35 | 26.73 | | |
| lambda | E | 2045-01-15T13:54:31.948 | | 33.45 | -11.77 | 50026.71 | 29.01 | | |
| epsilon | E | 2045-01-15T13:55:03.977 | | 33.33 | -11.67 | 50973.29 | 30.39 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2045-01-15T13:47:50.830
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : PMO
 Location : Purple Mtn Obs. Nanking
 Latitude (deg) : 32.06667
 E. Longitude (deg) : 118.82089
 Altitude (km) : 0.364
 Gaia source ID : 615909000420713856
 2Mass ID (if available) : 09514060+1346253
 ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 13.624
 G magnitude : 14.880
 RP magnitude : 14.440
 BP magnitude : 15.150
 DUPflag : 0
 Distance (au) : 17.510
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.03
 Sun-Target sep (deg) : 149.79
 Sun-Moon sep (deg) : 121.34
 B (ring opening deg) : 21.94
 PA of pole (deg) : 101.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.452
 C/A sky separation (km) : 43844.3
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

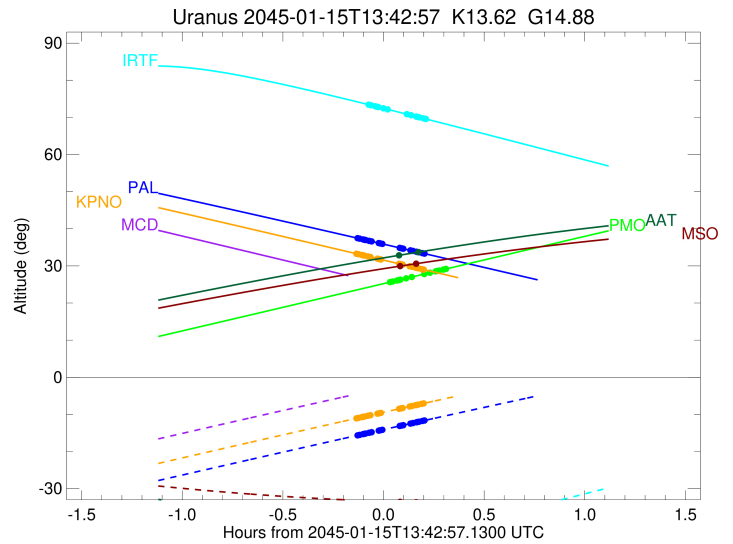
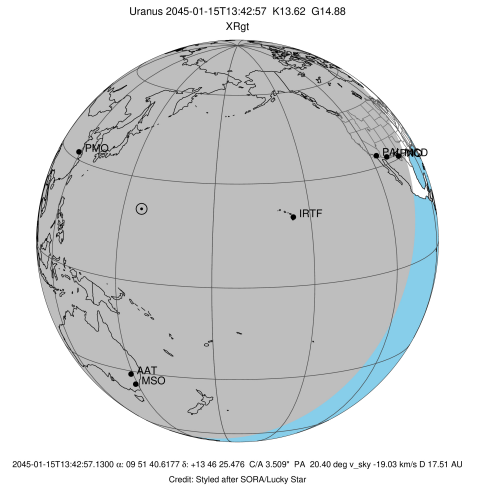


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I | 2045-01-15T13:44:44.436 | | 25.60 | -55.02 | 51416.59 | -25.41 | | |
| lambda | I | 2045-01-15T13:45:40.965 | | 25.80 | -55.22 | 50026.71 | -23.47 | | |
| delta | I | 2045-01-15T13:47:00.141 | | 26.08 | -55.49 | 48300.35 | -20.08 | | |
| gamma | I | 2045-01-15T13:47:35.261 | | 26.20 | -55.62 | 47623.46 | -18.46 | | |
| eta | I | 2045-01-15T13:48:00.304 | | 26.29 | -55.70 | 47176.12 | -17.26 | | |
| beta | I | 2045-01-15T13:49:42.653 | | 26.65 | -56.06 | 45672.59 | -12.02 | | |
| alpha | I | 2045-01-15T13:51:21.231 | | 27.00 | -56.40 | 44745.11 | -6.53 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| alpha | E | 2045-01-15T13:55:07.352 | | 27.81 | -57.19 | 44738.86 | 6.54 | | |
| beta | E | 2045-01-15T13:56:47.393 | | 28.16 | -57.54 | 45663.71 | 12.03 | | |
| eta | E | 2045-01-15T13:58:30.284 | | 28.52 | -57.89 | 47176.12 | 17.28 | | |
| gamma | E | 2045-01-15T13:58:55.509 | | 28.61 | -57.98 | 47627.26 | 18.48 | | |
| delta | E | 2045-01-15T13:59:30.388 | | 28.74 | -58.10 | 48300.35 | 20.10 | | |
| lambda | E | 2045-01-15T14:00:49.471 | | 29.02 | -58.37 | 50026.71 | 23.50 | | |
| epsilon | E | 2045-01-15T14:01:30.245 | | 29.16 | -58.52 | 51018.18 | 25.45 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2045-01-15T13:40:10.050
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : KPNO
 Location : Kitt Peak Natl Obs
 Latitude (deg) : 31.96333
 E. Longitude (deg) : 248.40000
 Altitude (km) : 2.120
 Gaia source ID : 615909000420713856
 2Mass ID (if available) : 09514060+1346253
 ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 13.624
 G magnitude : 14.880
 RP magnitude : 14.440
 BP magnitude : 15.150
 DUPflag : 0
 Distance (au) : 17.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.03
 Sun-Target sep (deg) : 149.79
 Sun-Moon sep (deg) : 122.07
 B (ring opening deg) : 21.94
 PA of pole (deg) : 101.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.195
 C/A sky separation (km) : 40580.6
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

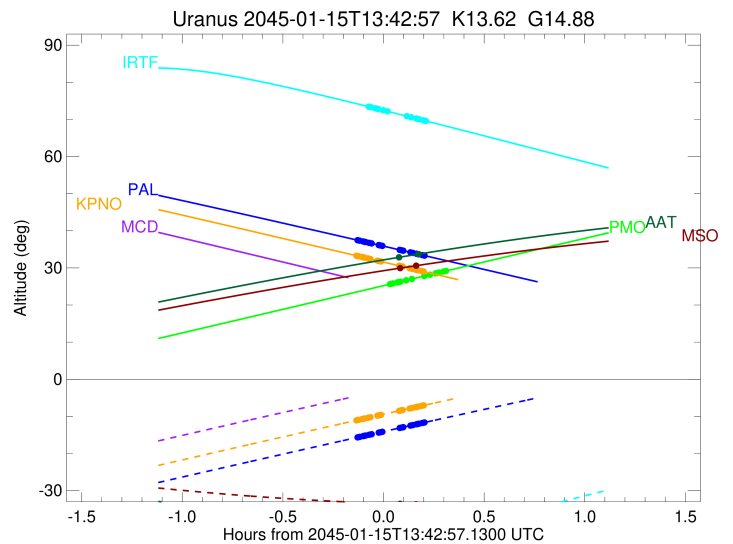
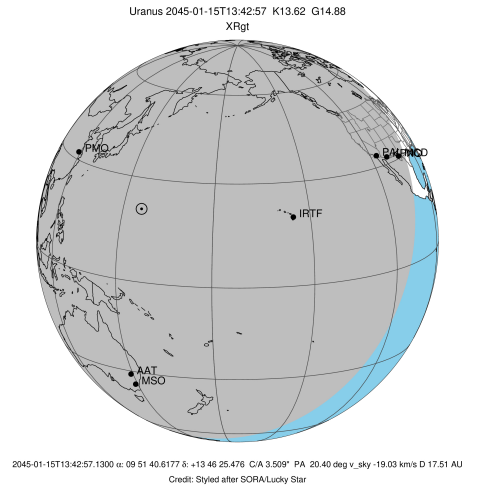


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I | 2045-01-15T13:34:43.787 | | 33.31 | -11.10 | 51450.10 | -30.49 | | |
| lambda | I | 2045-01-15T13:35:31.357 | | 33.15 | -10.94 | 50026.71 | -29.11 | | |
| delta | I | 2045-01-15T13:36:33.004 | | 32.93 | -10.73 | 48300.35 | -26.85 | | |
| gamma | I | 2045-01-15T13:36:58.720 | | 32.84 | -10.64 | 47622.79 | -25.84 | | |
| eta | I | 2045-01-15T13:37:16.250 | | 32.77 | -10.58 | 47176.12 | -25.12 | | |
| beta | I | 2045-01-15T13:38:19.366 | | 32.55 | -10.37 | 45675.82 | -22.35 | | |
| alpha | I | 2045-01-15T13:39:02.097 | | 32.40 | -10.23 | 44749.87 | -20.31 | | |
| 4 | I | 2045-01-15T13:41:07.986 | | 31.95 | -9.81 | 42612.04 | -13.80 | | |
| 5 | I | 2045-01-15T13:41:31.233 | | 31.87 | -9.73 | 42296.26 | -12.29 | | |
| 6 | I | 2045-01-15T13:42:17.010 | | 31.71 | -9.57 | 41796.43 | -9.72 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|-------|----------|-------|--|--|
| 6 | E | 2045-01-15T13:47:33.218 | | 30.59 | -8.52 | 41803.88 | 9.72 | | |
| 5 | E | 2045-01-15T13:48:14.848 | | 30.44 | -8.38 | 42264.69 | 12.29 | | |
| 4 | E | 2045-01-15T13:48:41.235 | | 30.35 | -8.29 | 42616.35 | 13.80 | | |
| alpha | E | 2045-01-15T13:50:44.727 | | 29.91 | -7.88 | 44730.41 | 20.30 | | |
| beta | E | 2045-01-15T13:51:28.913 | | 29.75 | -7.73 | 45659.32 | 22.33 | | |
| eta | E | 2045-01-15T13:52:32.721 | | 29.52 | -7.52 | 47176.12 | 25.09 | | |
| gamma | E | 2045-01-15T13:52:50.478 | | 29.46 | -7.46 | 47628.10 | 25.81 | | |
| delta | E | 2045-01-15T13:53:16.019 | | 29.37 | -7.37 | 48300.35 | 26.82 | | |
| lambda | E | 2045-01-15T13:54:17.746 | | 29.15 | -7.17 | 50026.71 | 29.08 | | |
| epsilon | E | 2045-01-15T13:54:49.675 | | 29.04 | -7.06 | 50972.39 | 30.45 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2045-01-15T13:42:05.180
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : IRTF
 Location : Mauna Kea/IRTF
 Latitude (deg) : 19.82622
 E. Longitude (deg) : 204.52800
 Altitude (km) : 4.168
 Gaia source ID : 615909000420713856
 2Mass ID (if available) : 09514060+1346253
 ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 13.624
 G magnitude : 14.880
 RP magnitude : 14.440
 BP magnitude : 15.150
 DUPflag : 0
 Distance (au) : 17.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.03
 Sun-Target sep (deg) : 149.79
 Sun-Moon sep (deg) : 122.26
 B (ring opening deg) : 21.94
 PA of pole (deg) : 101.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.417
 C/A sky separation (km) : 43390.2
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



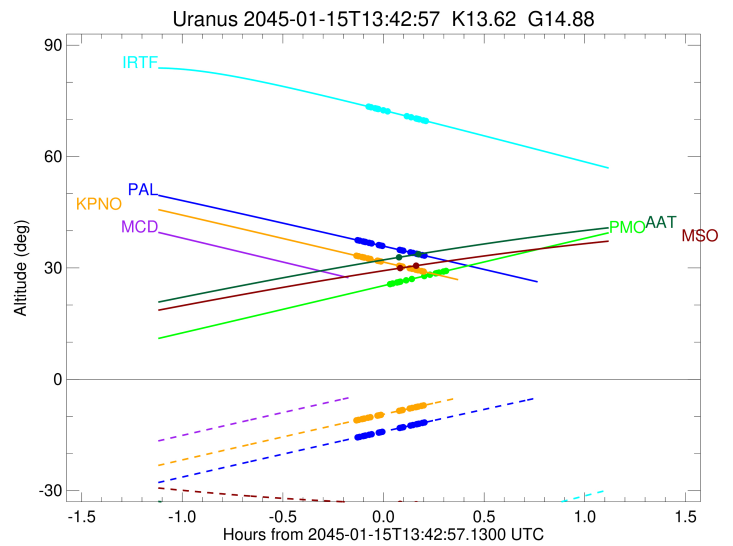
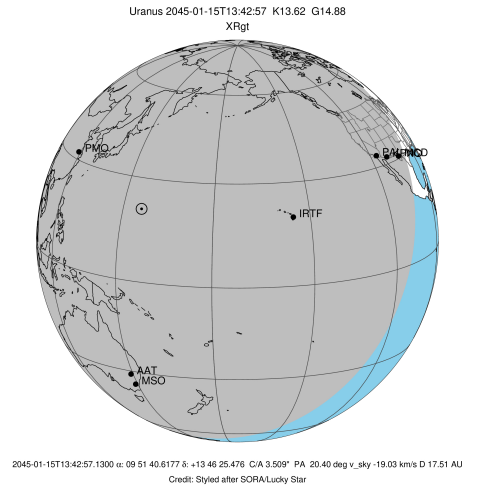
| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I | 2045-01-15T13:38:20.845 | | 73.48 | -46.30 | 51421.49 | -26.62 | | |
| lambda | I | 2045-01-15T13:39:14.822 | | 73.27 | -46.09 | 50026.71 | -24.77 | | |
| delta | I | 2045-01-15T13:40:29.230 | | 73.00 | -45.80 | 48300.35 | -21.57 | | |
| gamma | I | 2045-01-15T13:41:01.731 | | 72.88 | -45.68 | 47623.35 | -20.08 | | |
| eta | I | 2045-01-15T13:41:24.632 | | 72.79 | -45.59 | 47176.12 | -18.98 | | |
| beta | I | 2045-01-15T13:42:54.532 | | 72.46 | -45.24 | 45673.25 | -14.37 | | |
| alpha | I | 2045-01-15T13:44:08.879 | | 72.18 | -44.96 | 44746.47 | -10.23 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| alpha | E | 2045-01-15T13:49:54.398 | | 70.87 | -43.62 | 44736.77 | 10.23 | | |
| beta | E | 2045-01-15T13:51:10.241 | | 70.59 | -43.33 | 45662.76 | 14.37 | | |
| eta | E | 2045-01-15T13:52:40.776 | | 70.24 | -42.98 | 47176.12 | 18.97 | | |
| gamma | E | 2045-01-15T13:53:03.888 | | 70.16 | -42.89 | 47627.43 | 20.07 | | |
| delta | E | 2045-01-15T13:53:36.198 | | 70.03 | -42.77 | 48300.35 | 21.57 | | |
| lambda | E | 2045-01-15T13:54:50.636 | | 69.75 | -42.48 | 50026.71 | 24.76 | | |
| epsilon | E | 2045-01-15T13:55:29.120 | | 69.60 | -42.33 | 51009.10 | 26.61 | | |

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch              : 2045-01-15T13:44:32.050
Event type             : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code         : AAT
Location              : Siding Spring (AAT)
Latitude (deg)        : -31.27703
E. Longitude (deg)    : 149.06608
Altitude (km)         : 1.164
Gaia source ID        : 615909000420713856
2Mass ID (if available) : 09514060+1346253
ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
RUWE (>1.4 is poor)  : 1.06
K magnitude           : 13.624
G magnitude           : 14.880
RP magnitude          : 14.440
BP magnitude          : 15.150
DUPflag              : 0
Distance (au)         : 17.511
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -19.03
Sun-Target sep (deg)  : 149.79
Sun-Moon sep (deg)    : 121.74
B (ring opening deg)  : 21.94
PA of pole (deg)      : 101.06
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.923
C/A sky separation (km) : 49818.9
NAIF SPICE kernels    : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



```

b: ring blocked by planet  x: target alt < 5.0 deg or sun > -5.0 deg
Ring      I/E      UTC          b? alt  alt-sun  radius  r-dot  lat-geo lat-geodetic
-----
epsilon   I  2045-01-15T13:47:20.486  32.82 -37.55  51297.96  -9.25

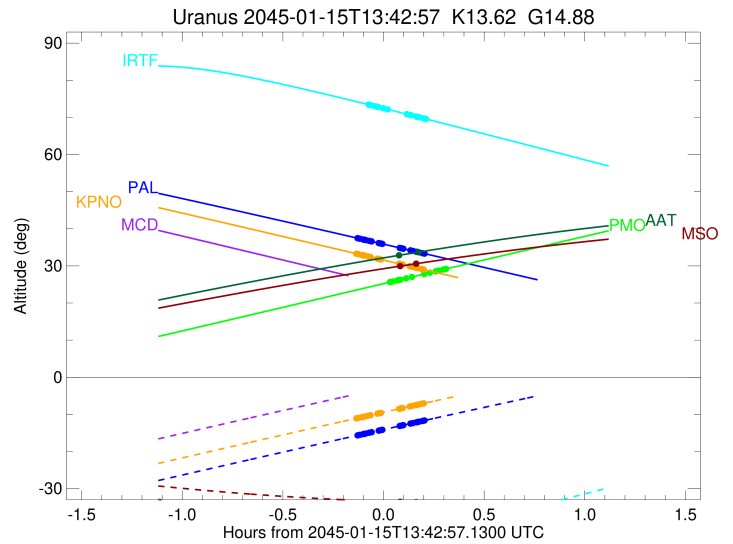
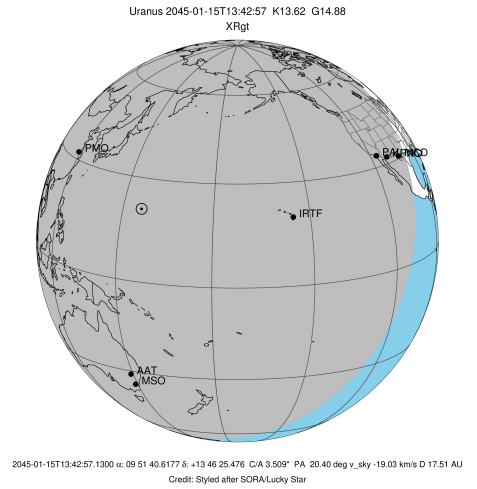
No planet occultations

epsilon   E  2045-01-15T13:53:20.850  33.71 -37.70  51154.05   9.26
  
```



```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2045-01-15T13:44:18.820
Event type          : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code       : MSO
Location            : Mt. Stromlo Observatory
Latitude (deg)      : -35.32000
E. Longitude (deg)  : 149.00833
Altitude (km)       : 0.770
Gaia source ID      : 615909000420713856
2Mass ID (if available) : 09514060+1346253
ICRS Star Coord at Epoch: 09h 51m 40.61775s +13:46:25.47575s
RUWE (>1.4 is poor) : 1.06
K magnitude         : 13.624
G magnitude         : 14.880
RP magnitude        : 14.440
BP magnitude        : 15.150
DUPflag            : 0
Distance (au)       : 17.511
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -19.03
Sun-Target sep (deg) : 149.79
Sun-Moon sep (deg)  : 121.73
B (ring opening deg) : 21.94
PA of pole (deg)    : 101.06
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.942
C/A sky separation (km) : 50065.5
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



```

b: ring blocked by planet  x: target alt < 5.0 deg or sun > -5.0 deg
Ring      I/E      UTC      b? alt  alt-sun  radius  r-dot  lat-geo lat-geodetic
-----
epsilon   I  2045-01-15T13:47:38.497  29.90 -33.55  51286.80  -7.75

No planet occultations

epsilon   E  2045-01-15T13:52:41.091  30.60 -33.67  51166.04  7.76
  
```