

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:48:51.340
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3414236732437048192
 2Mass ID (if available) : 05142295+2126043

Saturn 2031-12-07T22:48:51 K8.98 G12.13 PgtRgt

ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s

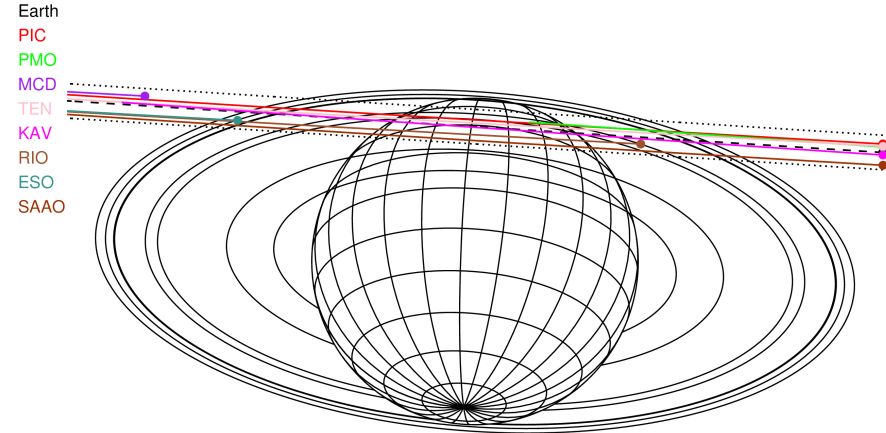
RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 94.78
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47

a(km) ring

- 1 74490.6 C (IER)
- 2 91984.7 B (IER)
- 3 117571.2 B (OER)
- 4 122050.4 A (IER)
- 5 133423.3 Encke (IEG)
- 6 133744.9 Encke (OEG)
- 7 136774.4 A (OER)
- 8 140461.0 F ring

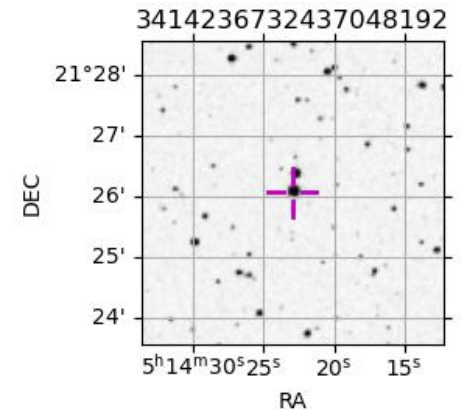


2031-12-07T22:48:51.3400 α: 05 14 22.9469 δ: +21 26 04.292 C/A 8.514° PA 176.38 deg v_sky -20.01 km/s D 08.05 AU
 Credit: Styled after SORA/Lucky Star

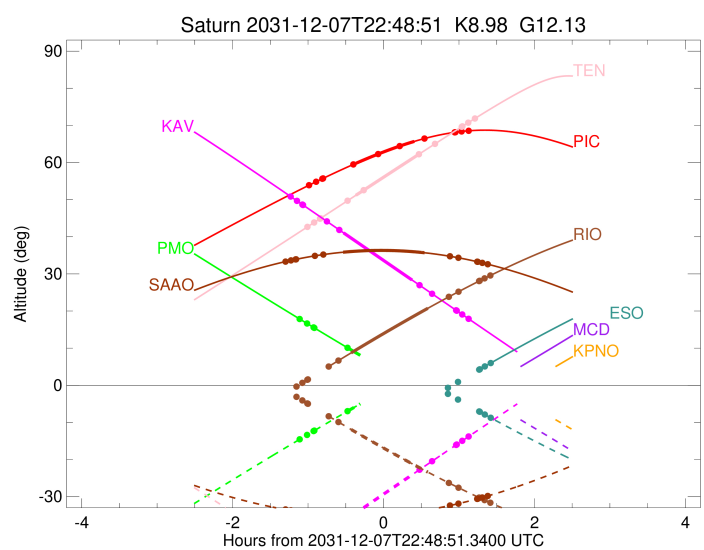
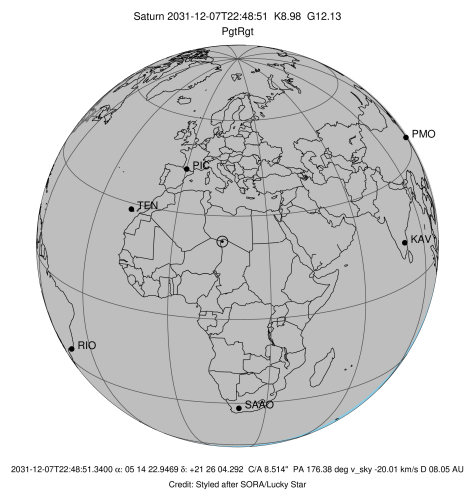


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| Obs | Location | lat | Elon | Rings I | Planet | Rings E | Observed Events Interval | OEcode | | |
|------|----------------|-------|-------|---------|--------|---------|--------------------------|--------|-----------------------------|--------|
| PIC | Pic du Midi | 42.9 | 0.1 | + | + | + | + | + | DEC 07 21:49 - DEC 07 23:56 | PieRie |
| PAL | Palomar Mt (20 | 33.4 | 243.1 | | | | | | | PnnRnn |
| PMO | Purple Mtn Obs | 32.1 | 118.8 | + | + | + | + | + | DEC 07 21:42 - DEC 07 22:21 | PinRin |
| KPNO | Kitt Peak Natl | 32.0 | 248.4 | | | | | | | PnnRnn |
| MCD | McDonald Obs. | 30.7 | 256.0 | | | | | | | PnnRnn |
| TEN | Teide Obs./Ten | 28.3 | 343.5 | + | + | + | + | + | DEC 07 21:48 - DEC 08 00:01 | PieRie |
| IRTF | Mauna Kea/IRTF | 19.8 | 204.5 | | | | | | | PnnRnn |
| KAV | Kavalur Observ | 12.6 | 78.8 | + | + | + | + | + | DEC 07 21:35 - DEC 07 23:56 | PieRie |
| RIO | Rio de Janeiro | -22.9 | 316.8 | | + | + | + | + | DEC 07 22:05 - DEC 08 00:13 | PieRie |
| ESO | European South | -29.3 | 289.3 | | | | + | + | DEC 08 00:09 - DEC 08 00:14 | PnnRne |
| AAT | Siding Spring | -31.3 | 149.1 | | | | | | | PnnRnn |
| SAAO | So. Afr. Astro | -32.4 | 20.8 | + | + | + | + | + | DEC 07 21:30 - DEC 08 00:11 | PieRie |
| MSO | Mt. Stromlo Ob | -35.3 | 149.0 | | | | | | | PnnRnn |



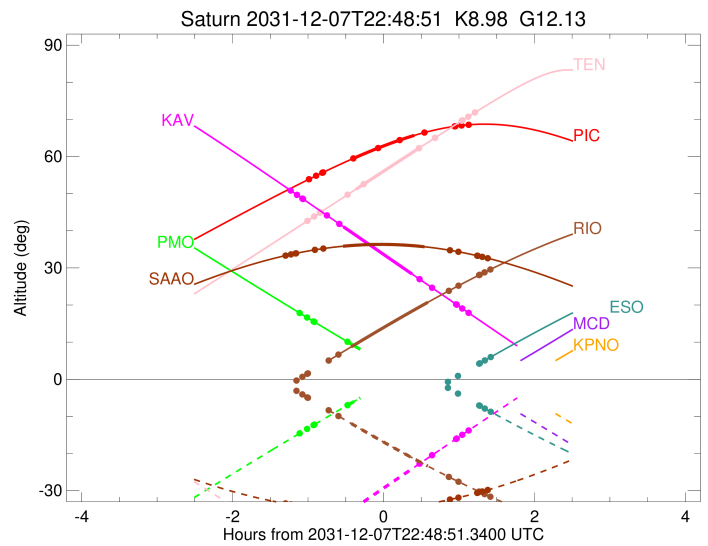
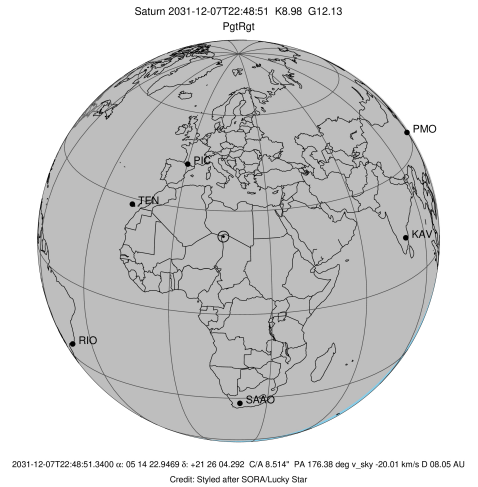
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:50:11.350
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 95.57
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 8.945
 C/A sky separation (km) : 52191.4
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 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 |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:49:35.947 | | 53.88 | -57.82 | 140461.00 | -11.26 | | |
| A (OER) | I | 2031-12-07T21:55:14.065 | | 54.82 | -58.72 | 136774.40 | -10.54 | | |
| Encke (OEG) | I | 2031-12-07T22:00:10.970 | | 55.63 | -59.49 | 133744.89 | -9.86 | | |
| Encke (IEG) | I | 2031-12-07T22:00:43.713 | | 55.72 | -59.58 | 133423.31 | -9.78 | | |
| A (IER) | I | 2031-12-07T22:24:47.587 | | 59.48 | -63.11 | 122050.38 | -5.79 | | |
| B (OER) | I | 2031-12-07T22:43:47.227 | b | 62.18 | -65.55 | 117571.17 | -2.00 | | |
| Saturn | I | 2031-12-07T22:26:58.666 | | 59.80 | -63.41 | 59376.65 | | 52.59 | 57.76 |
| Saturn | E | 2031-12-07T23:13:26.528 | | 65.70 | -68.46 | 59409.83 | | 51.17 | 56.44 |
| B (OER) | E | 2031-12-07T23:02:43.877 | b | 64.54 | -67.55 | 117571.19 | 2.00 | | |
| A (IER) | E | 2031-12-07T23:21:41.391 | | 66.49 | -69.02 | 122050.38 | 5.81 | | |
| Encke (IEG) | E | 2031-12-07T23:45:41.085 | | 68.15 | -69.89 | 133423.31 | 9.82 | | |
| Encke (OEG) | E | 2031-12-07T23:46:13.717 | | 68.17 | -69.89 | 133744.89 | 9.89 | | |
| A (OER) | E | 2031-12-07T23:51:09.585 | | 68.38 | -69.92 | 136774.40 | 10.58 | | |
| F ring | E | 2031-12-07T23:56:46.441 | | 68.56 | -69.88 | 140461.00 | 11.30 | | |

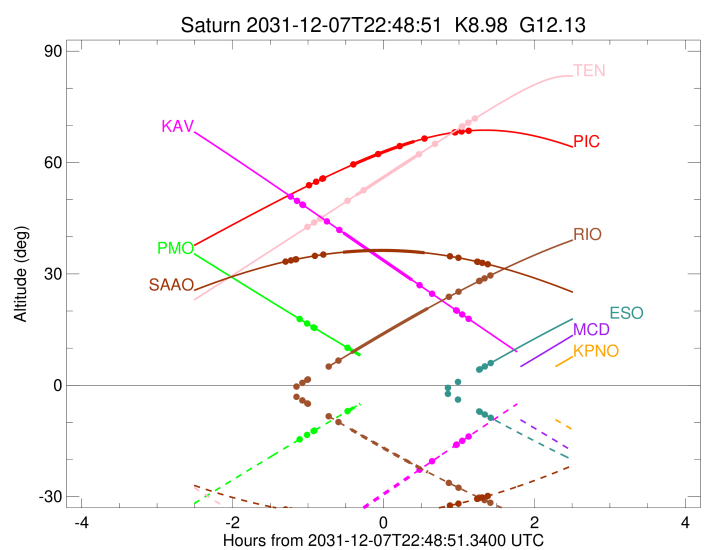
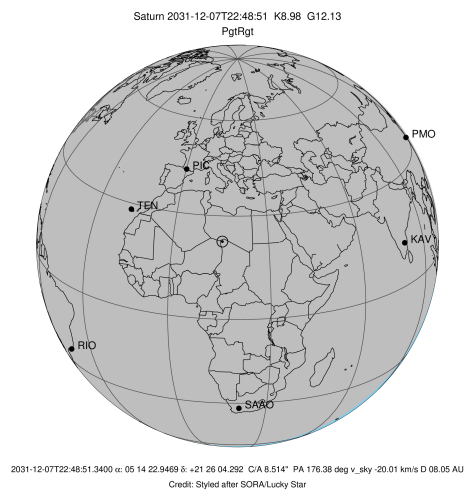
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:43:54.170
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PMO
 Location : Purple Mtn Obs. Nanking
 Latitude (deg) : 32.06667
 E. Longitude (deg) : 118.82089
 Altitude (km) : 0.364
 Gaia source ID : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 94.92
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 9.039
 C/A sky separation (km) : 52743.1
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 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 |
|-------------|-----|-------------------------|----|--------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:42:09.850 | | 17.86 | -14.57 | 140461.00 | -10.83 | | |
| A (OER) | I | 2031-12-07T21:48:02.237 | | 16.65 | -13.39 | 136774.40 | -10.08 | | |
| Encke (OEG) | I | 2031-12-07T21:53:13.738 | | 15.59 | -12.34 | 133744.89 | -9.36 | | |
| Encke (IEG) | I | 2031-12-07T21:53:48.233 | | 15.47 | -12.23 | 133423.31 | -9.28 | | |
| A (IER) | I | 2031-12-07T22:20:09.279 | | 10.12 | -7.00 | 122050.38 | -4.92 | | |
| Saturn | I | 2031-12-07T22:21:10.762 | | 9.91 | -6.80 | 59368.03 | | 52.96 | 58.11 |
| Saturn | E | 2031-12-07T23:06:41.698 | | 0.93x | 1.92x | 59381.12 | | 52.40 | 57.59 |
| A (IER) | E | 2031-12-07T23:10:22.693 | | 0.22x | 2.60x | 122050.38 | 4.90 | | |
| Encke (IEG) | E | 2031-12-07T23:36:54.787 | | -4.80x | 7.44x | 133423.31 | 9.19 | | |
| Encke (OEG) | E | 2031-12-07T23:37:29.614 | | -4.91x | 7.55x | 133744.89 | 9.27 | | |
| A (OER) | E | 2031-12-07T23:42:44.287 | | -5.88x | 8.48x | 136774.40 | 9.97 | | |
| F ring | E | 2031-12-07T23:48:40.635 | | -6.98x | 9.52x | 140461.00 | 10.71 | | |

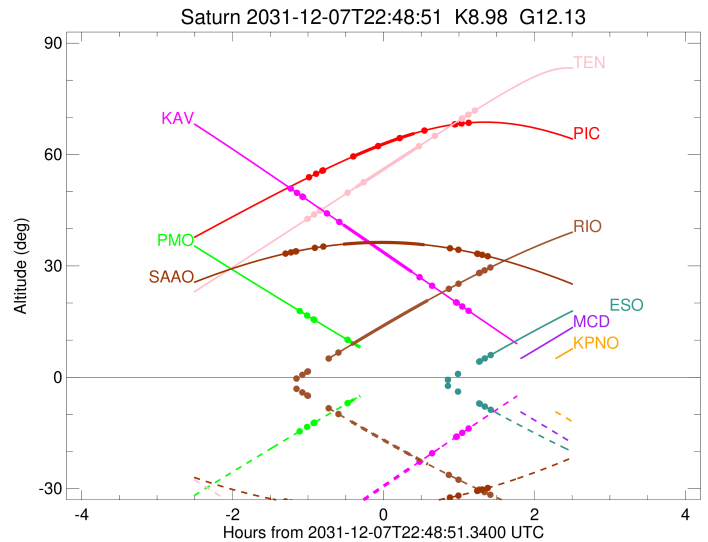
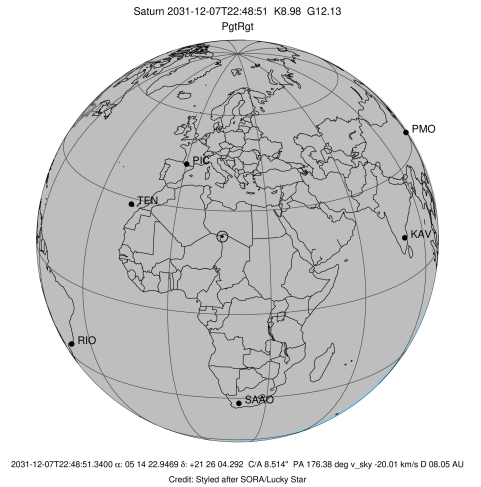
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:51:46.800
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : TEN
 Location : Teide Obs./Tenerife
 Latitude (deg) : 28.30050
 E. Longitude (deg) : 343.48909
 Altitude (km) : 2.395
 Gaia source ID : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 95.50
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 8.744
 C/A sky separation (km) : 51018.7
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 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 |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:48:19.733 | | 42.66 | -47.19 | 140461.00 | -11.80 | | |
| A (OER) | I | 2031-12-07T21:53:40.982 | | 43.84 | -48.37 | 136774.40 | -11.15 | | |
| Encke (OEG) | I | 2031-12-07T21:58:20.261 | | 44.87 | -49.39 | 133744.89 | -10.54 | | |
| Encke (IEG) | I | 2031-12-07T21:58:50.870 | | 44.98 | -49.51 | 133423.31 | -10.47 | | |
| A (IER) | I | 2031-12-07T22:20:13.673 | | 49.70 | -54.22 | 122050.38 | -7.11 | | |
| B (OER) | I | 2031-12-07T22:32:48.182 | b | 52.48 | -56.99 | 117571.16 | -4.72 | | |
| Saturn | I | 2031-12-07T22:26:49.191 | | 51.16 | -55.67 | 59412.66 | | 51.05 | 56.33 |
| Saturn | E | 2031-12-07T23:16:46.098 | | 62.18 | -66.65 | 59452.11 | | 49.39 | 54.77 |
| B (OER) | E | 2031-12-07T23:17:29.437 | | 62.34 | -66.81 | 117571.16 | 4.74 | | |
| A (IER) | E | 2031-12-07T23:30:00.758 | | 65.08 | -69.53 | 122050.38 | 7.14 | | |
| Encke (IEG) | E | 2031-12-07T23:51:16.111 | | 69.68 | -74.09 | 133423.31 | 10.54 | | |
| Encke (OEG) | E | 2031-12-07T23:51:46.509 | | 69.78 | -74.19 | 133744.89 | 10.61 | | |
| A (OER) | E | 2031-12-07T23:56:23.803 | | 70.77 | -75.17 | 136774.40 | 11.23 | | |
| F ring | E | 2031-12-08T00:01:42.606 | | 71.90 | -76.27 | 140461.00 | 11.89 | | |

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:44:14.440
 Event type : PgtRgt
 : Saturn 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 : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 95.36
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 8.471
 C/A sky separation (km) : 49427.4
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 naif0012.tls
 earth_flat_IAU.spk

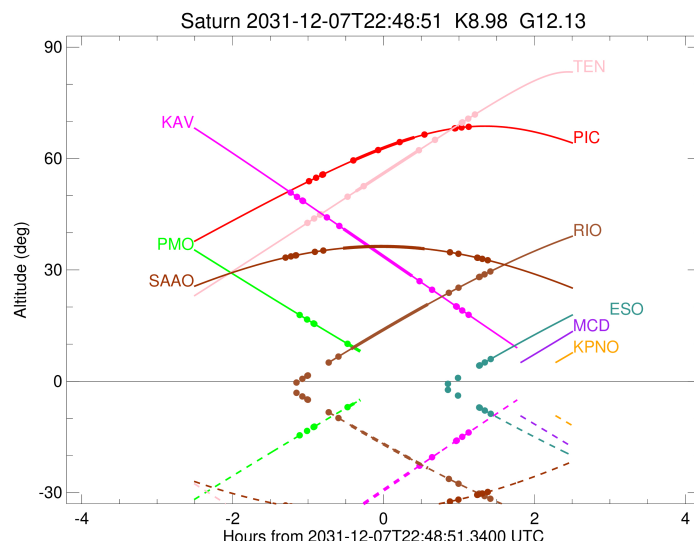
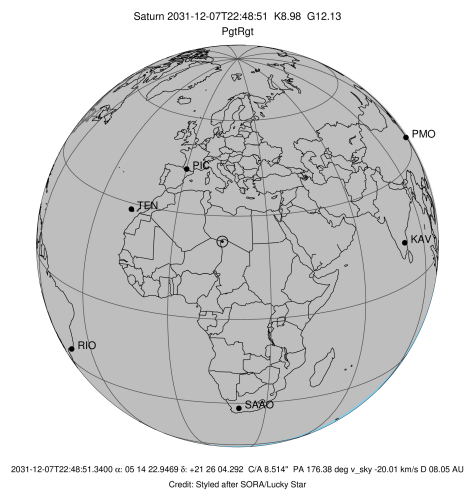


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

| Ring | I/E | UTC | b? | alt | alt-sun | radius | r-dot | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:35:02.180 | | 50.84 | -46.35 | 140461.00 | -12.54 | | |
| A (OER) | I | 2031-12-07T21:40:02.966 | | 49.68 | -45.20 | 136774.40 | -11.96 | | |
| Encke (OEG) | I | 2031-12-07T21:44:22.046 | | 48.68 | -44.21 | 133744.89 | -11.42 | | |
| Encke (IEG) | I | 2031-12-07T21:44:50.280 | | 48.57 | -44.10 | 133423.31 | -11.36 | | |
| A (IER) | I | 2031-12-07T22:03:47.320 | | 44.16 | -39.74 | 122050.38 | -8.52 | | |
| B (OER) | I | 2031-12-07T22:13:31.818 | | 41.89 | -37.49 | 117571.16 | -6.77 | | |
| Saturn | I | 2031-12-07T22:17:04.466 | | 41.06 | -36.67 | 59475.14 | | 48.43 | 53.86 |
| Saturn | E | 2031-12-07T23:11:29.545 | | 28.37 | -24.13 | 59492.41 | | 47.72 | 53.18 |
| B (OER) | E | 2031-12-07T23:17:51.953 | | 26.88 | -22.67 | 117571.16 | 6.74 | | |
| A (IER) | E | 2031-12-07T23:27:40.089 | | 24.60 | -20.41 | 122050.38 | 8.46 | | |
| Encke (IEG) | E | 2031-12-07T23:46:47.233 | | 20.16 | -16.03 | 133423.31 | 11.24 | | |
| Encke (OEG) | E | 2031-12-07T23:47:15.768 | | 20.05 | -15.92 | 133744.89 | 11.30 | | |
| A (OER) | E | 2031-12-07T23:51:37.718 | | 19.03 | -14.92 | 136774.40 | 11.83 | | |
| F ring | E | 2031-12-07T23:56:42.083 | | 17.86 | -13.77 | 140461.00 | 12.39 | | |

```

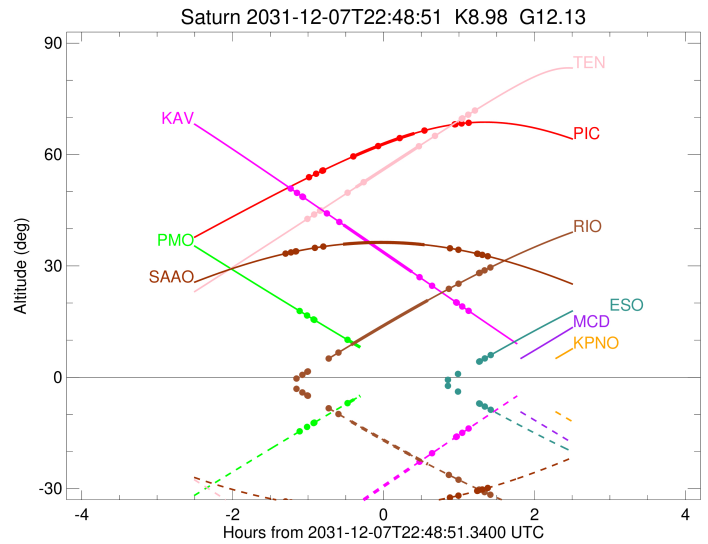
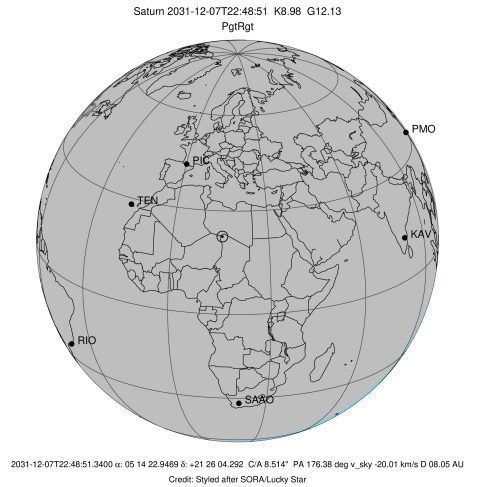
target                : Saturn
target radius (km)   : 60268.00
C/A epoch             : 2031-12-07T22:53:38.430
Event type            : PgtRgt
: Saturn occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code        : RIO
Location              : Rio de Janeiro
Latitude (deg)       : -22.89506
E. Longitude (deg)   : 316.77708
Altitude (km)        : 0.033
Gaia source ID       : 3414236732437048192
2Mass ID (if available) : 051422295+2126043
ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
RUWE (>1.4 is poor) : 1.19
K magnitude           : 8.976
G magnitude           : 12.134
RP magnitude          : 11.189
BP magnitude          : 13.049
DUPflag              : 0
Distance (au)         : 8.045
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -20.01
Sun-Target sep (deg) : 175.50
Sun-Moon sep (deg)   : 94.94
B (ring opening deg) : -26.50
PA of pole (deg)     : -4.47
Pole direction: RA (deg): 40.60000
Dec (deg): 83.50000
C/A sky separation (") : 8.006
C/A sky separation (km) : 46712.7
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl.spk
Saturn_ring_plane.tf
sat378.bsp
sat286.bsp
vgr1.sat286.bsp
vgr2.sat286.bsp
HST1081HSPephemUTC.bsp
pfb10000r.bsp
cassini.bsp
earthstns_itrf93_040916.bsp
earth_200101_990628_predict.bpc
earth_720101_070426.bpc
cpck28Mar2008.tpc
pck.sat440.tpc
IAU_SATURN_for_RINGFIT.tpc
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 |
|-------------|-----|-------------------------|--------|--------|-----------|--------|-------|---------|--------------|
| F ring | I | 2031-12-07T21:39:40.077 | -0.35x | -3.11x | 140461.00 | -13.40 | | | |
| A (OER) | I | 2031-12-07T21:44:19.939 | 0.64x | -4.08x | 136774.40 | -12.94 | | | |
| Encke (OEG) | I | 2031-12-07T21:48:17.894 | 1.48x | -4.89x | 133744.89 | -12.52 | | | |
| Encke (IEG) | I | 2031-12-07T21:48:43.631 | 1.57x | -4.98x | 133423.31 | -12.47 | | | |
| A (IER) | I | 2031-12-07T22:05:15.935 | 5.04 | -8.34 | 122050.38 | -10.35 | | | |
| B (OER) | I | 2031-12-07T22:12:54.229 | 6.62 | -9.88 | 117571.16 | -9.17 | | | |
| Saturn | I | 2031-12-07T22:23:08.418 | 8.73 | -11.91 | 59544.05 | | | 45.59 | 51.13 |
| Saturn | E | 2031-12-07T23:24:07.502 | 20.74 | -23.40 | 59592.51 | | | 43.60 | 49.19 |
| B (OER) | E | 2031-12-07T23:41:05.572 | 23.87 | -26.35 | 117571.16 | 9.25 | | | |
| A (IER) | E | 2031-12-07T23:48:39.651 | 25.23 | -27.63 | 122050.38 | 10.46 | | | |
| Encke (IEG) | E | 2031-12-08T00:05:00.934 | 28.09 | -30.28 | 133423.31 | 12.63 | | | |
| Encke (OEG) | E | 2031-12-08T00:05:26.350 | 28.16 | -30.35 | 133744.89 | 12.68 | | | |
| A (OER) | E | 2031-12-08T00:09:21.248 | 28.83 | -30.96 | 136774.40 | 13.11 | | | |
| F ring | E | 2031-12-08T00:13:57.317 | 29.60 | -31.67 | 140461.00 | 13.59 | | | |

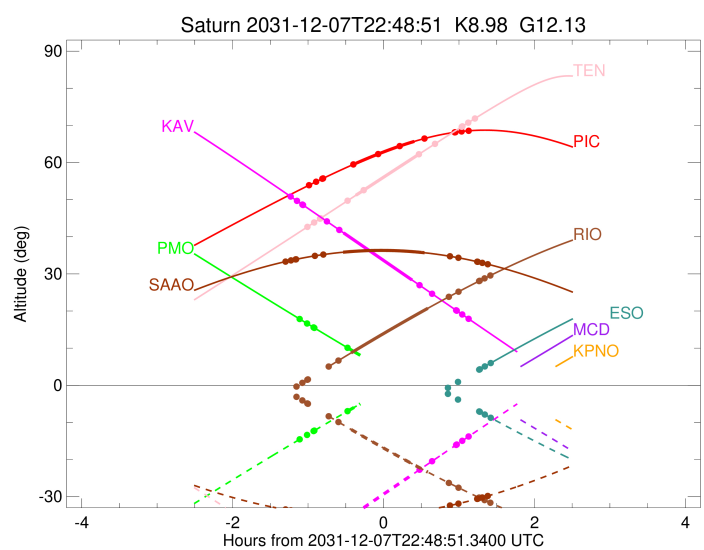
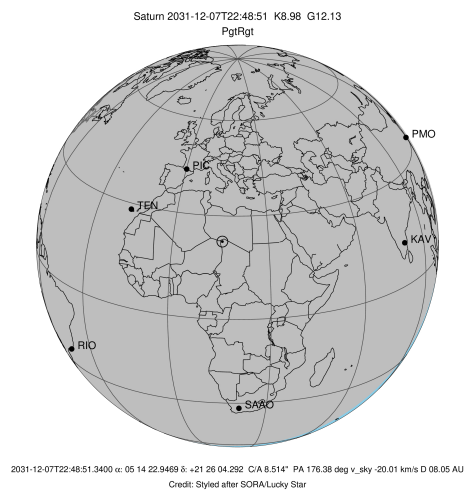
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:53:55.400
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : ESO
 Location : European Southern Obs. (3.6m)
 Latitude (deg) : -29.26097
 E. Longitude (deg) : 289.26831
 Altitude (km) : 2.400
 Gaia source ID : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 94.54
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 8.078
 C/A sky separation (km) : 47134.3
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 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 |
|-------------|-----|-------------------------|----|---------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:40:01.111 | | -25.71x | 22.14x | 140461.00 | -13.10 | | |
| A (OER) | I | 2031-12-07T21:44:47.657 | | -24.68x | 21.13x | 136774.40 | -12.63 | | |
| Encke (OEG) | I | 2031-12-07T21:48:51.676 | | -23.81x | 20.28x | 133744.89 | -12.20 | | |
| Encke (IEG) | I | 2031-12-07T21:49:18.093 | | -23.72x | 20.18x | 133423.31 | -12.15 | | |
| A (IER) | I | 2031-12-07T22:06:21.626 | | -20.08x | 16.61x | 122050.38 | -9.97 | | |
| B (OER) | I | 2031-12-07T22:14:19.576 | | -18.39x | 14.95x | 117571.16 | -8.75 | | |
| Saturn | I | 2031-12-07T22:23:34.660 | | -16.43x | 13.03x | 59531.75 | | 46.09 | 51.62 |
| Saturn | E | 2031-12-07T23:24:14.988 | | -3.88x | 0.77x | 59579.86 | | 44.12 | 49.70 |
| B (OER) | E | 2031-12-07T23:40:22.304 | | -0.63x | -2.37x | 117571.16 | 8.83 | | |
| A (IER) | E | 2031-12-07T23:48:15.549 | | 0.93x | -3.89x | 122050.38 | 10.08 | | |
| Encke (IEG) | E | 2031-12-08T00:05:06.792 | | 4.24x | -7.08 | 133423.31 | 12.32 | | |
| Encke (OEG) | E | 2031-12-08T00:05:32.851 | | 4.33x | -7.16 | 133744.89 | 12.37 | | |
| A (OER) | E | 2031-12-08T00:09:33.464 | | 5.10 | -7.91 | 136774.40 | 12.81 | | |
| F ring | E | 2031-12-08T00:14:15.783 | | 6.01 | -8.79 | 140461.00 | 13.30 | | |

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-07T22:49:06.640
 Event type : PgtRgt
 : Saturn 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 : 3414236732437048192
 2Mass ID (if available) : 051422295+2126043
 ICRS Star Coord at Epoch: 05h 14m 22.94687s +21:26:04.29218s
 RUWE (>1.4 is poor) : 1.19
 K magnitude : 8.976
 G magnitude : 12.134
 RP magnitude : 11.189
 BP magnitude : 13.049
 DUPflag : 0
 Distance (au) : 8.045
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.01
 Sun-Target sep (deg) : 175.50
 Sun-Moon sep (deg) : 95.32
 B (ring opening deg) : -26.50
 PA of pole (deg) : -4.47
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 7.636
 C/A sky separation (km) : 44557.7
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 Saturn_ring_plane.tf
 sat378.bsp
 sat286.bsp
 vgr1.sat286.bsp
 vgr2.sat286.bsp
 HST1081HSPephemUTC.bsp
 pfb10000r.bsp
 cassini.bsp
 earthstns_itrf93_040916.bsp
 earth_200101_990628_predict.bpc
 earth_720101_070426.bpc
 cpck28Mar2008.tpc
 pck.sat440.tpc
 IAU_SATURN_for_RINGFIT.tpc
 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 |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring | I | 2031-12-07T21:30:57.719 | | 33.31 | -33.46 | 140461.00 | -14.37 | | |
| A (OER) | I | 2031-12-07T21:35:17.879 | | 33.64 | -33.70 | 136774.40 | -13.96 | | |
| Encke (OEG) | I | 2031-12-07T21:38:57.696 | | 33.90 | -33.89 | 133744.89 | -13.59 | | |
| Encke (IEG) | I | 2031-12-07T21:39:21.386 | | 33.93 | -33.91 | 133423.31 | -13.55 | | |
| A (IER) | I | 2031-12-07T21:54:17.505 | | 34.86 | -34.54 | 122050.38 | -11.75 | | |
| B (OER) | I | 2031-12-07T22:00:54.836 | | 35.20 | -34.75 | 117571.16 | -10.78 | | |
| Saturn | I | 2031-12-07T22:16:46.352 | | 35.84 | -35.07 | 59613.65 | | 42.73 | 48.33 |
| Saturn | E | 2031-12-07T23:21:29.342 | | 35.69 | -33.68 | 59648.74 | | 41.28 | 46.90 |
| B (OER) | E | 2031-12-07T23:41:56.492 | | 34.73 | -32.38 | 117571.16 | 10.79 | | |
| A (IER) | E | 2031-12-07T23:48:33.681 | | 34.33 | -31.88 | 122050.38 | 11.75 | | |
| Encke (IEG) | E | 2031-12-08T00:03:29.555 | | 33.28 | -30.60 | 133423.31 | 13.56 | | |
| Encke (OEG) | E | 2031-12-08T00:03:53.239 | | 33.25 | -30.57 | 133744.89 | 13.60 | | |
| A (OER) | E | 2031-12-08T00:07:33.006 | | 32.96 | -30.22 | 136774.40 | 13.97 | | |
| F ring | E | 2031-12-08T00:11:53.108 | | 32.60 | -29.81 | 140461.00 | 14.37 | | |