

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:25:20.640  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119

Saturn 2031-12-27T08:25:20 K8.18 G11.09 PgtRgt

ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s

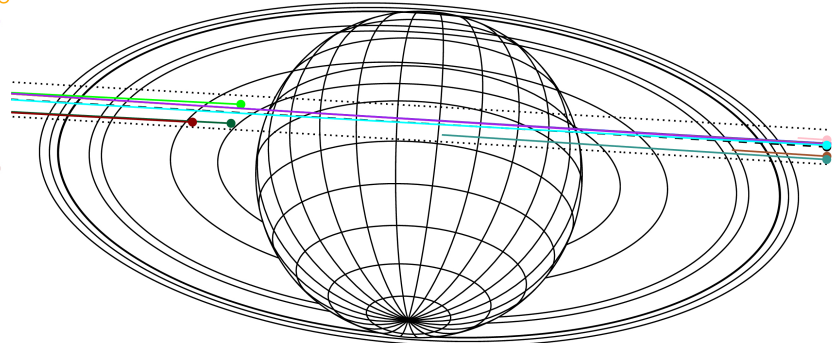
RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 2.15  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30

#	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



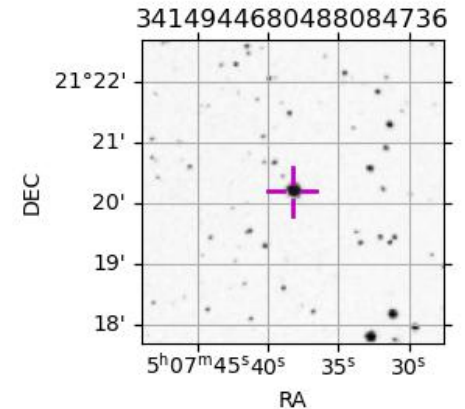
2031-12-27T08:25:20.6400 ra: 05 07 38.2626 s: +21 20 11.928 C/A 3.229° PA 176.66 deg v\_sky -18.77 km/s D 08.08 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PAL  
 PMO  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO  
 AAT  
 MSO

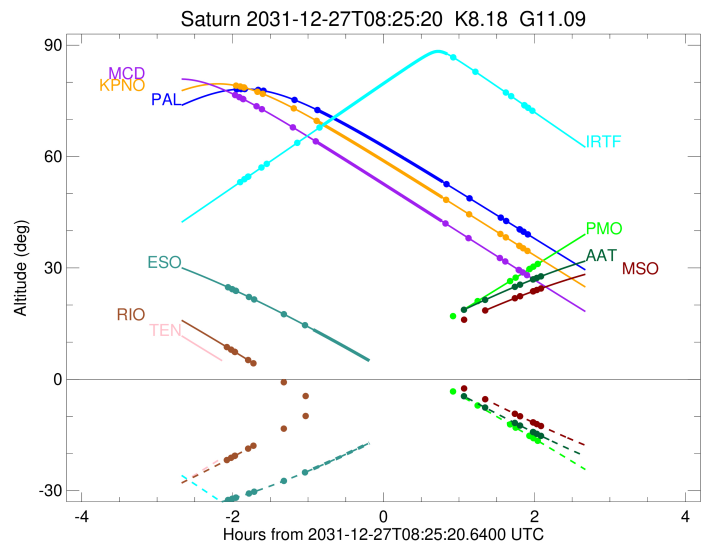
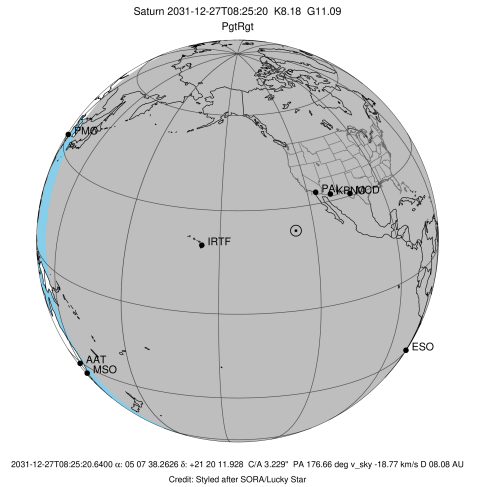


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+	+	+	DEC 27 06:28 - DEC 27 10:20	PieRie
PMO	Purple Mtn Obs	32.1	118.8	+	+	+	DEC 27 09:40 - DEC 27 10:28	PnnRne
KPNO	Kitt Peak Natl	32.0	248.4	+	+	+	DEC 27 06:28 - DEC 27 10:19	PieRie
MCD	McDonald Obs.	30.7	256.0	+	+	+	DEC 27 06:27 - DEC 27 10:19	PieRie
TEN	Teide Obs./Ten	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+	+	+	DEC 27 06:31 - DEC 27 10:23	PieRie
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+			DEC 27 06:20 - DEC 27 06:37	PnnRin
ESO	European South	-29.3	289.3	+	+		DEC 27 06:21 - DEC 27 07:29	PinRin
AAT	Siding Spring	-31.3	149.1			+	DEC 27 09:46 - DEC 27 10:30	PnnRne
SAAO	So. Afr. Astro	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Ob	-35.3	149.0			+	DEC 27 09:46 - DEC 27 10:30	PnnRne



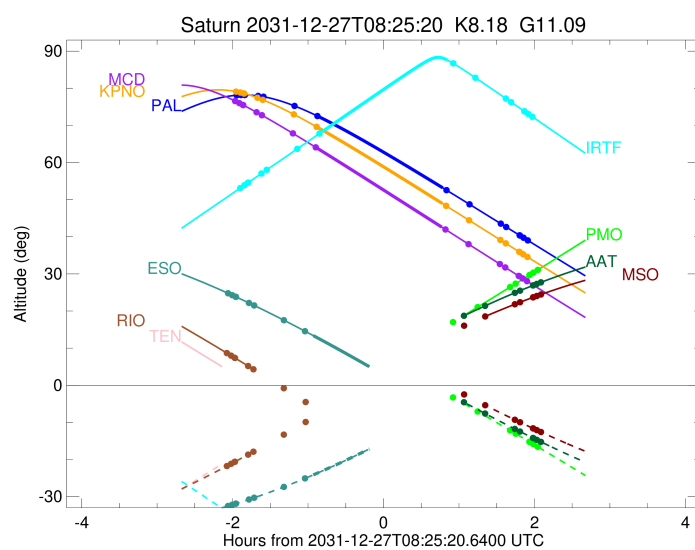
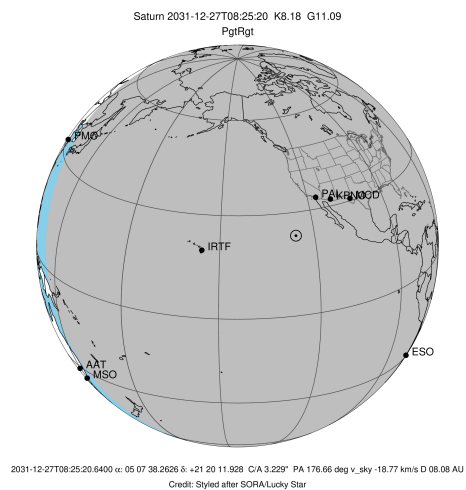
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:23:04.120  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 2.00  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.466  
 C/A sky separation (km) : 20318.1  
 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	2031-12-27T06:28:40.703		78.12	-69.95	140461.00	-18.17		
A (OER)	I	2031-12-27T06:32:03.914		78.18	-70.59	136774.40	-18.11		
Encke (OEG)	I	2031-12-27T06:34:51.418		78.19	-71.11	133744.89	-18.06		
Encke (IEG)	I	2031-12-27T06:35:09.227		78.19	-71.17	133423.31	-18.05		
A (IER)	I	2031-12-27T06:45:43.114		77.95	-73.10	122050.38	-17.82		
B (OER)	I	2031-12-27T06:49:55.280		77.72	-73.84	117571.16	-17.71		
B (IER)	I	2031-12-27T07:14:38.268		75.24	-77.68	91984.69	-16.68		
C (IER)	I	2031-12-27T07:32:51.410		72.52	-79.58	74490.58	-15.17		
Saturn	I	2031-12-27T07:33:47.917		72.36	-79.64	60125.04		18.35	22.13
Saturn	E	2031-12-27T09:12:27.977		53.18	-69.07	60145.56		16.93	20.47
C (IER)	E	2031-12-27T09:15:26.982		52.56	-68.49	74490.58	15.10		
B (IER)	E	2031-12-27T09:33:46.309		48.74	-64.87	91984.69	16.57		
B (OER)	E	2031-12-27T09:58:40.736		43.52	-59.80	117571.16	17.55		
A (IER)	E	2031-12-27T10:02:55.185		42.63	-58.93	122050.38	17.66		
Encke (IEG)	E	2031-12-27T10:13:35.234		40.39	-56.72	133423.31	17.87		
Encke (OEG)	E	2031-12-27T10:13:53.225		40.33	-56.66	133744.89	17.88		
A (OER)	E	2031-12-27T10:16:42.462		39.74	-56.07	136774.40	17.92		
F ring	E	2031-12-27T10:20:07.831		39.02	-55.36	140461.00	17.98		

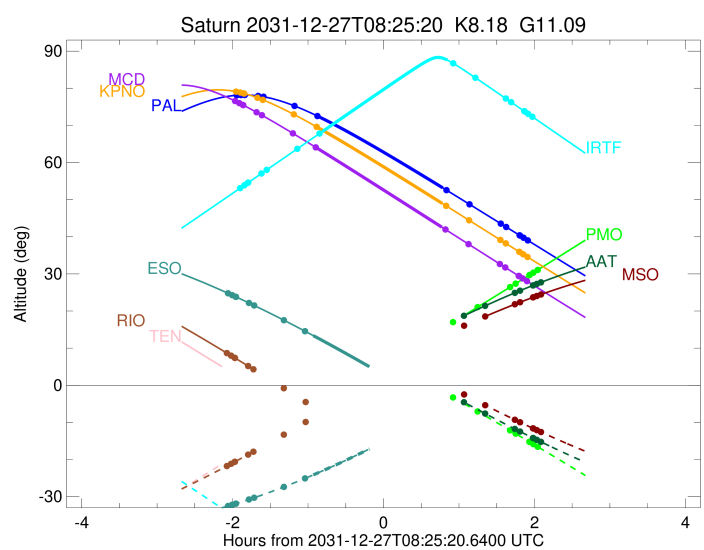
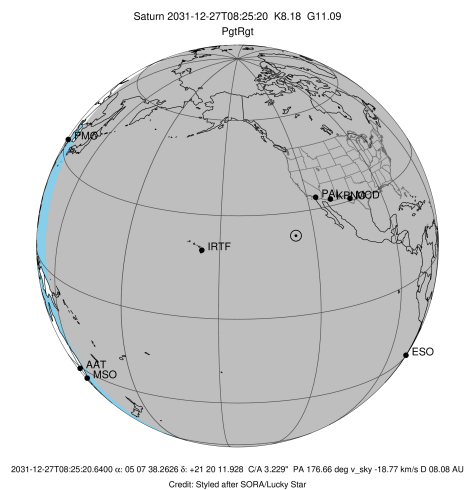
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:30:06.510  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PMO  
 Location : Purple Mtn Obs. Nanking  
 Latitude (deg) : 32.06667  
 E. Longitude (deg) : 118.82089  
 Altitude (km) : 0.364  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 3.06  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.847  
 C/A sky separation (km) : 22548.7  
 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	2031-12-27T06:34:54.036		-14.64x	24.24x	140461.00	-17.31		
A (OER)	I	2031-12-27T06:38:27.374		-14.04x	23.78x	136774.40	-17.25		
Encke (OEG)	I	2031-12-27T06:41:23.321		-13.54x	23.39x	133744.89	-17.19		
Encke (IEG)	I	2031-12-27T06:41:42.033		-13.48x	23.35x	133423.31	-17.18		
A (IER)	I	2031-12-27T06:52:48.893		-11.55x	21.82x	122050.38	-16.91		
B (OER)	I	2031-12-27T06:57:14.718		-10.77x	21.20x	117571.16	-16.78		
B (IER)	I	2031-12-27T07:23:29.123		-6.02x	17.29x	91984.69	-15.56		
C (IER)	I	2031-12-27T07:43:16.486	b	-2.32x	14.14x	74490.58	-13.70		
Saturn	I	2031-12-27T07:40:25.461		-2.86x	14.60x	60086.02		20.81	24.97
Saturn	E	2031-12-27T09:19:37.002		16.81	-3.09x	60124.20		18.40	22.19
C (IER)	E	2031-12-27T09:20:38.631		17.02	-3.29x	74490.58	13.83		
B (IER)	E	2031-12-27T09:40:13.242		21.06	-7.07	91984.69	15.76		
B (OER)	E	2031-12-27T10:06:04.781		26.46	-12.17	117571.16	17.07		
A (IER)	E	2031-12-27T10:10:26.081		27.38	-13.04	122050.38	17.21		
Encke (IEG)	E	2031-12-27T10:21:20.761		29.67	-15.23	133423.31	17.52		
Encke (OEG)	E	2031-12-27T10:21:39.115		29.74	-15.29	133744.89	17.52		
A (OER)	E	2031-12-27T10:24:31.646		30.34	-15.87	136774.40	17.59		
F ring	E	2031-12-27T10:28:00.735		31.08	-16.58	140461.00	17.67		

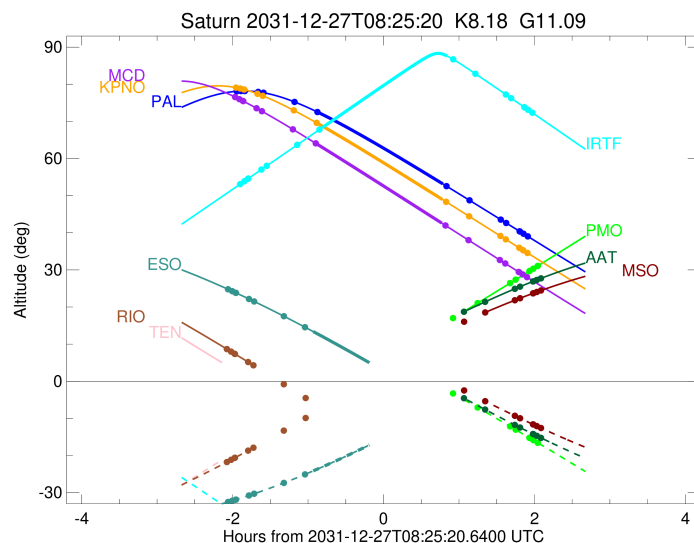
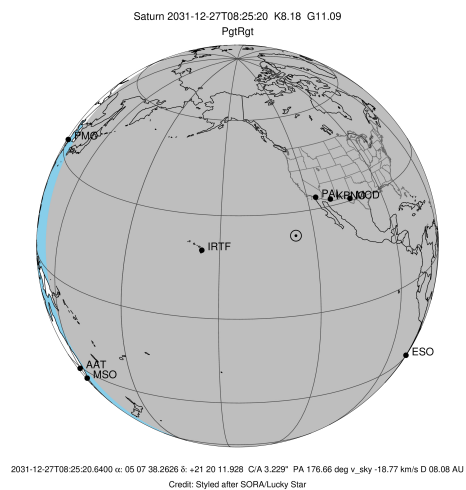
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:22:39.010  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KPNO  
 Location : Kitt Peak Natl Obs  
 Latitude (deg) : 31.96333  
 E. Longitude (deg) : 248.40000  
 Altitude (km) : 2.120  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 1.94  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.452  
 C/A sky separation (km) : 20232.9  
 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\_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	2031-12-27T06:28:07.816		79.10	-74.43	140461.00	-18.18		
A (OER)	I	2031-12-27T06:31:30.869		78.85	-75.06	136774.40	-18.13		
Encke (OEG)	I	2031-12-27T06:34:18.243		78.62	-75.56	133744.89	-18.07		
Encke (IEG)	I	2031-12-27T06:34:36.038		78.59	-75.61	133423.31	-18.07		
A (IER)	I	2031-12-27T06:45:09.420		77.44	-77.42	122050.38	-17.83		
B (OER)	I	2031-12-27T06:49:21.377		76.89	-78.09	117571.17	-17.72		
B (IER)	I	2031-12-27T07:14:02.878		72.97	-81.05	91984.69	-16.70		
C (IER)	I	2031-12-27T07:32:14.209		69.61	-81.46	74490.58	-15.21		
Saturn	I	2031-12-27T07:33:19.923		69.40	-81.43	60126.71		18.24	22.00
Saturn	E	2031-12-27T09:12:06.857		48.98	-65.35	60146.16		16.89	20.42
C (IER)	E	2031-12-27T09:15:09.100		48.33	-64.72	74490.58	15.12		
B (IER)	E	2031-12-27T09:33:27.677		44.43	-60.90	91984.69	16.57		
B (OER)	E	2031-12-27T09:58:22.546		39.12	-55.64	117571.16	17.54		
A (IER)	E	2031-12-27T10:02:37.169		38.22	-54.74	122050.38	17.64		
Encke (IEG)	E	2031-12-27T10:13:17.746		35.95	-52.48	133423.31	17.86		
Encke (OEG)	E	2031-12-27T10:13:35.753		35.89	-52.42	133744.89	17.86		
A (OER)	E	2031-12-27T10:16:25.150		35.29	-51.82	136774.40	17.91		
F ring	E	2031-12-27T10:19:50.723		34.56	-51.09	140461.00	17.96		

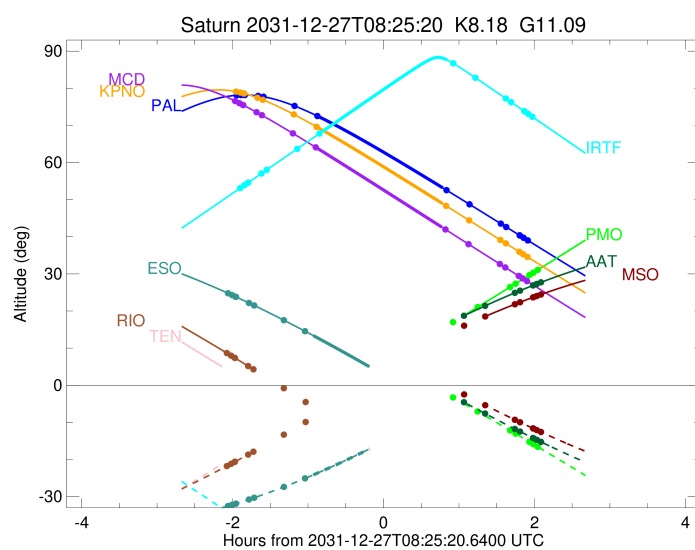
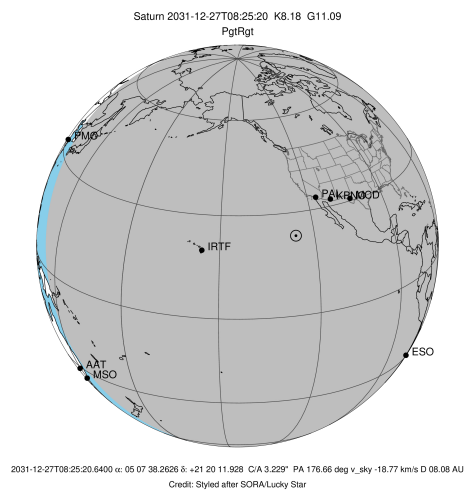
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:22:05.200  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 1.87  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.449  
 C/A sky separation (km) : 20214.9  
 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	2031-12-27T06:27:24.109		76.56	-80.27	140461.00	-18.19		
A (OER)	I	2031-12-27T06:30:47.160		75.99	-80.77	136774.40	-18.13		
Encke (OEG)	I	2031-12-27T06:33:34.538		75.51	-81.14	133744.89	-18.07		
Encke (IEG)	I	2031-12-27T06:33:52.334		75.46	-81.18	133423.31	-18.07		
A (IER)	I	2031-12-27T06:44:25.775		73.54	-82.31	122050.38	-17.83		
B (OER)	I	2031-12-27T06:48:37.773		72.75	-82.59	117571.16	-17.72		
B (IER)	I	2031-12-27T07:13:19.689		67.85	-81.95	91984.69	-16.69		
C (IER)	I	2031-12-27T07:31:31.419		64.08	-79.47	74490.58	-15.20		
Saturn	I	2031-12-27T07:32:42.614		63.84	-79.28	60127.68		18.17	21.92
Saturn	E	2031-12-27T09:11:38.018		42.61	-59.25	60145.75		16.92	20.46
C (IER)	E	2031-12-27T09:14:38.117		41.97	-58.61	74490.58	15.10		
B (IER)	E	2031-12-27T09:32:58.530		38.01	-54.67	91984.69	16.54		
B (OER)	E	2031-12-27T09:57:56.428		32.65	-49.29	117571.16	17.50		
A (IER)	E	2031-12-27T10:02:11.611		31.73	-48.38	122050.38	17.60		
Encke (IEG)	E	2031-12-27T10:12:53.648		29.45	-46.08	133423.31	17.81		
Encke (OEG)	E	2031-12-27T10:13:11.697		29.38	-46.01	133744.89	17.82		
A (OER)	E	2031-12-27T10:16:01.491		28.78	-45.40	136774.40	17.86		
F ring	E	2031-12-27T10:19:27.552		28.05	-44.66	140461.00	17.92		

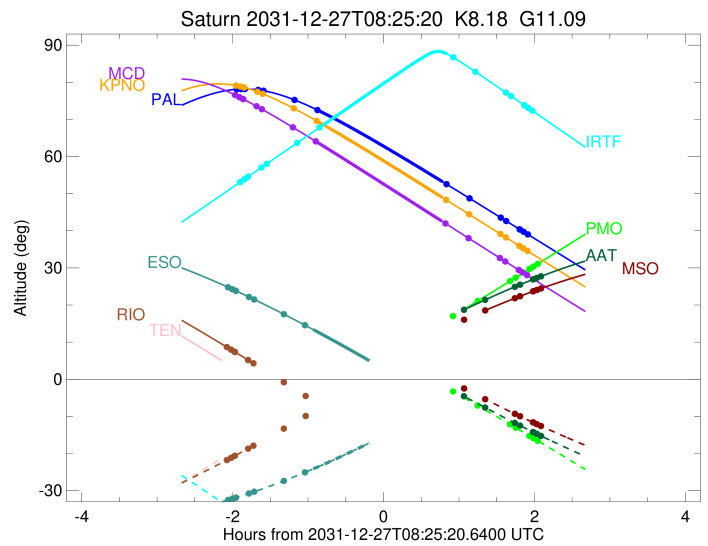
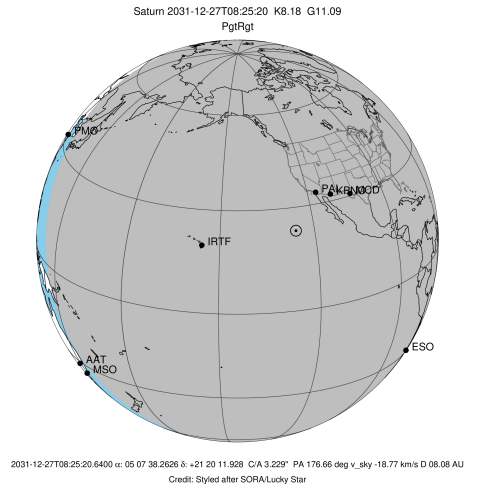
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:26:22.780  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : IRTF  
 Location : Mauna Kea/IRTF  
 Latitude (deg) : 19.82622  
 E. Longitude (deg) : 204.52800  
 Altitude (km) : 4.168  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 2.32  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.216  
 C/A sky separation (km) : 18848.8  
 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\_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	2031-12-27T06:31:24.810		53.11	-36.44	140461.00	-18.27		
A (OER)	I	2031-12-27T06:34:46.859		53.90	-37.20	136774.40	-18.22		
Encke (OEG)	I	2031-12-27T06:37:33.294		54.54	-37.83	133744.89	-18.18		
Encke (IEG)	I	2031-12-27T06:37:50.983		54.61	-37.90	133423.31	-18.18		
A (IER)	I	2031-12-27T06:48:19.764		57.05	-40.29	122050.38	-17.99		
B (OER)	I	2031-12-27T06:52:29.390		58.02	-41.24	117571.17	-17.90		
B (IER)	I	2031-12-27T07:16:49.090		63.70	-46.79	91984.69	-17.05		
C (IER)	I	2031-12-27T07:34:29.268		67.82	-50.84	74490.58	-15.82		
Saturn	I	2031-12-27T07:36:47.087		68.36	-51.37	60140.39		17.30	20.90
Saturn	E	2031-12-27T09:15:57.725		87.62	-74.06	60166.66		15.36	18.62
C (IER)	E	2031-12-27T09:20:47.828		86.72	-75.15	74490.58	15.84		
B (IER)	E	2031-12-27T09:38:26.246		82.83	-79.08	91984.69	17.08		
B (OER)	E	2031-12-27T10:02:42.877		77.23	-84.10	117571.16	17.94		
A (IER)	E	2031-12-27T10:06:51.899		76.26	-84.83	122050.38	18.03		
Encke (IEG)	E	2031-12-27T10:17:19.058		73.82	-86.17	133423.31	18.23		
Encke (OEG)	E	2031-12-27T10:17:36.699		73.76	-86.19	133744.89	18.23		
A (OER)	E	2031-12-27T10:20:22.680		73.11	-86.34	136774.40	18.27		
F ring	E	2031-12-27T10:23:44.164		72.33	-86.38	140461.00	18.32		

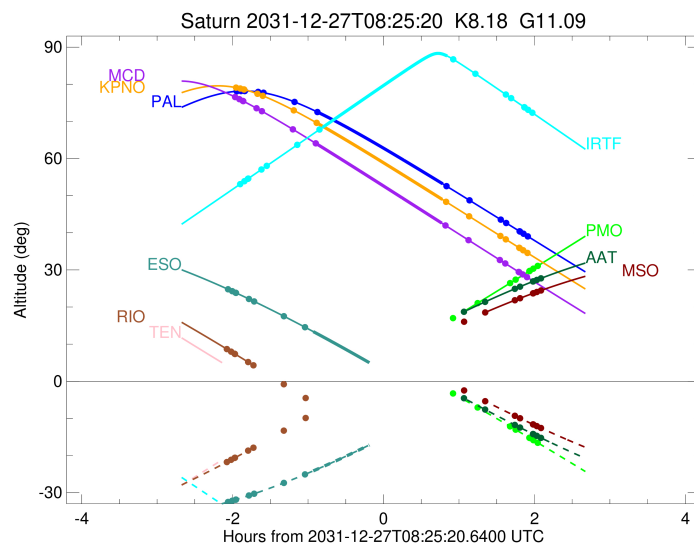
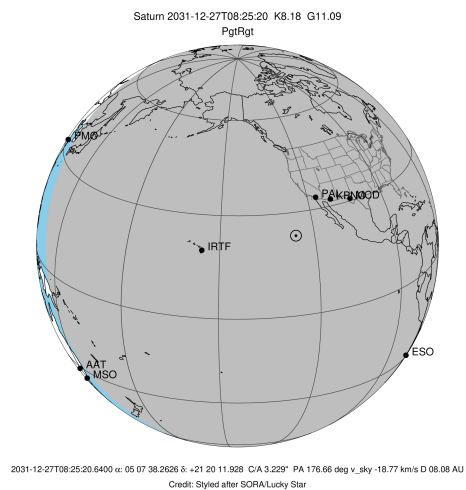
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:20:10.850  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 1.30  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.849  
 C/A sky separation (km) : 16699.5  
 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\_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	2031-12-27T06:20:50.563		8.67	-21.76	140461.00	-18.26		
A (OER)	I	2031-12-27T06:24:12.688		7.97	-21.15	136774.40	-18.22		
Encke (OEG)	I	2031-12-27T06:26:59.169		7.40	-20.65	133744.89	-18.18		
Encke (IEG)	I	2031-12-27T06:27:16.862		7.34	-20.60	133423.31	-18.17		
A (IER)	I	2031-12-27T06:37:45.525		5.17	-18.68	122050.38	-18.00		
B (OER)	I	2031-12-27T06:41:54.904		4.30x	-17.90	117571.16	-17.92		
B (IER)	I	2031-12-27T07:06:07.824		-0.81x	-13.29	91984.69	-17.22		
C (IER)	I	2031-12-27T07:23:29.736		-4.53x	-9.89	74490.58	-16.26		
Saturn	I	2031-12-27T07:28:48.446		-5.67x	-8.83	60173.94		14.78	17.94
Saturn	E	2031-12-27T09:11:50.521		-28.48x	12.70x	60183.72		13.98	16.98
C (IER)	E	2031-12-27T09:18:13.275		-29.92x	14.08x	74490.58	16.06		
B (IER)	E	2031-12-27T09:35:50.028		-33.90x	17.92x	91984.69	16.95		
B (OER)	E	2031-12-27T10:00:30.033		-39.51x	23.34x	117571.16	17.55		
A (IER)	E	2031-12-27T10:04:44.793		-40.48x	24.28x	122050.38	17.61		
Encke (IEG)	E	2031-12-27T10:15:27.952		-42.93x	26.65x	133423.31	17.75		
Encke (OEG)	E	2031-12-27T10:15:46.072		-43.00x	26.72x	133744.89	17.75		
A (OER)	E	2031-12-27T10:18:36.622		-43.65x	27.35x	136774.40	17.78		
F ring	E	2031-12-27T10:22:03.810		-44.44x	28.12x	140461.00	17.81		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:20:42.190  
 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 : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 1.25  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.586  
 C/A sky separation (km) : 15158.1  
 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

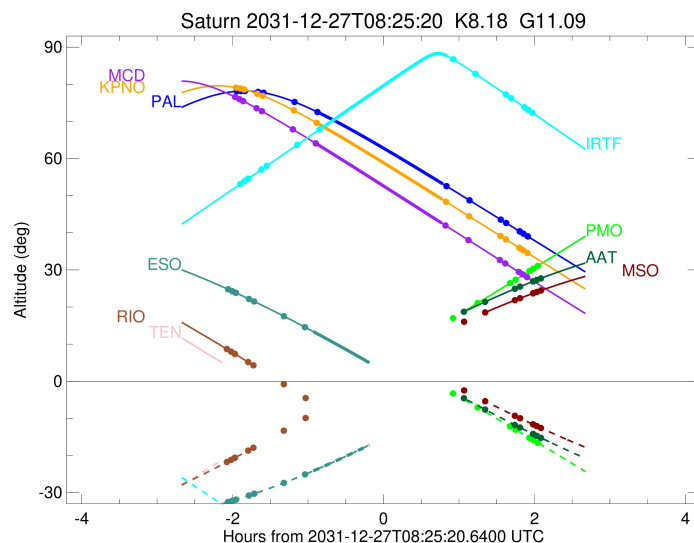
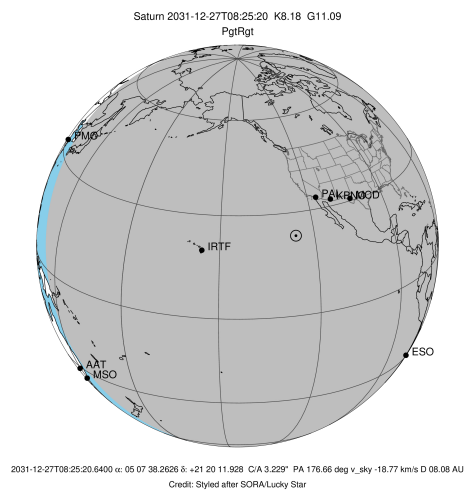


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2031-12-27T06:21:45.774		24.78	-32.52	140461.00	-18.54		
A (OER)	I	2031-12-27T06:25:04.838		24.27	-32.19	136774.40	-18.50		
Encke (OEG)	I	2031-12-27T06:27:48.720		23.85	-31.91	133744.89	-18.47		
Encke (IEG)	I	2031-12-27T06:28:06.132		23.80	-31.88	133423.31	-18.47		
A (IER)	I	2031-12-27T06:38:24.248		22.17	-30.76	122050.38	-18.33		
B (OER)	I	2031-12-27T06:42:29.089		21.50	-30.30	117571.16	-18.26		
B (IER)	I	2031-12-27T07:06:09.920		17.52	-27.38	91984.69	-17.69		
C (IER)	I	2031-12-27T07:22:58.812		14.56	-25.08	74490.58	-16.91		
Saturn	I	2031-12-27T07:29:27.605		13.39	-24.15	60189.06		13.52	16.44
Saturn	E	2031-12-27T09:12:12.358		-6.60x	-6.87	60199.49		12.57	15.31
C (IER)	E	2031-12-27T09:19:47.899		-8.16x	-5.45	74490.58	16.72		
B (IER)	E	2031-12-27T09:36:49.936		-11.68x	-2.22x	91984.69	17.43		
B (OER)	E	2031-12-27T10:00:54.792		-16.73x	2.47x	117571.16	17.92		
A (IER)	E	2031-12-27T10:05:04.411		-17.61x	3.30x	122050.38	17.97		
Encke (IEG)	E	2031-12-27T10:15:35.407		-19.84x	5.39x	133423.31	18.07		
Encke (OEG)	E	2031-12-27T10:15:53.199		-19.91x	5.45x	133744.89	18.08		
A (OER)	E	2031-12-27T10:18:40.700		-20.50x	6.01x	136774.40	18.10		
F ring	E	2031-12-27T10:22:04.267		-21.22x	6.69x	140461.00	18.12		



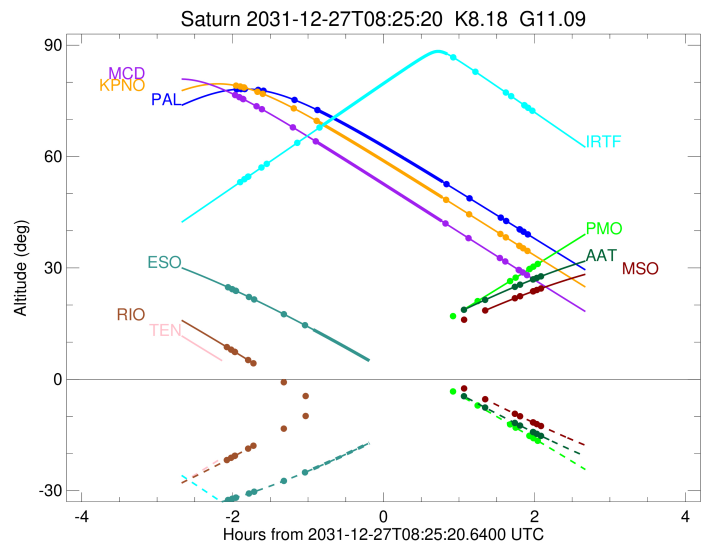
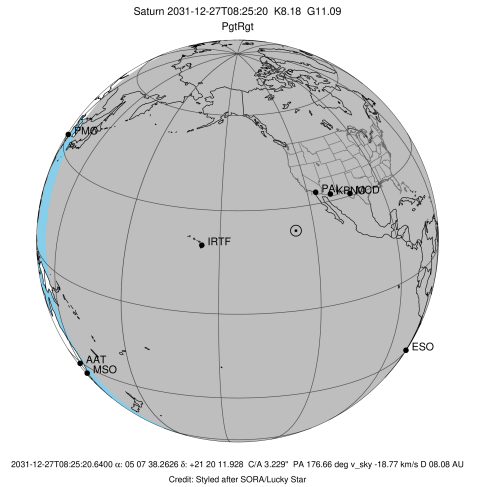
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:30:01.620  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : AAT  
 Location : Siding Spring (AAT)  
 Latitude (deg) : -31.27703  
 E. Longitude (deg) : 149.06608  
 Altitude (km) : 1.164  
 Gaia source ID : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 2.66  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.612  
 C/A sky separation (km) : 15313.4  
 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	2031-12-27T06:30:58.827	-14.96x	31.11x	140461.00	-18.19			
A (OER)	I	2031-12-27T06:34:21.632	-14.26x	30.40x	136774.40	-18.16			
Encke (OEG)	I	2031-12-27T06:37:08.517	-13.69x	29.81x	133744.89	-18.14			
Encke (IEG)	I	2031-12-27T06:37:26.245	-13.63x	29.75x	133423.31	-18.14			
A (IER)	I	2031-12-27T06:47:55.030	-11.48x	27.55x	122050.38	-18.03			
B (OER)	I	2031-12-27T06:52:03.824	-10.64x	26.69x	117571.16	-17.98			
B (IER)	I	2031-12-27T07:16:04.621	-5.80x	21.69x	91984.69	-17.47			
C (IER)	I	2031-12-27T07:33:04.911	-2.43x	18.19x	74490.58	-16.74			
Saturn	I	2031-12-27T07:38:40.799	-1.33x	17.05x	60178.88			14.38	17.47
Saturn	E	2031-12-27T09:21:11.512	17.39	-3.06x	60205.86			11.97	14.58
C (IER)	E	2031-12-27T09:29:19.231	18.72	-4.56x	74490.58	16.89			
B (IER)	E	2031-12-27T09:46:08.741	21.39	-7.62	91984.69	17.68			
B (OER)	E	2031-12-27T10:09:49.979	24.91	-11.77	117571.16	18.26			
A (IER)	E	2031-12-27T10:13:54.893	25.48	-12.47	122050.38	18.32			
Encke (IEG)	E	2031-12-27T10:24:13.224	26.89	-14.20	133423.31	18.46			
Encke (OEG)	E	2031-12-27T10:24:30.643	26.93	-14.25	133744.89	18.46			
A (OER)	E	2031-12-27T10:27:14.595	27.29	-14.70	136774.40	18.49			
F ring	E	2031-12-27T10:30:33.749	27.73	-15.25	140461.00	18.53			

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2031-12-27T08:29:50.440  
 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 : 3414944680488084736  
 2Mass ID (if available) : 05073825+2120119  
 ICRS Star Coord at Epoch: 05h 07m 38.26264s +21:20:11.92756s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.175  
 G magnitude : 11.089  
 RP magnitude : 10.221  
 BP magnitude : 11.878  
 DUPflag : 0  
 Distance (au) : 8.082  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.77  
 Sun-Target sep (deg) : 162.82  
 Sun-Moon sep (deg) : 2.62  
 B (ring opening deg) : -26.52  
 PA of pole (deg) : -4.30  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.558  
 C/A sky separation (km) : 14993.8  
 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	2031-12-27T06:30:33.856		-16.18x	31.87x	140461.00	-18.21		
A (OER)	I	2031-12-27T06:33:56.388		-15.51x	31.18x	136774.40	-18.19		
Encke (OEG)	I	2031-12-27T06:36:43.040		-14.96x	30.62x	133744.89	-18.17		
Encke (IEG)	I	2031-12-27T06:37:00.742		-14.90x	30.56x	133423.31	-18.16		
A (IER)	I	2031-12-27T06:47:28.546		-12.85x	28.45x	122050.38	-18.06		
B (OER)	I	2031-12-27T06:51:36.903		-12.04x	27.62x	117571.16	-18.01		
B (IER)	I	2031-12-27T07:15:34.275		-7.40x	22.82x	91984.69	-17.53		
C (IER)	I	2031-12-27T07:32:30.441		-4.19x	19.47x	74490.58	-16.83		
Saturn	I	2031-12-27T07:38:24.022		-3.08x	18.31x	60182.44		14.08	17.11
Saturn	E	2031-12-27T09:21:06.427		14.75	-1.00x	60208.53		11.70	14.27
C (IER)	E	2031-12-27T09:29:26.652		16.04	-2.47x	74490.58	16.98		
B (IER)	E	2031-12-27T09:46:12.543		18.54	-5.37	91984.69	17.73		
B (OER)	E	2031-12-27T10:09:51.272		21.83	-9.31	117571.16	18.28		
A (IER)	E	2031-12-27T10:13:55.930		22.37	-9.97	122050.38	18.34		
Encke (IEG)	E	2031-12-27T10:24:13.772		23.68	-11.61	133423.31	18.47		
Encke (OEG)	E	2031-12-27T10:24:31.181		23.72	-11.65	133744.89	18.47		
A (OER)	E	2031-12-27T10:27:15.036		24.05	-12.08	136774.40	18.50		
F ring	E	2031-12-27T10:30:34.089		24.46	-12.60	140461.00	18.54		