

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:31:41.490  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278

Saturn 2048-07-07T06:31:41 K9.39 G13.45 PgtRgt

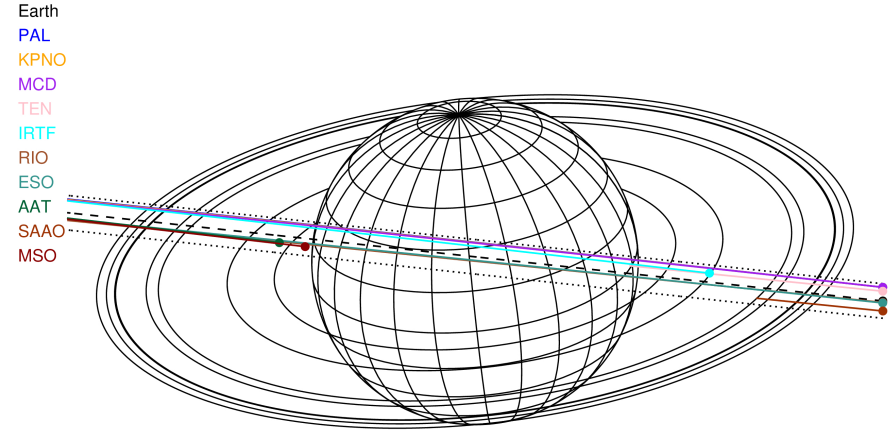
ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s

RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 140.86  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36

#	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

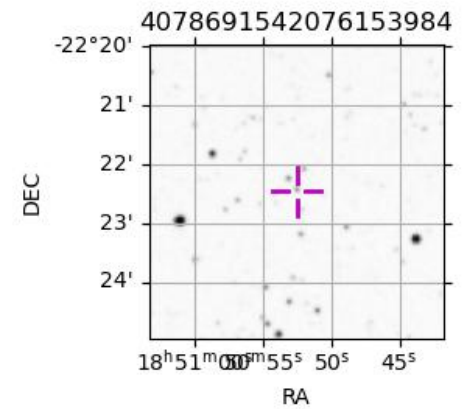


2048-07-07T06:31:41.4900 at: 18 50 52.6376 s -22 22 27.896 C/A 0.262° PA 173.83 deg v\_sky -20.12 km/s D 09.02 AU  
 Credit: Styled after SORA/Lucky Star

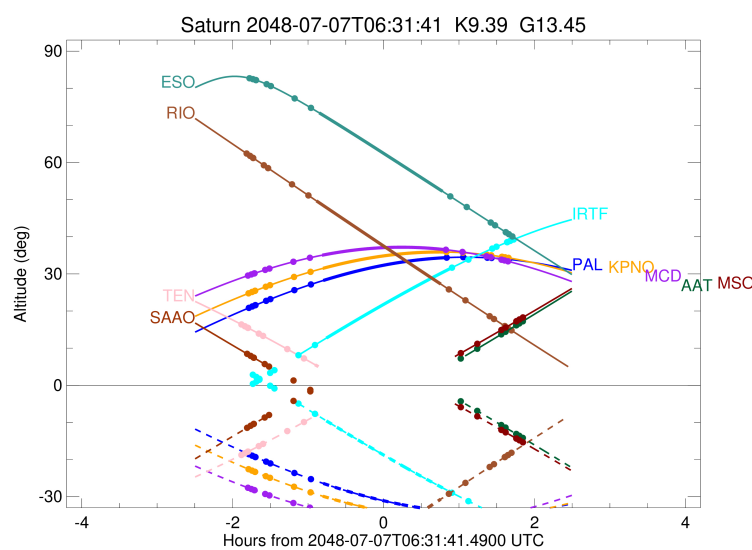
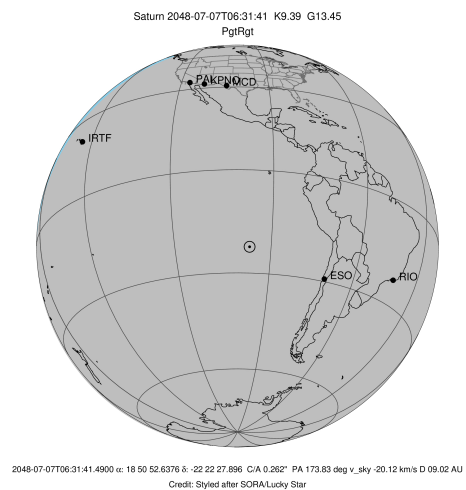


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+	+	+	JUL 07 04:44 - JUL 07 08:11	PieRie
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4	+	+	+	JUL 07 04:44 - JUL 07 08:11	PieRie
MCD	McDonald Obs.	30.7	256.0	+	+	+	JUL 07 04:43 - JUL 07 08:10	PieRie
TEN	Teide Obs./Ten	28.3	343.5	+	+	+	JUL 07 04:38 - JUL 07 05:37	PinRin
IRTF	Mauna Kea/IRTF	19.8	204.5		+	+	JUL 07 05:37 - JUL 07 08:15	PieRie
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+	+	+	JUL 07 04:42 - JUL 07 08:13	PieRie
ESO	European South	-29.3	289.3	+	+	+	JUL 07 04:45 - JUL 07 08:14	PieRie
AAT	Siding Spring	-31.3	149.1			+	JUL 07 07:46 - JUL 07 08:22	PnnRne
SAAO	So. Afr. Astro	-32.4	20.8	+			JUL 07 04:43 - JUL 07 05:00	PnnRin
MSO	Mt. Stromlo Ob	-35.3	149.0			+	JUL 07 07:33 - JUL 07 08:22	PnnRne



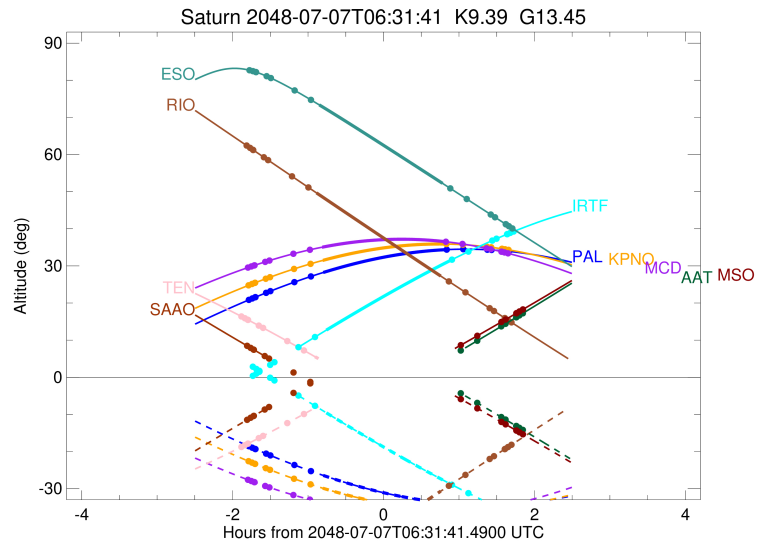
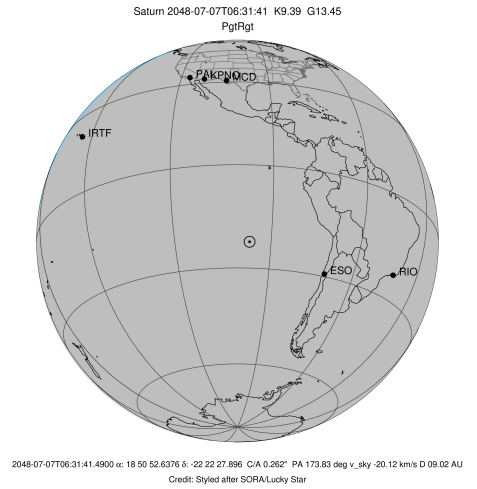
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:32:26.350  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.08  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 1.074  
 C/A sky separation (km) : 7024.9  
 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	2048-07-07T04:44:41.521		20.85	-18.58	140461.00	-22.39		
A (OER)	I	2048-07-07T04:47:26.225		21.24	-18.99	136774.40	-22.38		
Encke (OEG)	I	2048-07-07T04:49:41.604		21.56	-19.32	133744.89	-22.38		
Encke (IEG)	I	2048-07-07T04:49:55.976		21.59	-19.35	133423.31	-22.38		
A (IER)	I	2048-07-07T04:58:24.511		22.75	-20.58	122050.38	-22.35		
B (OER)	I	2048-07-07T05:01:44.958		23.20	-21.05	117571.16	-22.34		
B (IER)	I	2048-07-07T05:20:52.709		25.63	-23.64	91984.69	-22.23		
C (IER)	I	2048-07-07T05:34:02.146		27.17	-25.29	74490.58	-22.07		
Saturn	I	2048-07-07T05:43:44.085		28.22	-26.43	60257.01		-5.29	-6.49
Saturn	E	2048-07-07T07:21:00.915		34.37	-33.83	60154.26		17.26	20.86
C (IER)	E	2048-07-07T07:21:53.449		34.38	-33.86	74490.58	22.05		
B (IER)	E	2048-07-07T07:35:03.597		34.50	-34.18	91984.69	22.21		
B (OER)	E	2048-07-07T07:54:12.399		34.36	-34.33	117571.17	22.32		
A (IER)	E	2048-07-07T07:57:33.042		34.30	-34.32	122050.38	22.33		
Encke (IEG)	E	2048-07-07T08:06:02.096		34.08	-34.24	133423.31	22.35		
Encke (OEG)	E	2048-07-07T08:06:16.484		34.08	-34.24	133744.89	22.35		
A (OER)	E	2048-07-07T08:08:32.006		34.01	-34.20	136774.40	22.36		
F ring	E	2048-07-07T08:11:16.888		33.91	-34.16	140461.00	22.36		

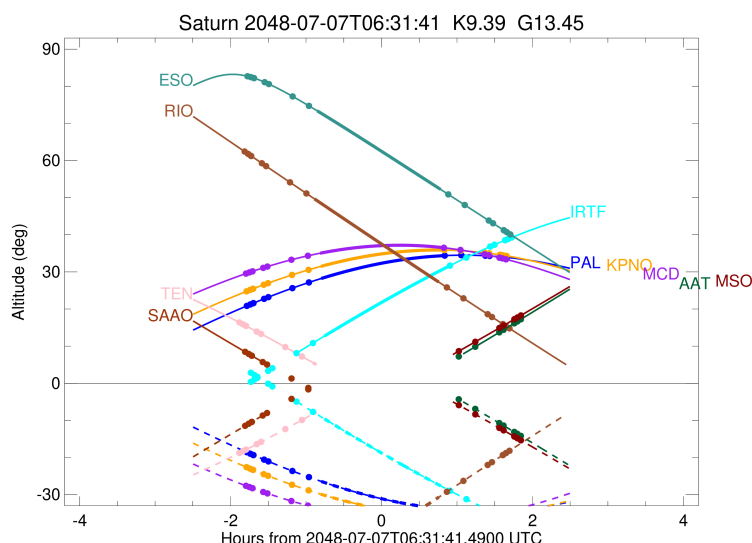
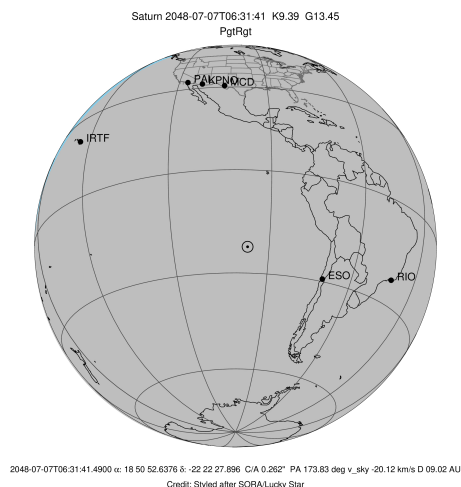
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:32:04.530  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KPNO  
 Location : Kitt Peak Natl Obs  
 Latitude (deg) : 31.96333  
 E. Longitude (deg) : 248.40000  
 Altitude (km) : 2.120  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.15  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 1.059  
 C/A sky separation (km) : 6928.8  
 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	2048-07-07T04:44:26.128		24.77	-22.61	140461.00	-22.41		
A (OER)	I	2048-07-07T04:47:10.671		25.13	-23.00	136774.40	-22.40		
Encke (OEG)	I	2048-07-07T04:49:25.918		25.43	-23.31	133744.89	-22.40		
Encke (IEG)	I	2048-07-07T04:49:40.277		25.46	-23.34	133423.31	-22.40		
A (IER)	I	2048-07-07T04:58:08.326		26.55	-24.50	122050.38	-22.37		
B (OER)	I	2048-07-07T05:01:28.585		26.96	-24.94	117571.16	-22.36		
B (IER)	I	2048-07-07T05:20:35.262		29.18	-27.34	91984.69	-22.25		
C (IER)	I	2048-07-07T05:33:43.918		30.56	-28.85	74490.58	-22.10		
Saturn	I	2048-07-07T05:43:24.046		31.48	-29.88	60256.81		-5.34	-6.55
Saturn	E	2048-07-07T07:20:38.411		35.89	-35.66	60155.75		17.15	20.72
C (IER)	E	2048-07-07T07:21:38.011		35.88	-35.67	74490.58	22.06		
B (IER)	E	2048-07-07T07:34:48.058		35.71	-35.72	91984.69	22.21		
B (OER)	E	2048-07-07T07:53:57.037		35.15	-35.46	117571.16	22.31		
A (IER)	E	2048-07-07T07:57:17.742		35.01	-35.37	122050.38	22.32		
Encke (IEG)	E	2048-07-07T08:05:46.984		34.61	-35.10	133423.31	22.34		
Encke (OEG)	E	2048-07-07T08:06:01.377		34.60	-35.10	133744.89	22.34		
A (OER)	E	2048-07-07T08:08:16.958		34.48	-35.01	136774.40	22.35		
F ring	E	2048-07-07T08:11:01.915		34.32	-34.90	140461.00	22.35		

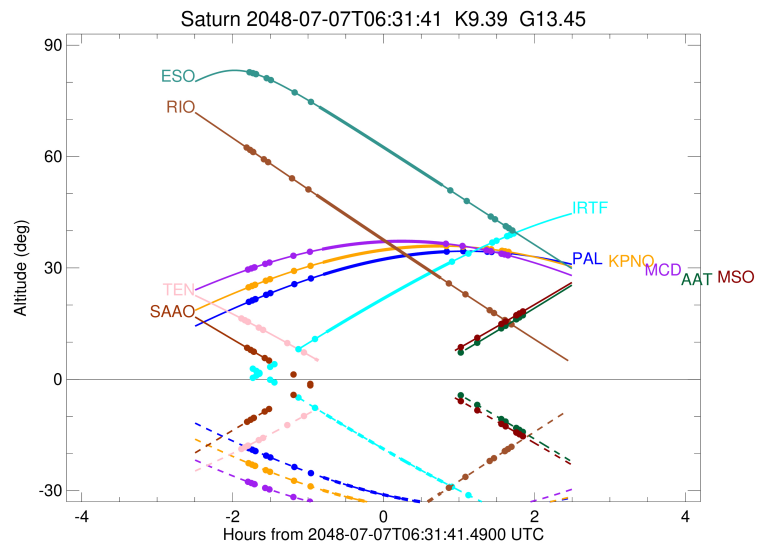
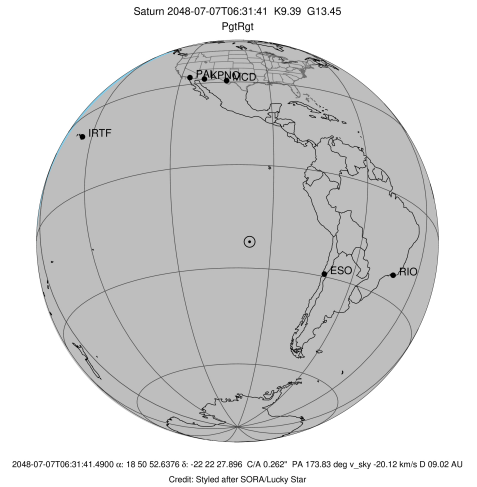
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:31:30.960  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.24  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 1.039  
 C/A sky separation (km) : 6800.2  
 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	2048-07-07T04:43:58.877		29.56	-27.62	140461.00	-22.43		
A (OER)	I	2048-07-07T04:46:43.254		29.87	-27.97	136774.40	-22.42		
Encke (OEG)	I	2048-07-07T04:48:58.367		30.13	-28.24	133744.88	-22.42		
Encke (IEG)	I	2048-07-07T04:49:12.711		30.16	-28.27	133423.31	-22.42		
A (IER)	I	2048-07-07T04:57:40.272		31.09	-29.29	122050.38	-22.39		
B (OER)	I	2048-07-07T05:01:00.343		31.44	-29.68	117571.16	-22.38		
B (IER)	I	2048-07-07T05:20:05.974		33.27	-31.73	91984.69	-22.27		
C (IER)	I	2048-07-07T05:33:13.871		34.35	-32.96	74490.58	-22.12		
Saturn	I	2048-07-07T05:42:51.914		35.03	-33.78	60256.56		-5.39	-6.62
Saturn	E	2048-07-07T07:20:05.020		36.55	-36.81	60157.78		16.99	20.54
C (IER)	E	2048-07-07T07:21:14.225		36.51	-36.79	74490.58	22.06		
B (IER)	E	2048-07-07T07:34:24.496		35.92	-36.41	91984.69	22.20		
B (OER)	E	2048-07-07T07:53:34.235		34.74	-35.53	117571.17	22.29		
A (IER)	E	2048-07-07T07:56:55.111		34.50	-35.34	122050.38	22.30		
Encke (IEG)	E	2048-07-07T08:05:24.837		33.84	-34.81	133423.31	22.32		
Encke (OEG)	E	2048-07-07T08:05:39.245		33.82	-34.79	133744.89	22.32		
A (OER)	E	2048-07-07T08:07:54.965		33.63	-34.64	136774.40	22.32		
F ring	E	2048-07-07T08:10:40.097		33.39	-34.44	140461.00	22.33		

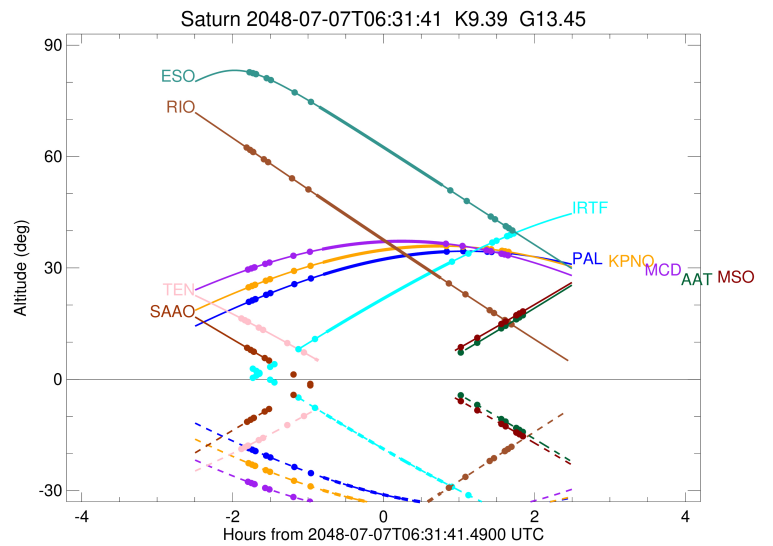
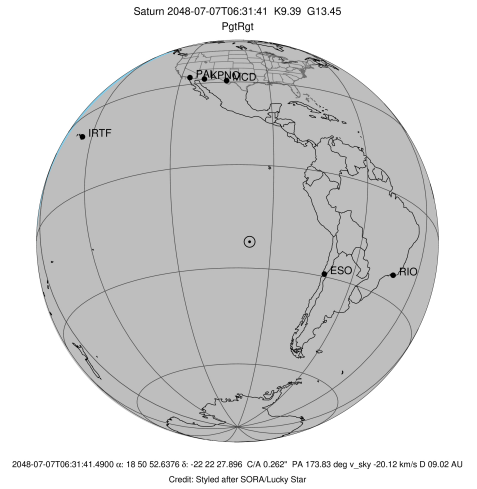
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:26:50.570  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.47  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.630  
 C/A sky separation (km) : 4123.6  
 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	2048-07-07T04:38:45.519		16.37	-18.77	140461.00	-22.20		
A (OER)	I	2048-07-07T04:41:31.599		15.89	-18.30	136774.40	-22.19		
Encke (OEG)	I	2048-07-07T04:43:48.121		15.48	-17.91	133744.89	-22.19		
Encke (IEG)	I	2048-07-07T04:44:02.615		15.44	-17.87	133423.31	-22.19		
A (IER)	I	2048-07-07T04:52:35.511		13.91	-16.39	122050.38	-22.16		
B (OER)	I	2048-07-07T04:55:57.685		13.30	-15.80	117571.16	-22.15		
B (IER)	I	2048-07-07T05:15:14.768		9.73	-12.34	91984.69	-22.07		
C (IER)	I	2048-07-07T05:28:28.766		7.22	-9.90	74490.58	-21.99		
Saturn	I	2048-07-07T05:37:14.611		5.54	-8.25	60246.89		-7.34	-8.99
Saturn	E	2048-07-07T07:16:36.728		-14.64x	11.56x	60187.83		14.42	17.51
C (IER)	E	2048-07-07T07:20:14.427		-15.40x	12.32x	74490.58	21.78		
B (IER)	E	2048-07-07T07:33:36.898		-18.23x	15.11x	91984.69	21.82		
B (OER)	E	2048-07-07T07:53:09.326		-22.40x	19.24x	117571.16	21.83		
A (IER)	E	2048-07-07T07:56:34.546		-23.14x	19.96x	122050.38	21.83		
Encke (IEG)	E	2048-07-07T08:05:15.651		-25.00x	21.81x	133423.31	21.82		
Encke (OEG)	E	2048-07-07T08:05:30.387		-25.06x	21.86x	133744.89	21.82		
A (OER)	E	2048-07-07T08:07:49.214		-25.56x	22.36x	136774.40	21.82		
F ring	E	2048-07-07T08:10:38.164		-26.16x	22.96x	140461.00	21.82		

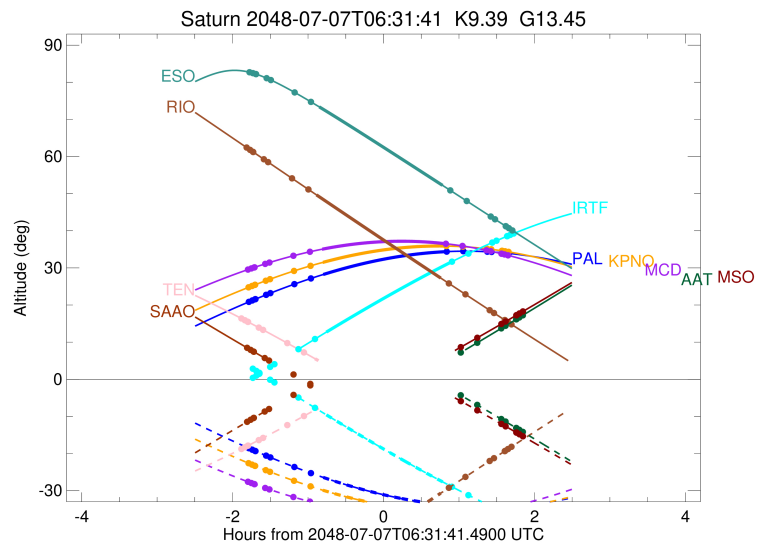
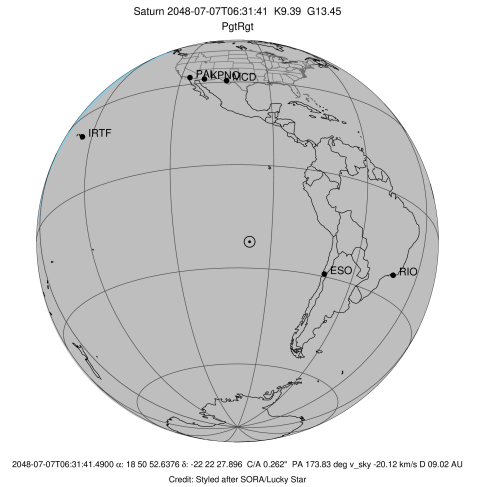
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:35:21.870  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : IRTF  
 Location : Mauna Kea/IRTF  
 Latitude (deg) : 19.82622  
 E. Longitude (deg) : 204.52800  
 Altitude (km) : 4.168  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 140.59  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.852  
 C/A sky separation (km) : 5571.6  
 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	2048-07-07T04:47:50.956	0.39x	2.83x	140461.00	-22.29			
A (OER)	I	2048-07-07T04:50:36.369	0.98x	2.23x	136774.40	-22.29			
Encke (OEG)	I	2048-07-07T04:52:52.299	1.47x	1.74x	133744.89	-22.29			
Encke (IEG)	I	2048-07-07T04:53:06.728	1.52x	1.69x	133423.31	-22.29			
A (IER)	I	2048-07-07T05:01:37.047	3.35x	-0.14x	122050.38	-22.28			
B (OER)	I	2048-07-07T05:04:58.067	4.06x	-0.86x	117571.17	-22.28			
B (IER)	I	2048-07-07T05:24:07.318	8.11	-4.94x	91984.69	-22.24			
C (IER)	I	2048-07-07T05:37:15.286	10.85	-7.70	74490.58	-22.16			
Saturn	I	2048-07-07T05:46:13.681	12.70	-9.57	60249.83			-6.80	-8.34
Saturn	E	2048-07-07T07:24:15.599	31.36	-28.63	60166.42			16.29	19.71
C (IER)	E	2048-07-07T07:26:05.004	31.67	-28.95	74490.58	22.27			
B (IER)	E	2048-07-07T07:39:08.458	33.84	-31.21	91984.69	22.38			
B (OER)	E	2048-07-07T07:58:09.257	36.82	-34.34	117571.16	22.47			
A (IER)	E	2048-07-07T08:01:28.583	37.31	-34.87	122050.38	22.48			
Encke (IEG)	E	2048-07-07T08:09:54.321	38.53	-36.17	133423.31	22.50			
Encke (OEG)	E	2048-07-07T08:10:08.614	38.57	-36.21	133744.88	22.50			
A (OER)	E	2048-07-07T08:12:23.254	38.88	-36.55	136774.40	22.50			
F ring	E	2048-07-07T08:15:07.060	39.26	-36.95	140461.00	22.51			

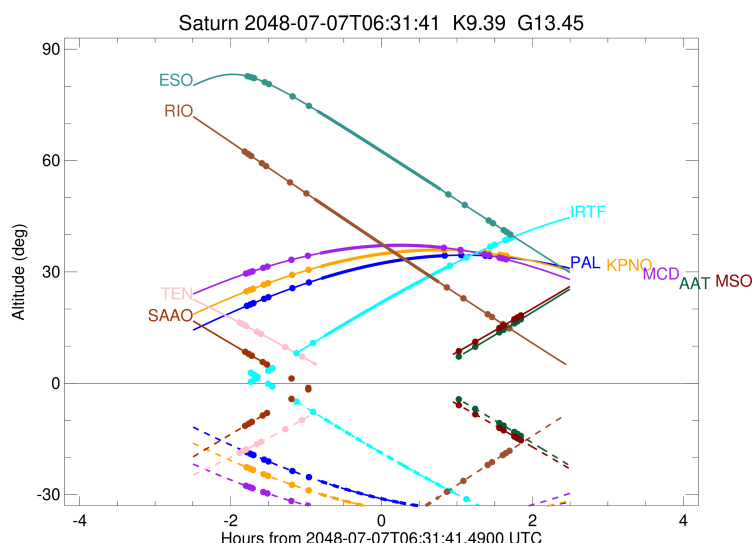
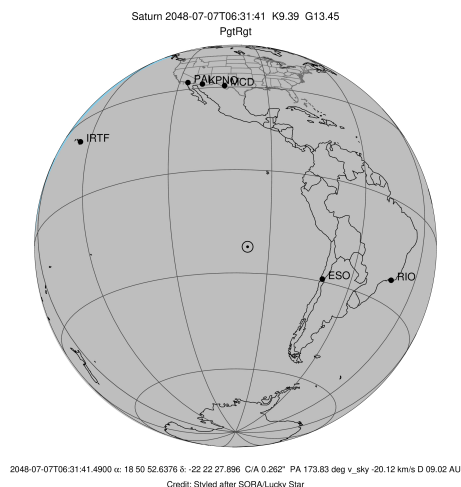
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:27:46.070  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.72  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.021  
 C/A sky separation (km) : 135.4  
 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	2048-07-07T04:42:55.821		62.41	-65.78	140461.00	-22.43		
A (OER)	I	2048-07-07T04:45:40.193		61.78	-65.15	136774.40	-22.43		
Encke (OEG)	I	2048-07-07T04:47:55.292		61.26	-64.64	133744.89	-22.42		
Encke (IEG)	I	2048-07-07T04:48:09.634		61.20	-64.58	133423.31	-22.42		
A (IER)	I	2048-07-07T04:56:37.013		59.26	-62.64	122050.38	-22.41		
B (OER)	I	2048-07-07T04:59:56.932		58.49	-61.88	117571.16	-22.40		
B (IER)	I	2048-07-07T05:18:59.945		54.12	-57.51	91984.69	-22.37		
C (IER)	I	2048-07-07T05:32:02.534		51.12	-54.52	74490.58	-22.34		
Saturn	I	2048-07-07T05:38:30.788		49.64	-53.04	60222.74		-10.78	-13.16
Saturn	E	2048-07-07T07:17:12.805		27.26	-30.68	60221.05		10.98	13.40
C (IER)	E	2048-07-07T07:23:36.046		25.83	-29.25	74490.58	22.12		
B (IER)	E	2048-07-07T07:36:47.141		22.89	-26.31	91984.69	22.10		
B (OER)	E	2048-07-07T07:56:05.703		18.61	-22.02	117571.17	22.07		
A (IER)	E	2048-07-07T07:59:28.718		17.86	-21.27	122050.38	22.06		
Encke (IEG)	E	2048-07-07T08:08:04.447		15.97	-19.37	133423.31	22.04		
Encke (OEG)	E	2048-07-07T08:08:19.035		15.91	-19.32	133744.89	22.04		
A (OER)	E	2048-07-07T08:10:36.482		15.41	-18.81	136774.40	22.04		
F ring	E	2048-07-07T08:13:23.777		14.80	-18.20	140461.00	22.03		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:29:33.320  
 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 : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.63  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.061  
 C/A sky separation (km) : 400.4  
 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\_itr93\_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

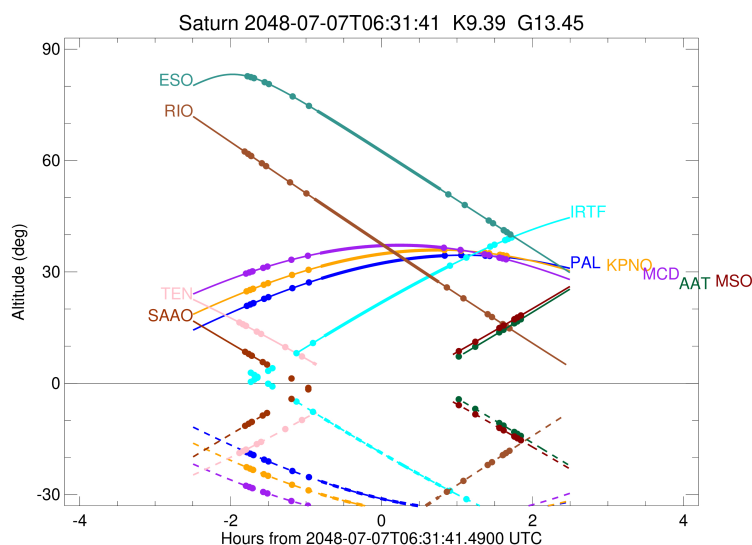
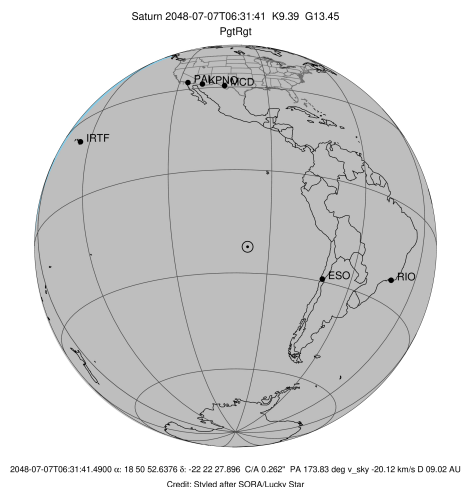


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2048-07-07T04:45:12.691		82.70	-83.38	140461.00	-22.53		
A (OER)	I	2048-07-07T04:47:56.298		82.45	-83.40	136774.40	-22.53		
Encke (OEG)	I	2048-07-07T04:50:10.757		82.22	-83.38	133744.89	-22.53		
Encke (IEG)	I	2048-07-07T04:50:25.030		82.19	-83.38	133423.31	-22.53		
A (IER)	I	2048-07-07T04:58:49.907		81.10	-82.96	122050.38	-22.52		
B (OER)	I	2048-07-07T05:02:08.802		80.60	-82.66	117571.16	-22.52		
B (IER)	I	2048-07-07T05:21:05.541		77.26	-80.04	91984.69	-22.50		
C (IER)	I	2048-07-07T05:34:03.445		74.71	-77.70	74490.58	-22.48		
Saturn	I	2048-07-07T05:40:33.139		73.39	-76.45	60223.49		-10.69	-13.05
Saturn	E	2048-07-07T07:18:39.869		52.23	-55.58	60218.24		11.31	13.80
C (IER)	E	2048-07-07T07:24:45.212		50.89	-54.25	74490.58	22.32		
B (IER)	E	2048-07-07T07:37:49.285		48.03	-51.39	91984.69	22.30		
B (OER)	E	2048-07-07T07:56:57.298		43.84	-47.22	117571.16	22.27		
A (IER)	E	2048-07-07T08:00:18.438		43.11	-46.48	122050.38	22.27		
Encke (IEG)	E	2048-07-07T08:08:49.375		41.25	-44.63	133423.31	22.25		
Encke (OEG)	E	2048-07-07T08:09:03.827		41.20	-44.57	133744.89	22.25		
A (OER)	E	2048-07-07T08:11:19.990		40.70	-44.08	136774.40	22.25		
F ring	E	2048-07-07T08:14:05.719		40.10	-43.48	140461.00	22.24		



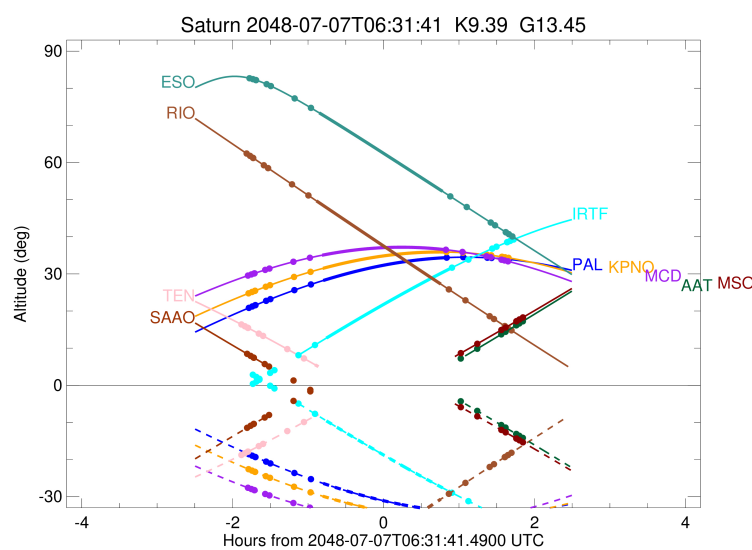
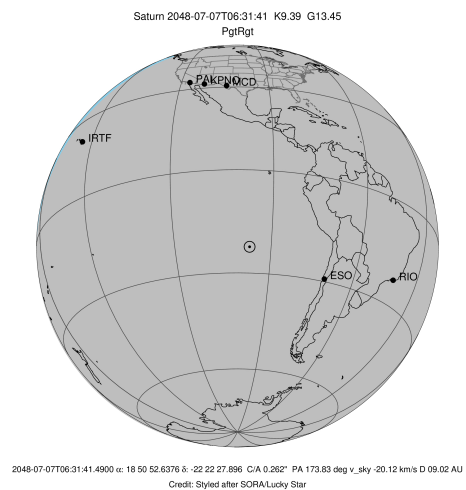
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:36:17.210  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : AAT  
 Location : Siding Spring (AAT)  
 Latitude (deg) : -31.27703  
 E. Longitude (deg) : 149.06608  
 Altitude (km) : 1.164  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 140.19  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.216  
 C/A sky separation (km) : 1411.4  
 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	2048-07-07T04:51:07.826	-21.78x	23.75x	140461.00	-21.95			
A (OER)	I	2048-07-07T04:53:55.731	-21.36x	23.36x	136774.40	-21.96			
Encke (OEG)	I	2048-07-07T04:56:13.684	-21.02x	23.03x	133744.89	-21.96			
Encke (IEG)	I	2048-07-07T04:56:28.326	-20.98x	22.99x	133423.31	-21.96			
A (IER)	I	2048-07-07T05:05:06.009	-19.65x	21.73x	122050.38	-21.98			
B (OER)	I	2048-07-07T05:08:29.814	-19.12x	21.23x	117571.16	-21.98			
B (IER)	I	2048-07-07T05:27:53.160	-15.98x	18.23x	91984.69	-22.01			
C (IER)	I	2048-07-07T05:41:07.854	-13.74x	16.09x	74490.58	-22.02			
Saturn	I	2048-07-07T05:46:02.293	-12.90x	15.28x	60203.61	-12.89		-12.89	-15.70
Saturn	E	2048-07-07T07:26:20.902	5.86	-3.00x	60225.20	10.48		10.48	12.80
C (IER)	E	2048-07-07T07:33:04.400	7.20	-4.31x	74490.58	22.22			
B (IER)	E	2048-07-07T07:46:10.943	9.83	-6.89	91984.69	22.26			
B (OER)	E	2048-07-07T08:05:19.440	13.71	-10.71	117571.16	22.30			
A (IER)	E	2048-07-07T08:08:40.293	14.39	-11.39	122050.38	22.30			
Encke (IEG)	E	2048-07-07T08:17:10.014	16.14	-13.11	133423.31	22.32			
Encke (OEG)	E	2048-07-07T08:17:24.422	16.19	-13.16	133744.89	22.32			
A (OER)	E	2048-07-07T08:19:40.138	16.65	-13.62	136774.40	22.32			
F ring	E	2048-07-07T08:22:25.258	17.22	-14.18	140461.00	22.33			

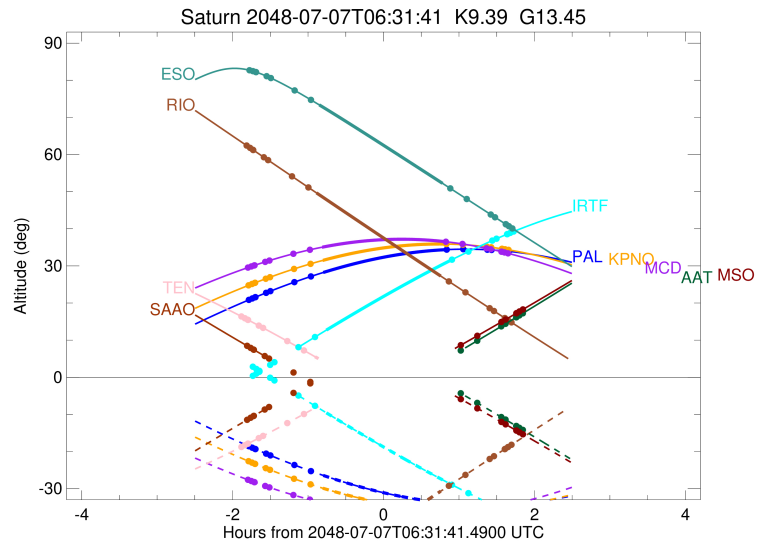
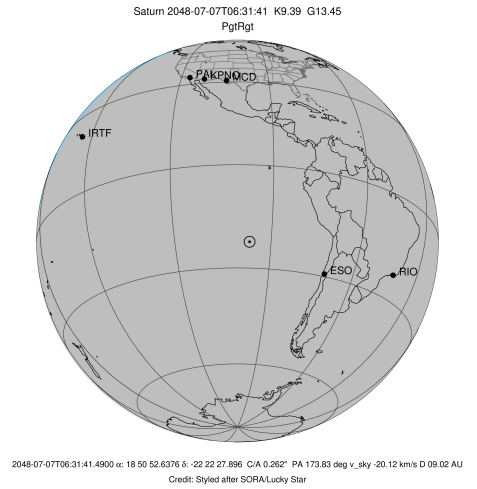
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:28:14.240  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : SAAO  
 Location : So. Afr. Astro. Obs. (Sutherland)  
 Latitude (deg) : -32.37953  
 E. Longitude (deg) : 20.81070  
 Altitude (km) : 1.768  
 Gaia source ID : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 141.16  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.452  
 C/A sky separation (km) : 2956.7  
 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	2048-07-07T04:43:18.622		8.46	-11.45	140461.00	-21.94		
A (OER)	I	2048-07-07T04:46:06.654		7.90	-10.90	136774.40	-21.94		
Encke (OEG)	I	2048-07-07T04:48:24.772		7.45	-10.44	133744.89	-21.93		
Encke (IEG)	I	2048-07-07T04:48:39.435		7.40	-10.39	133423.31	-21.93		
A (IER)	I	2048-07-07T04:57:18.243		5.70	-8.68	122050.38	-21.91		
B (OER)	I	2048-07-07T05:00:42.708		5.04	-8.01	117571.16	-21.90		
B (IER)	I	2048-07-07T05:20:12.270		1.28x	-4.20x	91984.69	-21.85		
C (IER)	I	2048-07-07T05:33:33.877		-1.26x	-1.64x	74490.58	-21.80		
Saturn	I	2048-07-07T05:37:59.529		-2.09x	-0.80x	60197.38		-13.52	-16.44
Saturn	E	2048-07-07T07:18:42.205		-19.37x	16.90x	60239.65		8.51	10.42
C (IER)	E	2048-07-07T07:26:55.052		-20.60x	18.18x	74490.58	21.67		
B (IER)	E	2048-07-07T07:40:22.009		-22.55x	20.22x	91984.69	21.69		
B (OER)	E	2048-07-07T08:00:01.428		-25.20x	23.03x	117571.16	21.70		
A (IER)	E	2048-07-07T08:03:27.857		-25.65x	23.50x	122050.38	21.70		
Encke (IEG)	E	2048-07-07T08:12:11.965		-26.73x	24.67x	133423.31	21.70		
Encke (OEG)	E	2048-07-07T08:12:26.784		-26.76x	24.70x	133744.89	21.70		
A (OER)	E	2048-07-07T08:14:46.391		-27.04x	25.00x	136774.40	21.70		
F ring	E	2048-07-07T08:17:36.278		-27.38x	25.36x	140461.00	21.70		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2048-07-07T06:36:07.470  
 Event type : PgtRgt  
 : Saturn 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 : 4078691542076153984  
 2Mass ID (if available) : 18505264-2222278  
 ICRS Star Coord at Epoch: 18h 50m 52.63760s -22:22:27.89595s  
 RUWE (>1.4 is poor) : 1.10  
 K magnitude : 9.388  
 G magnitude : 13.448  
 RP magnitude : 12.321  
 BP magnitude : 14.785  
 DUPflag : 0  
 Distance (au) : 9.021  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.12  
 Sun-Target sep (deg) : 176.54  
 Sun-Moon sep (deg) : 140.23  
 B (ring opening deg) : 25.29  
 PA of pole (deg) : 6.36  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.268  
 C/A sky separation (km) : 1754.6  
 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	2048-07-07T04:51:13.496	-18.88x	20.70x	140461.00	-21.96			
A (OER)	I	2048-07-07T04:54:01.365	-18.49x	20.34x	136774.40	-21.96			
Encke (OEG)	I	2048-07-07T04:56:19.291	-18.16x	20.03x	133744.89	-21.97			
Encke (IEG)	I	2048-07-07T04:56:33.930	-18.13x	20.00x	133423.31	-21.97			
A (IER)	I	2048-07-07T05:05:11.528	-16.88x	18.82x	122050.38	-21.98			
B (OER)	I	2048-07-07T05:08:35.309	-16.38x	18.34x	117571.16	-21.98			
B (IER)	I	2048-07-07T05:27:58.628	-13.42x	15.53x	91984.69	-22.00			
C (IER)	I	2048-07-07T05:41:13.458	-11.31x	13.51x	74490.58	-22.01			
Saturn	I	2048-07-07T05:45:54.101	-10.55x	12.78x	60200.88			-13.17	-16.02
Saturn	E	2048-07-07T07:26:10.441	7.32	-4.59x	60227.69			10.17	12.42
C (IER)	E	2048-07-07T07:33:07.335	8.64	-5.89	74490.58	22.21			
B (IER)	E	2048-07-07T07:46:14.368	11.16	-8.36	91984.69	22.24			
B (OER)	E	2048-07-07T08:05:23.496	14.89	-12.03	117571.17	22.29			
A (IER)	E	2048-07-07T08:08:44.457	15.55	-12.68	122050.38	22.29			
Encke (IEG)	E	2048-07-07T08:17:14.449	17.22	-14.33	133423.31	22.31			
Encke (OEG)	E	2048-07-07T08:17:28.864	17.27	-14.38	133744.89	22.31			
A (OER)	E	2048-07-07T08:19:44.653	17.72	-14.82	136774.40	22.31			
F ring	E	2048-07-07T08:22:29.860	18.26	-15.35	140461.00	22.32			