

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-02-23T10:03:41.040  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 34585619288713856  
 2Mass ID (if available) : 03064849+1712479

Uranus 2024-02-23T10:03:41 K14.90 G18.14 PgtRgt

ICRS Star Coord at Epoch: 03h 06m 48.56316s +17:12:46.88733s

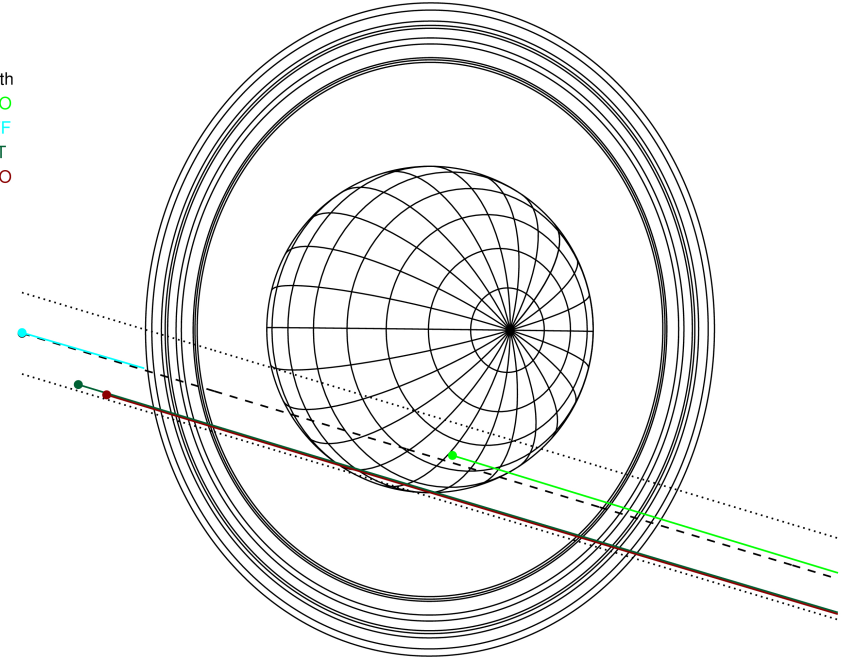
RUWE (>1.4 is poor) : 1.02  
 K magnitude : 14.900  
 G magnitude : 18.145  
 RP magnitude : 17.149  
 BP magnitude : 19.052  
 DUPflag : 0  
 Distance (au) : 19.835  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 14.00  
 Sun-Target sep (deg) : 75.13  
 Sun-Moon sep (deg) : 92.87  
 B (ring opening deg) : 60.56  
 PA of pole (deg) : -90.49

| #  | 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 |



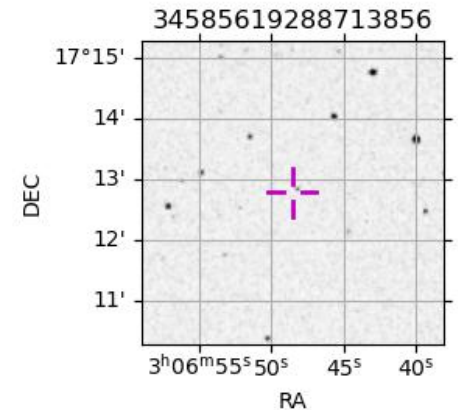
2024-02-23T10:03:41.0400 ex: 03 06 48.5632 z: +17 12 46.887 C/A 1.319° PA 343.24 deg v\_sky +14.00 km/s D 19.84 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PMO  
 IRTF  
 AAT  
 MSO

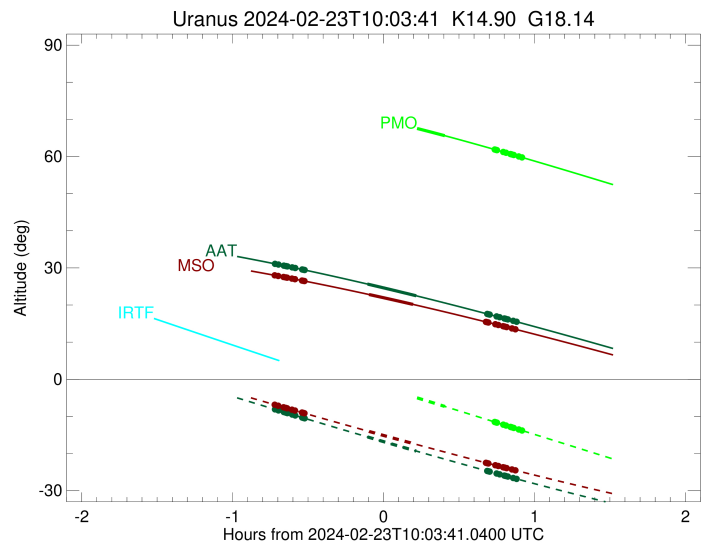
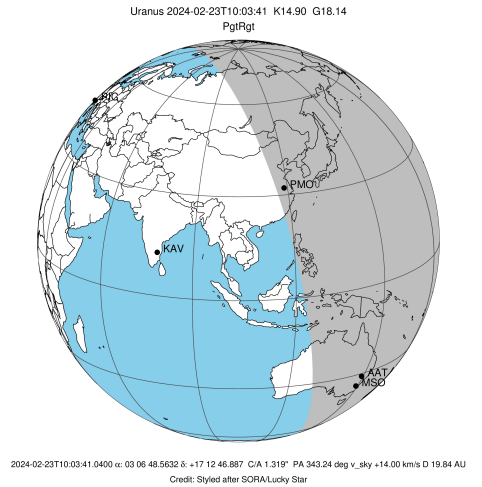


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| 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 |         | +      | +++++++ | FEB 23 10:28 - FEB 23 10:59 | PneRne |
| 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 |         |        |         |                             | PnnRnn |
| 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 | +++++++ | + +    | +++++++ | FEB 23 09:21 - FEB 23 10:56 | PieRie |
| SAAO | So. Afr. Astro. Obs.  | -32.4 | 20.8  |         |        |         |                             | PnnRnn |
| MSO  | Mt. Stromlo Observato | -35.3 | 149.0 | +++++++ | + +    | +++++++ | FEB 23 09:20 - FEB 23 10:56 | PieRie |

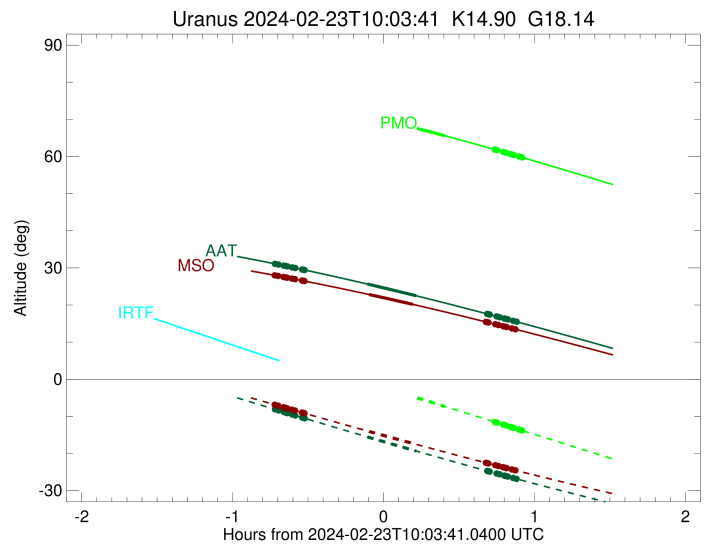
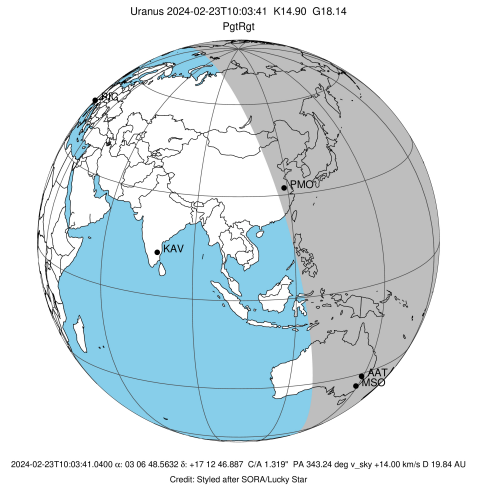


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-02-23T10:05:50.270  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PMO  
 Location : Purple Mtn Obs. Nanking  
 Latitude (deg) : 32.06667  
 E. Longitude (deg) : 118.82089  
 Altitude (km) : 0.364  
 Gaia source ID : 34585619288713856  
 2Mass ID (if available) : 03064849+1712479  
 ICRS Star Coord at Epoch: 03h 06m 48.56316s +17:12:46.88733s  
 RUWE (>1.4 is poor) : 1.02  
 K magnitude : 14.900  
 G magnitude : 18.145  
 RP magnitude : 17.149  
 BP magnitude : 19.052  
 DUPflag : 0  
 Distance (au) : 19.835  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 14.00  
 Sun-Target sep (deg) : 75.13  
 Sun-Moon sep (deg) : 93.73  
 B (ring opening deg) : 60.56  
 PA of pole (deg) : -90.49  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.239  
 C/A sky separation (km) : 17819.9  
 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



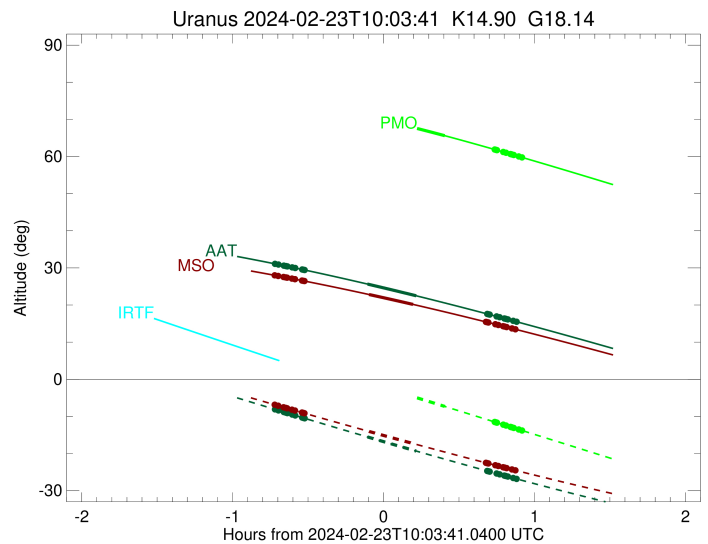
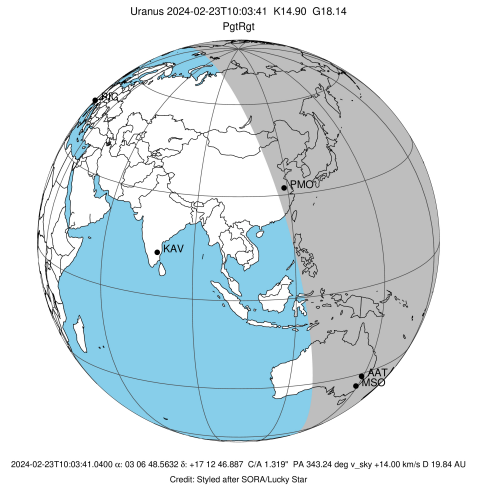
| Ring    | I/E | UTC                     | b? | alt   | alt-sun | radius   | r-dot  | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|--------|---------|--------------|
| epsilon | I   | 2024-02-23T09:16:13.073 |    | 75.05 | 7.58x   | 50744.06 | -14.44 |         |              |
| lambda  | I   | 2024-02-23T09:17:02.781 |    | 75.01 | 7.41x   | 50026.71 | -14.42 |         |              |
| delta   | I   | 2024-02-23T09:19:02.850 |    | 74.90 | 7.00x   | 48300.35 | -14.34 |         |              |
| gamma   | I   | 2024-02-23T09:19:49.844 |    | 74.85 | 6.84x   | 47627.31 | -14.30 |         |              |
| eta     | I   | 2024-02-23T09:20:21.408 |    | 74.82 | 6.73x   | 47176.12 | -14.28 |         |              |
| beta    | I   | 2024-02-23T09:22:08.582 |    | 74.70 | 6.37x   | 45651.97 | -14.20 |         |              |
| alpha   | I   | 2024-02-23T09:23:12.364 |    | 74.63 | 6.15x   | 44752.27 | -14.15 |         |              |
| 4       | I   | 2024-02-23T09:25:43.167 |    | 74.44 | 5.64x   | 42611.81 | -14.00 |         |              |
| 5       | I   | 2024-02-23T09:26:11.290 |    | 74.40 | 5.54x   | 42207.08 | -13.96 |         |              |
| 6       | I   | 2024-02-23T09:26:36.958 |    | 74.37 | 5.46x   | 41850.09 | -13.95 |         |              |
| Uranus  | I   | 2024-02-23T09:44:00.041 |    | 72.56 | 1.88x   | 25213.73 |        | -25.63  | -26.67       |
| Uranus  | E   | 2024-02-23T10:28:03.775 |    | 65.61 | -7.32   | 25452.70 |        | 13.78   | 14.41        |
| 6       | E   | 2024-02-23T10:47:55.631 |    | 61.88 | -11.51  | 41860.60 | 14.01  |         |              |
| 5       | E   | 2024-02-23T10:48:19.119 |    | 61.81 | -11.59  | 42194.48 | 14.02  |         |              |
| 4       | E   | 2024-02-23T10:48:44.881 |    | 61.73 | -11.69  | 42560.65 | 14.07  |         |              |
| alpha   | E   | 2024-02-23T10:51:14.707 |    | 61.24 | -12.21  | 44693.26 | 14.21  |         |              |
| beta    | E   | 2024-02-23T10:52:24.258 |    | 61.02 | -12.46  | 45680.42 | 14.27  |         |              |
| eta     | E   | 2024-02-23T10:54:08.864 |    | 60.67 | -12.83  | 47176.12 | 14.35  |         |              |
| gamma   | E   | 2024-02-23T10:54:39.895 |    | 60.57 | -12.94  | 47621.88 | 14.38  |         |              |
| delta   | E   | 2024-02-23T10:55:27.032 |    | 60.42 | -13.10  | 48300.35 | 14.41  |         |              |
| lambda  | E   | 2024-02-23T10:57:26.486 |    | 60.03 | -13.53  | 50026.71 | 14.49  |         |              |
| epsilon | E   | 2024-02-23T10:59:03.704 |    | 59.71 | -13.87  | 51438.58 | 14.52  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-02-23T10:06:45.260  
 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 : 34585619288713856  
 2Mass ID (if available) : 03064849+1712479  
 ICRS Star Coord at Epoch: 03h 06m 48.56316s +17:12:46.88733s  
 RUWE (>1.4 is poor) : 1.02  
 K magnitude : 14.900  
 G magnitude : 18.145  
 RP magnitude : 17.149  
 BP magnitude : 19.052  
 DUPflag : 0  
 Distance (au) : 19.835  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 14.00  
 Sun-Target sep (deg) : 75.13  
 Sun-Moon sep (deg) : 93.26  
 B (ring opening deg) : 60.56  
 PA of pole (deg) : -90.49  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.683  
 C/A sky separation (km) : 24205.6  
 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   | 2024-02-23T09:21:03.781 |    | 31.02 | -8.22   | 50745.23 | -13.60 |         |              |
| lambda  | I   | 2024-02-23T09:21:56.760 |    | 30.90 | -8.40   | 50026.71 | -13.53 |         |              |
| delta   | I   | 2024-02-23T09:24:05.041 |    | 30.60 | -8.83   | 48300.35 | -13.38 |         |              |
| gamma   | I   | 2024-02-23T09:24:55.528 |    | 30.49 | -9.01   | 47626.48 | -13.31 |         |              |
| eta     | I   | 2024-02-23T09:25:29.409 |    | 30.41 | -9.12   | 47176.12 | -13.27 |         |              |
| beta    | I   | 2024-02-23T09:27:24.898 |    | 30.14 | -9.51   | 45655.03 | -13.11 |         |              |
| alpha   | I   | 2024-02-23T09:28:34.435 |    | 29.97 | -9.75   | 44751.22 | -13.00 |         |              |
| 4       | I   | 2024-02-23T09:31:19.412 |    | 29.58 | -10.31  | 42614.78 | -12.71 |         |              |
| 5       | I   | 2024-02-23T09:31:51.736 |    | 29.50 | -10.42  | 42193.92 | -12.63 |         |              |
| 6       | I   | 2024-02-23T09:32:18.622 |    | 29.44 | -10.51  | 41857.29 | -12.60 |         |              |
| Uranus  | I   | 2024-02-23T09:57:19.009 |    | 25.64 | -15.53  | 25417.70 |        | -15.96  | -16.68       |
| Uranus  | E   | 2024-02-23T10:16:43.656 |    | 22.48 | -19.34  | 25558.14 |        | 1.22    | 1.28         |
| 6       | E   | 2024-02-23T10:44:57.575 |    | 17.59 | -24.71  | 41866.38 | 12.70  |         |              |
| 5       | E   | 2024-02-23T10:45:22.119 |    | 17.52 | -24.78  | 42183.25 | 12.73  |         |              |
| 4       | E   | 2024-02-23T10:45:52.052 |    | 17.43 | -24.87  | 42568.24 | 12.82  |         |              |
| alpha   | E   | 2024-02-23T10:48:35.395 |    | 16.94 | -25.38  | 44697.15 | 13.12  |         |              |
| beta    | E   | 2024-02-23T10:49:50.297 |    | 16.72 | -25.61  | 45681.06 | 13.23  |         |              |
| eta     | E   | 2024-02-23T10:51:42.663 |    | 16.38 | -25.95  | 47176.12 | 13.40  |         |              |
| gamma   | E   | 2024-02-23T10:52:15.848 |    | 16.28 | -26.05  | 47621.49 | 13.44  |         |              |
| delta   | E   | 2024-02-23T10:53:06.214 |    | 16.13 | -26.21  | 48300.35 | 13.51  |         |              |
| lambda  | E   | 2024-02-23T10:55:13.205 |    | 15.75 | -26.59  | 50026.71 | 13.67  |         |              |
| epsilon | E   | 2024-02-23T10:56:53.075 |    | 15.44 | -26.90  | 51398.13 | 13.74  |         |              |

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-02-23T10:06:26.020  
 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 : 34585619288713856  
 2Mass ID (if available) : 03064849+1712479  
 ICRS Star Coord at Epoch: 03h 06m 48.56316s +17:12:46.88733s  
 RUWE (>1.4 is poor) : 1.02  
 K magnitude : 14.900  
 G magnitude : 18.145  
 RP magnitude : 17.149  
 BP magnitude : 19.052  
 DUPflag : 0  
 Distance (au) : 19.835  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 14.00  
 Sun-Target sep (deg) : 75.13  
 Sun-Moon sep (deg) : 93.22  
 B (ring opening deg) : 60.56  
 PA of pole (deg) : -90.49  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.699  
 C/A sky separation (km) : 24448.7  
 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   | 2024-02-23T09:20:57.211 |    | 27.93 | -6.96   | 50745.44 | -13.57 |         |              |
| lambda  | I   | 2024-02-23T09:21:50.313 |    | 27.82 | -7.13   | 50026.71 | -13.50 |         |              |
| delta   | I   | 2024-02-23T09:23:58.881 |    | 27.55 | -7.55   | 48300.35 | -13.35 |         |              |
| gamma   | I   | 2024-02-23T09:24:49.494 |    | 27.44 | -7.71   | 47626.45 | -13.28 |         |              |
| eta     | I   | 2024-02-23T09:25:23.461 |    | 27.36 | -7.82   | 47176.12 | -13.23 |         |              |
| beta    | I   | 2024-02-23T09:27:19.264 |    | 27.11 | -8.20   | 45655.15 | -13.07 |         |              |
| alpha   | I   | 2024-02-23T09:28:29.031 |    | 26.96 | -8.42   | 44751.16 | -12.96 |         |              |
| 4       | I   | 2024-02-23T09:31:14.593 |    | 26.59 | -8.96   | 42614.86 | -12.66 |         |              |
| 5       | I   | 2024-02-23T09:31:47.094 |    | 26.52 | -9.06   | 42193.43 | -12.58 |         |              |
| 6       | I   | 2024-02-23T09:32:14.034 |    | 26.46 | -9.15   | 41857.57 | -12.55 |         |              |
| Uranus  | I   | 2024-02-23T09:57:55.584 |    | 22.83 | -14.05  | 25430.52 |        | -15.20  | -15.88       |
| Uranus  | E   | 2024-02-23T10:15:29.034 |    | 20.16 | -17.32  | 25558.93 |        | 0.35    | 0.37         |
| 6       | E   | 2024-02-23T10:44:26.270 |    | 15.45 | -22.51  | 41866.61 | 12.65  |         |              |
| 5       | E   | 2024-02-23T10:44:50.872 |    | 15.38 | -22.59  | 42182.81 | 12.68  |         |              |
| 4       | E   | 2024-02-23T10:45:21.001 |    | 15.30 | -22.67  | 42568.56 | 12.76  |         |              |
| alpha   | E   | 2024-02-23T10:48:04.988 |    | 14.83 | -23.15  | 44697.32 | 13.07  |         |              |
| beta    | E   | 2024-02-23T10:49:20.137 |    | 14.62 | -23.37  | 45681.07 | 13.19  |         |              |
| eta     | E   | 2024-02-23T10:51:12.860 |    | 14.30 | -23.69  | 47176.12 | 13.36  |         |              |
| gamma   | E   | 2024-02-23T10:51:46.143 |    | 14.21 | -23.79  | 47621.48 | 13.40  |         |              |
| delta   | E   | 2024-02-23T10:52:36.655 |    | 14.06 | -23.93  | 48300.35 | 13.47  |         |              |
| lambda  | E   | 2024-02-23T10:54:43.983 |    | 13.70 | -24.30  | 50026.71 | 13.64  |         |              |
| epsilon | E   | 2024-02-23T10:56:23.962 |    | 13.41 | -24.58  | 51396.34 | 13.71  |         |              |