

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T08:51:27.360
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326

ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s

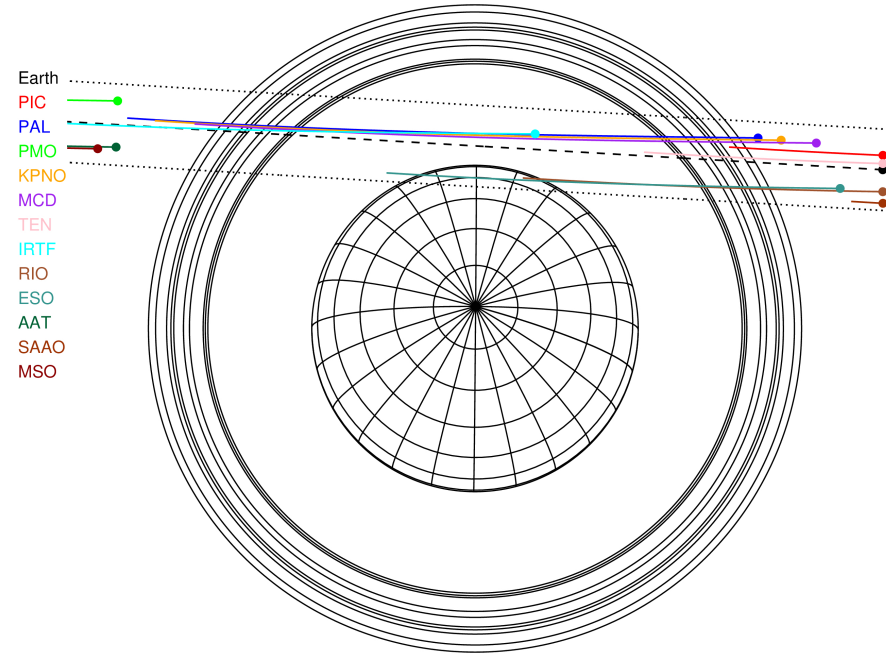
RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.21
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69

| # | 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 |



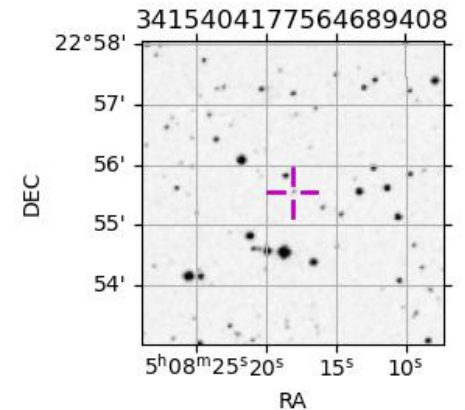
2029-09-30T08:51:27.3600 α: 05 08 18.1382 δ: +22 55 32.228 C/A 2.092° PA 176.63 deg v_sky - 3.34 km/s D 18.89 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2029-09-30T08:51:27 K14.54 G18.20 PtRgt

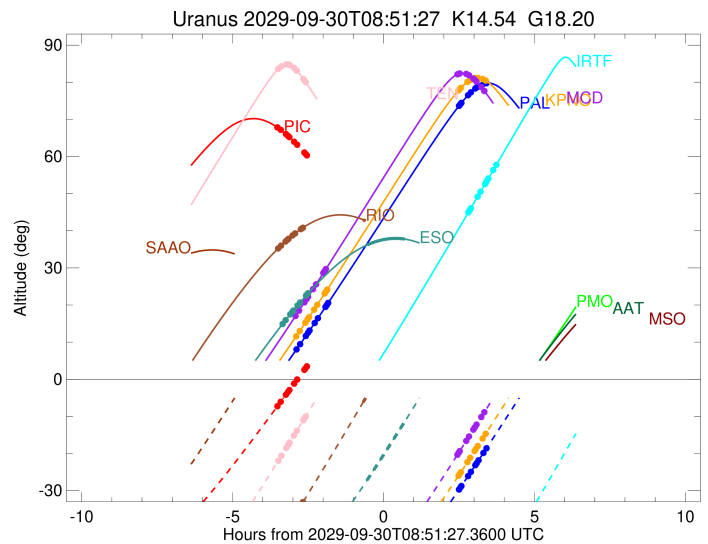
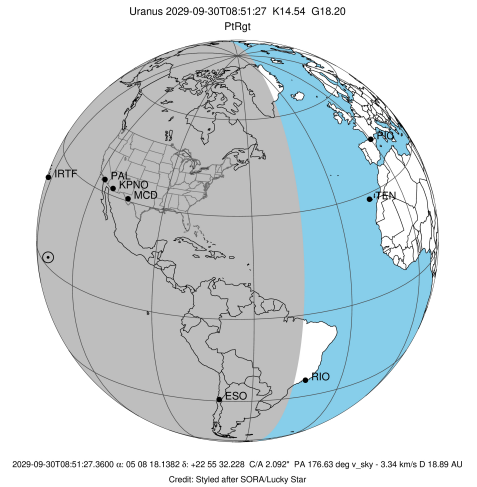


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| Obs | Location | lat | Elon | Rings I | Planet | Rings E | Observed Events Interval | OCode |
|------|-----------------------|-------|-------|---------|--------|---------|-----------------------------|--------|
| PIC | Pic du Midi | 42.9 | 0.1 | ++ | | | SEP 30 05:21 - SEP 30 05:27 | PnnRin |
| PAL | Palomar Mt (200") | 33.4 | 243.1 | +++++ | | +++++ | SEP 30 05:59 - SEP 30 12:14 | PnnRie |
| PMO | Purple Mtn Obs. Nanki | 32.1 | 118.8 | | | | | PnnRnn |
| KPNO | Kitt Peak Natl Obs | 32.0 | 248.4 | +++++ | | +++++ | SEP 30 05:58 - SEP 30 12:12 | PnnRie |
| MCD | McDonald Obs. 2.7m | 30.7 | 256.0 | +++++ | | +++++ | SEP 30 05:57 - SEP 30 12:10 | PnnRie |
| TEN | Teide Obs./Tenerife | 28.3 | 343.5 | +++++ | | | SEP 30 05:23 - SEP 30 06:17 | PnnRin |
| IRTF | Mauna Kea/IRTF | 19.8 | 204.5 | | | +++++ | SEP 30 11:40 - SEP 30 12:33 | PnnRne |
| KAV | Kavalur Observatory | 12.6 | 78.8 | | | | | PnnRnn |
| RIO | Rio de Janeiro | -22.9 | 316.8 | +++++ | + | | SEP 30 05:22 - SEP 30 08:10 | PinRin |
| ESO | European Southern Obs | -29.3 | 289.3 | +++++ | + + | | SEP 30 05:31 - SEP 30 09:33 | PieRin |
| AAT | Siding Spring (AAT) | -31.3 | 149.1 | | | | | PnnRnn |
| SAAO | So. Afr. Astro. Obs. | -32.4 | 20.8 | | | | | PnnRnn |
| MSO | Mt. Stromlo Observato | -35.3 | 149.0 | | | | | PnnRnn |



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T08:26:06.780
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 12.70
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.289
 C/A sky separation (km) : 31360.0
 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

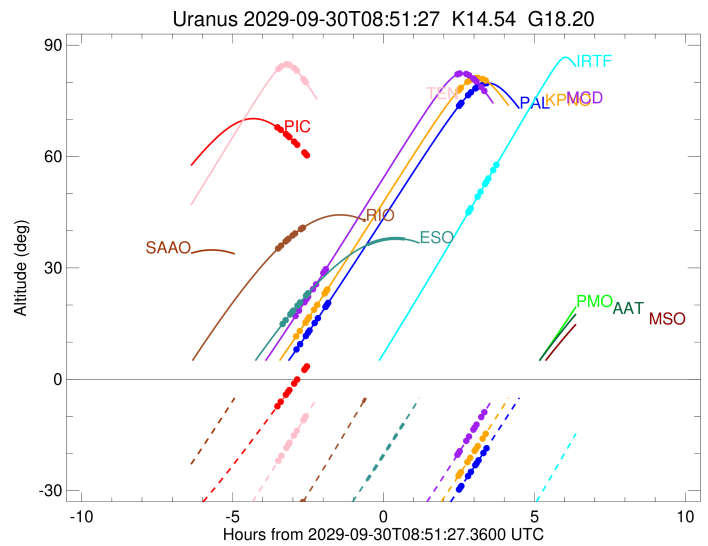
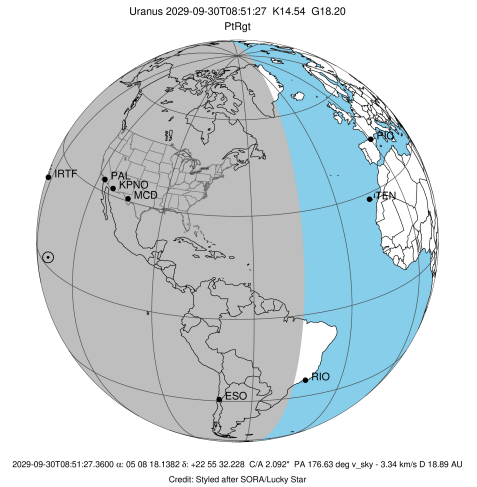


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:21:23.761 | | 67.77 | -7.12 | 51025.71 | -2.84 | | |
| lambda | I | 2029-09-30T05:27:15.520 | | 67.19 | -6.04 | 50026.71 | -2.82 | | |
| delta | I | 2029-09-30T05:37:34.864 | | 66.05 | -4.15x | 48300.35 | -2.75 | | |
| gamma | I | 2029-09-30T05:41:40.265 | | 65.56 | -3.40x | 47628.69 | -2.72 | | |
| eta | I | 2029-09-30T05:44:27.176 | | 65.22 | -2.89x | 47176.12 | -2.70 | | |
| beta | I | 2029-09-30T05:53:58.481 | | 63.98 | -1.15x | 45654.51 | -2.62 | | |
| alpha | I | 2029-09-30T05:59:51.539 | | 63.17 | -0.07x | 44736.43 | -2.57 | | |
| 4 | I | 2029-09-30T06:14:18.493 | | 61.07 | 2.57x | 42565.76 | -2.43 | | |
| 5 | I | 2029-09-30T06:16:47.657 | | 60.69 | 3.03x | 42207.18 | -2.41 | | |
| 6 | I | 2029-09-30T06:19:29.760 | | 60.28 | 3.52x | 41817.59 | -2.38 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| 6 | E | 2029-09-30T10:37:21.052 | | 14.36 | 41.45x | 41871.11 | 2.22 | | |
| 5 | E | 2029-09-30T10:40:31.406 | | 13.81 | 41.68x | 42305.41 | 2.25 | | |
| 4 | E | 2029-09-30T10:42:51.344 | | 13.40 | 41.85x | 42615.16 | 2.27 | | |
| alpha | E | 2029-09-30T10:57:43.673 | | 10.83 | 42.79x | 44690.23 | 2.38 | | |
| beta | E | 2029-09-30T11:04:36.152 | | 9.66 | 43.14x | 45680.20 | 2.42 | | |
| eta | E | 2029-09-30T11:14:46.381 | | 7.93 | 43.58x | 47176.12 | 2.48 | | |
| gamma | E | 2029-09-30T11:17:49.026 | | 7.42 | 43.69x | 47630.75 | 2.50 | | |
| delta | E | 2029-09-30T11:22:15.914 | | 6.68 | 43.83x | 48300.35 | 2.52 | | |
| lambda | E | 2029-09-30T11:33:33.653 | | 4.81x | 44.10x | 50026.71 | 2.57 | | |
| epsilon | E | 2029-09-30T11:38:30.330 | | 4.01x | 44.17x | 50793.19 | 2.59 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T09:15:19.880
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.94
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.230
 C/A sky separation (km) : 30544.7
 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

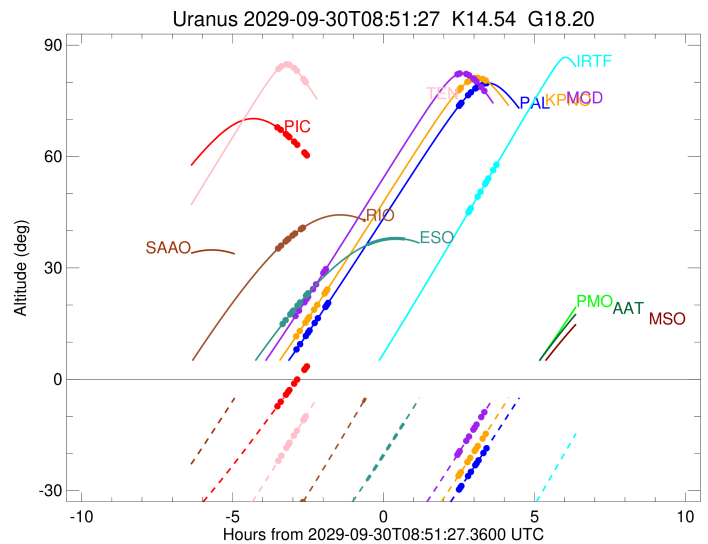
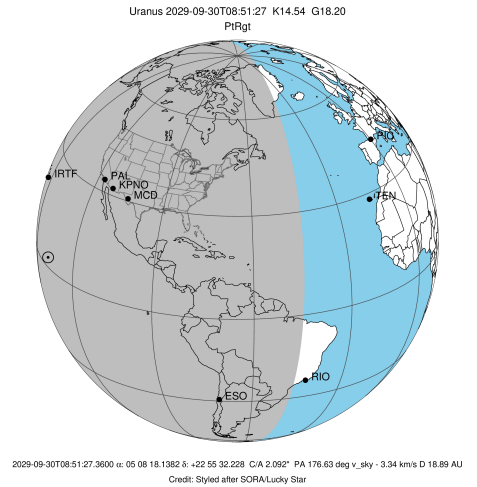


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:59:29.437 | | 8.23 | -52.06 | 51010.85 | -2.58 | | |
| lambda | I | 2029-09-30T06:05:50.852 | | 9.47 | -52.94 | 50026.71 | -2.57 | | |
| delta | I | 2029-09-30T06:17:07.438 | | 11.68 | -54.40 | 48300.35 | -2.53 | | |
| gamma | I | 2029-09-30T06:21:33.618 | | 12.56 | -54.94 | 47628.86 | -2.51 | | |
| eta | I | 2029-09-30T06:24:34.171 | | 13.15 | -55.29 | 47176.12 | -2.50 | | |
| beta | I | 2029-09-30T06:34:47.847 | | 15.19 | -56.40 | 45655.19 | -2.45 | | |
| alpha | I | 2029-09-30T06:41:04.913 | | 16.45 | -57.01 | 44735.42 | -2.42 | | |
| 4 | I | 2029-09-30T06:56:17.735 | | 19.51 | -58.27 | 42567.21 | -2.33 | | |
| 5 | I | 2029-09-30T06:58:53.115 | | 20.04 | -58.45 | 42209.58 | -2.31 | | |
| 6 | I | 2029-09-30T07:01:42.140 | | 20.61 | -58.63 | 41818.78 | -2.29 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| 6 | E | 2029-09-30T11:21:43.192 | | 73.68 | -29.67 | 41873.26 | 2.57 | | |
| 5 | E | 2029-09-30T11:24:28.101 | | 74.15 | -29.12 | 42308.54 | 2.60 | | |
| 4 | E | 2029-09-30T11:26:27.681 | | 74.48 | -28.72 | 42615.98 | 2.63 | | |
| alpha | E | 2029-09-30T11:39:15.506 | | 76.48 | -26.15 | 44688.75 | 2.76 | | |
| beta | E | 2029-09-30T11:45:10.735 | | 77.29 | -24.94 | 45680.66 | 2.82 | | |
| eta | E | 2029-09-30T11:53:53.899 | | 78.33 | -23.17 | 47176.12 | 2.90 | | |
| gamma | E | 2029-09-30T11:56:30.170 | | 78.60 | -22.63 | 47630.51 | 2.92 | | |
| delta | E | 2029-09-30T12:00:18.485 | | 78.95 | -21.85 | 48300.35 | 2.95 | | |
| lambda | E | 2029-09-30T12:09:56.716 | | 79.57 | -19.87 | 50026.71 | 3.02 | | |
| epsilon | E | 2029-09-30T12:14:14.542 | | 79.72 | -18.99 | 50809.45 | 3.04 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T09:13:42.770
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.91
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.209
 C/A sky separation (km) : 30261.8
 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



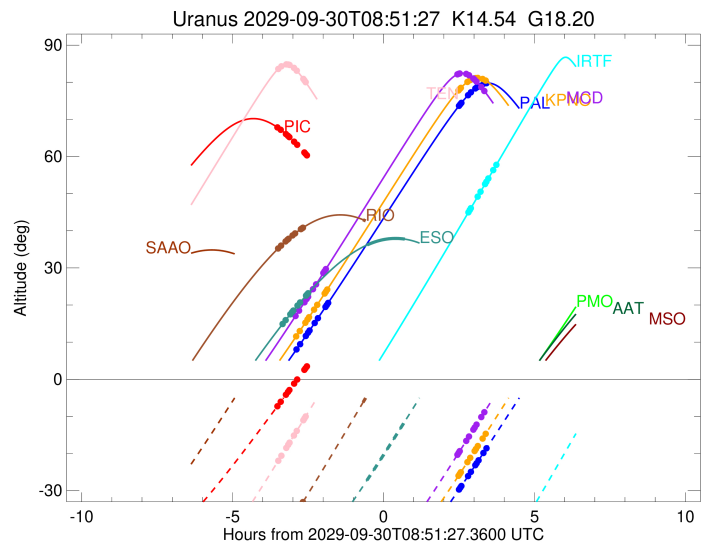
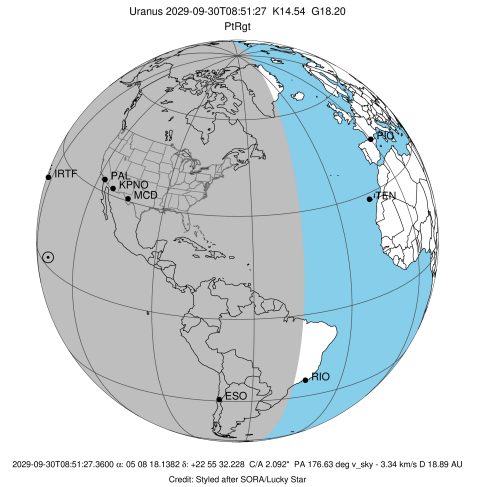
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:58:50.391 | | 11.75 | -55.86 | 51013.78 | -2.62 | | |
| lambda | I | 2029-09-30T06:05:06.432 | | 13.01 | -56.63 | 50026.71 | -2.62 | | |
| delta | I | 2029-09-30T06:16:11.250 | | 15.25 | -57.86 | 48300.35 | -2.58 | | |
| gamma | I | 2029-09-30T06:20:32.712 | | 16.13 | -58.30 | 47628.82 | -2.56 | | |
| eta | I | 2029-09-30T06:23:30.001 | | 16.73 | -58.58 | 47176.12 | -2.55 | | |
| beta | I | 2029-09-30T06:33:32.457 | | 18.78 | -59.44 | 45655.01 | -2.50 | | |
| alpha | I | 2029-09-30T06:39:42.184 | | 20.05 | -59.89 | 44735.70 | -2.47 | | |
| 4 | I | 2029-09-30T06:54:37.157 | | 23.13 | -60.70 | 42566.73 | -2.38 | | |
| 5 | I | 2029-09-30T06:57:09.412 | | 23.65 | -60.80 | 42208.76 | -2.36 | | |
| 6 | I | 2029-09-30T06:59:54.741 | | 24.22 | -60.89 | 41818.36 | -2.34 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| 6 | E | 2029-09-30T11:20:41.583 | | 77.83 | -25.97 | 41873.43 | 2.61 | | |
| 5 | E | 2029-09-30T11:23:24.182 | | 78.23 | -25.41 | 42308.77 | 2.64 | | |
| 4 | E | 2029-09-30T11:25:22.020 | | 78.52 | -25.00 | 42616.03 | 2.66 | | |
| alpha | E | 2029-09-30T11:38:00.211 | | 80.07 | -22.38 | 44688.65 | 2.80 | | |
| beta | E | 2029-09-30T11:43:51.592 | | 80.60 | -21.15 | 45680.69 | 2.85 | | |
| eta | E | 2029-09-30T11:52:29.551 | | 81.07 | -19.34 | 47176.12 | 2.92 | | |
| gamma | E | 2029-09-30T11:55:04.380 | | 81.14 | -18.80 | 47630.49 | 2.95 | | |
| delta | E | 2029-09-30T11:58:50.692 | | 81.17 | -18.01 | 48300.35 | 2.97 | | |
| lambda | E | 2029-09-30T12:08:24.279 | | 80.90 | -15.99 | 50026.71 | 3.04 | | |
| epsilon | E | 2029-09-30T12:12:40.537 | | 80.62 | -15.09 | 50810.41 | 3.06 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T09:10:53.640
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.86
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.186
 C/A sky separation (km) : 29940.5
 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

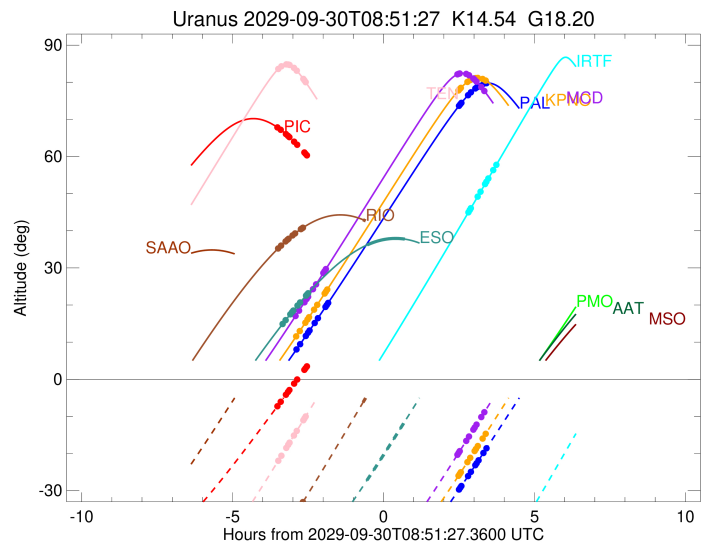
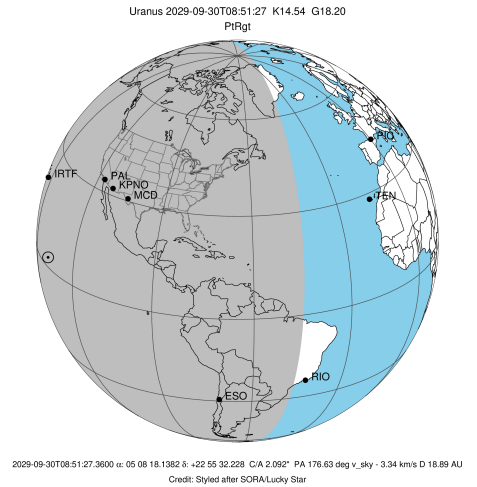


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:57:30.811 | | 17.23 | -60.13 | 51017.49 | -2.68 | | |
| lambda | I | 2029-09-30T06:03:39.803 | | 18.50 | -60.66 | 50026.71 | -2.68 | | |
| delta | I | 2029-09-30T06:14:29.514 | | 20.75 | -61.44 | 48300.35 | -2.64 | | |
| gamma | I | 2029-09-30T06:18:44.969 | | 21.64 | -61.68 | 47628.77 | -2.62 | | |
| eta | I | 2029-09-30T06:21:38.122 | | 22.24 | -61.83 | 47176.12 | -2.61 | | |
| beta | I | 2029-09-30T06:31:26.461 | | 24.30 | -62.22 | 45654.79 | -2.56 | | |
| alpha | I | 2029-09-30T06:37:27.063 | | 25.56 | -62.36 | 44736.05 | -2.53 | | |
| 4 | I | 2029-09-30T06:52:00.097 | | 28.64 | -62.40 | 42566.14 | -2.44 | | |
| 5 | I | 2029-09-30T06:54:28.554 | | 29.16 | -62.37 | 42207.76 | -2.42 | | |
| 6 | I | 2029-09-30T06:57:09.419 | | 29.73 | -62.31 | 41817.85 | -2.40 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| 6 | E | 2029-09-30T11:18:32.336 | | 82.16 | -20.31 | 41873.59 | 2.65 | | |
| 5 | E | 2029-09-30T11:21:12.601 | | 82.30 | -19.74 | 42308.99 | 2.68 | | |
| 4 | E | 2029-09-30T11:23:08.698 | | 82.38 | -19.33 | 42616.07 | 2.70 | | |
| alpha | E | 2029-09-30T11:35:37.341 | | 82.28 | -16.66 | 44688.56 | 2.83 | | |
| beta | E | 2029-09-30T11:41:24.981 | | 81.90 | -15.42 | 45680.71 | 2.88 | | |
| eta | E | 2029-09-30T11:49:57.988 | | 81.02 | -13.59 | 47176.12 | 2.95 | | |
| gamma | E | 2029-09-30T11:52:31.470 | | 80.70 | -13.04 | 47630.48 | 2.97 | | |
| delta | E | 2029-09-30T11:56:15.931 | | 80.19 | -12.23 | 48300.35 | 3.00 | | |
| lambda | E | 2029-09-30T12:05:45.348 | | 78.71 | -10.19 | 50026.71 | 3.06 | | |
| epsilon | E | 2029-09-30T12:10:00.239 | | 77.99 | -9.28 | 50811.22 | 3.08 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T08:28:31.330
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 12.75
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.153
 C/A sky separation (km) : 29491.2
 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_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

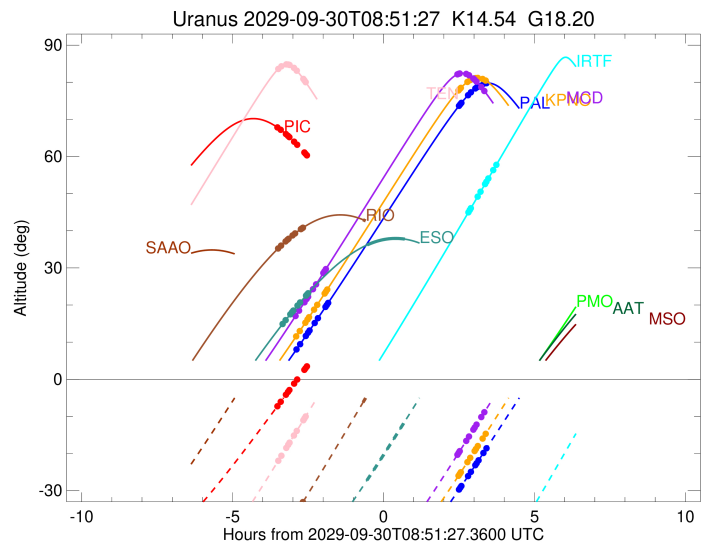
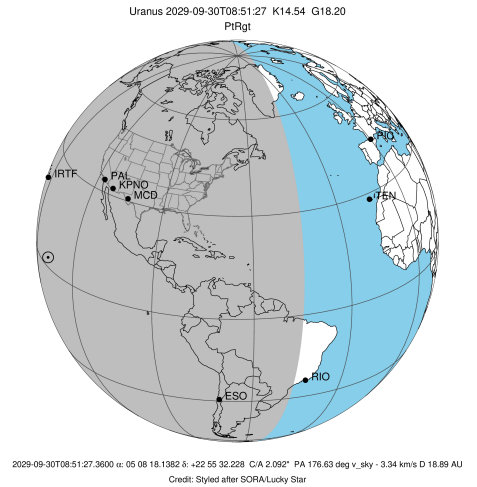


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|----|-------|---------|----------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:23:00.414 | | 83.69 | -21.81 | 51040.45 | -3.01 | | |
| lambda | I | 2029-09-30T05:28:37.217 | | 84.32 | -20.58 | 50026.71 | -2.99 | | |
| delta | I | 2029-09-30T05:38:19.134 | | 84.83 | -18.46 | 48300.35 | -2.94 | | |
| gamma | I | 2029-09-30T05:42:08.814 | | 84.78 | -17.63 | 47628.48 | -2.91 | | |
| eta | I | 2029-09-30T05:44:44.577 | | 84.67 | -17.06 | 47176.12 | -2.90 | | |
| beta | I | 2029-09-30T05:53:36.065 | | 83.87 | -15.11 | 45653.61 | -2.83 | | |
| alpha | I | 2029-09-30T05:59:01.640 | | 83.14 | -13.92 | 44737.85 | -2.79 | | |
| 4 | I | 2029-09-30T06:12:17.480 | | 80.88 | -11.00 | 42563.25 | -2.67 | | |
| 5 | I | 2029-09-30T06:14:33.512 | | 80.45 | -10.50 | 42202.93 | -2.65 | | |
| 6 | I | 2029-09-30T06:16:59.794 | | 79.99 | -9.97 | 41815.42 | -2.63 | | |

No planet occultations

| | | | | | | | | | |
|---------|---|-------------------------|--|-------|--------|----------|------|--|--|
| 6 | E | 2029-09-30T10:44:25.133 | | 21.89 | 45.64x | 41872.74 | 2.47 | | |
| 5 | E | 2029-09-30T10:47:17.006 | | 21.27 | 46.13x | 42307.77 | 2.49 | | |
| 4 | E | 2029-09-30T10:49:22.441 | | 20.83 | 46.48x | 42615.79 | 2.51 | | |
| alpha | E | 2029-09-30T11:02:53.041 | | 17.96 | 48.68x | 44689.20 | 2.60 | | |
| beta | E | 2029-09-30T11:09:11.539 | | 16.63 | 49.66x | 45680.52 | 2.64 | | |
| eta | E | 2029-09-30T11:18:33.491 | | 14.66 | 51.05x | 47176.12 | 2.69 | | |
| gamma | E | 2029-09-30T11:21:22.283 | | 14.07 | 51.45x | 47630.60 | 2.70 | | |
| delta | E | 2029-09-30T11:25:29.539 | | 13.21 | 52.02x | 48300.35 | 2.72 | | |
| lambda | E | 2029-09-30T11:35:59.614 | | 11.03 | 53.41x | 50026.71 | 2.76 | | |
| epsilon | E | 2029-09-30T11:40:39.713 | | 10.06 | 53.98x | 50802.40 | 2.77 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T09:28:12.760
 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.888
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 14.06
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.230
 C/A sky separation (km) : 30548.2
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl1.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

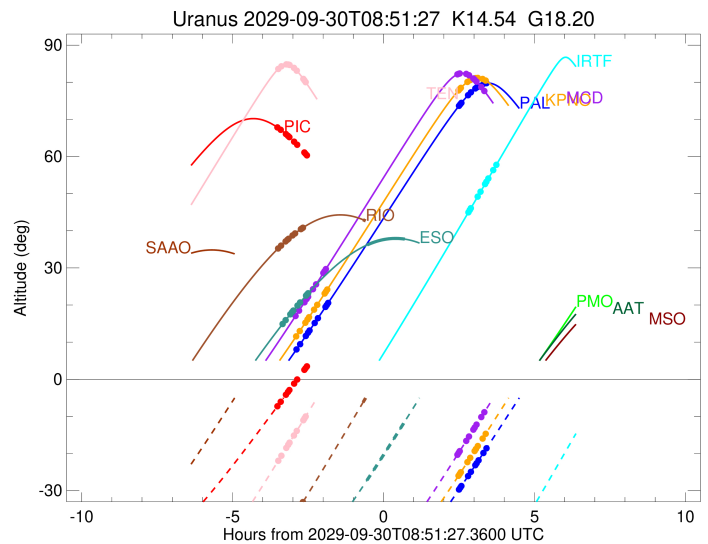
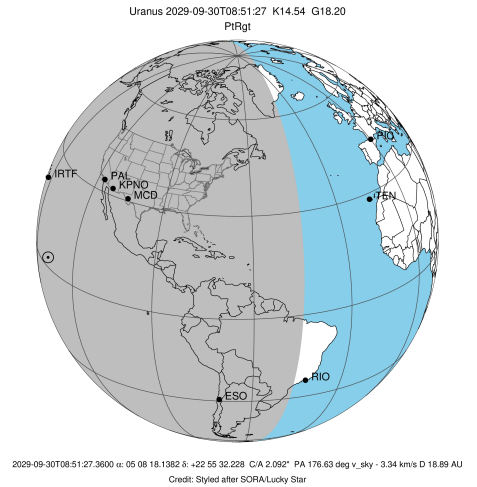


| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|---------|-----|-------------------------|---------|--------|----------|--------|-------|---------|--------------|
| epsilon | I | 2029-09-30T05:54:46.814 | -28.80x | -25.18 | 51009.08 | -2.33 | | | |
| lambda | I | 2029-09-30T06:01:47.888 | -27.56x | -26.82 | 50026.71 | -2.32 | | | |
| delta | I | 2029-09-30T06:14:15.864 | -25.30x | -29.73 | 48300.35 | -2.29 | | | |
| gamma | I | 2029-09-30T06:19:09.972 | -24.39x | -30.87 | 47628.89 | -2.28 | | | |
| eta | I | 2029-09-30T06:22:29.434 | -23.78x | -31.65 | 47176.12 | -2.26 | | | |
| beta | I | 2029-09-30T06:33:46.874 | -21.64x | -34.27 | 45655.33 | -2.22 | | | |
| alpha | I | 2029-09-30T06:40:42.969 | -20.31x | -35.87 | 44735.19 | -2.19 | | | |
| 4 | I | 2029-09-30T06:57:28.272 | -17.03x | -39.73 | 42567.60 | -2.12 | | | |
| 5 | I | 2029-09-30T07:00:19.134 | -16.47x | -40.39 | 42210.25 | -2.10 | | | |
| 6 | I | 2029-09-30T07:03:25.147 | -15.85x | -41.10 | 41819.13 | -2.08 | | | |

No planet occultations

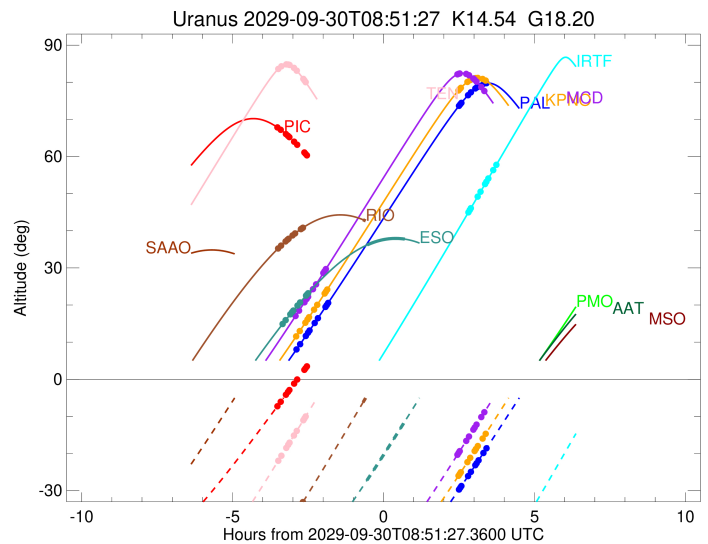
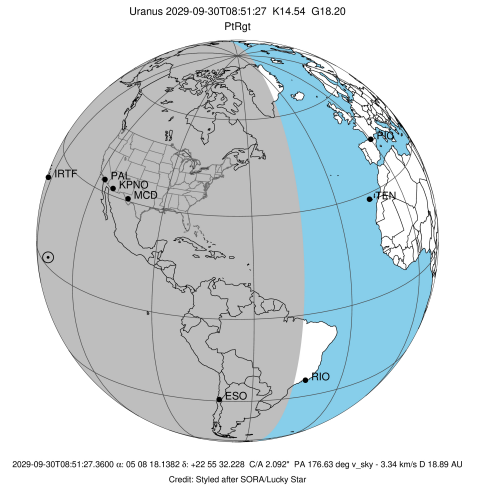
| | | | | | | | | | |
|---------|---|-------------------------|-------|--------|----------|------|--|--|--|
| 6 | E | 2029-09-30T11:40:24.009 | 45.01 | -62.68 | 41873.70 | 2.51 | | | |
| 5 | E | 2029-09-30T11:43:13.253 | 45.66 | -62.13 | 42309.16 | 2.54 | | | |
| 4 | E | 2029-09-30T11:45:15.530 | 46.12 | -61.73 | 42616.11 | 2.57 | | | |
| alpha | E | 2029-09-30T11:58:20.352 | 49.13 | -59.10 | 44688.43 | 2.71 | | | |
| beta | E | 2029-09-30T12:04:22.642 | 50.52 | -57.85 | 45680.76 | 2.77 | | | |
| eta | E | 2029-09-30T12:13:14.755 | 52.57 | -55.99 | 47176.12 | 2.85 | | | |
| gamma | E | 2029-09-30T12:15:53.415 | 53.18 | -55.43 | 47630.44 | 2.88 | | | |
| delta | E | 2029-09-30T12:19:45.053 | 54.07 | -54.60 | 48300.35 | 2.91 | | | |
| lambda | E | 2029-09-30T12:29:30.458 | 56.32 | -52.49 | 50026.71 | 2.99 | | | |
| epsilon | E | 2029-09-30T12:33:52.514 | 57.33 | -51.53 | 50814.21 | 3.01 | | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T08:42:03.060
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.10
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.752
 C/A sky separation (km) : 24008.2
 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_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 | 2029-09-30T05:22:25.723 | | 35.29 | -43.39 | 51083.73 | -3.22 | | |
| lambda | I | 2029-09-30T05:27:53.605 | | 36.01 | -42.27 | 50026.71 | -3.22 | | |
| delta | I | 2029-09-30T05:36:52.407 | | 37.14 | -40.41 | 48300.35 | -3.19 | | |
| gamma | I | 2029-09-30T05:40:23.554 | | 37.57 | -39.68 | 47627.87 | -3.18 | | |
| eta | I | 2029-09-30T05:42:45.843 | | 37.85 | -39.18 | 47176.12 | -3.17 | | |
| beta | I | 2029-09-30T05:50:48.980 | | 38.76 | -37.48 | 45651.24 | -3.14 | | |
| alpha | I | 2029-09-30T05:55:39.493 | | 39.29 | -36.45 | 44741.45 | -3.12 | | |
| 4 | I | 2029-09-30T06:07:26.295 | | 40.46 | -33.92 | 42556.71 | -3.06 | | |
| 5 | I | 2029-09-30T06:09:25.839 | | 40.65 | -33.49 | 42192.20 | -3.05 | | |
| 6 | I | 2029-09-30T06:11:31.267 | | 40.84 | -33.03 | 41810.08 | -3.04 | | |
| Uranus | I | 2029-09-30T08:10:44.216 | | 42.98 | -6.23 | 25040.01 | | 7.35 | 7.69 |
| Uranus | E | 2029-09-30T09:13:03.641 | | 37.31 | 8.12x | 25016.25 | | 7.52 | 7.88 |
| 6 | E | 2029-09-30T11:14:14.259 | | 17.92 | 35.84x | 41876.44 | 2.99 | | |
| 5 | E | 2029-09-30T11:16:37.873 | | 17.47 | 36.38x | 42312.70 | 3.00 | | |
| 4 | E | 2029-09-30T11:18:20.509 | | 17.15 | 36.76x | 42616.57 | 3.01 | | |
| alpha | E | 2029-09-30T11:29:42.384 | | 14.97 | 39.29x | 44686.77 | 3.06 | | |
| beta | E | 2029-09-30T11:35:06.249 | | 13.93 | 40.49x | 45681.12 | 3.08 | | |
| eta | E | 2029-09-30T11:43:09.356 | | 12.35 | 42.27x | 47176.12 | 3.11 | | |
| gamma | E | 2029-09-30T11:45:35.205 | | 11.87 | 42.80x | 47630.09 | 3.12 | | |
| delta | E | 2029-09-30T11:49:09.911 | | 11.17 | 43.58x | 48300.35 | 3.13 | | |
| lambda | E | 2029-09-30T11:58:19.805 | | 9.34 | 45.58x | 50026.71 | 3.15 | | |
| epsilon | E | 2029-09-30T12:02:35.929 | | 8.48 | 46.50x | 50835.06 | 3.15 | | |

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-09-30T08:56:17.390
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415404177564689408
 2Mass ID (if available) : 05081811+2255326
 ICRS Star Coord at Epoch: 05h 08m 18.13820s +22:55:32.22798s
 RUWE (>1.4 is poor) : 1.06
 K magnitude : 14.536
 G magnitude : 18.196
 RP magnitude : 17.065
 BP magnitude : 19.475
 DUPflag : 0
 Distance (au) : 18.889
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -3.34
 Sun-Target sep (deg) : 108.96
 Sun-Moon sep (deg) : 13.49
 B (ring opening deg) : 82.25
 PA of pole (deg) : -1.69
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.720
 C/A sky separation (km) : 23559.4
 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 | 2029-09-30T05:31:19.811 | | 14.96 | -55.06 | 51081.41 | -3.10 | | |
| lambda | I | 2029-09-30T05:36:58.753 | | 15.94 | -54.49 | 50026.71 | -3.11 | | |
| delta | I | 2029-09-30T05:46:15.970 | | 17.51 | -53.47 | 48300.35 | -3.09 | | |
| gamma | I | 2029-09-30T05:49:53.980 | | 18.12 | -53.04 | 47627.90 | -3.08 | | |
| eta | I | 2029-09-30T05:52:20.797 | | 18.52 | -52.74 | 47176.12 | -3.07 | | |
| beta | I | 2029-09-30T06:00:38.565 | | 19.88 | -51.69 | 45651.32 | -3.05 | | |
| alpha | I | 2029-09-30T06:05:37.425 | | 20.68 | -51.02 | 44741.35 | -3.03 | | |
| 4 | I | 2029-09-30T06:17:42.566 | | 22.56 | -49.30 | 42556.86 | -2.99 | | |
| 5 | I | 2029-09-30T06:19:44.955 | | 22.88 | -48.99 | 42192.44 | -2.98 | | |
| 6 | I | 2029-09-30T06:21:53.339 | | 23.20 | -48.67 | 41810.19 | -2.97 | | |
| Uranus | I | 2029-09-30T08:18:36.032 | | 36.17 | -27.22 | 25054.44 | | 7.24 | 7.58 |
| Uranus | E | 2029-09-30T09:33:35.535 | | 37.76 | -11.41 | 25039.71 | | 7.35 | 7.70 |
| 6 | E | 2029-09-30T11:27:39.638 | | 28.94 | 13.44x | 41876.93 | 3.10 | | |
| 5 | E | 2029-09-30T11:29:57.892 | | 28.64 | 13.94x | 42313.28 | 3.12 | | |
| 4 | E | 2029-09-30T11:31:36.311 | | 28.43 | 14.30x | 42616.55 | 3.13 | | |
| alpha | E | 2029-09-30T11:42:31.537 | | 26.99 | 16.67x | 44686.43 | 3.19 | | |
| beta | E | 2029-09-30T11:47:42.672 | | 26.27 | 17.80x | 45681.18 | 3.21 | | |
| eta | E | 2029-09-30T11:55:26.261 | | 25.18 | 19.48x | 47176.12 | 3.24 | | |
| gamma | E | 2029-09-30T11:57:46.112 | | 24.85 | 19.98x | 47629.98 | 3.25 | | |
| delta | E | 2029-09-30T12:01:12.000 | | 24.35 | 20.73x | 48300.35 | 3.26 | | |
| lambda | E | 2029-09-30T12:09:58.841 | | 23.03 | 22.62x | 50026.71 | 3.29 | | |
| epsilon | E | 2029-09-30T12:14:06.221 | | 22.41 | 23.51x | 50842.29 | 3.29 | | |