

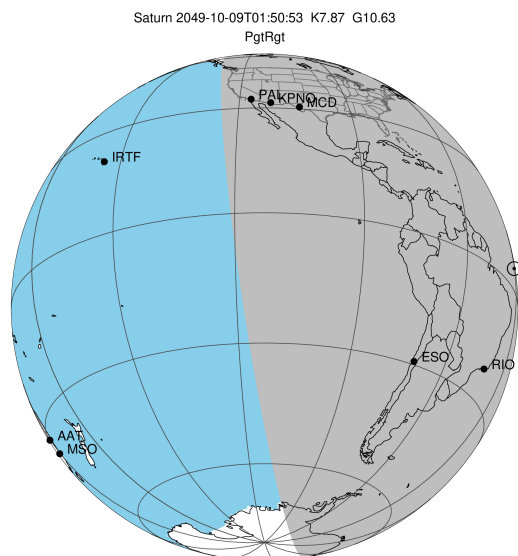
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T01:50:53.480  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041

ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s

RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.15  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74

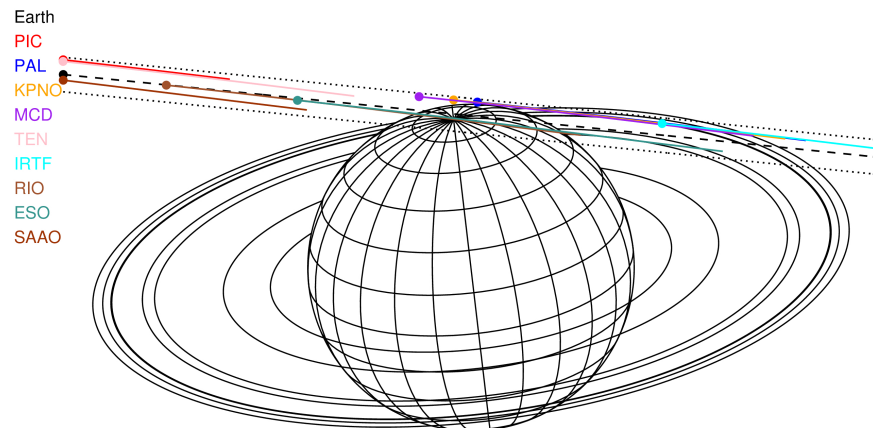
# a(km) ring

- 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



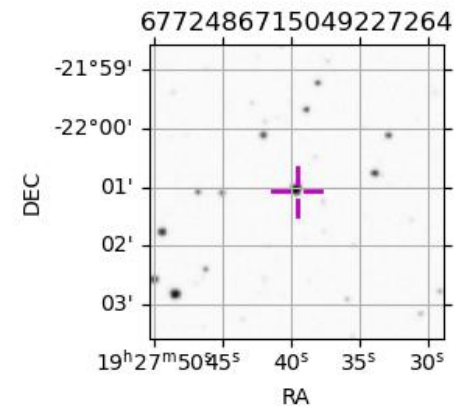
2049-10-09T01:50:53.4800 α: 19 27 39.7190 δ: -22 01 04.578 C/A 7.796° PA 174.21 deg v\_sky + 7.16 km/s D 09.86 AU  
 Credit: Styled after SORA/Lucky Star

Saturn 2049-10-09T01:50:53 K7.87 G10.63 PgtRgt

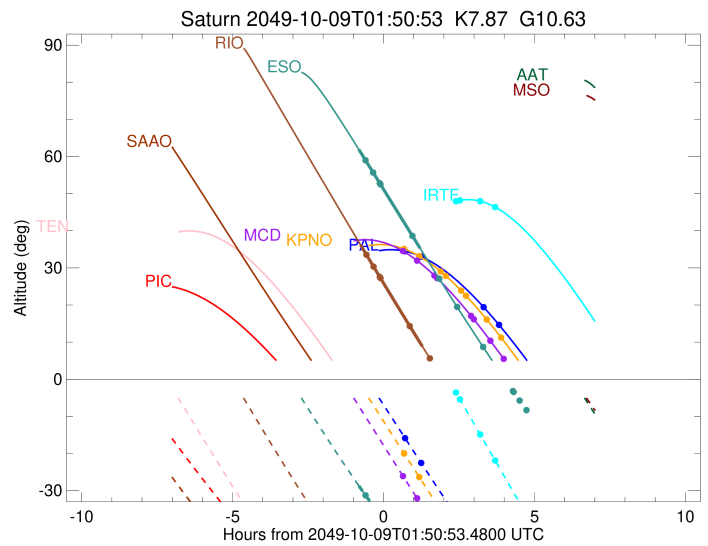
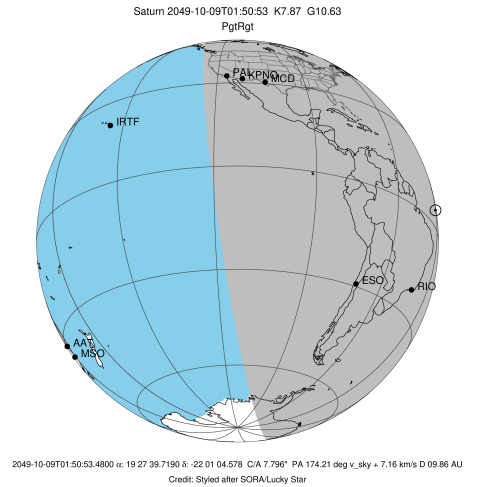


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+		+	OCT 09 02:33 - OCT 09 05:41	PnnRie
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4	+		+	OCT 09 02:31 - OCT 09 05:45	PnnRie
MCD	McDonald Obs.	30.7	256.0	+		+	OCT 09 02:29 - OCT 09 05:50	PnnRie
TEN	Teide Obs./Ten	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5			+	OCT 09 04:24 - OCT 09 05:33	PnnRne
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+	+		OCT 09 01:05 - OCT 09 03:21	PieRin
ESO	European South	-29.3	289.3	+	+	+	OCT 09 01:01 - OCT 09 05:09	PieRie
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 : 2049-10-09T01:52:08.820  
 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 : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.56  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 8.526  
 C/A sky separation (km) : 60991.5  
 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



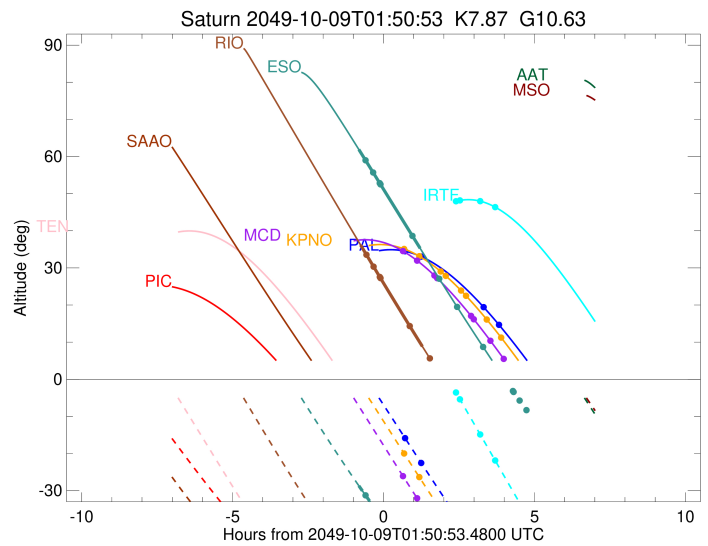
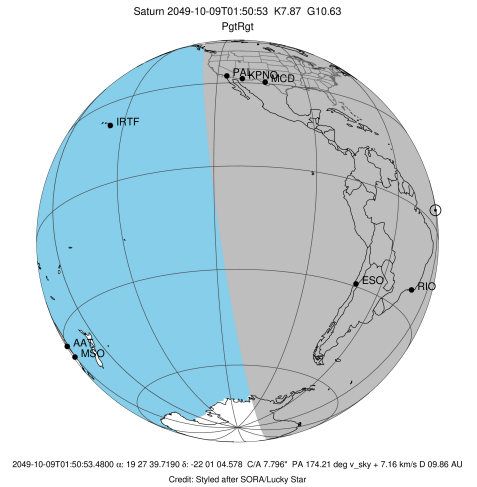
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T02:33:33.176		34.50	-15.82	140461.00	-2.28		
A (OER)	I	2049-10-09T03:05:15.554		33.08	-22.43	136774.40	-1.58		

No planet occultations

A (OER)	E	2049-10-09T05:11:01.154		19.27	-47.32	136774.40	1.65		
F ring	E	2049-10-09T05:41:13.431		14.54	-52.51	140461.00	2.42		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T01:53:39.660  
 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 : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.54  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 8.506  
 C/A sky separation (km) : 60849.3  
 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\_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

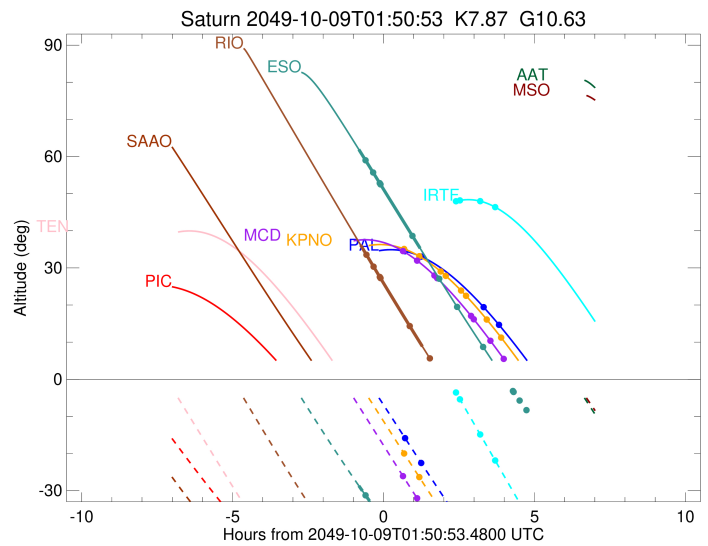
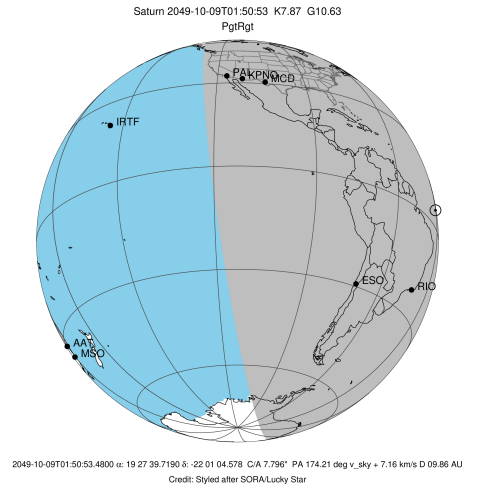


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T02:31:42.627		35.11	-19.95	140461.00	-2.38		
A (OER)	I	2049-10-09T03:01:36.762		33.19	-26.26	136774.40	-1.72		
Encke (OEG)	I	2049-10-09T03:42:42.442		29.25	-34.79	133744.89	-0.72		
Encke (IEG)	I	2049-10-09T03:51:34.909		28.23	-36.60	133423.38	-0.49		

No planet occultations

Encke (IEG)	E	2049-10-09T04:28:33.875		23.40	-43.95	133423.45	0.50		
Encke (OEG)	E	2049-10-09T04:37:18.314		22.14	-45.63	133744.90	0.73		
A (OER)	E	2049-10-09T05:17:07.674		15.93	-52.85	136774.40	1.80		
F ring	E	2049-10-09T05:45:27.351		11.10	-57.37	140461.00	2.53		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T01:55:51.730  
 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 : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.49  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 8.478  
 C/A sky separation (km) : 60651.2  
 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

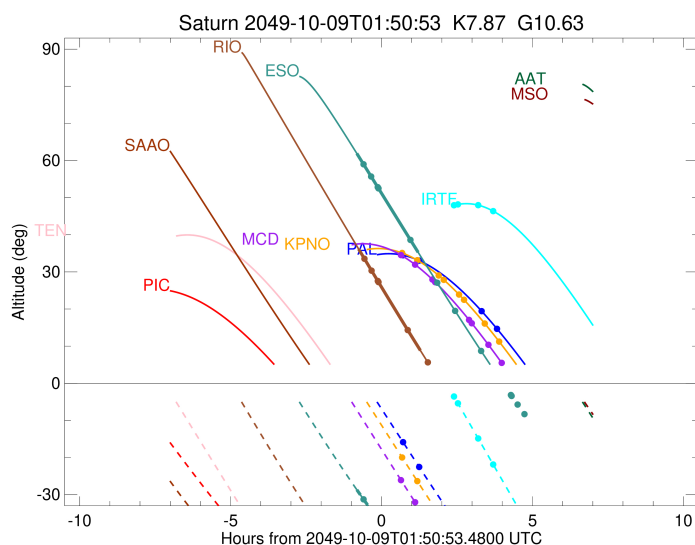
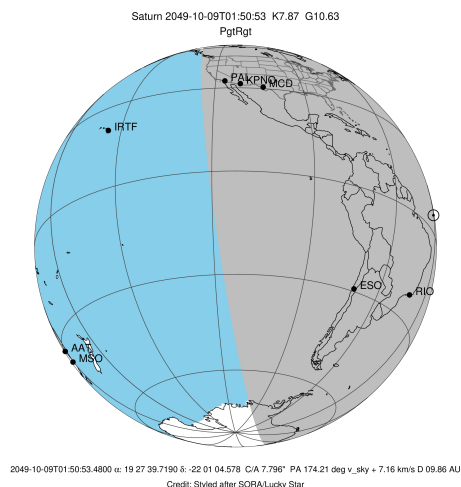


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T02:29:27.906		34.54	-26.06	140461.00	-2.51		
A (OER)	I	2049-10-09T02:57:18.048		32.00	-31.97	136774.40	-1.90		
Encke (OEG)	I	2049-10-09T03:31:03.557		28.09	-38.99	133744.89	-1.08		
Encke (IEG)	I	2049-10-09T03:36:21.491		27.40	-40.07	133423.31	-0.94		

No planet occultations

Encke (IEG)	E	2049-10-09T04:46:42.332		16.77	-53.59	133423.31	0.97		
Encke (OEG)	E	2049-10-09T04:51:51.940		15.90	-54.49	133744.89	1.11		
A (OER)	E	2049-10-09T05:24:18.258		10.20	-59.64	136774.40	2.00		
F ring	E	2049-10-09T05:50:30.284		5.37	-62.95	140461.00	2.69		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T01:40:17.400  
 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 : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.84  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 8.356  
 C/A sky separation (km) : 59780.0  
 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

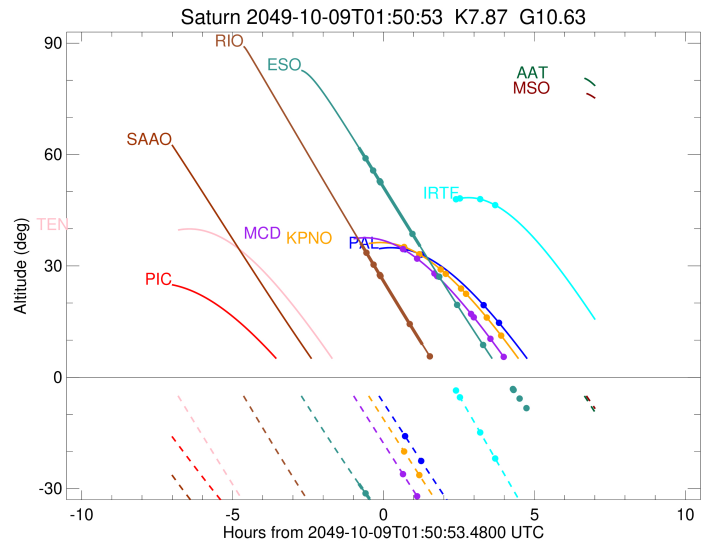
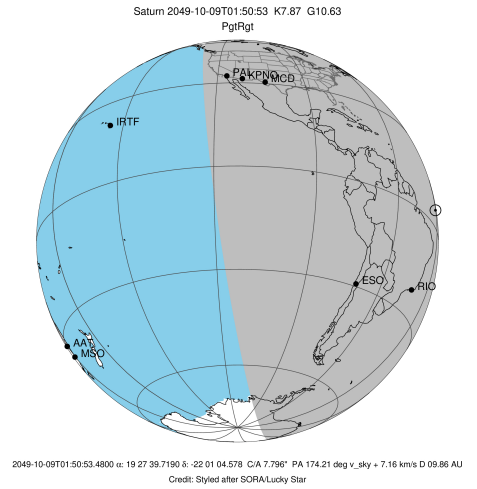


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T02:07:02.735		34.10	25.93x	140461.00	-2.36		
A (OER)	I	2049-10-09T02:37:09.242		38.73	19.12x	136774.40	-1.72		
Encke (OEG)	I	2049-10-09T03:16:52.250		43.73	9.99x	133744.89	-0.81		
Encke (IEG)	I	2049-10-09T03:24:14.609		44.49	8.28x	133423.32	-0.64		

No planet occultations

Encke (IEG)	E	2049-10-09T04:17:34.822		48.04	-4.17x	133423.33	0.64		
Encke (OEG)	E	2049-10-09T04:24:54.139		48.23	-5.89	133744.89	0.82		
A (OER)	E	2049-10-09T05:04:08.043		47.94	-15.11	136774.40	1.75		
F ring	E	2049-10-09T05:33:38.159		46.31	-22.06	140461.00	2.41		

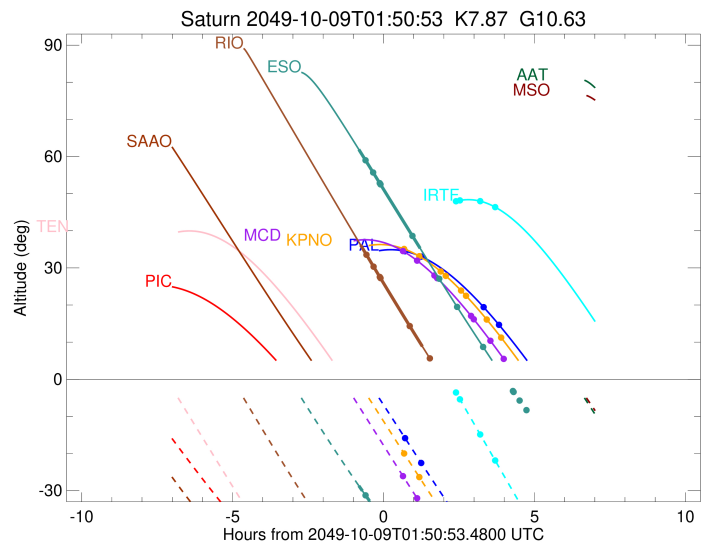
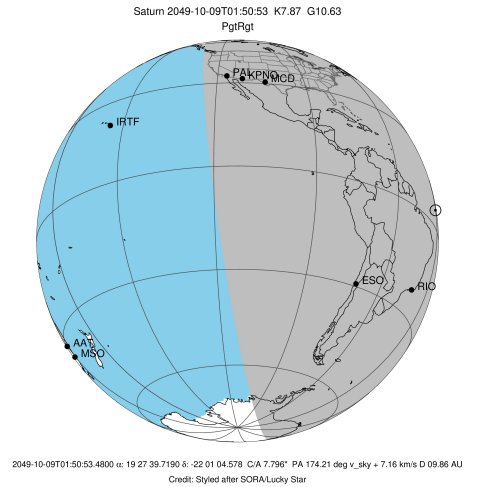
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T02:06:27.580  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.11  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 7.480  
 C/A sky separation (km) : 53510.9  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T01:17:06.622	b	33.51	-54.51	140461.00	-4.45		
A (OER)	I	2049-10-09T01:31:18.313	b	30.31	-56.37	136774.40	-4.20		
Encke (OEG)	I	2049-10-09T01:43:39.812	b	27.53	-57.77	133744.89	-3.97		
Encke (IEG)	I	2049-10-09T01:45:01.187	b	27.22	-57.91	133423.31	-3.94		
A (IER)	I	2049-10-09T02:42:58.294	b	14.34	-60.84	122050.38	-2.52		
B (OER)	I	2049-10-09T03:21:42.228		5.91	-59.11	117571.16	-1.30		
Saturn	I	2049-10-09T01:05:12.929		36.20	-52.77	59373.98		63.44	67.55
Saturn	E	2049-10-09T03:08:19.686		8.81	-60.03	59718.30		44.29	49.87
B (OER)	E	2049-10-09T04:35:04.122		-9.46x	-49.47	117571.17	1.33		
A (IER)	E	2049-10-09T05:12:32.165		-16.89x	-42.65	122050.38	2.64		
Encke (IEG)	E	2049-10-09T06:07:01.336		-26.88x	-31.59	133423.31	4.26		
Encke (OEG)	E	2049-10-09T06:08:16.562		-27.10x	-31.32	133744.89	4.29		
A (OER)	E	2049-10-09T06:19:39.488		-29.02x	-28.90	136774.40	4.58		
F ring	E	2049-10-09T06:32:38.442		-31.13x	-26.10	140461.00	4.88		



target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-10-09T02:02:12.760  
 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 : 6772486715049227264  
 2Mass ID (if available) : 19273969-2201041  
 ICRS Star Coord at Epoch: 19h 27m 39.71897s -22:01:04.57755s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 7.867  
 G magnitude : 10.629  
 RP magnitude : 9.818  
 BP magnitude : 11.338  
 DUPflag : 0  
 Distance (au) : 9.864  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 7.16  
 Sun-Target sep (deg) : 94.71  
 Sun-Moon sep (deg) : 58.54  
 B (ring opening deg) : 23.96  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 7.541  
 C/A sky separation (km) : 53948.7  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-10-09T01:15:21.192	b	58.96	-31.29	140461.00	-4.21		
A (OER)	I	2049-10-09T01:30:24.120	b	55.67	-34.12	136774.40	-3.96		
Encke (OEG)	I	2049-10-09T01:43:33.600	b	52.79	-36.52	133744.89	-3.72		
Encke (IEG)	I	2049-10-09T01:45:00.468	b	52.48	-36.78	133423.31	-3.69		
A (IER)	I	2049-10-09T02:48:15.721	b	38.64	-46.88	122050.38	-2.22		
B (OER)	I	2049-10-09T03:38:42.302		27.72	-52.41	117571.22	-0.70		
Saturn	I	2049-10-09T01:01:40.858		61.93	-28.65	59369.51		63.73	67.81
Saturn	E	2049-10-09T03:03:40.637		35.29	-48.87	59700.66		45.20	50.76
B (OER)	E	2049-10-09T04:20:39.660		18.77	-54.41	117571.28	0.71		
A (IER)	E	2049-10-09T05:09:31.070		8.58	-53.22	122050.38	2.33		
Encke (IEG)	E	2049-10-09T06:08:28.067		-3.23x	-47.29	133423.31	4.04		
Encke (OEG)	E	2049-10-09T06:09:47.342		-3.49x	-47.11	133744.89	4.07		
A (OER)	E	2049-10-09T06:21:44.628		-5.79x	-45.44	136774.40	4.37		
F ring	E	2049-10-09T06:35:18.213		-8.37x	-43.40	140461.00	4.69		