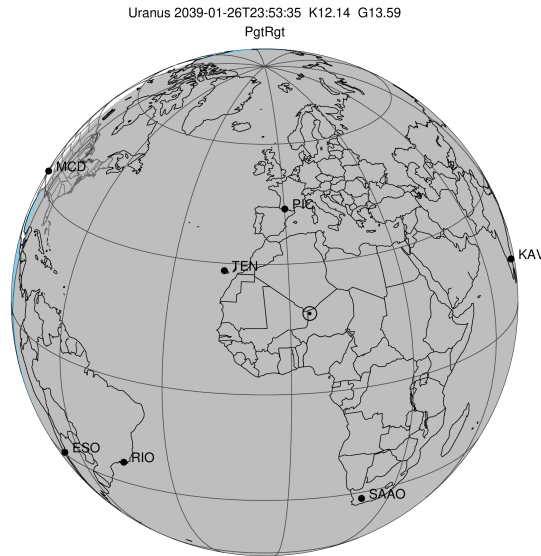


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-26T23:53:35.480  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 673809832496893568  
 2Mass ID (if available) : 07512686+2131483

ICRS Star Coord at Epoch: 07h 51m 26.86968s +21:31:48.39620s

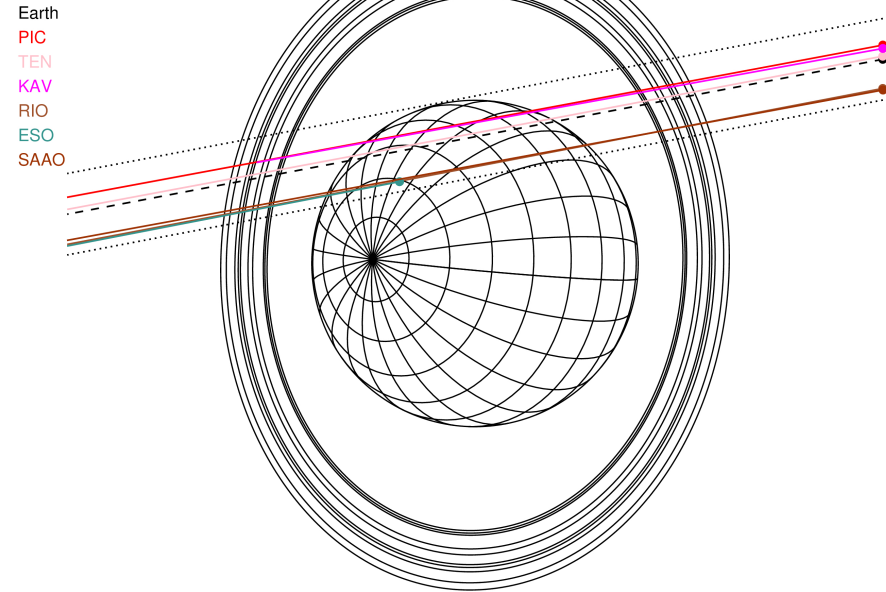
RUWE (>1.4 is poor) : 0.98  
 K magnitude : 12.144  
 G magnitude : 13.590  
 RP magnitude : 13.084  
 BP magnitude : 13.927  
 DUPflag : 0  
 Distance (au) : 17.674  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.77  
 Sun-Target sep (deg) : 169.42  
 Sun-Moon sep (deg) : 138.61  
 B (ring opening deg) : 51.10  
 PA of pole (deg) : 87.66

| #  | 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 |



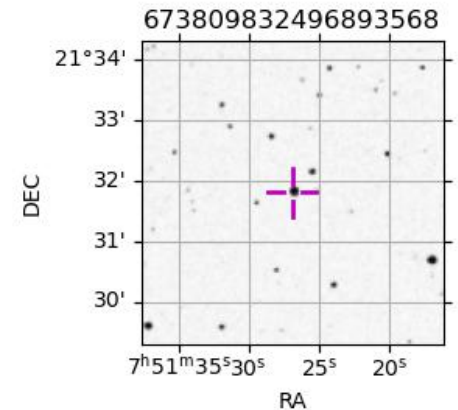
2039-01-26T23:53:35.4800 α: 07 51 26.8697 δ: +21 31 48.396 C/A 1.529° PA 190.76 deg v\_sky -22.77 km/s D 17.67 AU  
 Credit: Styled after SORA/Lucky Star

Uranus 2039-01-26T23:53:35 K12.14 G13.59 PgtRgt



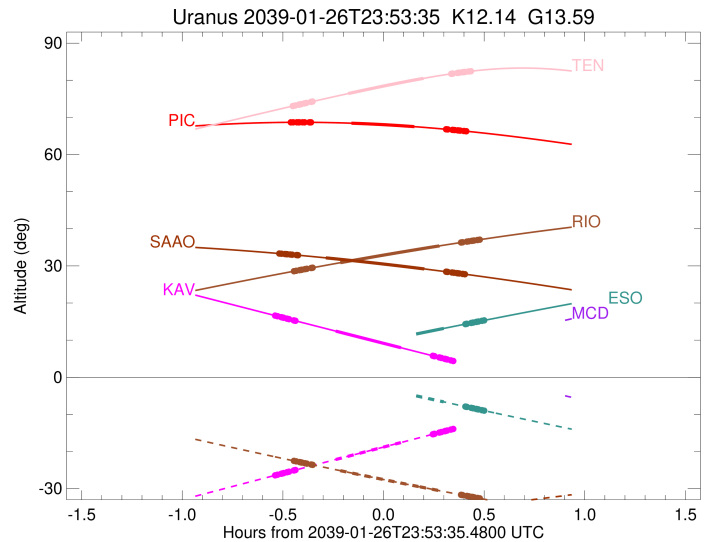
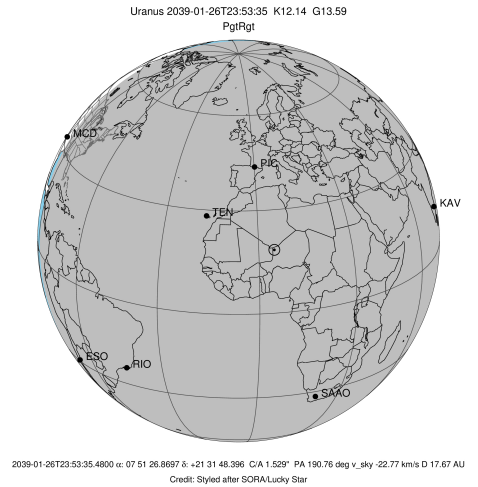
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| Obs  | Location              | lat   | Elon  | Rings I | Planet | Rings E | Observed Events Interval    | OEcode |
|------|-----------------------|-------|-------|---------|--------|---------|-----------------------------|--------|
| PIC  | Pic du Midi           | 42.9  | 0.1   | +++++   | + +    | +++++   | JAN 26 23:26 - JAN 27 00:18 | PieRie |
| PAL  | Palomar Mt (200")     | 33.4  | 243.1 |         |        |         |                             | PnnRnn |
| PMO  | Purple Mtn Obs. Nanki | 32.1  | 118.8 |         |        |         |                             | PnnRnn |
| 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 | +++++   | + +    | +++++   | JAN 26 23:26 - JAN 27 00:19 | PieRie |
| IRTF | Mauna Kea/IRTF        | 19.8  | 204.5 |         |        |         |                             | PnnRnn |
| KAV  | Kavalur Observatory   | 12.6  | 78.8  | +++++   | + +    | +++++   | JAN 26 23:21 - JAN 27 00:10 | PieRie |
| RIO  | Rio de Janeiro        | -22.9 | 316.8 | +++++   | + +    | +++++   | JAN 26 23:27 - JAN 27 00:22 | PieRie |
| ESO  | European Southern Obs | -29.3 | 289.3 |         | +      | +++++   | JAN 27 00:11 - JAN 27 00:23 | PneRne |
| AAT  | Siding Spring (AAT)   | -31.3 | 149.1 |         |        |         |                             | PnnRnn |
| SAAO | So. Afr. Astro. Obs.  | -32.4 | 20.8  | +++++   | + +    | +++++   | JAN 26 23:22 - JAN 27 00:17 | PieRie |
| MSO  | Mt. Stromlo Observato | -35.3 | 149.0 |         |        |         |                             | PnnRnn |



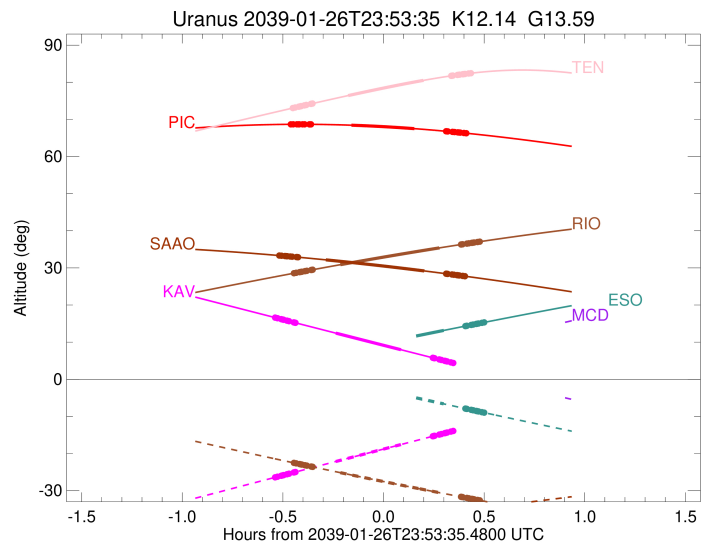
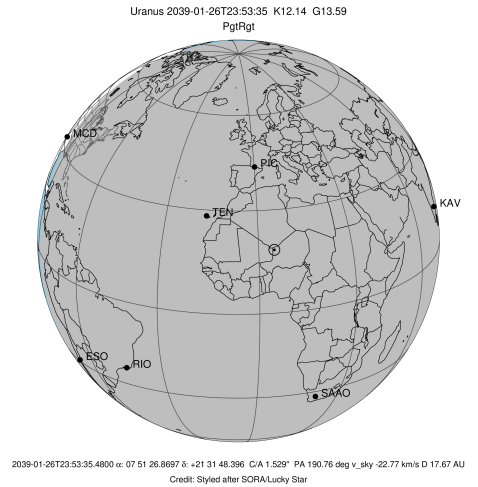
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2039-01-26T23:53:29.770
Event type           : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code        : PIC
Location             : Pic du Midi
Latitude (deg)       : 42.93656
E. Longitude (deg)  : 0.14231
Altitude (km)        : 2.890
Gaia source ID       : 673809832496893568
2Mass ID (if available) : 07512686+2131483
ICRS Star Coord at Epoch: 07h 51m 26.86968s +21:31:48.39620s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 12.144
G magnitude           : 13.590
RP magnitude          : 13.084
BP magnitude          : 13.927
DUPflag              : 0
Distance (au)        : 17.674
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -22.77
Sun-Target sep (deg) : 169.42
Sun-Moon sep (deg)  : 139.15
B (ring opening deg) : 51.10
PA of pole (deg)    : 87.66
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.707
C/A sky separation (km) : 21877.5
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
  
```



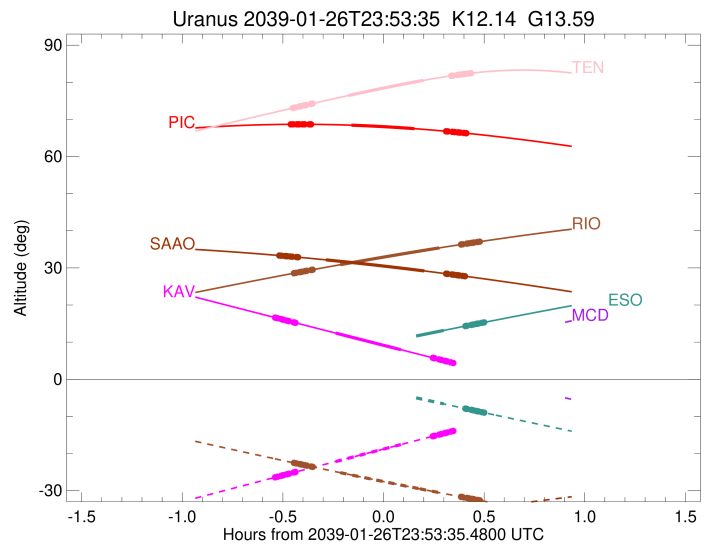
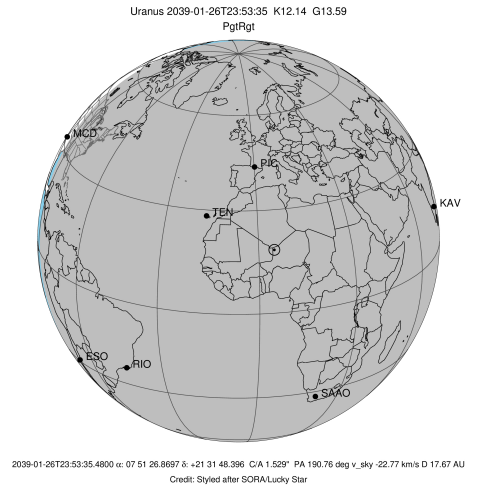
| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2039-01-26T23:26:08.365 |    | 68.68 | -63.94  | 50886.83 | -26.40 |         |              |
| lambda  | I   | 2039-01-26T23:26:40.916 |    | 68.68 | -63.98  | 50026.71 | -26.37 |         |              |
| delta   | I   | 2039-01-26T23:27:46.672 |    | 68.68 | -64.07  | 48300.35 | -26.13 |         |              |
| gamma   | I   | 2039-01-26T23:28:12.468 |    | 68.68 | -64.10  | 47627.44 | -26.03 |         |              |
| eta     | I   | 2039-01-26T23:28:29.826 |    | 68.68 | -64.12  | 47176.12 | -25.97 |         |              |
| beta    | I   | 2039-01-26T23:29:29.177 |    | 68.68 | -64.20  | 45642.47 | -25.71 |         |              |
| alpha   | I   | 2039-01-26T23:30:06.215 |    | 68.68 | -64.24  | 44686.84 | -25.53 |         |              |
| 4       | I   | 2039-01-26T23:31:28.100 |    | 68.67 | -64.34  | 42607.47 | -25.11 |         |              |
| 5       | I   | 2039-01-26T23:31:44.659 |    | 68.67 | -64.36  | 42180.13 | -25.00 |         |              |
| 6       | I   | 2039-01-26T23:32:01.640 |    | 68.67 | -64.38  | 41794.78 | -24.95 |         |              |
| Uranus  | I   | 2039-01-26T23:44:00.781 |    | 68.44 | -65.10  | 25524.27 |        | -11.25  | -11.77       |
| Uranus  | E   | 2039-01-27T00:02:47.510 |    | 67.51 | -65.73  | 25390.42 |        | 25.56   | 26.60        |
| 6       | E   | 2039-01-27T00:12:15.879 |    | 66.80 | -65.80  | 41854.32 | 24.93  |         |              |
| 5       | E   | 2039-01-27T00:12:29.480 |    | 66.79 | -65.80  | 42207.23 | 24.98  |         |              |
| 4       | E   | 2039-01-27T00:12:42.135 |    | 66.77 | -65.80  | 42530.43 | 25.10  |         |              |
| alpha   | E   | 2039-01-27T00:14:09.298 |    | 66.65 | -65.80  | 44724.23 | 25.52  |         |              |
| beta    | E   | 2039-01-27T00:14:45.575 |    | 66.59 | -65.79  | 45664.74 | 25.70  |         |              |
| eta     | E   | 2039-01-27T00:15:44.198 |    | 66.51 | -65.79  | 47176.12 | 25.95  |         |              |
| gamma   | E   | 2039-01-27T00:16:01.333 |    | 66.48 | -65.79  | 47621.34 | 26.02  |         |              |
| delta   | E   | 2039-01-27T00:16:27.381 |    | 66.44 | -65.78  | 48300.35 | 26.12  |         |              |
| lambda  | E   | 2039-01-27T00:17:33.184 |    | 66.35 | -65.77  | 50026.71 | 26.35  |         |              |
| epsilon | E   | 2039-01-27T00:18:12.503 |    | 66.29 | -65.76  | 51065.33 | 26.38  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-26T23:54:22.900  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 673809832496893568  
 2Mass ID (if available) : 07512686+2131483  
 ICRS Star Coord at Epoch: 07h 51m 26.8697s +21:31:48.39620s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 12.144  
 G magnitude : 13.590  
 RP magnitude : 13.084  
 BP magnitude : 13.927  
 DUPflag : 0  
 Distance (au) : 17.674  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.77  
 Sun-Target sep (deg) : 169.42  
 Sun-Moon sep (deg) : 139.34  
 B (ring opening deg) : 51.10  
 PA of pole (deg) : 87.66  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.566  
 C/A sky separation (km) : 20070.5  
 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   | 2039-01-26T23:26:43.665 |    | 73.10 | -62.70  | 50898.87 | -26.95 |         |              |
| lambda  | I   | 2039-01-26T23:27:15.991 |    | 73.21 | -62.82  | 50026.71 | -26.93 |         |              |
| delta   | I   | 2039-01-26T23:28:20.313 |    | 73.43 | -63.04  | 48300.35 | -26.74 |         |              |
| gamma   | I   | 2039-01-26T23:28:45.507 |    | 73.52 | -63.13  | 47627.66 | -26.66 |         |              |
| eta     | I   | 2039-01-26T23:29:02.462 |    | 73.58 | -63.19  | 47176.12 | -26.60 |         |              |
| beta    | I   | 2039-01-26T23:30:00.332 |    | 73.78 | -63.40  | 45642.82 | -26.39 |         |              |
| alpha   | I   | 2039-01-26T23:30:36.362 |    | 73.90 | -63.53  | 44687.42 | -26.24 |         |              |
| 4       | I   | 2039-01-26T23:31:55.895 |    | 74.17 | -63.81  | 42608.75 | -25.90 |         |              |
| 5       | I   | 2039-01-26T23:32:11.863 |    | 74.23 | -63.86  | 42183.06 | -25.80 |         |              |
| 6       | I   | 2039-01-26T23:32:28.419 |    | 74.29 | -63.92  | 41794.92 | -25.76 |         |              |
| Uranus  | I   | 2039-01-26T23:43:04.602 |    | 76.42 | -66.16  | 25494.37 |        | -15.44  | -16.14       |
| Uranus  | E   | 2039-01-27T00:05:30.751 |    | 80.52 | -70.74  | 25346.28 |        | 29.03   | 30.16        |
| 6       | E   | 2039-01-27T00:13:48.264 |    | 81.74 | -72.36  | 41856.29 | 25.77  |         |              |
| 5       | E   | 2039-01-27T00:14:01.615 |    | 81.77 | -72.40  | 42211.09 | 25.81  |         |              |
| 4       | E   | 2039-01-27T00:14:13.653 |    | 81.80 | -72.44  | 42529.50 | 25.91  |         |              |
| alpha   | E   | 2039-01-27T00:15:38.320 |    | 81.98 | -72.71  | 44725.80 | 26.25  |         |              |
| beta    | E   | 2039-01-27T00:16:13.573 |    | 82.05 | -72.82  | 45665.64 | 26.40  |         |              |
| eta     | E   | 2039-01-27T00:17:10.653 |    | 82.17 | -73.00  | 47176.12 | 26.61  |         |              |
| gamma   | E   | 2039-01-27T00:17:27.370 |    | 82.20 | -73.05  | 47621.43 | 26.67  |         |              |
| delta   | E   | 2039-01-27T00:17:52.790 |    | 82.25 | -73.13  | 48300.35 | 26.75  |         |              |
| lambda  | E   | 2039-01-27T00:18:57.091 |    | 82.37 | -73.33  | 50026.71 | 26.94  |         |              |
| epsilon | E   | 2039-01-27T00:19:36.154 |    | 82.44 | -73.45  | 51081.33 | 26.96  |         |              |

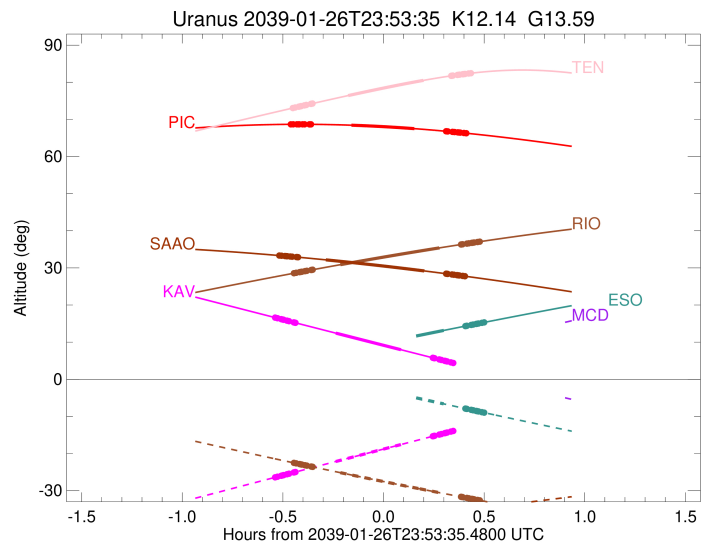
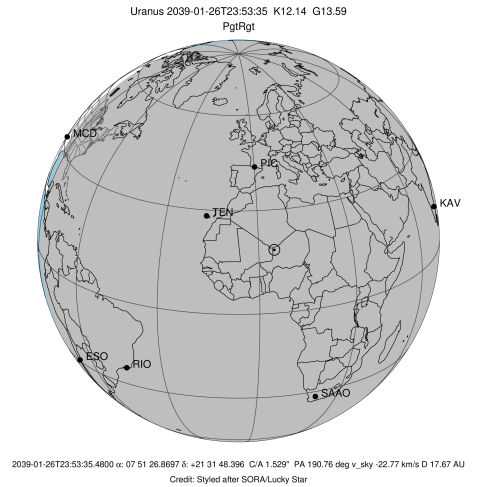
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-26T23:49:10.100  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 673809832496893568  
 2Mass ID (if available) : 07512686+2131483  
 ICRS Star Coord at Epoch: 07h 51m 26.86968s +21:31:48.39620s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 12.144  
 G magnitude : 13.590  
 RP magnitude : 13.084  
 BP magnitude : 13.927  
 DUPflag : 0  
 Distance (au) : 17.674  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.77  
 Sun-Target sep (deg) : 169.42  
 Sun-Moon sep (deg) : 138.03  
 B (ring opening deg) : 51.10  
 PA of pole (deg) : 87.66  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.693  
 C/A sky separation (km) : 21696.0  
 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   | 2039-01-26T23:21:27.192 |    | 16.57 | -26.38  | 50889.24 | -26.16 |         |              |
| lambda  | I   | 2039-01-26T23:22:00.136 |    | 16.44 | -26.25  | 50026.71 | -26.13 |         |              |
| delta   | I   | 2039-01-26T23:23:06.494 |    | 16.19 | -25.99  | 48300.35 | -25.90 |         |              |
| gamma   | I   | 2039-01-26T23:23:32.523 |    | 16.09 | -25.89  | 47627.48 | -25.80 |         |              |
| eta     | I   | 2039-01-26T23:23:50.040 |    | 16.02 | -25.82  | 47176.12 | -25.73 |         |              |
| beta    | I   | 2039-01-26T23:24:49.922 |    | 15.79 | -25.58  | 45642.53 | -25.49 |         |              |
| alpha   | I   | 2039-01-26T23:25:27.281 |    | 15.64 | -25.43  | 44686.94 | -25.31 |         |              |
| 4       | I   | 2039-01-26T23:26:49.875 |    | 15.33 | -25.11  | 42607.71 | -24.90 |         |              |
| 5       | I   | 2039-01-26T23:27:06.559 |    | 15.26 | -25.04  | 42180.65 | -24.79 |         |              |
| 6       | I   | 2039-01-26T23:27:23.705 |    | 15.20 | -24.98  | 41794.80 | -24.74 |         |              |
| Uranus  | I   | 2039-01-26T23:39:20.624 |    | 12.44 | -22.16  | 25520.42 |        | -11.86  | -12.41       |
| Uranus  | E   | 2039-01-26T23:58:48.877 |    | 7.95  | -17.58  | 25386.99 |        | 25.84   | 26.89        |
| 6       | E   | 2039-01-27T00:08:18.518 |    | 5.78  | -15.35  | 41854.41 | 24.64  |         |              |
| 5       | E   | 2039-01-27T00:08:32.287 |    | 5.73  | -15.30  | 42207.41 | 24.69  |         |              |
| 4       | E   | 2039-01-27T00:08:45.081 |    | 5.68  | -15.25  | 42530.39 | 24.80  |         |              |
| alpha   | E   | 2039-01-27T00:10:13.302 |    | 5.34  | -14.90  | 44724.30 | 25.21  |         |              |
| beta    | E   | 2039-01-27T00:10:50.029 |    | 5.20  | -14.76  | 45664.77 | 25.38  |         |              |
| eta     | E   | 2039-01-27T00:11:49.394 |    | 4.97x | -14.53  | 47176.12 | 25.62  |         |              |
| gamma   | E   | 2039-01-27T00:12:06.749 |    | 4.91x | -14.46  | 47621.34 | 25.69  |         |              |
| delta   | E   | 2039-01-27T00:12:33.135 |    | 4.81x | -14.36  | 48300.35 | 25.78  |         |              |
| lambda  | E   | 2039-01-27T00:13:39.804 |    | 4.55x | -14.10  | 50026.71 | 26.00  |         |              |
| epsilon | E   | 2039-01-27T00:14:19.668 |    | 4.40x | -13.94  | 51065.83 | 26.03  |         |              |

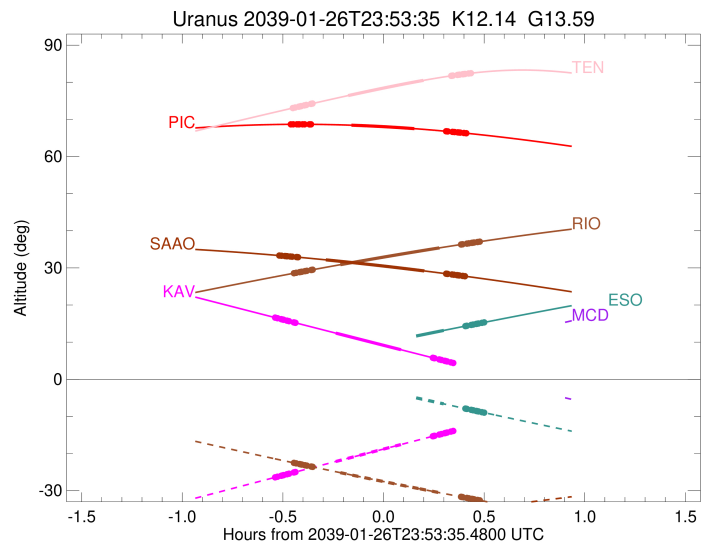
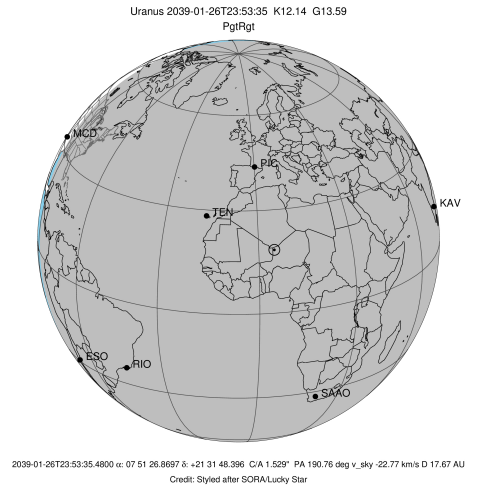
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2039-01-26T23:55:33.830
Event type           : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code        : RIO
Location              : Rio de Janeiro
Latitude (deg)       : -22.89506
E. Longitude (deg)   : 316.77708
Altitude (km)        : 0.033
Gaia source ID       : 673809832496893568
2Mass ID (if available) : 07512686+2131483
ICRS Star Coord at Epoch: 07h 51m 26.86978s +21:31:48.39620s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 12.144
G magnitude           : 13.590
RP magnitude          : 13.084
BP magnitude          : 13.927
DUPflag              : 0
Distance (au)         : 17.674
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -22.77
Sun-Target sep (deg) : 169.42
Sun-Moon sep (deg)   : 139.31
B (ring opening deg) : 51.10
PA of pole (deg)     : 87.66
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.161
C/A sky separation (km) : 14884.3
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
  
```



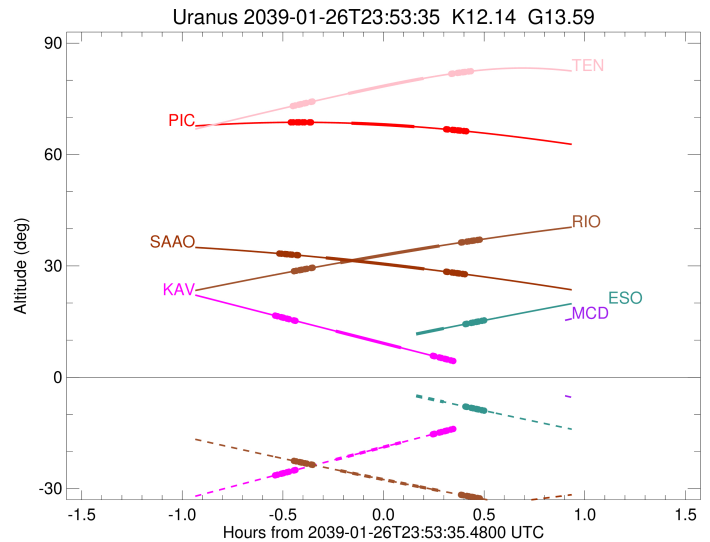
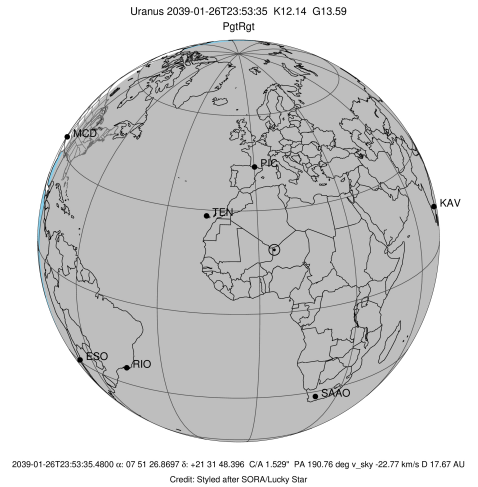
| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2039-01-26T23:27:01.604 |    | 28.59 | -22.55  | 50934.35 | -28.00 |         |              |
| lambda  | I   | 2039-01-26T23:27:33.983 |    | 28.68 | -22.65  | 50026.71 | -28.01 |         |              |
| delta   | I   | 2039-01-26T23:28:35.732 |    | 28.86 | -22.85  | 48300.35 | -27.91 |         |              |
| gamma   | I   | 2039-01-26T23:28:59.834 |    | 28.92 | -22.93  | 47628.24 | -27.86 |         |              |
| eta     | I   | 2039-01-26T23:29:16.069 |    | 28.97 | -22.98  | 47176.12 | -27.83 |         |              |
| beta    | I   | 2039-01-26T23:30:11.242 |    | 29.13 | -23.16  | 45643.96 | -27.73 |         |              |
| alpha   | I   | 2039-01-26T23:30:45.415 |    | 29.22 | -23.27  | 44689.35 | -27.65 |         |              |
| 4       | I   | 2039-01-26T23:32:00.698 |    | 29.43 | -23.51  | 42611.78 | -27.47 |         |              |
| 5       | I   | 2039-01-26T23:32:15.505 |    | 29.47 | -23.55  | 42191.70 | -27.41 |         |              |
| 6       | I   | 2039-01-26T23:32:31.305 |    | 29.52 | -23.60  | 41795.83 | -27.40 |         |              |
| Uranus  | I   | 2039-01-26T23:40:43.451 |    | 30.87 | -25.16  | 25405.37 |        | -24.31  | -25.32       |
| Uranus  | E   | 2039-01-27T00:10:15.836 |    | 35.39 | -30.54  | 25258.54 |        | 35.33   | 36.58        |
| 6       | E   | 2039-01-27T00:16:43.329 |    | 36.30 | -31.67  | 41861.44 | 27.45  |         |              |
| 5       | E   | 2039-01-27T00:16:56.401 |    | 36.33 | -31.70  | 42221.95 | 27.46  |         |              |
| 4       | E   | 2039-01-27T00:17:07.177 |    | 36.36 | -31.74  | 42527.47 | 27.52  |         |              |
| alpha   | E   | 2039-01-27T00:18:27.321 |    | 36.54 | -31.97  | 44730.04 | 27.70  |         |              |
| beta    | E   | 2039-01-27T00:19:00.698 |    | 36.62 | -32.06  | 45668.09 | 27.78  |         |              |
| eta     | E   | 2039-01-27T00:19:54.957 |    | 36.74 | -32.22  | 47176.12 | 27.89  |         |              |
| gamma   | E   | 2039-01-27T00:20:10.925 |    | 36.78 | -32.26  | 47621.73 | 27.92  |         |              |
| delta   | E   | 2039-01-27T00:20:35.209 |    | 36.84 | -32.33  | 48300.35 | 27.97  |         |              |
| lambda  | E   | 2039-01-27T00:21:36.823 |    | 36.97 | -32.50  | 50026.71 | 28.07  |         |              |
| epsilon | E   | 2039-01-27T00:22:15.961 |    | 37.06 | -32.62  | 51126.50 | 28.06  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-26T23:56:42.200  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : ESO  
 Location : European Southern Obs. (3.6m)  
 Latitude (deg) : -29.26097  
 E. Longitude (deg) : 289.26831  
 Altitude (km) : 2.400  
 Gaia source ID : 673809832496893568  
 2Mass ID (if available) : 07512686+2131483  
 ICRS Star Coord at Epoch: 07h 51m 26.8697s +21:31:48.39620s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 12.144  
 G magnitude : 13.590  
 RP magnitude : 13.084  
 BP magnitude : 13.927  
 DUPflag : 0  
 Distance (au) : 17.674  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.77  
 Sun-Target sep (deg) : 169.42  
 Sun-Moon sep (deg) : 139.25  
 B (ring opening deg) : 51.10  
 PA of pole (deg) : 87.66  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.157  
 C/A sky separation (km) : 14832.1  
 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   | 2039-01-26T23:27:56.407 |    | 4.96x | 2.15x   | 50933.89 | -27.79 |         |              |
| lambda  | I   | 2039-01-26T23:28:29.005 |    | 5.07  | 2.04x   | 50026.71 | -27.80 |         |              |
| delta   | I   | 2039-01-26T23:29:31.203 |    | 5.27  | 1.83x   | 48300.35 | -27.71 |         |              |
| gamma   | I   | 2039-01-26T23:29:55.480 |    | 5.35  | 1.75x   | 47628.23 | -27.66 |         |              |
| eta     | I   | 2039-01-26T23:30:11.831 |    | 5.40  | 1.69x   | 47176.12 | -27.64 |         |              |
| beta    | I   | 2039-01-26T23:31:07.401 |    | 5.58  | 1.50x   | 45643.94 | -27.53 |         |              |
| alpha   | I   | 2039-01-26T23:31:41.819 |    | 5.69  | 1.38x   | 44689.33 | -27.45 |         |              |
| 4       | I   | 2039-01-26T23:32:57.635 |    | 5.93  | 1.12x   | 42611.76 | -27.28 |         |              |
| 5       | I   | 2039-01-26T23:33:12.549 |    | 5.98  | 1.07x   | 42191.62 | -27.22 |         |              |
| 6       | I   | 2039-01-26T23:33:28.459 |    | 6.03  | 1.02x   | 41795.82 | -27.21 |         |              |
| Uranus  | I   | 2039-01-26T23:41:44.015 |    | 7.61  | -0.66x  | 25405.54 |        | -24.30  | -25.30       |
| Uranus  | E   | 2039-01-27T00:11:31.588 |    | 13.15 | -6.63   | 25257.13 |        | 35.42   | 36.68        |
| 6       | E   | 2039-01-27T00:18:00.404 |    | 14.32 | -7.90   | 41861.57 | 27.29  |         |              |
| 5       | E   | 2039-01-27T00:18:13.570 |    | 14.36 | -7.94   | 42222.24 | 27.29  |         |              |
| 4       | E   | 2039-01-27T00:18:24.397 |    | 14.39 | -7.98   | 42527.43 | 27.35  |         |              |
| alpha   | E   | 2039-01-27T00:19:45.028 |    | 14.64 | -8.24   | 44730.16 | 27.53  |         |              |
| beta    | E   | 2039-01-27T00:20:18.606 |    | 14.74 | -8.35   | 45668.15 | 27.61  |         |              |
| eta     | E   | 2039-01-27T00:21:13.191 |    | 14.90 | -8.53   | 47176.12 | 27.72  |         |              |
| gamma   | E   | 2039-01-27T00:21:29.255 |    | 14.95 | -8.58   | 47621.74 | 27.75  |         |              |
| delta   | E   | 2039-01-27T00:21:53.686 |    | 15.02 | -8.66   | 48300.35 | 27.80  |         |              |
| lambda  | E   | 2039-01-27T00:22:55.673 |    | 15.20 | -8.86   | 50026.71 | 27.90  |         |              |
| epsilon | E   | 2039-01-27T00:23:35.099 |    | 15.32 | -8.99   | 51127.92 | 27.89  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-26T23:51:07.560  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : SAAO  
 Location : So. Afr. Astro. Obs. (Sutherland)  
 Latitude (deg) : -32.37953  
 E. Longitude (deg) : 20.81070  
 Altitude (km) : 1.768  
 Gaia source ID : 673809832496893568  
 2Mass ID (if available) : 07512686+2131483  
 ICRS Star Coord at Epoch: 07h 51m 26.86968s +21:31:48.39620s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 12.144  
 G magnitude : 13.590  
 RP magnitude : 13.084  
 BP magnitude : 13.927  
 DUPflag : 0  
 Distance (au) : 17.674  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.77  
 Sun-Target sep (deg) : 169.42  
 Sun-Moon sep (deg) : 138.61  
 B (ring opening deg) : 51.10  
 PA of pole (deg) : 87.66  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.179  
 C/A sky separation (km) : 15113.3  
 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



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   | 2039-01-26T23:22:39.794 |    | 33.32 | -38.62  | 50934.65 | -28.01 |         |              |
| lambda  | I   | 2039-01-26T23:23:12.168 |    | 33.27 | -38.60  | 50026.71 | -28.02 |         |              |
| delta   | I   | 2039-01-26T23:24:13.896 |    | 33.19 | -38.56  | 48300.35 | -27.91 |         |              |
| gamma   | I   | 2039-01-26T23:24:37.993 |    | 33.16 | -38.54  | 47628.24 | -27.87 |         |              |
| eta     | I   | 2039-01-26T23:24:54.226 |    | 33.14 | -38.53  | 47176.12 | -27.84 |         |              |
| beta    | I   | 2039-01-26T23:25:49.399 |    | 33.07 | -38.49  | 45643.96 | -27.72 |         |              |
| alpha   | I   | 2039-01-26T23:26:23.578 |    | 33.02 | -38.47  | 44689.35 | -27.64 |         |              |
| 4       | I   | 2039-01-26T23:27:38.892 |    | 32.92 | -38.42  | 42611.78 | -27.45 |         |              |
| 5       | I   | 2039-01-26T23:27:53.709 |    | 32.90 | -38.41  | 42191.68 | -27.39 |         |              |
| 6       | I   | 2039-01-26T23:28:09.519 |    | 32.88 | -38.40  | 41795.83 | -27.38 |         |              |
| Uranus  | I   | 2039-01-26T23:36:24.002 |    | 32.17 | -38.00  | 25406.87 |        | -24.18  | -25.19       |
| Uranus  | E   | 2039-01-27T00:05:43.881 |    | 29.19 | -36.05  | 25263.06 |        | 35.01   | 36.26        |
| 6       | E   | 2039-01-27T00:12:16.418 |    | 28.43 | -35.50  | 41861.06 | 27.33  |         |              |
| 5       | E   | 2039-01-27T00:12:29.503 |    | 28.40 | -35.48  | 42221.10 | 27.34  |         |              |
| 4       | E   | 2039-01-27T00:12:40.366 |    | 28.38 | -35.46  | 42527.60 | 27.40  |         |              |
| alpha   | E   | 2039-01-27T00:14:00.835 |    | 28.22 | -35.34  | 44729.71 | 27.58  |         |              |
| beta    | E   | 2039-01-27T00:14:34.355 |    | 28.16 | -35.30  | 45667.89 | 27.67  |         |              |
| eta     | E   | 2039-01-27T00:15:28.842 |    | 28.05 | -35.21  | 47176.12 | 27.78  |         |              |
| gamma   | E   | 2039-01-27T00:15:44.873 |    | 28.02 | -35.19  | 47621.70 | 27.81  |         |              |
| delta   | E   | 2039-01-27T00:16:09.256 |    | 27.97 | -35.15  | 48300.35 | 27.86  |         |              |
| lambda  | E   | 2039-01-27T00:17:11.115 |    | 27.84 | -35.06  | 50026.71 | 27.96  |         |              |
| epsilon | E   | 2039-01-27T00:17:50.267 |    | 27.76 | -35.00  | 51122.58 | 27.95  |         |              |