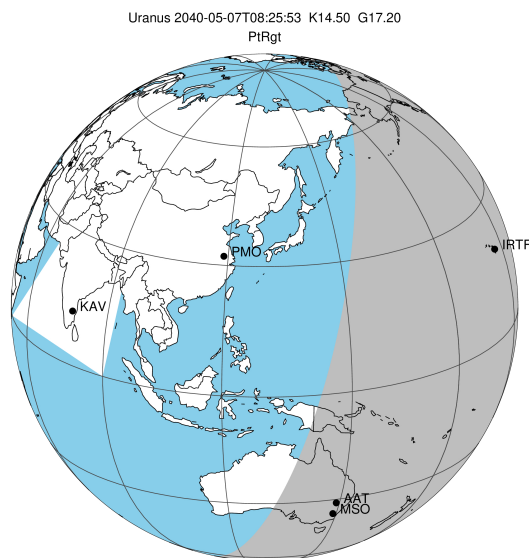


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2040-05-07T08:25:53.370  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 670702028520534400  
 2Mass ID (if available) : 08054850+2052353

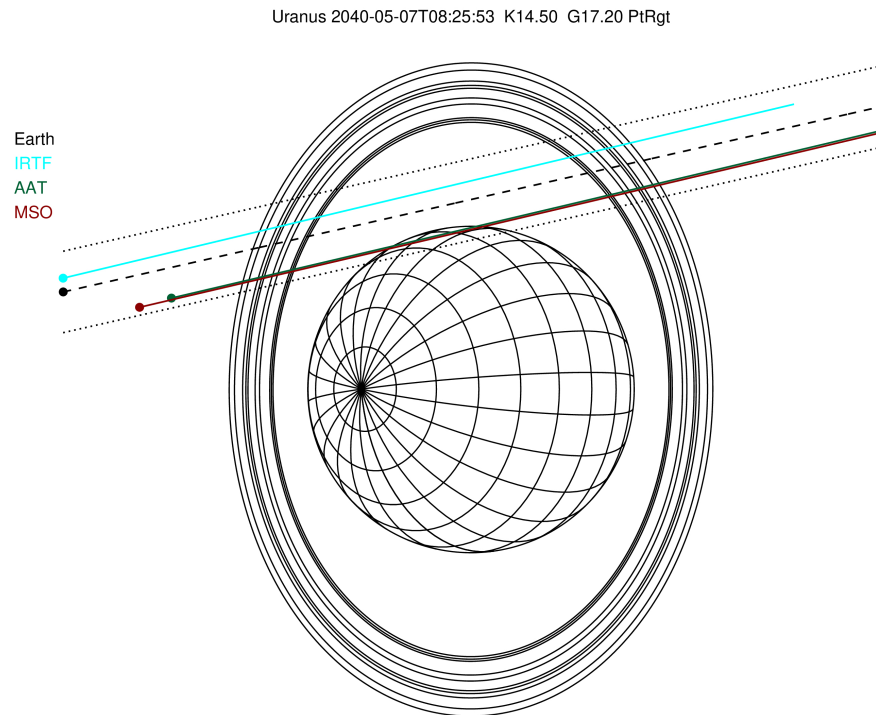
ICRS Star Coord at Epoch: 08h 05m 48.52280s +20:52:35.72865s

RUWE (>1.4 is poor) : 1.00  
 K magnitude : 14.499  
 G magnitude : 17.199  
 RP magnitude : 16.477  
 BP magnitude : 17.751  
 DUPflag : 0  
 Distance (au) : 18.854  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 15.56  
 Sun-Target sep (deg) : 72.34  
 Sun-Moon sep (deg) : 117.48  
 B (ring opening deg) : 47.77  
 PA of pole (deg) : 89.81

| #  | 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 |

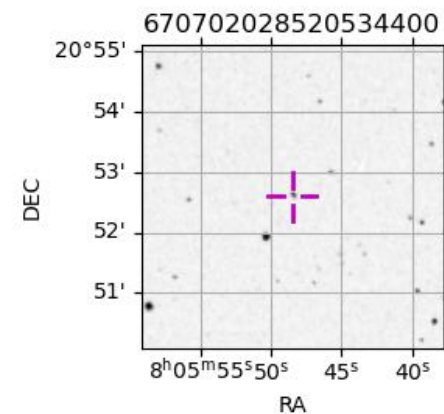


2040-05-07T08:25:53.3700 ex: 08 05 48.5228 s: +20 52 35.729 C/A 2.133° PA 192.77 deg v\_sky +15.56 km/s D 18.85 AU  
 Credit: Styled after SORA/Lucky Star



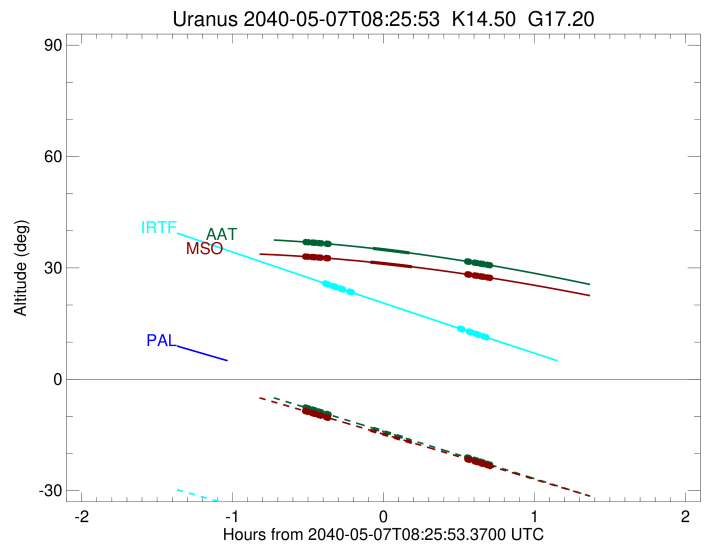
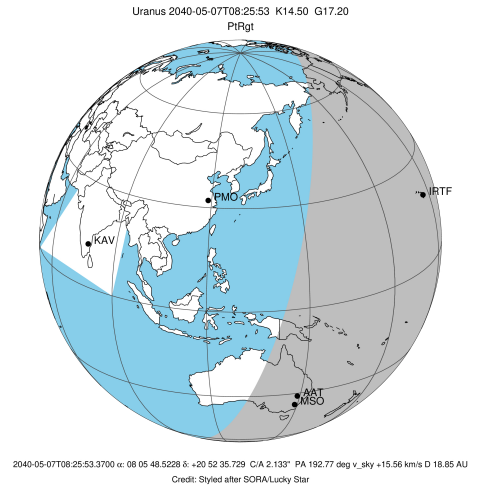
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| 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 |         |        |         |                             | 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 |         |        |         |                             | PnnRnn |
| IRTF | Mauna Kea/IRTF        | 19.8  | 204.5 | +++++   |        | +++++   | MAY 07 08:02 - MAY 07 09:06 | 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 | +++++   | + +    | +++++   | MAY 07 07:54 - MAY 07 09:07 | PieRie |
| SAAO | So. Afr. Astro. Obs.  | -32.4 | 20.8  |         |        |         |                             | PnnRnn |
| MSO  | Mt. Stromlo Observato | -35.3 | 149.0 | +++++   | + +    | +++++   | MAY 07 07:54 - MAY 07 09:07 | PieRie |



```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2040-05-07T08:31:14.380
Event type           : PtRgt
: Uranus occs: topocentric, not geocentric
: 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       : 670702028520534400
2Mass ID (if available) : 08054850+2052353
ICRS Star Coord at Epoch: 08h 05m 48.52280s +20:52:35.72865s
RUWE (>1.4 is poor) : 1.00
K magnitude           : 14.499
G magnitude           : 17.199
RP magnitude          : 16.477
BP magnitude          : 17.751
DUPflag              : 0
Distance (au)        : 18.854
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : 15.56
Sun-Target sep (deg) : 72.34
Sun-Moon sep (deg)   : 117.39
B (ring opening deg) : 47.77
PA of pole (deg)     : 89.81
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.325
C/A sky separation (km) : 31787.9
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.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
    
```

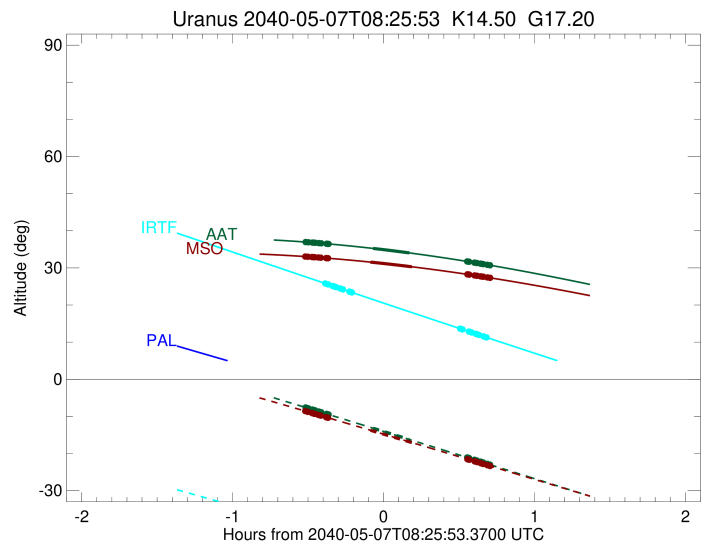
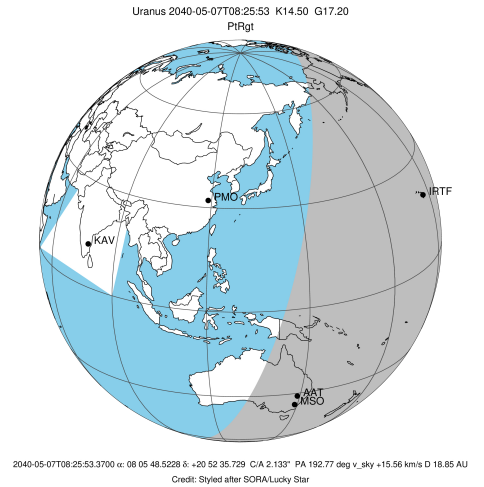


| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2040-05-07T08:02:23.677 |    | 25.89 | -40.37  | 51503.03 | -16.01 |         |              |
| lambda  | I   | 2040-05-07T08:03:56.502 |    | 25.53 | -40.62  | 50026.71 | -15.75 |         |              |
| delta   | I   | 2040-05-07T08:05:47.537 |    | 25.11 | -40.93  | 48300.35 | -15.34 |         |              |
| gamma   | I   | 2040-05-07T08:06:31.736 |    | 24.94 | -41.05  | 47626.14 | -15.17 |         |              |
| eta     | I   | 2040-05-07T08:07:01.528 |    | 24.83 | -41.13  | 47176.12 | -15.04 |         |              |
| beta    | I   | 2040-05-07T08:08:42.541 |    | 24.44 | -41.40  | 45676.84 | -14.61 |         |              |
| alpha   | I   | 2040-05-07T08:09:47.156 |    | 24.20 | -41.57  | 44746.44 | -14.29 |         |              |
| 4       | I   | 2040-05-07T08:12:18.997 |    | 23.62 | -41.97  | 42616.31 | -13.49 |         |              |
| 5       | I   | 2040-05-07T08:12:45.213 |    | 23.52 | -42.04  | 42266.11 | -13.38 |         |              |
| 6       | I   | 2040-05-07T08:13:18.214 |    | 23.39 | -42.13  | 41852.81 | -13.16 |         |              |

No planet occultations

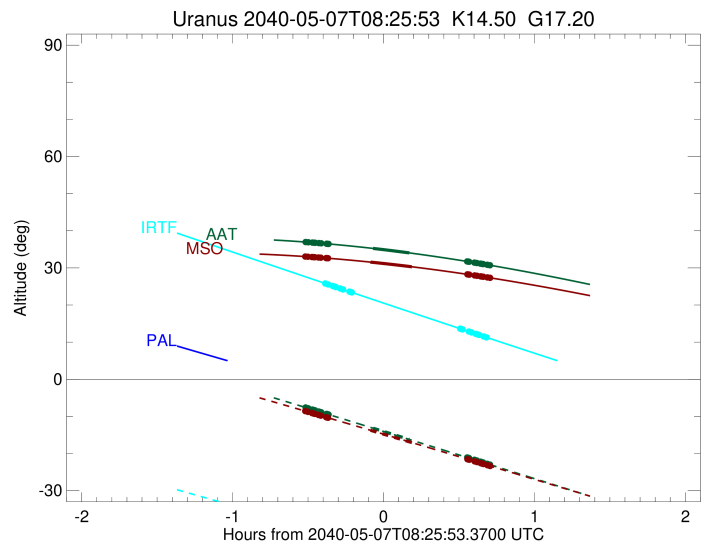
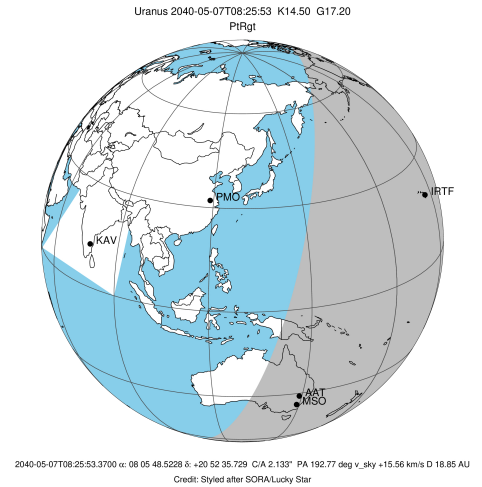
|         |   |                         |  |       |        |          |       |  |  |
|---------|---|-------------------------|--|-------|--------|----------|-------|--|--|
| 6       | E | 2040-05-07T08:56:25.205 |  | 13.62 | -48.12 | 41878.96 | 13.25 |  |  |
| 5       | E | 2040-05-07T08:56:54.909 |  | 13.51 | -48.18 | 42312.93 | 13.46 |  |  |
| 4       | E | 2040-05-07T08:57:15.941 |  | 13.43 | -48.22 | 42582.32 | 13.58 |  |  |
| alpha   | E | 2040-05-07T08:59:48.023 |  | 12.86 | -48.51 | 44700.28 | 14.39 |  |  |
| beta    | E | 2040-05-07T09:00:54.379 |  | 12.61 | -48.64 | 45673.56 | 14.72 |  |  |
| eta     | E | 2040-05-07T09:02:35.065 |  | 12.23 | -48.82 | 47176.12 | 15.16 |  |  |
| gamma   | E | 2040-05-07T09:03:04.974 |  | 12.12 | -48.88 | 47631.57 | 15.29 |  |  |
| delta   | E | 2040-05-07T09:03:48.458 |  | 11.96 | -48.96 | 48300.35 | 15.47 |  |  |
| lambda  | E | 2040-05-07T09:05:38.548 |  | 11.55 | -49.16 | 50026.71 | 15.89 |  |  |
| epsilon | E | 2040-05-07T09:06:31.923 |  | 11.35 | -49.25 | 50879.74 | 16.15 |  |  |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2040-05-07T08:28:47.440  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 670702028520534400  
 2Mass ID (if available) : 08054850+2052353  
 ICRS Star Coord at Epoch: 08h 05m 48.52280s +20:52:35.72865s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 14.499  
 G magnitude : 17.199  
 RP magnitude : 16.477  
 BP magnitude : 17.751  
 DUPflag : 0  
 Distance (au) : 18.854  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 15.56  
 Sun-Target sep (deg) : 72.34  
 Sun-Moon sep (deg) : 117.79  
 B (ring opening deg) : 47.77  
 PA of pole (deg) : 89.81  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.804  
 C/A sky separation (km) : 24664.5  
 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   | 2040-05-07T07:54:35.354 |    | 36.98 | -7.53   | 51531.42 | -17.68 |         |              |
| lambda  | I   | 2040-05-07T07:56:00.715 |    | 36.91 | -7.83   | 50026.71 | -17.54 |         |              |
| delta   | I   | 2040-05-07T07:57:39.710 |    | 36.82 | -8.17   | 48300.35 | -17.33 |         |              |
| gamma   | I   | 2040-05-07T07:58:18.770 |    | 36.78 | -8.30   | 47625.14 | -17.24 |         |              |
| eta     | I   | 2040-05-07T07:58:44.862 |    | 36.76 | -8.39   | 47176.12 | -17.18 |         |              |
| beta    | I   | 2040-05-07T08:00:12.804 |    | 36.68 | -8.70   | 45674.01 | -16.96 |         |              |
| alpha   | I   | 2040-05-07T08:01:07.624 |    | 36.63 | -8.89   | 44749.83 | -16.80 |         |              |
| 4       | I   | 2040-05-07T08:03:15.104 |    | 36.51 | -9.33   | 42614.05 | -16.41 |         |              |
| 5       | I   | 2040-05-07T08:03:37.924 |    | 36.48 | -9.41   | 42248.29 | -16.36 |         |              |
| 6       | I   | 2040-05-07T08:04:03.567 |    | 36.46 | -9.50   | 41843.11 | -16.25 |         |              |
| Uranus  | I   | 2040-05-07T08:21:45.134 |    | 35.25 | -13.18  | 25487.33 |        | 18.42   | 19.23        |
| Uranus  | E   | 2040-05-07T08:36:07.773 |    | 34.04 | -16.20  | 25558.71 |        | -1.17   | -1.23        |
| 6       | E   | 2040-05-07T08:59:11.938 |    | 31.73 | -21.08  | 41875.84 | 16.31  |         |              |
| 5       | E   | 2040-05-07T08:59:35.363 |    | 31.69 | -21.16  | 42306.32 | 16.43  |         |              |
| 4       | E   | 2040-05-07T08:59:52.773 |    | 31.66 | -21.23  | 42571.92 | 16.47  |         |              |
| alpha   | E   | 2040-05-07T09:02:00.589 |    | 31.42 | -21.68  | 44694.66 | 16.87  |         |              |
| beta    | E   | 2040-05-07T09:02:57.603 |    | 31.32 | -21.88  | 45670.08 | 17.03  |         |              |
| eta     | E   | 2040-05-07T09:04:25.569 |    | 31.15 | -22.19  | 47176.12 | 17.26  |         |              |
| gamma   | E   | 2040-05-07T09:04:51.905 |    | 31.10 | -22.29  | 47631.41 | 17.32  |         |              |
| delta   | E   | 2040-05-07T09:05:30.425 |    | 31.03 | -22.42  | 48300.35 | 17.41  |         |              |
| lambda  | E   | 2040-05-07T09:07:08.952 |    | 30.84 | -22.77  | 50026.71 | 17.63  |         |              |
| epsilon | E   | 2040-05-07T09:07:54.506 |    | 30.75 | -22.93  | 50831.88 | 17.77  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2040-05-07T08:28:46.490  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 670702028520534400  
 2Mass ID (if available) : 08054850+2052353  
 ICRS Star Coord at Epoch: 08h 05m 48.52280s +20:52:35.72865s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 14.499  
 G magnitude : 17.199  
 RP magnitude : 16.477  
 BP magnitude : 17.751  
 DUPflag : 0  
 Distance (au) : 18.854  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 15.56  
 Sun-Target sep (deg) : 72.34  
 Sun-Moon sep (deg) : 117.75  
 B (ring opening deg) : 47.77  
 PA of pole (deg) : 89.81  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.783  
 C/A sky separation (km) : 24382.2  
 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\_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   | 2040-05-07T07:54:26.611 |    | 33.07 | -8.51   | 51532.25 | -17.77 |         |              |
| lambda  | I   | 2040-05-07T07:55:51.615 |    | 33.00 | -8.79   | 50026.71 | -17.63 |         |              |
| delta   | I   | 2040-05-07T07:57:30.109 |    | 32.93 | -9.12   | 48300.35 | -17.42 |         |              |
| gamma   | I   | 2040-05-07T07:58:08.963 |    | 32.89 | -9.24   | 47625.11 | -17.34 |         |              |
| eta     | I   | 2040-05-07T07:58:34.910 |    | 32.87 | -9.33   | 47176.12 | -17.27 |         |              |
| beta    | I   | 2040-05-07T08:00:02.356 |    | 32.80 | -9.62   | 45673.89 | -17.06 |         |              |
| alpha   | I   | 2040-05-07T08:00:56.826 |    | 32.75 | -9.80   | 44749.92 | -16.90 |         |              |
| 4       | I   | 2040-05-07T08:03:03.480 |    | 32.64 | -10.22  | 42613.93 | -16.52 |         |              |
| 5       | I   | 2040-05-07T08:03:26.185 |    | 32.62 | -10.29  | 42247.65 | -16.48 |         |              |
| 6       | I   | 2040-05-07T08:03:51.593 |    | 32.60 | -10.38  | 41842.76 | -16.37 |         |              |
| Uranus  | I   | 2040-05-07T08:20:41.373 |    | 31.56 | -13.74  | 25476.64 |        | 19.81   | 20.67        |
| Uranus  | E   | 2040-05-07T08:37:09.317 |    | 30.30 | -17.05  | 25557.42 |        | -2.69   | -2.82        |
| 6       | E   | 2040-05-07T08:59:17.264 |    | 28.26 | -21.54  | 41875.68 | 16.43  |         |              |
| 5       | E   | 2040-05-07T08:59:40.498 |    | 28.22 | -21.62  | 42306.00 | 16.54  |         |              |
| 4       | E   | 2040-05-07T08:59:57.794 |    | 28.19 | -21.68  | 42571.53 | 16.59  |         |              |
| alpha   | E   | 2040-05-07T09:02:04.784 |    | 27.97 | -22.11  | 44694.46 | 16.97  |         |              |
| beta    | E   | 2040-05-07T09:03:01.459 |    | 27.88 | -22.30  | 45669.94 | 17.13  |         |              |
| eta     | E   | 2040-05-07T09:04:28.940 |    | 27.73 | -22.60  | 47176.12 | 17.35  |         |              |
| gamma   | E   | 2040-05-07T09:04:55.135 |    | 27.68 | -22.69  | 47631.40 | 17.41  |         |              |
| delta   | E   | 2040-05-07T09:05:33.455 |    | 27.61 | -22.82  | 48300.35 | 17.50  |         |              |
| lambda  | E   | 2040-05-07T09:07:11.498 |    | 27.44 | -23.15  | 50026.71 | 17.71  |         |              |
| epsilon | E   | 2040-05-07T09:07:56.744 |    | 27.36 | -23.30  | 50830.18 | 17.85  |         |              |