

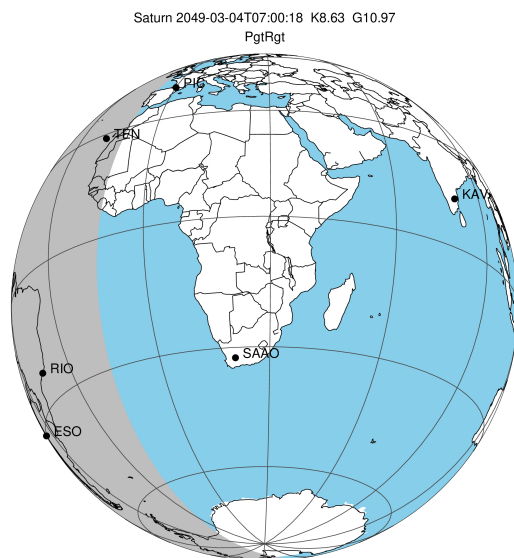
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-03-04T07:00:18.760  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 6868103819609232640  
 2Mass ID (if available) : 19420084-2111469

Saturn 2049-03-04T07:00:18 K8.63 G10.97 PgtRgt

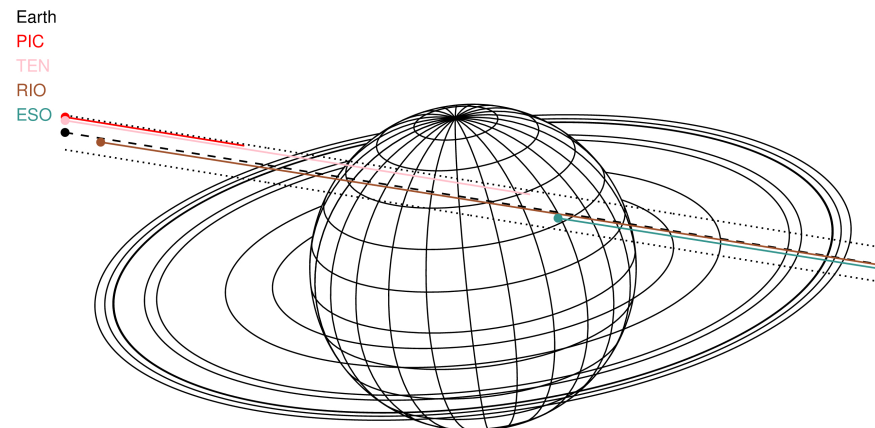
ICRS Star Coord at Epoch: 19h 42m 00.84761s -21:11:46.91852s

RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.626  
 G magnitude : 10.967  
 RP magnitude : 10.244  
 BP magnitude : 11.547  
 DUPflag : 0  
 Distance (au) : 10.631  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 28.87  
 Sun-Target sep (deg) : 49.78  
 Sun-Moon sep (deg) : 53.72  
 B (ring opening deg) : 22.75  
 PA of pole (deg) : 6.81

| # | 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      |

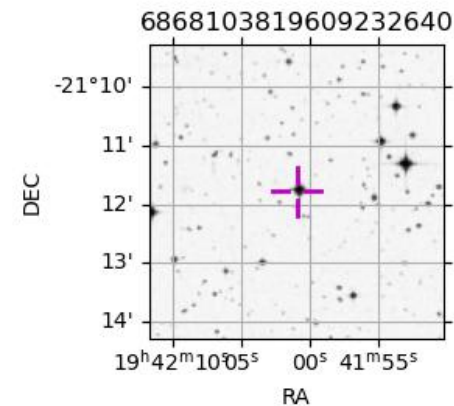


2049-03-04T07:00:18.7600 α: 19 42 00.8476 s: -21 11 46.919 C/A 3.262° PA 170.80 deg v\_sky +28.87 km/s D 10.63 AU  
 Credit: Styled after SORA/Lucky Star

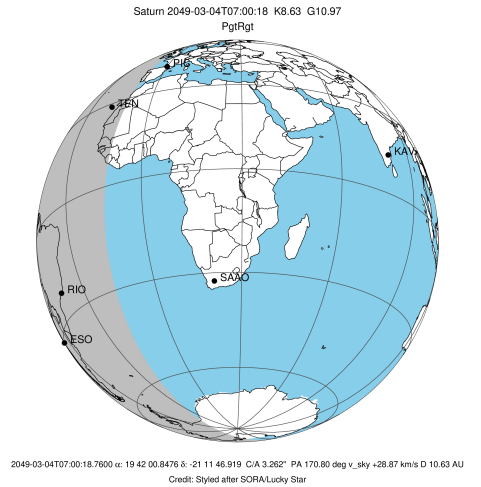


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

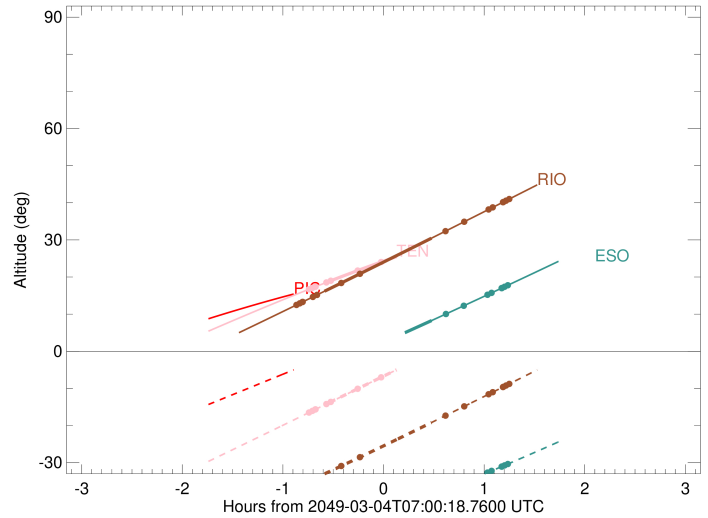
| Obs  | Location       | lat   | Elon  | Rings I | Planet | Rings E | Observed Events Interval    | OEncode |
|------|----------------|-------|-------|---------|--------|---------|-----------------------------|---------|
| PIC  | Pic du Midi    | 42.9  | 0.1   |         |        |         |                             | PnnRnn  |
| PAL  | Palomar Mt (20 | 33.4  | 243.1 |         |        |         |                             | PnnRnn  |
| PMO  | Purple Mtn Obs | 32.1  | 118.8 |         |        |         |                             | PnnRnn  |
| 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 | +       | +      |         | MAR 04 06:15 - MAR 04 06:28 | PinRin  |
| IRTF | Mauna Kea/IRTF | 19.8  | 204.5 |         |        |         |                             | PnnRnn  |
| KAV  | Kavalur Observ | 12.6  | 78.8  |         |        |         |                             | PnnRnn  |
| RIO  | Rio de Janeiro | -22.9 | 316.8 | +       | +      | +       | MAR 04 06:08 - MAR 04 08:15 | PieRie  |
| ESO  | European South | -29.3 | 289.3 |         | +      | +       | MAR 04 07:28 - MAR 04 08:14 | PneRne  |
| AAT  | Siding Spring  | -31.3 | 149.1 |         |        |         |                             | PnnRnn  |
| SAAO | So. Afr. Astro | -32.4 | 20.8  |         |        |         |                             | PnnRnn  |
| MSO  | Mt. Stromlo Ob | -35.3 | 149.0 |         |        |         |                             | PnnRnn  |



target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-03-04T06:58:23.430  
 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 : 6868103819609232640  
 2Mass ID (if available) : 19420084-2111469  
 ICRS Star Coord at Epoch: 19h 42m 00.84761s -21:11:46.91852s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.626  
 G magnitude : 10.967  
 RP magnitude : 10.244  
 BP magnitude : 11.547  
 DUPflag : 0  
 Distance (au) : 10.631  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 28.87  
 Sun-Target sep (deg) : 49.78  
 Sun-Moon sep (deg) : 54.30  
 B (ring opening deg) : 22.75  
 PA of pole (deg) : 6.81  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.887  
 C/A sky separation (km) : 29969.7  
 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

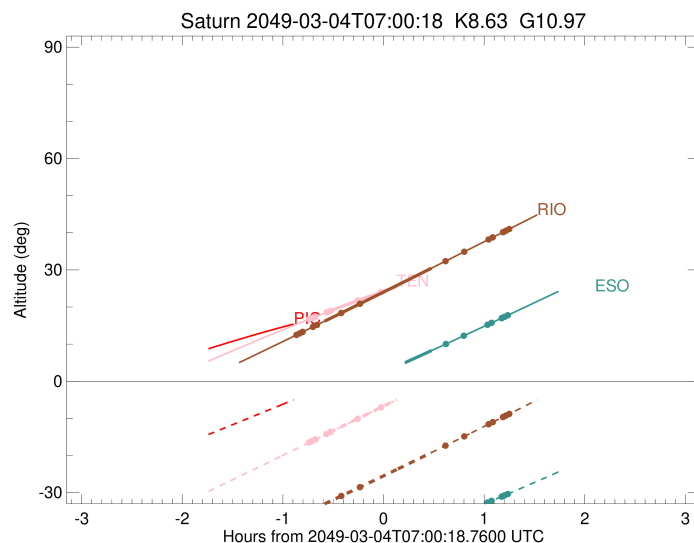
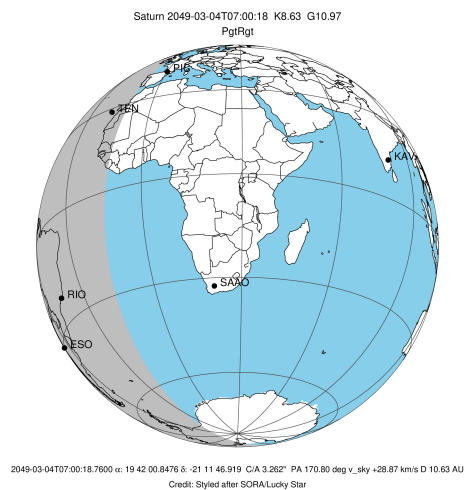


Saturn 2049-03-04T07:00:18 K8.63 G10.97



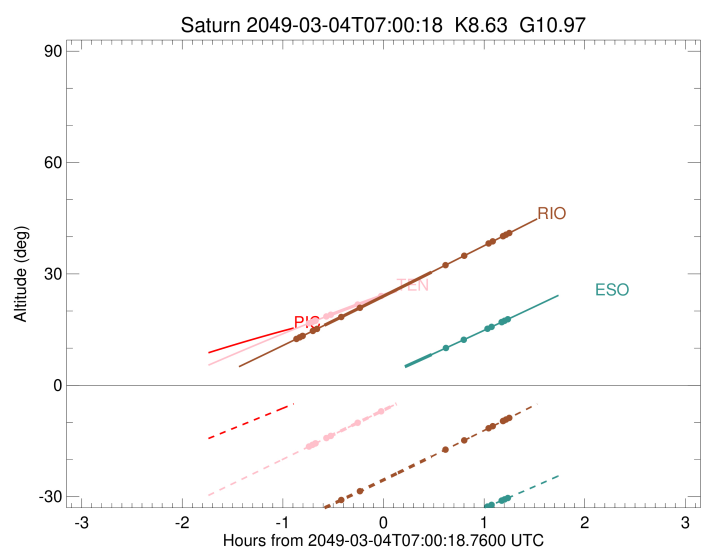
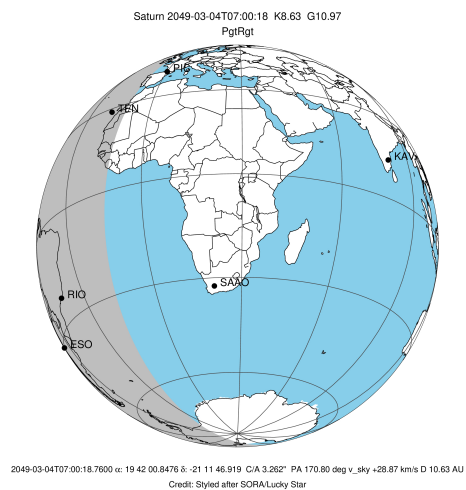
| Ring        | I/E | UTC                     | b? | alt   | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2049-03-04T06:15:55.768 |    | 16.71 | -16.50  | 140461.00 | -30.26 |         |              |
| A (OER)     | I   | 2049-03-04T06:17:58.061 |    | 17.07 | -16.05  | 136774.40 | -30.03 |         |              |
| Encke (OEG) | I   | 2049-03-04T06:19:39.291 |    | 17.37 | -15.67  | 133744.89 | -29.82 |         |              |
| Encke (IEG) | I   | 2049-03-04T06:19:50.078 |    | 17.41 | -15.64  | 133423.31 | -29.80 |         |              |
| A (IER)     | I   | 2049-03-04T06:26:17.540 |    | 18.55 | -14.21  | 122050.38 | -28.86 |         |              |
| B (OER)     | I   | 2049-03-04T06:28:53.945 | b  | 19.00 | -13.64  | 117571.16 | -28.41 |         |              |
| B (IER)     | I   | 2049-03-04T06:44:59.943 | b  | 21.75 | -10.08  | 91984.69  | -24.05 |         |              |
| C (IER)     | I   | 2049-03-04T06:59:03.793 | b  | 24.06 | -6.98   | 74490.58  | -16.66 |         |              |
| Saturn      | I   | 2049-03-04T06:28:12.069 |    | 18.88 | -13.79  | 59827.82  |        | 41.47   | 47.09        |
| Saturn      | E   | 2049-03-04T07:28:53.398 |    | 28.63 | -0.43x  | 60217.75  |        | 12.87   | 15.66        |
| C (IER)     | E   | 2049-03-04T07:34:39.053 |    | 29.45 | 0.83x   | 74490.58  | 16.71  |         |              |
| B (IER)     | E   | 2049-03-04T07:48:39.424 |    | 31.36 | 3.89x   | 91984.69  | 24.14  |         |              |
| B (OER)     | E   | 2049-03-04T08:04:43.869 |    | 33.38 | 7.38x   | 117571.17 | 28.40  |         |              |
| A (IER)     | E   | 2049-03-04T08:07:20.350 |    | 33.69 | 7.94x   | 122050.38 | 28.84  |         |              |
| Encke (IEG) | E   | 2049-03-04T08:13:48.258 |    | 34.44 | 9.34x   | 133423.31 | 29.75  |         |              |
| Encke (OEG) | E   | 2049-03-04T08:13:59.062 |    | 34.46 | 9.38x   | 133744.89 | 29.78  |         |              |
| A (OER)     | E   | 2049-03-04T08:15:40.461 |    | 34.65 | 9.74x   | 136774.40 | 29.98  |         |              |
| F ring      | E   | 2049-03-04T08:17:42.983 |    | 34.87 | 10.18x  | 140461.00 | 30.20  |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-03-04T06:56:53.780  
 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 : 6868103819609232640  
 2Mass ID (if available) : 19420084-2111469  
 ICRS Star Coord at Epoch: 19h 42m 00.84761s -21:11:46.91852s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.626  
 G magnitude : 10.967  
 RP magnitude : 10.244  
 BP magnitude : 11.547  
 DUPflag : 0  
 Distance (au) : 10.631  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 28.87  
 Sun-Target sep (deg) : 49.78  
 Sun-Moon sep (deg) : 54.58  
 B (ring opening deg) : 22.75  
 PA of pole (deg) : 6.81  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.167  
 C/A sky separation (km) : 24420.1  
 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



| Ring        | I/E | UTC                     | b? | alt   | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2049-03-04T06:08:26.695 |    | 12.49 | -36.48  | 140461.00 | -31.75 |         |              |
| A (OER)     | I   | 2049-03-04T06:10:23.093 |    | 12.91 | -36.08  | 136774.40 | -31.60 |         |              |
| Encke (OEG) | I   | 2049-03-04T06:11:59.176 |    | 13.27 | -35.75  | 133744.89 | -31.46 |         |              |
| Encke (IEG) | I   | 2049-03-04T06:12:09.399 |    | 13.31 | -35.71  | 133423.31 | -31.45 |         |              |
| A (IER)     | I   | 2049-03-04T06:18:14.378 |    | 14.65 | -34.45  | 122050.38 | -30.85 |         |              |
| B (OER)     | I   | 2049-03-04T06:20:40.261 |    | 15.18 | -33.95  | 117571.17 | -30.56 |         |              |
| B (IER)     | I   | 2049-03-04T06:35:11.049 | b  | 18.40 | -30.89  | 91984.69  | -27.88 |         |              |
| C (IER)     | I   | 2049-03-04T06:46:22.089 | b  | 20.90 | -28.50  | 74490.58  | -23.85 |         |              |
| Saturn      | I   | 2049-03-04T06:25:10.548 |    | 16.18 | -33.00  | 59918.06  |        | 36.14   | 41.69        |
| Saturn      | E   | 2049-03-04T07:28:53.962 |    | 30.46 | -19.21  | 60250.56  |        | 7.53    | 9.23         |
| C (IER)     | E   | 2049-03-04T07:37:16.423 |    | 32.35 | -17.34  | 74490.58  | 23.97  |         |              |
| B (IER)     | E   | 2049-03-04T07:48:25.834 |    | 34.89 | -14.85  | 91984.69  | 27.88  |         |              |
| B (OER)     | E   | 2049-03-04T08:02:58.633 |    | 38.20 | -11.58  | 117571.16 | 30.44  |         |              |
| A (IER)     | E   | 2049-03-04T08:05:25.129 |    | 38.75 | -11.03  | 122050.38 | 30.71  |         |              |
| Encke (IEG) | E   | 2049-03-04T08:11:31.894 |    | 40.15 | -9.65   | 133423.31 | 31.28  |         |              |
| Encke (OEG) | E   | 2049-03-04T08:11:42.172 |    | 40.19 | -9.61   | 133744.89 | 31.29  |         |              |
| A (OER)     | E   | 2049-03-04T08:13:18.781 |    | 40.55 | -9.24   | 136774.40 | 31.42  |         |              |
| F ring      | E   | 2049-03-04T08:15:15.845 |    | 41.00 | -8.80   | 140461.00 | 31.56  |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-03-04T06:56:48.740  
 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 : 6868103819609232640  
 2Mass ID (if available) : 19420084-2111469  
 ICRS Star Coord at Epoch: 19h 42m 00.84761s -21:11:46.91852s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.626  
 G magnitude : 10.967  
 RP magnitude : 10.244  
 BP magnitude : 11.547  
 DUPflag : 0  
 Distance (au) : 10.631  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 28.87  
 Sun-Target sep (deg) : 49.78  
 Sun-Moon sep (deg) : 54.32  
 B (ring opening deg) : 22.75  
 PA of pole (deg) : 6.81  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.963  
 C/A sky separation (km) : 22843.8  
 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   | 2049-03-04T06:07:02.621 |    | -8.05x | -50.57  | 140461.00 | -32.28 |         |              |
| A (OER)     | I   | 2049-03-04T06:08:57.047 |    | -7.68x | -50.36  | 136774.40 | -32.15 |         |              |
| Encke (OEG) | I   | 2049-03-04T06:10:31.444 |    | -7.38x | -50.19  | 133744.89 | -32.03 |         |              |
| Encke (IEG) | I   | 2049-03-04T06:10:41.484 |    | -7.35x | -50.17  | 133423.31 | -32.02 |         |              |
| A (IER)     | I   | 2049-03-04T06:16:39.470 |    | -6.21x | -49.49  | 122050.38 | -31.49 |         |              |
| B (OER)     | I   | 2049-03-04T06:19:02.258 |    | -5.75x | -49.21  | 117571.16 | -31.24 |         |              |
| B (IER)     | I   | 2049-03-04T06:33:08.813 | b  | -3.00x | -47.42  | 91984.69  | -28.93 |         |              |
| C (IER)     | I   | 2049-03-04T06:43:47.730 | b  | -0.89x | -45.95  | 74490.58  | -25.48 |         |              |
| Saturn      | I   | 2049-03-04T06:24:54.345 |    | -4.61x | -48.49  | 59942.61  |        | 34.65   | 40.13        |
| Saturn      | E   | 2049-03-04T07:28:59.191 |    | 8.27   | -38.73  | 60256.58  |        | 6.09    | 7.47         |
| C (IER)     | E   | 2049-03-04T07:37:31.188 |    | 10.04  | -37.23  | 74490.58  | 25.58  |         |              |
| B (IER)     | E   | 2049-03-04T07:48:09.593 |    | 12.25  | -35.31  | 91984.69  | 28.87  |         |              |
| B (OER)     | E   | 2049-03-04T08:02:19.457 |    | 15.22  | -32.68  | 117571.16 | 31.07  |         |              |
| A (IER)     | E   | 2049-03-04T08:04:43.076 |    | 15.73  | -32.23  | 122050.38 | 31.30  |         |              |
| Encke (IEG) | E   | 2049-03-04T08:10:43.417 |    | 16.99  | -31.08  | 133423.31 | 31.80  |         |              |
| Encke (OEG) | E   | 2049-03-04T08:10:53.529 |    | 17.03  | -31.05  | 133744.89 | 31.81  |         |              |
| A (OER)     | E   | 2049-03-04T08:12:28.609 |    | 17.37  | -30.75  | 136774.40 | 31.92  |         |              |
| F ring      | E   | 2049-03-04T08:14:23.894 |    | 17.77  | -30.38  | 140461.00 | 32.04  |         |              |