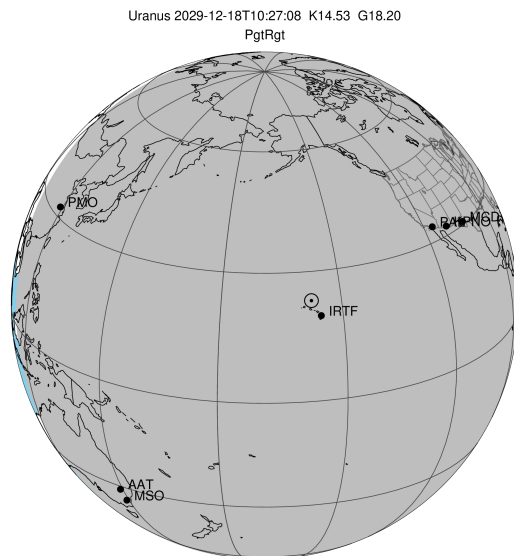


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:27:08.160
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585

ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s

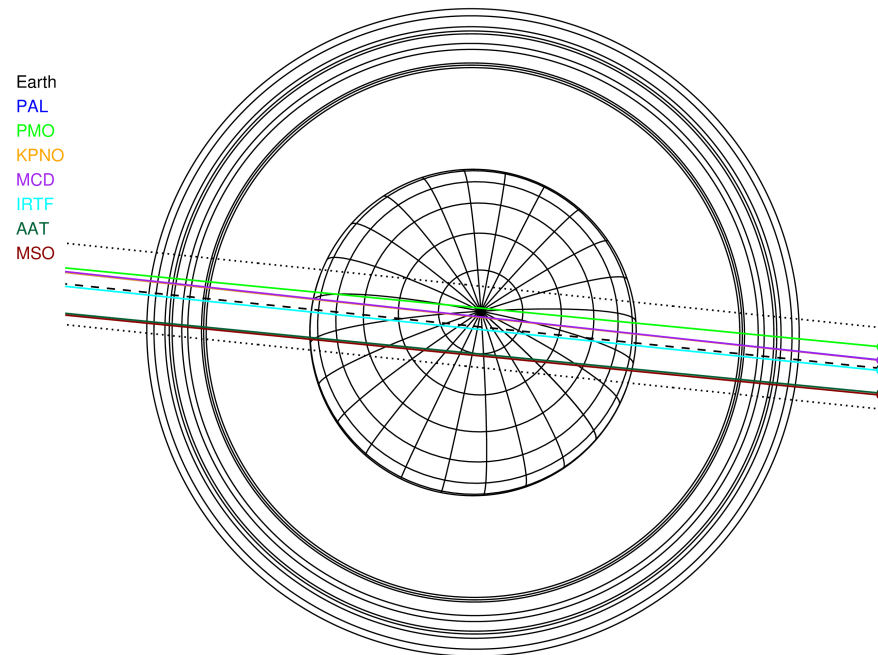
RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 17.29
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37

| # | 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 |



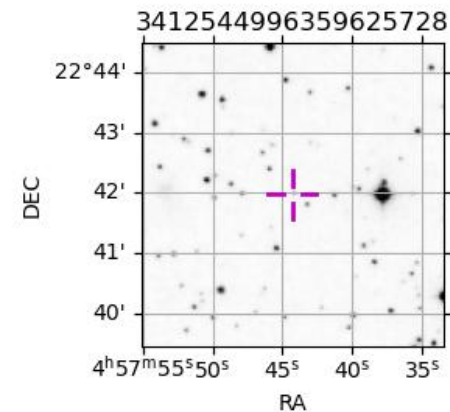
2029-12-18T10:27:08.1600 ra: 04 57 44.28356 ra: +22 41 58.352 C/A 0.080° PA 174.06 deg v_sky -22.93 km/s D 18.25 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2029-12-18T10:27:08 K14.53 G18.20 PgtRgt

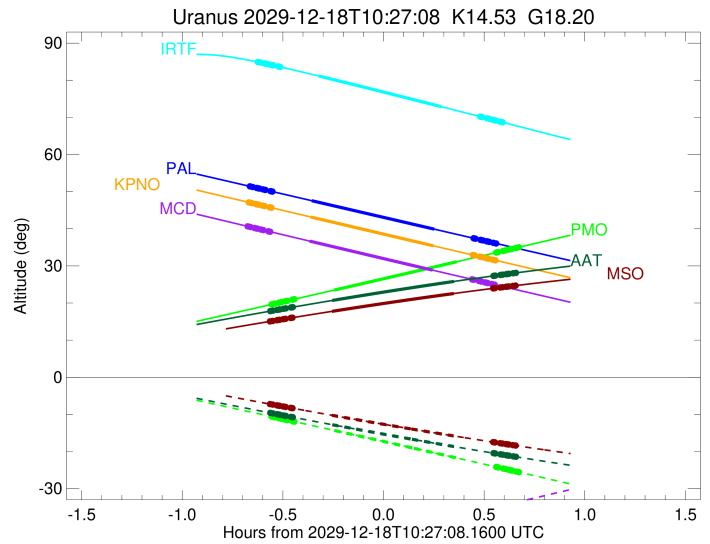
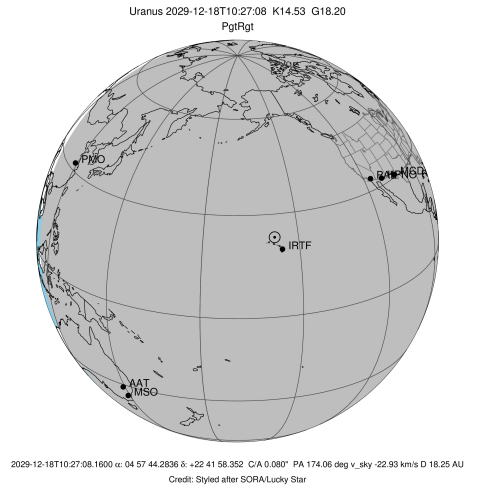


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| 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 | +++++ | + + | +++++ | DEC 18 09:47 - DEC 18 11:00 | PieRie |
| PMO | Purple Mtn Obs. Nanki | 32.1 | 118.8 | +++++ | + + | +++++ | DEC 18 09:53 - DEC 18 11:07 | PieRie |
| KPNO | Kitt Peak Natl Obs | 32.0 | 248.4 | +++++ | + + | +++++ | DEC 18 09:46 - DEC 18 11:00 | PieRie |
| MCD | McDonald Obs. 2.7m | 30.7 | 256.0 | +++++ | + + | +++++ | DEC 18 09:46 - DEC 18 11:00 | PieRie |
| TEN | Teide Obs./Tenerife | 28.3 | 343.5 | | | | | PnnRnn |
| IRTF | Mauna Kea/IRTF | 19.8 | 204.5 | +++++ | + + | +++++ | DEC 18 09:49 - DEC 18 11:02 | PieRie |
| 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 | +++++ | + + | +++++ | DEC 18 09:53 - DEC 18 11:06 | PieRie |
| SAAO | So. Afr. Astro. Obs. | -32.4 | 20.8 | | | | | PnnRnn |
| MSO | Mt. Stromlo Observato | -35.3 | 149.0 | +++++ | + + | +++++ | DEC 18 09:53 - DEC 18 11:06 | PieRie |

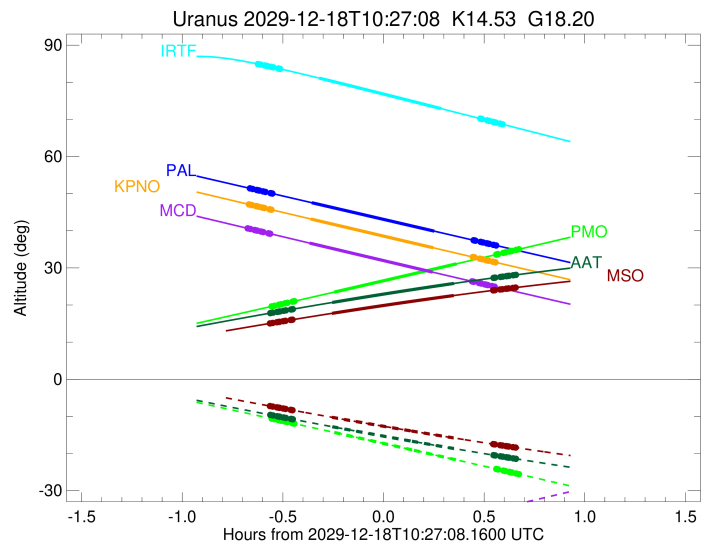
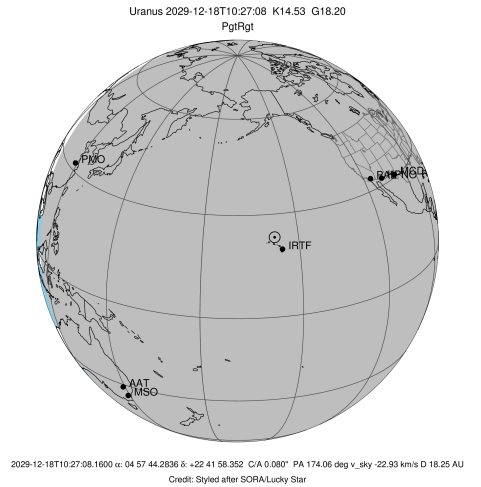


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:23:57.980
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585
 ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 18.05
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.189
 C/A sky separation (km) : 2497.8
 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_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 | 2029-12-18T09:47:05.033 | | 51.47 | -61.35 | 51472.48 | -23.21 | | |
| lambda | I | 2029-12-18T09:48:07.331 | | 51.26 | -61.14 | 50026.71 | -23.21 | | |
| delta | I | 2029-12-18T09:49:21.732 | | 51.00 | -60.88 | 48300.35 | -23.20 | | |
| gamma | I | 2029-12-18T09:49:50.897 | | 50.90 | -60.78 | 47623.68 | -23.20 | | |
| eta | I | 2029-12-18T09:50:10.190 | | 50.83 | -60.72 | 47176.12 | -23.20 | | |
| beta | I | 2029-12-18T09:51:14.933 | | 50.60 | -60.50 | 45674.43 | -23.19 | | |
| alpha | I | 2029-12-18T09:51:57.505 | | 50.45 | -60.35 | 44687.23 | -23.19 | | |
| 4 | I | 2029-12-18T09:53:26.854 | | 50.14 | -60.04 | 42615.53 | -23.19 | | |
| 5 | I | 2029-12-18T09:53:39.826 | | 50.10 | -60.00 | 42314.58 | -23.19 | | |
| 6 | I | 2029-12-18T09:53:58.734 | | 50.03 | -59.94 | 41876.54 | -23.18 | | |
| Uranus | I | 2029-12-18T10:05:44.280 | | 47.57 | -57.51 | 25490.66 | | 2.71 | 2.84 |
| Uranus | E | 2029-12-18T10:42:15.230 | | 39.91 | -49.91 | 25545.71 | | -1.19 | -1.25 |
| 6 | E | 2029-12-18T10:53:58.109 | | 37.45 | -47.46 | 41800.23 | 23.10 | | |
| 5 | E | 2029-12-18T10:54:13.564 | | 37.40 | -47.40 | 42157.34 | 23.10 | | |
| 4 | E | 2029-12-18T10:54:29.529 | | 37.34 | -47.35 | 42526.12 | 23.10 | | |
| alpha | E | 2029-12-18T10:56:05.834 | | 37.01 | -47.01 | 44751.11 | 23.11 | | |
| beta | E | 2029-12-18T10:56:44.579 | | 36.87 | -46.88 | 45646.24 | 23.11 | | |
| eta | E | 2029-12-18T10:57:50.792 | | 36.64 | -46.65 | 47176.12 | 23.11 | | |
| gamma | E | 2029-12-18T10:58:10.362 | | 36.57 | -46.58 | 47628.33 | 23.11 | | |
| delta | E | 2029-12-18T10:58:39.443 | | 36.47 | -46.48 | 48300.35 | 23.11 | | |
| lambda | E | 2029-12-18T10:59:54.150 | | 36.21 | -46.22 | 50026.71 | 23.11 | | |
| epsilon | E | 2029-12-18T11:00:29.771 | | 36.09 | -46.09 | 50849.87 | 23.12 | | |

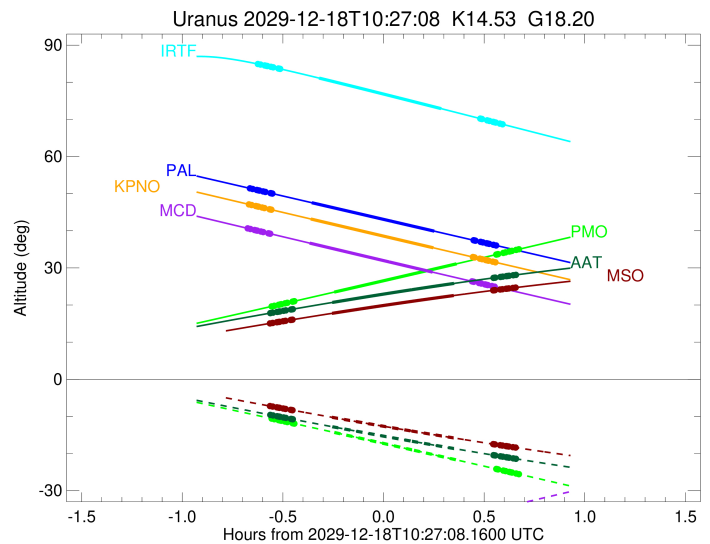
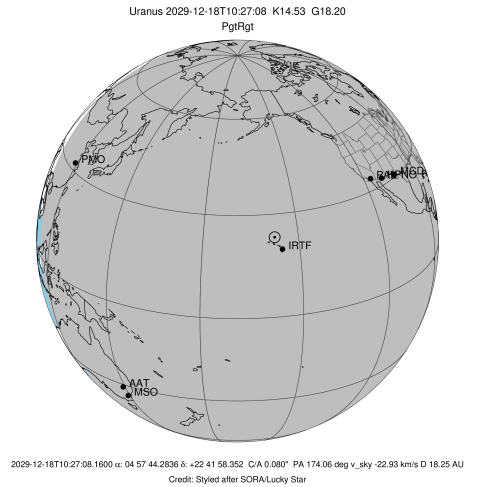
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:30:40.830
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PMO
 Location : Purple Mtn Obs. Nanking
 Latitude (deg) : 32.06667
 E. Longitude (deg) : 118.82089
 Altitude (km) : 0.364
 Gaia source ID : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585
 ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 16.70
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.296
 C/A sky separation (km) : 3915.7
 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 | 2029-12-18T09:53:33.222 | | 19.58 | -10.55 | 51481.69 | -22.93 | | |
| lambda | I | 2029-12-18T09:54:36.696 | | 19.80 | -10.76 | 50026.71 | -22.92 | | |
| delta | I | 2029-12-18T09:55:52.020 | | 20.06 | -11.01 | 48300.35 | -22.92 | | |
| gamma | I | 2029-12-18T09:56:21.555 | | 20.16 | -11.11 | 47623.50 | -22.92 | | |
| eta | I | 2029-12-18T09:56:41.078 | | 20.23 | -11.17 | 47176.12 | -22.91 | | |
| beta | I | 2029-12-18T09:57:46.654 | | 20.45 | -11.39 | 45673.79 | -22.91 | | |
| alpha | I | 2029-12-18T09:58:29.703 | | 20.60 | -11.53 | 44687.81 | -22.91 | | |
| 4 | I | 2029-12-18T10:00:00.212 | | 20.91 | -11.83 | 42615.07 | -22.90 | | |
| 5 | I | 2029-12-18T10:00:13.302 | | 20.96 | -11.88 | 42314.96 | -22.90 | | |
| 6 | I | 2029-12-18T10:00:32.442 | | 21.02 | -11.94 | 41877.22 | -22.90 | | |
| Uranus | I | 2029-12-18T10:12:28.225 | | 23.49 | -14.33 | 25463.56 | | 3.21 | 3.36 |
| Uranus | E | 2029-12-18T10:48:55.970 | | 31.10 | -21.73 | 25552.45 | | -0.84 | -0.88 |
| 6 | E | 2029-12-18T11:00:43.850 | | 33.59 | -24.16 | 41800.73 | 22.99 | | |
| 5 | E | 2029-12-18T11:00:59.377 | | 33.64 | -24.21 | 42157.82 | 22.99 | | |
| 4 | E | 2029-12-18T11:01:15.394 | | 33.70 | -24.27 | 42526.04 | 23.00 | | |
| alpha | E | 2029-12-18T11:02:52.137 | | 34.04 | -24.60 | 44751.30 | 23.01 | | |
| beta | E | 2029-12-18T11:03:31.021 | | 34.18 | -24.73 | 45645.97 | 23.01 | | |
| eta | E | 2029-12-18T11:04:37.502 | | 34.41 | -24.96 | 47176.12 | 23.02 | | |
| gamma | E | 2029-12-18T11:04:57.141 | | 34.48 | -25.03 | 47628.24 | 23.02 | | |
| delta | E | 2029-12-18T11:05:26.331 | | 34.58 | -25.13 | 48300.35 | 23.03 | | |
| lambda | E | 2029-12-18T11:06:41.292 | | 34.85 | -25.39 | 50026.71 | 23.03 | | |
| epsilon | E | 2029-12-18T11:07:17.229 | | 34.97 | -25.51 | 50854.56 | 23.05 | | |

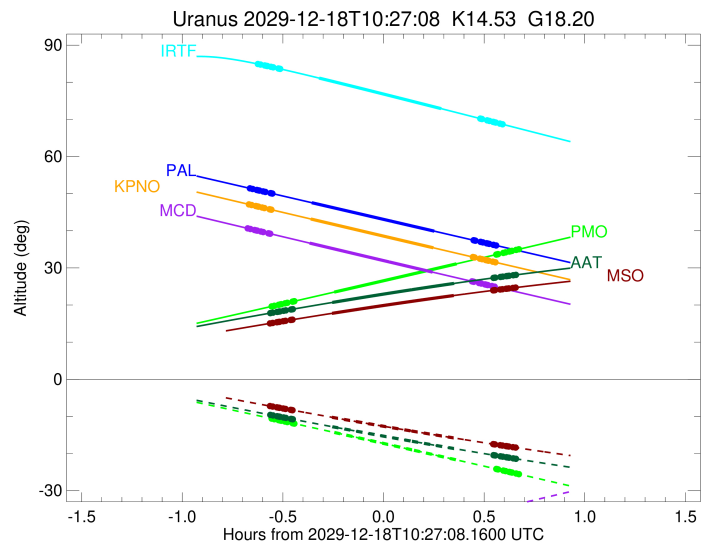
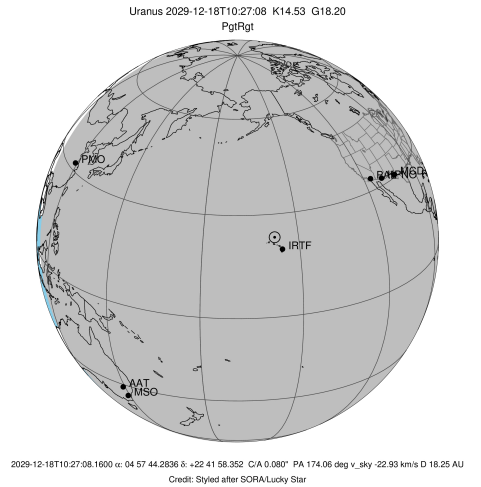
```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch              : 2029-12-18T10:23:42.530
Event type             : PgtRgt
: Uranus occs: geocentric, topocentric
: 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        : 3412544996359625728
2Mass ID (if available) : 04574429+2241585
ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
RUWE (>1.4 is poor)  : 0.99
K magnitude           : 14.530
G magnitude           : 18.196
RP magnitude          : 17.102
BP magnitude          : 19.510
DUPflag              : 0
Distance (au)         : 18.255
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -22.93
Sun-Target sep (deg)  : 169.30
Sun-Moon sep (deg)    : 18.08
B (ring opening deg)  : 82.00
PA of pole (deg)      : -20.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.187
C/A sky separation (km) : 2476.6
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_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 | 2029-12-18T09:46:47.454 | | 47.15 | -57.23 | 51472.24 | -23.20 | | |
| lambda | I | 2029-12-18T09:47:49.793 | | 46.93 | -57.02 | 50026.71 | -23.19 | | |
| delta | I | 2029-12-18T09:49:04.255 | | 46.67 | -56.75 | 48300.35 | -23.18 | | |
| gamma | I | 2029-12-18T09:49:33.445 | | 46.56 | -56.65 | 47623.69 | -23.18 | | |
| eta | I | 2029-12-18T09:49:52.754 | | 46.50 | -56.58 | 47176.12 | -23.18 | | |
| beta | I | 2029-12-18T09:50:57.551 | | 46.27 | -56.35 | 45674.44 | -23.17 | | |
| alpha | I | 2029-12-18T09:51:40.160 | | 46.11 | -56.20 | 44687.22 | -23.17 | | |
| 4 | I | 2029-12-18T09:53:09.583 | | 45.80 | -55.89 | 42615.55 | -23.17 | | |
| 5 | I | 2029-12-18T09:53:22.568 | | 45.75 | -55.84 | 42314.57 | -23.17 | | |
| 6 | I | 2029-12-18T09:53:41.491 | | 45.68 | -55.77 | 41876.52 | -23.16 | | |
| Uranus | I | 2029-12-18T10:05:27.632 | | 43.18 | -53.28 | 25491.18 | | 2.70 | 2.83 |
| Uranus | E | 2029-12-18T10:42:01.061 | | 35.41 | -45.52 | 25545.66 | | -1.20 | -1.25 |
| 6 | E | 2029-12-18T10:53:44.722 | | 32.93 | -43.03 | 41800.23 | 23.08 | | |
| 5 | E | 2029-12-18T10:54:00.194 | | 32.88 | -42.98 | 42157.34 | 23.08 | | |
| 4 | E | 2029-12-18T10:54:16.178 | | 32.82 | -42.92 | 42526.12 | 23.08 | | |
| alpha | E | 2029-12-18T10:55:52.596 | | 32.48 | -42.58 | 44751.10 | 23.08 | | |
| beta | E | 2029-12-18T10:56:31.386 | | 32.35 | -42.44 | 45646.24 | 23.08 | | |
| eta | E | 2029-12-18T10:57:37.677 | | 32.12 | -42.21 | 47176.12 | 23.08 | | |
| gamma | E | 2029-12-18T10:57:57.270 | | 32.05 | -42.14 | 47628.34 | 23.08 | | |
| delta | E | 2029-12-18T10:58:26.386 | | 31.94 | -42.03 | 48300.35 | 23.08 | | |
| lambda | E | 2029-12-18T10:59:41.182 | | 31.68 | -41.77 | 50026.71 | 23.08 | | |
| epsilon | E | 2029-12-18T11:00:16.846 | | 31.56 | -41.64 | 50849.89 | 23.09 | | |

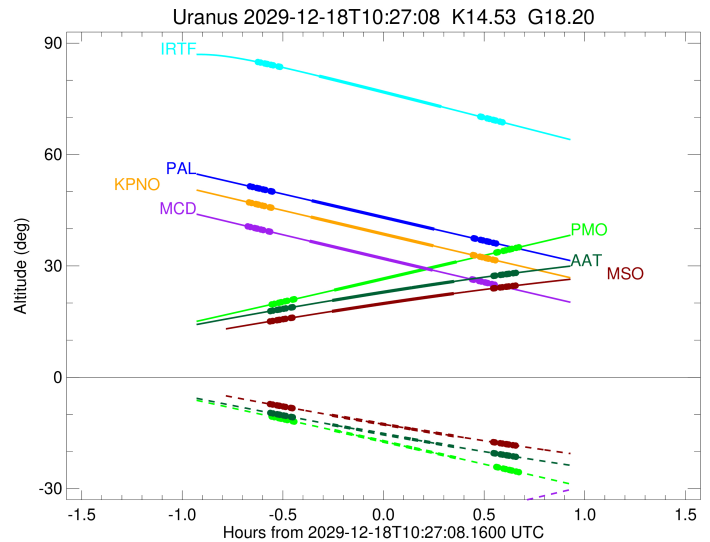
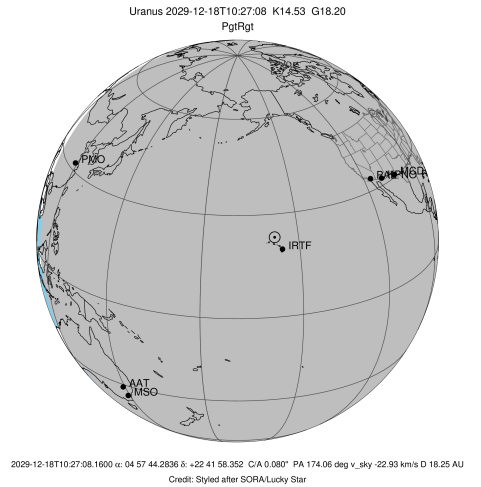
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:23:23.900
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : MCD
 Location : McDonald Obs. 2.7m
 Latitude (deg) : 30.67158
 E. Longitude (deg) : 255.97844
 Altitude (km) : 2.075
 Gaia source ID : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585
 ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 18.11
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.192
 C/A sky separation (km) : 2547.6
 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 | 2029-12-18T09:46:25.298 | | 40.70 | -50.89 | 51472.40 | -23.16 | | |
| lambda | I | 2029-12-18T09:47:27.745 | | 40.47 | -50.67 | 50026.71 | -23.15 | | |
| delta | I | 2029-12-18T09:48:42.327 | | 40.21 | -50.40 | 48300.35 | -23.14 | | |
| gamma | I | 2029-12-18T09:49:11.565 | | 40.10 | -50.30 | 47623.68 | -23.14 | | |
| eta | I | 2029-12-18T09:49:30.905 | | 40.03 | -50.23 | 47176.12 | -23.14 | | |
| beta | I | 2029-12-18T09:50:35.809 | | 39.80 | -50.00 | 45674.43 | -23.14 | | |
| alpha | I | 2029-12-18T09:51:18.488 | | 39.65 | -49.84 | 44687.23 | -23.13 | | |
| 4 | I | 2029-12-18T09:52:48.061 | | 39.33 | -49.52 | 42615.53 | -23.13 | | |
| 5 | I | 2029-12-18T09:53:01.067 | | 39.28 | -49.47 | 42314.58 | -23.13 | | |
| 6 | I | 2029-12-18T09:53:20.022 | | 39.21 | -49.41 | 41876.53 | -23.13 | | |
| Uranus | I | 2029-12-18T10:05:07.452 | | 36.68 | -46.87 | 25490.40 | | 2.72 | 2.84 |
| Uranus | E | 2029-12-18T10:41:44.169 | | 28.87 | -39.01 | 25546.26 | | -1.17 | -1.22 |
| 6 | E | 2029-12-18T10:53:29.293 | | 26.38 | -36.50 | 41800.28 | 23.03 | | |
| 5 | E | 2029-12-18T10:53:44.797 | | 26.32 | -36.45 | 42157.39 | 23.03 | | |
| 4 | E | 2029-12-18T10:54:00.812 | | 26.27 | -36.39 | 42526.12 | 23.03 | | |
| alpha | E | 2029-12-18T10:55:37.430 | | 25.93 | -36.05 | 44751.13 | 23.03 | | |
| beta | E | 2029-12-18T10:56:16.297 | | 25.79 | -35.91 | 45646.21 | 23.03 | | |
| eta | E | 2029-12-18T10:57:22.726 | | 25.56 | -35.67 | 47176.12 | 23.03 | | |
| gamma | E | 2029-12-18T10:57:42.359 | | 25.49 | -35.61 | 47628.33 | 23.03 | | |
| delta | E | 2029-12-18T10:58:11.536 | | 25.39 | -35.50 | 48300.35 | 23.03 | | |
| lambda | E | 2029-12-18T10:59:26.486 | | 25.12 | -35.24 | 50026.71 | 23.03 | | |
| epsilon | E | 2029-12-18T11:00:02.248 | | 25.00 | -35.11 | 50850.45 | 23.04 | | |

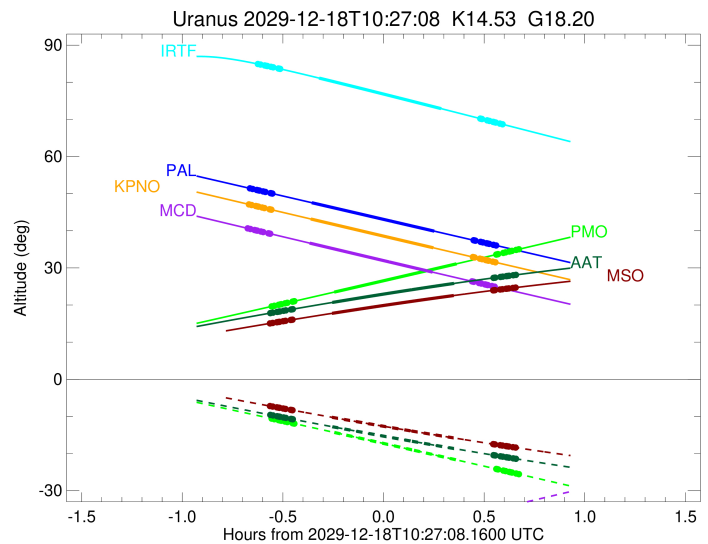
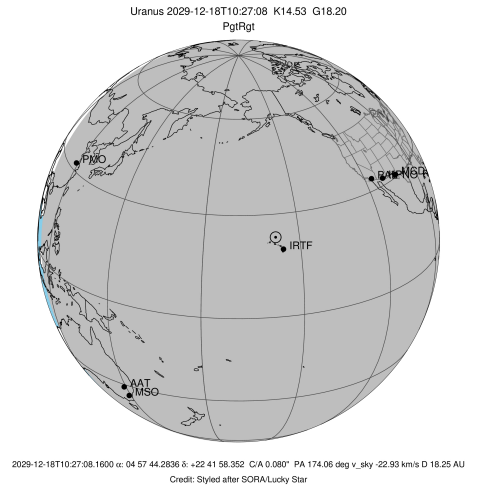
```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-12-18T10:26:08.510
Event type            : PgtRgt
: 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        : 3412544996359625728
2Mass ID (if available) : 04574429+2241585
ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
RUWE (>1.4 is poor)  : 0.99
K magnitude           : 14.530
G magnitude           : 18.196
RP magnitude          : 17.102
BP magnitude          : 19.510
DUPflag               : 0
Distance (au)         : 18.255
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -22.93
Sun-Target sep (deg)  : 169.30
Sun-Moon sep (deg)    : 17.76
B (ring opening deg)  : 82.00
PA of pole (deg)      : -20.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.044
C/A sky separation (km) : 577.5
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_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
    
```



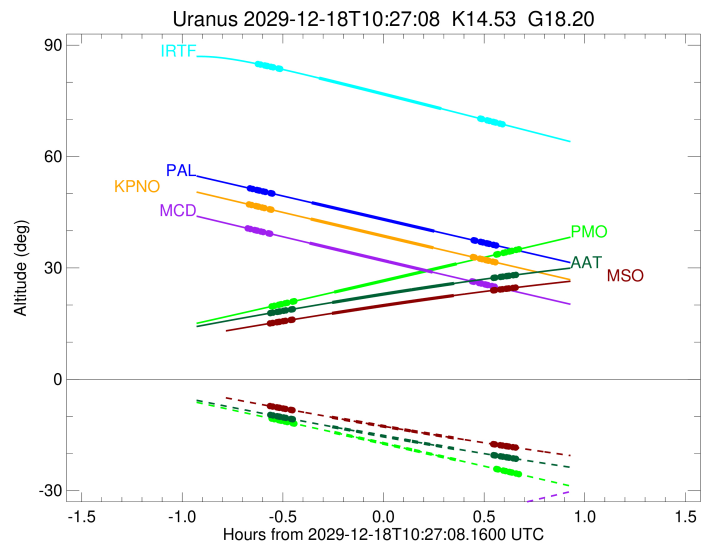
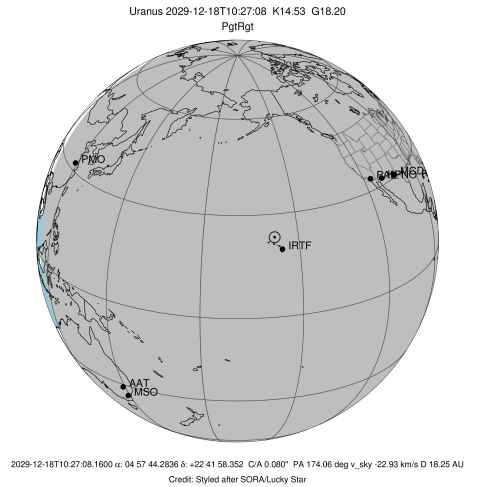
| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I | 2029-12-18T09:49:27.963 | | 84.96 | -82.29 | 51464.05 | -23.38 | | |
| lambda | I | 2029-12-18T09:50:29.455 | | 84.77 | -82.50 | 50026.71 | -23.37 | | |
| delta | I | 2029-12-18T09:51:43.314 | | 84.54 | -82.75 | 48300.35 | -23.37 | | |
| gamma | I | 2029-12-18T09:52:12.257 | | 84.44 | -82.85 | 47623.85 | -23.37 | | |
| eta | I | 2029-12-18T09:52:31.414 | | 84.38 | -82.91 | 47176.12 | -23.37 | | |
| beta | I | 2029-12-18T09:53:35.646 | | 84.17 | -83.12 | 45674.99 | -23.37 | | |
| alpha | I | 2029-12-18T09:54:17.936 | | 84.03 | -83.26 | 44686.74 | -23.37 | | |
| 4 | I | 2029-12-18T09:55:46.552 | | 83.73 | -83.54 | 42615.90 | -23.37 | | |
| 5 | I | 2029-12-18T09:55:59.464 | | 83.68 | -83.58 | 42314.08 | -23.37 | | |
| 6 | I | 2029-12-18T09:56:18.223 | | 83.62 | -83.64 | 41875.82 | -23.37 | | |
| Uranus | I | 2029-12-18T10:07:56.568 | | 81.13 | -85.56 | 25515.17 | | 2.17 | 2.27 |
| Uranus | E | 2029-12-18T10:44:21.385 | | 72.90 | -82.96 | 25528.29 | | -1.81 | -1.90 |
| 6 | E | 2029-12-18T10:55:56.770 | | 70.23 | -80.57 | 41799.23 | 23.34 | | |
| 5 | E | 2029-12-18T10:56:12.075 | | 70.17 | -80.51 | 42156.44 | 23.34 | | |
| 4 | E | 2029-12-18T10:56:27.923 | | 70.11 | -80.45 | 42526.39 | 23.34 | | |
| alpha | E | 2029-12-18T10:58:03.213 | | 69.75 | -80.11 | 44750.62 | 23.34 | | |
| beta | E | 2029-12-18T10:58:41.614 | | 69.60 | -79.98 | 45646.88 | 23.34 | | |
| eta | E | 2029-12-18T10:59:47.131 | | 69.35 | -79.74 | 47176.12 | 23.34 | | |
| gamma | E | 2029-12-18T11:00:06.513 | | 69.27 | -79.67 | 47628.55 | 23.34 | | |
| delta | E | 2029-12-18T11:00:35.292 | | 69.16 | -79.57 | 48300.35 | 23.34 | | |
| lambda | E | 2029-12-18T11:01:49.250 | | 68.88 | -79.30 | 50026.71 | 23.34 | | |
| epsilon | E | 2029-12-18T11:02:24.034 | | 68.74 | -79.17 | 50838.66 | 23.34 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:30:02.830
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : 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 : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585
 ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 16.94
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.246
 C/A sky separation (km) : 3258.8
 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_itrff93_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 | 2029-12-18T09:53:10.863 | | 17.79 | -9.56 | 51445.18 | -23.13 | | |
| lambda | I | 2029-12-18T09:54:12.180 | | 17.95 | -9.74 | 50026.71 | -23.13 | | |
| delta | I | 2029-12-18T09:55:26.812 | | 18.15 | -9.96 | 48300.35 | -23.13 | | |
| gamma | I | 2029-12-18T09:55:56.044 | | 18.22 | -10.04 | 47624.22 | -23.13 | | |
| eta | I | 2029-12-18T09:56:15.418 | | 18.28 | -10.10 | 47176.12 | -23.13 | | |
| beta | I | 2029-12-18T09:57:20.282 | | 18.45 | -10.29 | 45676.11 | -23.13 | | |
| alpha | I | 2029-12-18T09:58:03.108 | | 18.56 | -10.41 | 44685.88 | -23.12 | | |
| 4 | I | 2029-12-18T09:59:32.619 | | 18.79 | -10.67 | 42616.40 | -23.12 | | |
| 5 | I | 2029-12-18T09:59:45.764 | | 18.83 | -10.71 | 42312.60 | -23.12 | | |
| 6 | I | 2029-12-18T10:00:04.728 | | 18.88 | -10.77 | 41874.11 | -23.12 | | |
| Uranus | I | 2029-12-18T10:11:50.926 | | 20.69 | -12.78 | 25548.99 | | 1.03 | 1.08 |
| Uranus | E | 2029-12-18T10:48:10.579 | | 25.82 | -18.66 | 25475.15 | | -3.00 | -3.15 |
| 6 | E | 2029-12-18T10:59:53.670 | | 27.31 | -20.44 | 41797.55 | 23.18 | | |
| 5 | E | 2029-12-18T11:00:09.119 | | 27.34 | -20.48 | 42155.25 | 23.18 | | |
| 4 | E | 2029-12-18T11:00:25.150 | | 27.37 | -20.52 | 42527.21 | 23.19 | | |
| alpha | E | 2029-12-18T11:02:00.990 | | 27.57 | -20.75 | 44749.48 | 23.19 | | |
| beta | E | 2029-12-18T11:02:39.745 | | 27.64 | -20.85 | 45648.22 | 23.20 | | |
| eta | E | 2029-12-18T11:03:45.609 | | 27.78 | -21.01 | 47176.12 | 23.20 | | |
| gamma | E | 2029-12-18T11:04:05.125 | | 27.82 | -21.06 | 47628.96 | 23.20 | | |
| delta | E | 2029-12-18T11:04:34.057 | | 27.87 | -21.13 | 48300.35 | 23.21 | | |
| lambda | E | 2029-12-18T11:05:48.440 | | 28.02 | -21.31 | 50026.71 | 23.21 | | |
| epsilon | E | 2029-12-18T11:06:22.547 | | 28.09 | -21.39 | 50818.45 | 23.21 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T10:29:57.210
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : 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 : 3412544996359625728
 2Mass ID (if available) : 04574429+2241585
 ICRS Star Coord at Epoch: 04h 57m 44.28357s +22:41:58.35151s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.530
 G magnitude : 18.196
 RP magnitude : 17.102
 BP magnitude : 19.510
 DUPflag : 0
 Distance (au) : 18.255
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.93
 Sun-Target sep (deg) : 169.30
 Sun-Moon sep (deg) : 16.95
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.37
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.268
 C/A sky separation (km) : 3544.6
 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 | 2029-12-18T09:53:04.895 | | 15.02 | -7.19 | 51443.53 | -23.11 | | |
| lambda | I | 2029-12-18T09:54:06.194 | | 15.17 | -7.36 | 50026.71 | -23.11 | | |
| delta | I | 2029-12-18T09:55:20.894 | | 15.36 | -7.56 | 48300.35 | -23.11 | | |
| gamma | I | 2029-12-18T09:55:50.152 | | 15.43 | -7.64 | 47624.25 | -23.11 | | |
| eta | I | 2029-12-18T09:56:09.546 | | 15.48 | -7.70 | 47176.12 | -23.11 | | |
| beta | I | 2029-12-18T09:57:14.468 | | 15.64 | -7.88 | 45676.19 | -23.10 | | |
| alpha | I | 2029-12-18T09:57:57.342 | | 15.75 | -8.00 | 44685.82 | -23.10 | | |
| 4 | I | 2029-12-18T09:59:26.942 | | 15.97 | -8.24 | 42616.42 | -23.09 | | |
| 5 | I | 2029-12-18T09:59:40.109 | | 16.00 | -8.28 | 42312.45 | -23.09 | | |
| 6 | I | 2029-12-18T09:59:59.093 | | 16.05 | -8.33 | 41873.96 | -23.09 | | |
| Uranus | I | 2029-12-18T10:11:46.276 | | 17.76 | -10.24 | 25550.68 | | 0.94 | 0.99 |
| Uranus | E | 2029-12-18T10:48:03.750 | | 22.55 | -15.80 | 25470.54 | | -3.09 | -3.23 |
| 6 | E | 2029-12-18T10:59:48.056 | | 23.94 | -17.47 | 41797.45 | 23.15 | | |
| 5 | E | 2029-12-18T11:00:03.527 | | 23.97 | -17.50 | 42155.20 | 23.16 | | |
| 4 | E | 2029-12-18T11:00:19.582 | | 24.00 | -17.54 | 42527.28 | 23.16 | | |
| alpha | E | 2029-12-18T11:01:55.528 | | 24.18 | -17.76 | 44749.39 | 23.17 | | |
| beta | E | 2029-12-18T11:02:34.335 | | 24.26 | -17.85 | 45648.31 | 23.17 | | |
| eta | E | 2029-12-18T11:03:40.268 | | 24.38 | -18.00 | 47176.12 | 23.18 | | |
| gamma | E | 2029-12-18T11:03:59.806 | | 24.42 | -18.05 | 47628.99 | 23.18 | | |
| delta | E | 2029-12-18T11:04:28.769 | | 24.47 | -18.11 | 48300.35 | 23.18 | | |
| lambda | E | 2029-12-18T11:05:43.230 | | 24.61 | -18.28 | 50026.71 | 23.19 | | |
| epsilon | E | 2029-12-18T11:06:17.318 | | 24.67 | -18.36 | 50817.18 | 23.18 | | |