

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-24T15:27:29.190  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3425574106069038720  
 2Mass ID (if available) : 06154900+2339410

ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s

RUWE (>1.4 is poor) : 1.08  
 K magnitude : 14.452  
 G magnitude : 17.975  
 RP magnitude : 16.829  
 BP magnitude : 19.146  
 DUPflag : 0  
 Distance (au) : 17.970  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.41  
 Sun-Target sep (deg) : 179.00  
 Sun-Moon sep (deg) : 146.11  
 B (ring opening deg) : 72.18  
 PA of pole (deg) : 64.59

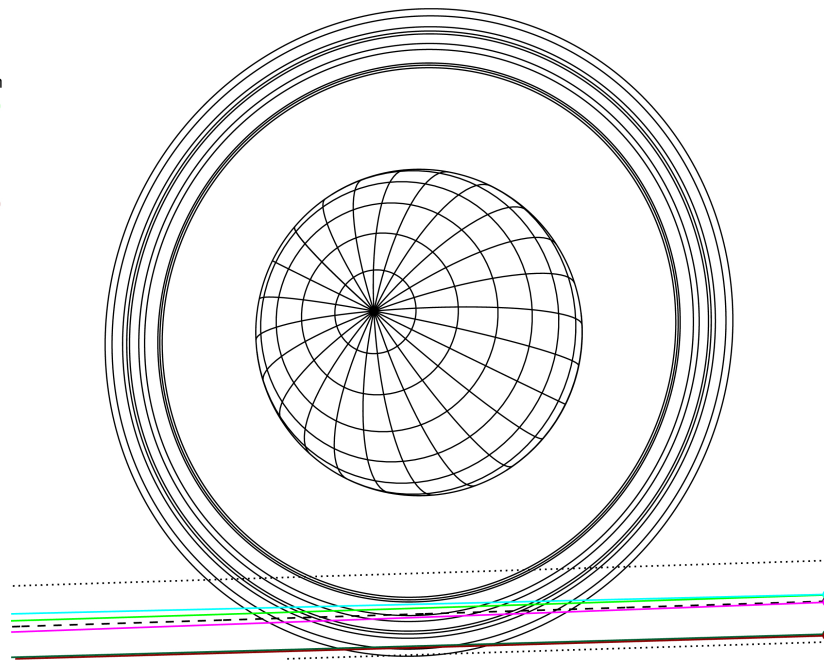
| #  | a(km)   | ring    |
|----|---------|---------|
| 1  | 41837.2 | 6       |
| 2  | 42235.0 | 5       |
| 3  | 42571.2 | 4       |
| 4  | 44718.5 | alpha   |
| 5  | 45661.1 | beta    |
| 6  | 47176.1 | eta     |
| 7  | 47626.3 | gamma   |
| 8  | 48300.3 | delta   |
| 9  | 50026.7 | lambda  |
| 10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



2033-12-24T15:27:29.1900 α: 06 15 49.0237 δ: +23 39 40.511 C/A 3.373° PA 1.79 deg v\_sky -23.41 km/s D 17.97 AU  
 Credit: Styled after SORA/Lucky Star

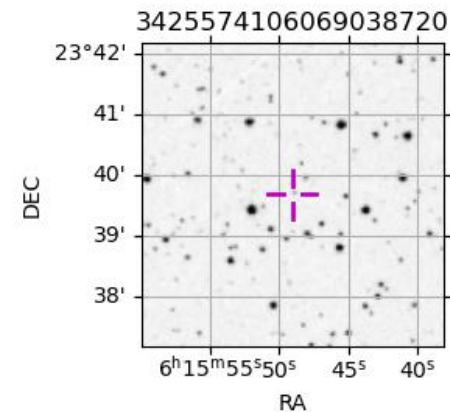
Earth  
 PMO  
 IRTF  
 KAV  
 AAT  
 MSO

Uranus 2033-12-24T15:27:29 K14.45 G17.98 XRgt

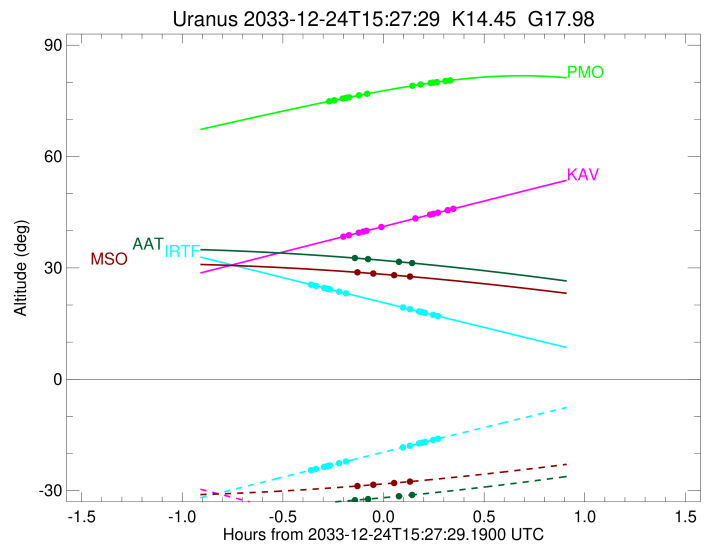
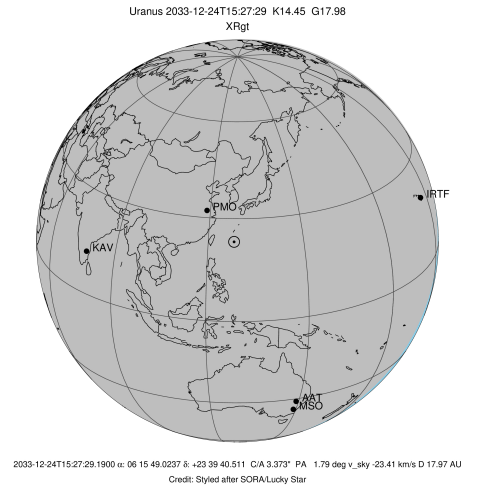


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| 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 |         |        |         |                             | PnnRnn |
| PMO  | Purple Mtn Obs. Nanki | 32.1  | 118.8 | ++++++  |        | ++++++  | DEC 24 15:11 - DEC 24 15:47 | PnnRie |
| KPNO | Kitt Peak Natl Obs    | 32.0  | 248.4 |         |        |         |                             | PnnRnn |
| 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 | ++++++  |        | ++++++  | DEC 24 15:05 - DEC 24 15:44 | PnnRie |
| KAV  | Kavalur Observatory   | 12.6  | 78.8  | ++++++  |        | ++++++  | DEC 24 15:15 - DEC 24 15:48 | PnnRie |
| 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 | ++      |        | ++      | DEC 24 15:18 - DEC 24 15:37 | PnnRie |
| SAAO | So. Afr. Astro. Obs.  | -32.4 | 20.8  |         |        |         |                             | PnnRnn |
| MSO  | Mt. Stromlo Observato | -35.3 | 149.0 | ++      |        | ++      | DEC 24 15:18 - DEC 24 15:36 | PnnRie |



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-24T15:28:10.130  
 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 : 3425574106069038720  
 2Mass ID (if available) : 06154900+2339410  
 ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s  
 RUWE (>1.4 is poor) : 1.08  
 K magnitude : 14.452  
 G magnitude : 17.975  
 RP magnitude : 16.829  
 BP magnitude : 19.146  
 DUPflag : 0  
 Distance (au) : 17.970  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.41  
 Sun-Target sep (deg) : 179.00  
 Sun-Moon sep (deg) : 146.76  
 B (ring opening deg) : 72.18  
 PA of pole (deg) : 64.59  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.311  
 C/A sky separation (km) : 43149.6  
 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



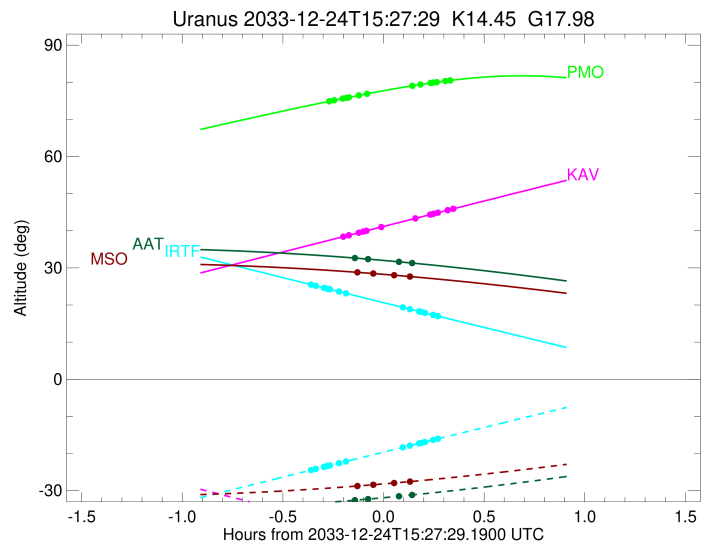
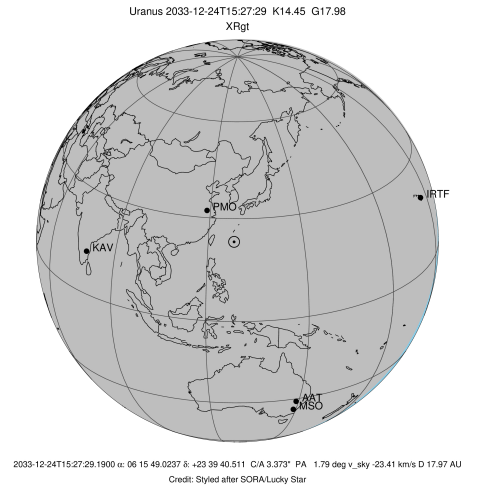
| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2033-12-24T15:11:04.598 |    | 74.84 | -75.46  | 51338.63 | -13.21 |         |              |
| lambda  | I   | 2033-12-24T15:12:48.704 |    | 75.16 | -75.77  | 50026.71 | -12.13 |         |              |
| delta   | I   | 2033-12-24T15:15:20.110 |    | 75.62 | -76.22  | 48300.35 | -10.65 |         |              |
| gamma   | I   | 2033-12-24T15:16:24.988 |    | 75.81 | -76.40  | 47631.58 | -9.96  |         |              |
| eta     | I   | 2033-12-24T15:17:11.898 |    | 75.95 | -76.54  | 47176.12 | -9.45  |         |              |
| beta    | I   | 2033-12-24T15:20:13.322 |    | 76.49 | -77.05  | 45649.10 | -7.33  |         |              |
| alpha   | I   | 2033-12-24T15:22:44.224 |    | 76.92 | -77.46  | 44687.55 | -5.44  |         |              |

No planet occultations

|         |   |                         |  |       |        |          |       |  |  |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| alpha   | E | 2033-12-24T15:35:59.125 |  | 79.04 | -79.43 | 44696.49 | 5.44  |  |  |
| beta    | E | 2033-12-24T15:38:27.024 |  | 79.39 | -79.74 | 45642.11 | 7.33  |  |  |
| eta     | E | 2033-12-24T15:41:29.446 |  | 79.80 | -80.10 | 47176.12 | 9.46  |  |  |
| gamma   | E | 2033-12-24T15:42:16.169 |  | 79.90 | -80.19 | 47629.87 | 9.97  |  |  |
| delta   | E | 2033-12-24T15:43:21.194 |  | 80.04 | -80.31 | 48300.35 | 10.65 |  |  |
| lambda  | E | 2033-12-24T15:45:52.537 |  | 80.34 | -80.56 | 50026.71 | 12.14 |  |  |
| epsilon | E | 2033-12-24T15:47:53.058 |  | 80.57 | -80.75 | 51554.93 | 13.22 |  |  |

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-24T15:23:37.480
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      : 3425574106069038720
2Mass ID (if available) : 06154900+2339410
ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s
RUWE (>1.4 is poor) : 1.08
K magnitude          : 14.452
G magnitude          : 17.975
RP magnitude         : 16.829
BP magnitude         : 19.146
DUPflag             : 0
Distance (au)       : 17.970
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.41
Sun-Target sep (deg) : 179.00
Sun-Moon sep (deg)  : 145.62
B (ring opening deg) : 72.18
PA of pole (deg)    : 64.59
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (" ) : 3.264
C/A sky separation (km) : 42540.3
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
    
```



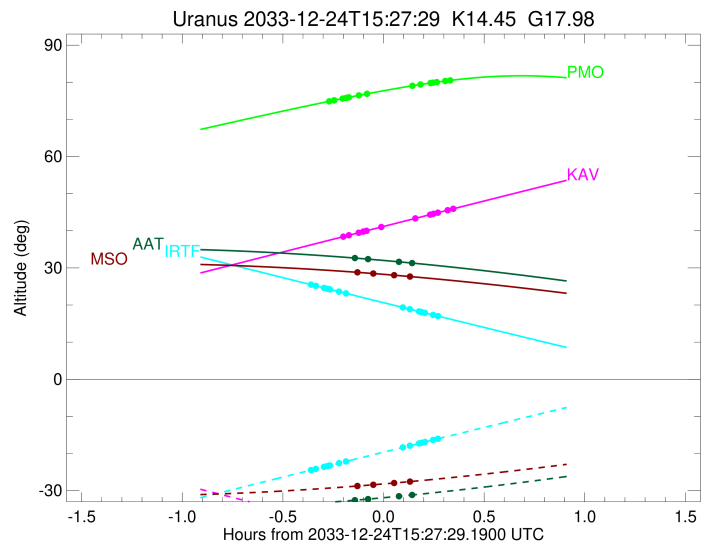
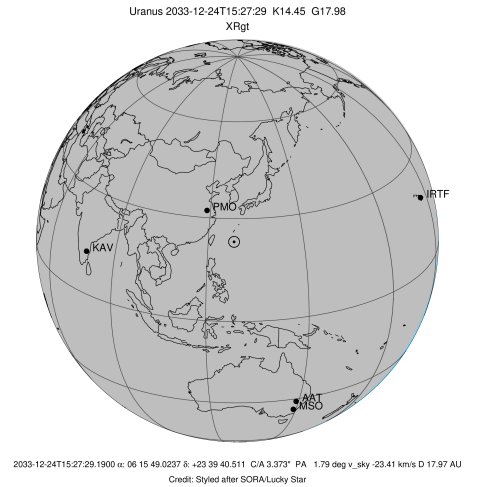
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2033-12-24T15:05:39.678 |    | 25.54 | -24.52  | 51333.27 | -13.55 |         |              |
| lambda  | I   | 2033-12-24T15:07:20.332 |    | 25.16 | -24.15  | 50026.71 | -12.55 |         |              |
| delta   | I   | 2033-12-24T15:09:45.672 |    | 24.61 | -23.60  | 48300.35 | -11.19 |         |              |
| gamma   | I   | 2033-12-24T15:10:47.140 |    | 24.38 | -23.37  | 47631.58 | -10.57 |         |              |
| eta     | I   | 2033-12-24T15:11:31.184 |    | 24.22 | -23.21  | 47176.12 | -10.11 |         |              |
| beta    | I   | 2033-12-24T15:14:16.902 |    | 23.60 | -22.59  | 45649.69 | -8.26  |         |              |
| alpha   | I   | 2033-12-24T15:16:25.659 |    | 23.12 | -22.11  | 44686.91 | -6.73  |         |              |

No planet occultations

|         |   |                         |  |       |        |          |       |  |  |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| alpha   | E | 2033-12-24T15:33:10.664 |  | 19.37 | -18.37 | 44698.19 | 6.72  |  |  |
| beta    | E | 2033-12-24T15:35:16.596 |  | 18.90 | -17.91 | 45641.81 | 8.25  |  |  |
| eta     | E | 2033-12-24T15:38:03.666 |  | 18.28 | -17.29 | 47176.12 | 10.09 |  |  |
| gamma   | E | 2033-12-24T15:38:47.625 |  | 18.12 | -17.13 | 47629.72 | 10.55 |  |  |
| delta   | E | 2033-12-24T15:39:49.404 |  | 17.89 | -16.90 | 48300.35 | 11.16 |  |  |
| lambda  | E | 2033-12-24T15:42:15.103 |  | 17.35 | -16.36 | 50026.71 | 12.51 |  |  |
| epsilon | E | 2033-12-24T15:44:12.488 |  | 16.91 | -15.92 | 51554.23 | 13.51 |  |  |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-24T15:30:40.510  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 3425574106069038720  
 2Mass ID (if available) : 06154900+2339410  
 ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s  
 RUWE (>1.4 is poor) : 1.08  
 K magnitude : 14.452  
 G magnitude : 17.975  
 RP magnitude : 16.829  
 BP magnitude : 19.146  
 DUPflag : 0  
 Distance (au) : 17.970  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.41  
 Sun-Target sep (deg) : 179.00  
 Sun-Moon sep (deg) : 147.03  
 B (ring opening deg) : 72.18  
 PA of pole (deg) : 64.59  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.421  
 C/A sky separation (km) : 44587.5  
 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



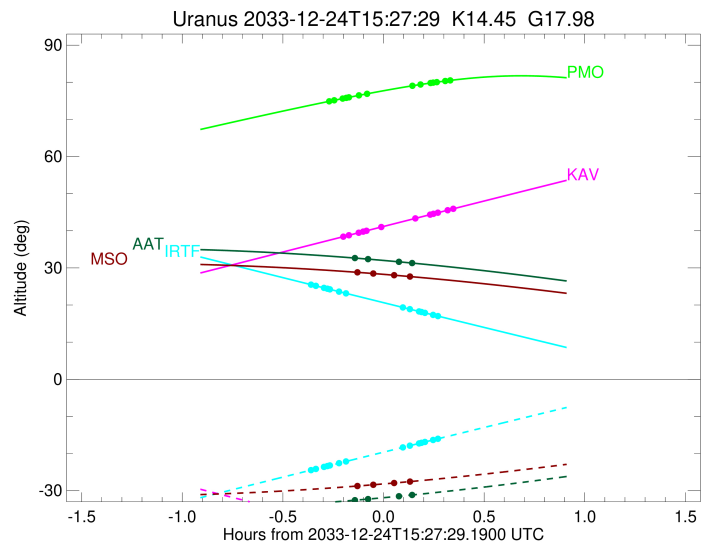
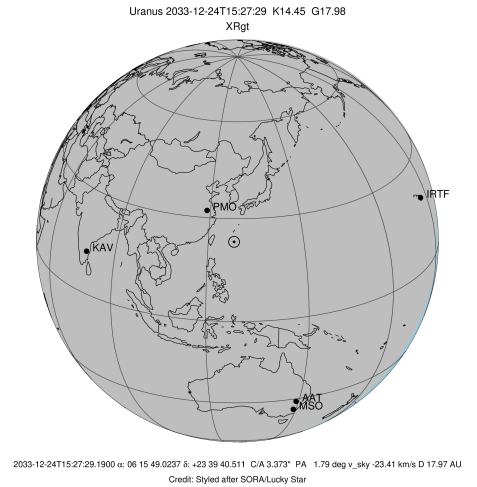
| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2033-12-24T15:15:13.549 |    | 38.35 | -39.34  | 51356.86 | -11.96 |         |              |
| lambda  | I   | 2033-12-24T15:17:11.634 |    | 38.80 | -39.79  | 50026.71 | -10.70 |         |              |
| delta   | I   | 2033-12-24T15:20:07.748 |    | 39.48 | -40.47  | 48300.35 | -8.87  |         |              |
| gamma   | I   | 2033-12-24T15:21:27.041 |    | 39.78 | -40.77  | 47631.56 | -7.99  |         |              |
| eta     | I   | 2033-12-24T15:22:26.601 |    | 40.01 | -41.00  | 47176.12 | -7.30  |         |              |
| beta    | I   | 2033-12-24T15:26:56.816 |    | 41.04 | -42.03  | 45647.04 | -3.95  |         |              |

No planet occultations

|         |   |                         |  |       |        |          |       |  |  |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| beta    | E | 2033-12-24T15:36:50.547 |  | 43.30 | -44.29 | 45643.24 | 3.95  |  |  |
| eta     | E | 2033-12-24T15:41:21.578 |  | 44.34 | -45.32 | 47176.12 | 7.31  |  |  |
| gamma   | E | 2033-12-24T15:42:20.893 |  | 44.56 | -45.54 | 47630.21 | 8.00  |  |  |
| delta   | E | 2033-12-24T15:43:40.243 |  | 44.87 | -45.85 | 48300.35 | 8.89  |  |  |
| lambda  | E | 2033-12-24T15:46:36.060 |  | 45.53 | -46.51 | 50026.71 | 10.72 |  |  |
| epsilon | E | 2033-12-24T15:48:50.557 |  | 46.05 | -47.02 | 51555.23 | 11.99 |  |  |

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-24T15:26:09.300
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      : 3425574106069038720
2Mass ID (if available) : 06154900+2339410
ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s
RUWE (>1.4 is poor) : 1.08
K magnitude          : 14.452
G magnitude          : 17.975
RP magnitude         : 16.829
BP magnitude         : 19.146
DUPflag             : 0
Distance (au)       : 17.970
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.41
Sun-Target sep (deg) : 179.00
Sun-Moon sep (deg)  : 146.04
B (ring opening deg) : 72.18
PA of pole (deg)    : 64.59
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.765
C/A sky separation (km) : 49075.4
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```

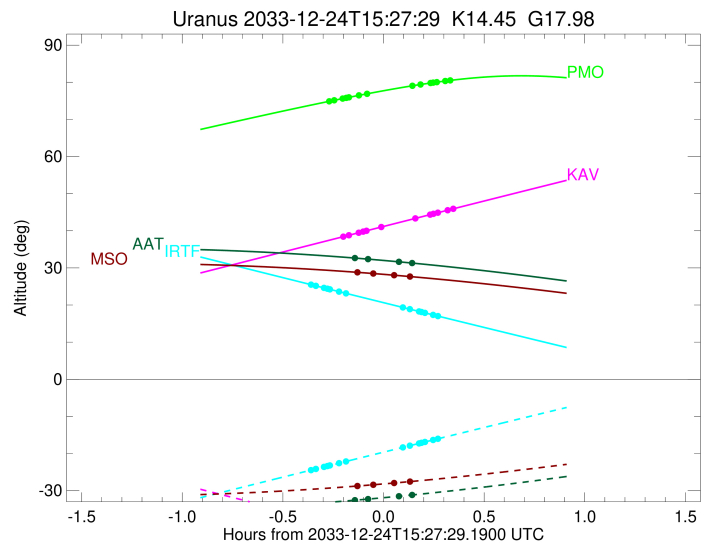
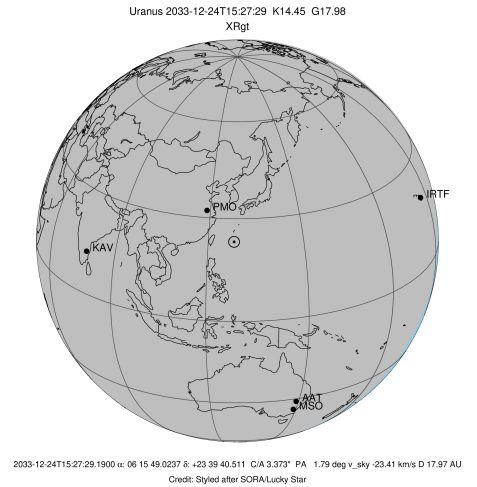


| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I   | 2033-12-24T15:18:14.577 |    | 32.70 | -32.63  | 51433.85 | -6.73 |         |              |
| lambda  | I   | 2033-12-24T15:22:56.966 |    | 32.36 | -32.27  | 50026.71 | -3.33 |         |              |

No planet occultations

|         |   |                         |  |       |        |          |      |  |  |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| lambda  | E | 2033-12-24T15:32:01.553 |  | 31.64 | -31.52 | 50026.71 | 3.33 |  |  |
| epsilon | E | 2033-12-24T15:37:00.434 |  | 31.22 | -31.08 | 51543.48 | 6.73 |  |  |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-24T15:26:12.380  
 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 : 3425574106069038720  
 2Mass ID (if available) : 06154900+2339410  
 ICRS Star Coord at Epoch: 06h 15m 49.02372s +23:39:40.51103s  
 RUWE (>1.4 is poor) : 1.08  
 K magnitude : 14.452  
 G magnitude : 17.975  
 RP magnitude : 16.829  
 BP magnitude : 19.146  
 DUPflag : 0  
 Distance (au) : 17.970  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.41  
 Sun-Target sep (deg) : 179.00  
 Sun-Moon sep (deg) : 146.02  
 B (ring opening deg) : 72.18  
 PA of pole (deg) : 64.59  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.785  
 C/A sky separation (km) : 49328.8  
 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\_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   | 2033-12-24T15:18:55.782 | 28.86  | -28.81  | 51439.30 | -6.27 |         |              |
| lambda  | I   | 2033-12-24T15:24:32.398 | 28.48  | -28.41  | 50026.71 | -2.20 |         |              |

No planet occultations

|         |   |                         |       |        |          |      |  |  |
|---------|---|-------------------------|-------|--------|----------|------|--|--|
| lambda  | E | 2033-12-24T15:30:33.233 | 28.04 | -27.96 | 50026.71 | 2.20 |  |  |
| epsilon | E | 2033-12-24T15:36:26.351 | 27.58 | -27.48 | 51541.57 | 6.27 |  |  |