

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:12:53.140  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518

Saturn 2049-09-29T10:12:53 K8.54 G11.88 PgtRgt

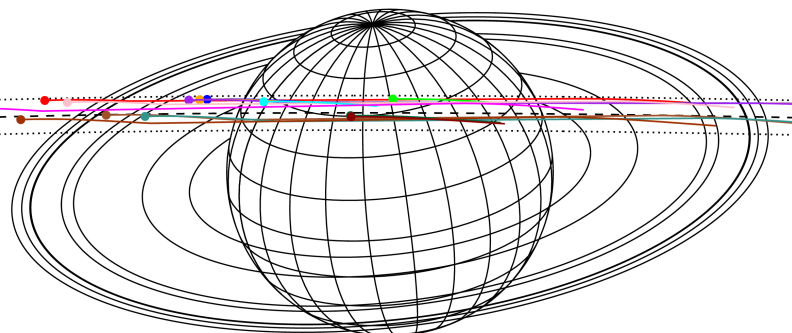
ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s

RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.43  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74



2049-09-29T10:12:53.1400 α: 19 26 59.6493 δ: -22 01 51.874 C/A 3.129° PA 179.88 deg v\_sky + 2.39 km/s D 09.71 AU  
 Credit: Styled after SORA/Lucky Star

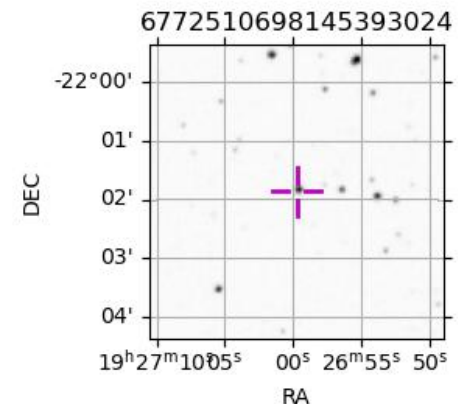
Earth  
 PIC  
 PAL  
 PMO  
 KPNO  
 MCD  
 TEN  
 IRTF  
 KAV  
 RIO  
 ESO  
 AAT  
 SAAO  
 MSO



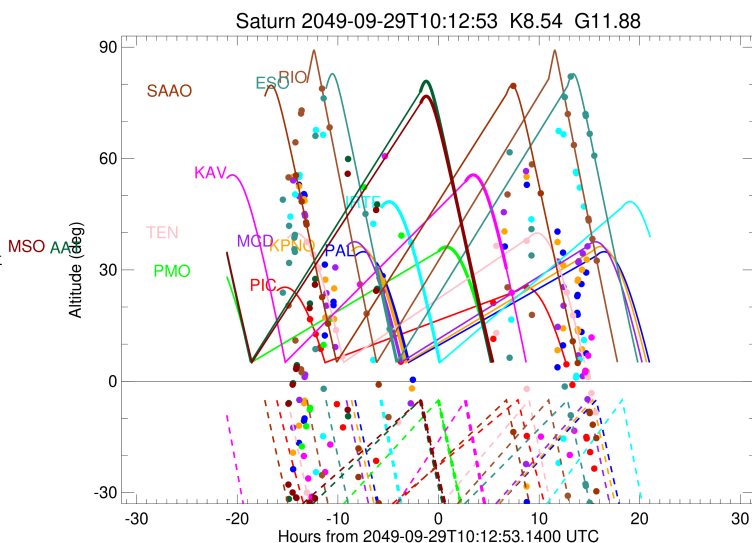
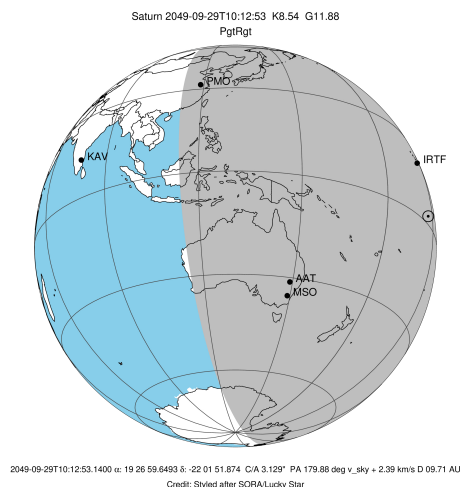
#	a(km)	ring
1	74490.6	C (IER)
2	91984.7	B (IER)
3	117571.2	B (OER)
4	122050.4	A (IER)
5	133423.3	Encke (IEG)
6	133744.9	Encke (OEG)
7	136774.4	A (OER)
8	140461.0	F ring

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	+	+	+	SEP 28 21:27 - SEP 29 19:00	PnnRie
PAL	Palomar Mt (20	33.4	243.1		+		SEP 29 04:01 - SEP 29 04:01	PinRnn
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4		+		SEP 29 04:04 - SEP 29 04:04	PinRnn
MCD	McDonald Obs.	30.7	256.0		+		SEP 29 04:09 - SEP 29 04:09	PinRnn
TEN	Teide Obs./Ten	28.3	343.5	+		+	SEP 28 21:09 - SEP 29 23:35	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observ	12.6	78.8		+	+	SEP 29 16:58 - SEP 29 17:29	PneRne
RIO	Rio de Janeiro	-22.9	316.8				SEP 28 22:39 - SEP 30 01:56	PnnRie
ESO	European South	-29.3	289.3		+		SEP 29 02:58 - SEP 30 01:41	PinRie
AAT	Siding Spring	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro	-32.4	20.8	+		+	SEP 28 20:04 - SEP 29 23:33	PnnRie
MSO	Mt. Stromlo Ob	-35.3	149.0					PnnRnn



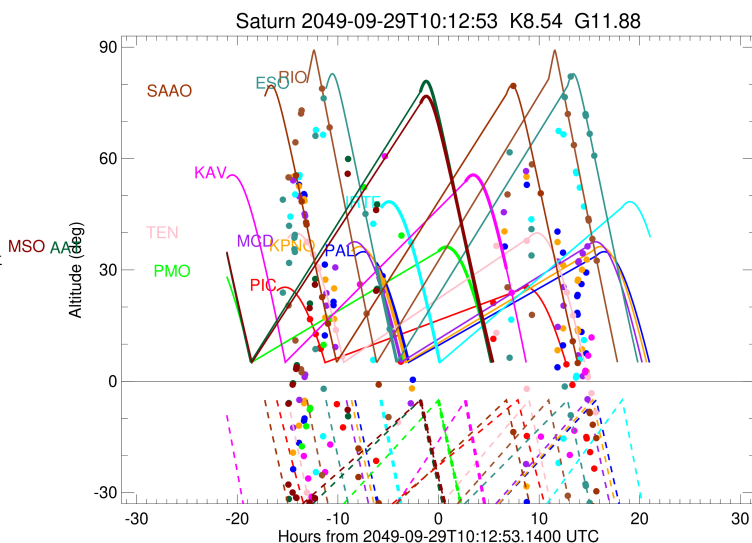
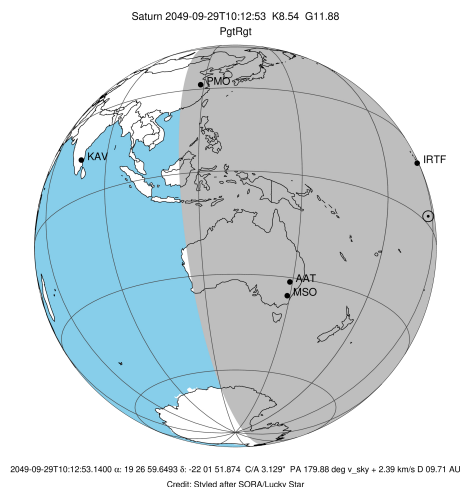
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T09:44:59.520  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 75.69  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.519  
 C/A sky separation (km) : 24772.3  
 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



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	2049-09-28T21:27:24.224		16.62	-38.75	140461.00	-1.78		
A (OER)	I	2049-09-28T22:01:21.227		12.62	-43.04	136774.40	-1.84		
Encke (OEG)	I	2049-09-28T22:28:28.270		9.04	-45.85	133744.89	-1.89		
Encke (IEG)	I	2049-09-28T22:31:18.622		8.65	-46.10	133423.31	-1.89		
A (IER)	I	2049-09-29T00:07:31.160		-6.27x	-49.57	122050.38	-2.05		
B (OER)	I	2049-09-29T00:43:34.039		-12.45x	-48.01	117571.16	-2.09		
B (IER)	I	2049-09-29T04:01:25.813		-48.32x	-21.35	91984.69	-2.14		
C (IER)	I	2049-09-29T06:29:04.165	b	-68.47x	5.44x	74490.58	-1.73		
Saturn	I	2049-09-29T04:02:56.583		-48.59x	-21.08	60016.74		28.01	33.04
Saturn	E	2049-09-29T15:56:57.900		13.58	18.24x	60156.62		18.19	21.94
C (IER)	E	2049-09-29T15:40:20.142	b	11.47	21.04x	74490.58	1.32		
B (IER)	E	2049-09-29T19:00:00.677		25.31	-14.82	91984.69	1.59		
B (OER)	E	2049-09-29T22:56:21.899		4.46x	-48.42	117571.16	2.07		
A (IER)	E	2049-09-29T23:31:32.849		-1.00x	-49.94	122050.38	2.17		
Encke (IEG)	E	2049-09-30T00:54:20.855		-15.02x	-47.61	133423.31	2.41		
Encke (OEG)	E	2049-09-30T00:56:34.168		-15.42x	-47.44	133744.89	2.42		
A (OER)	E	2049-09-30T01:17:13.117		-19.10x	-45.62	136774.40	2.47		
F ring	E	2049-09-30T01:41:41.925		-23.53x	-42.97	140461.00	2.54		

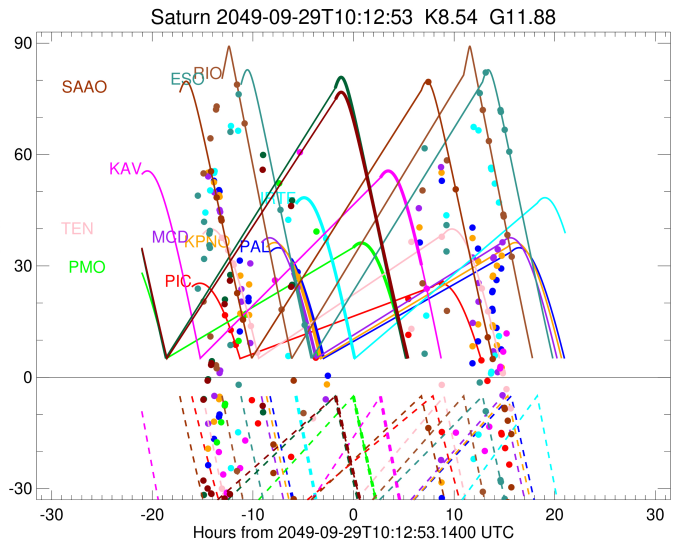
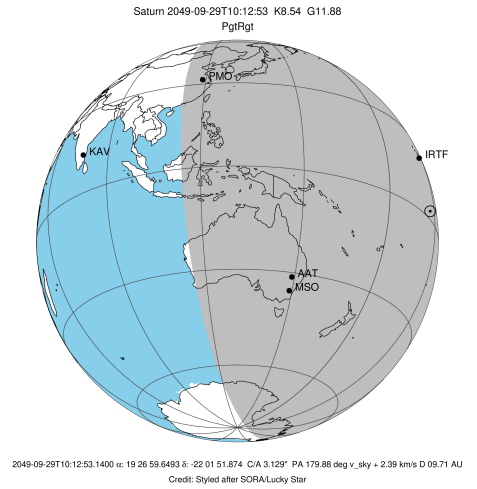
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:52:18.430  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.16  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.434  
 C/A sky separation (km) : 24174.9  
 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

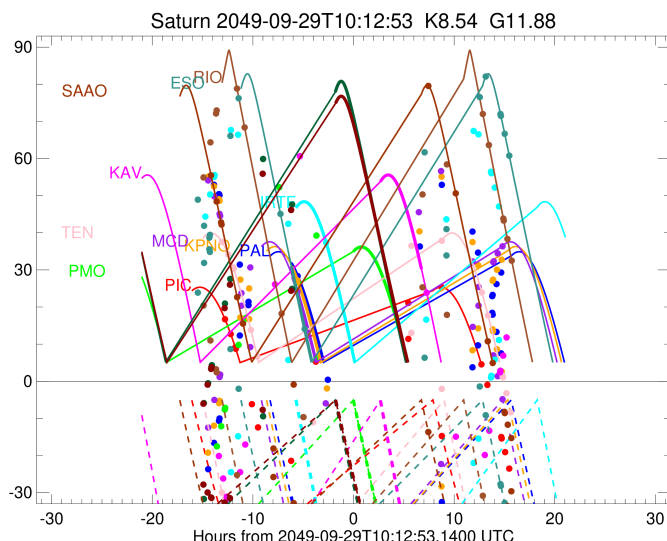
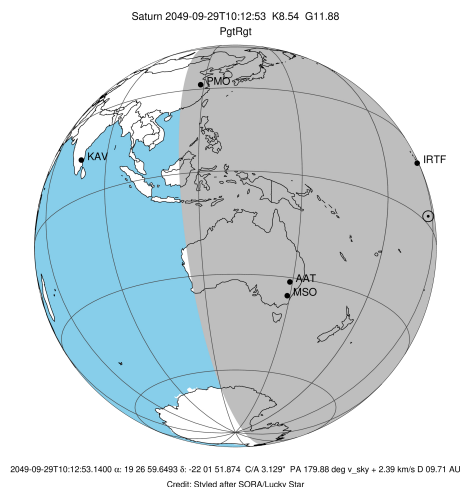
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-09-28T19:46:59.358		-23.54x	54.32x	140461.00	-1.80		
A (OER)	I	2049-09-28T20:21:47.421		-16.45x	52.89x	136774.40	-1.73		
Encke (OEG)	I	2049-09-28T20:51:28.396		-10.51x	50.34x	133744.89	-1.67		
Encke (IEG)	I	2049-09-28T20:54:41.037		-9.88x	50.00x	133423.31	-1.67		
A (IER)	I	2049-09-28T22:55:45.095		12.47	31.27x	122050.38	-1.48		
B (OER)	I	2049-09-28T23:47:00.634		20.52	21.37x	117571.16	-1.44		
B (IER)	I	2049-09-29T04:40:25.002	b	28.27	-38.54	91984.69	-1.56		
C (IER)	I	2049-09-29T07:41:08.044	b	0.20x	-59.44	74490.58	-1.61		
Saturn	I	2049-09-29T04:01:06.031		31.89	-30.96	59979.03		30.26	35.48
Saturn	E	2049-09-29T16:16:26.514		-66.28x	30.53x	60196.40		14.49	17.59
C (IER)	E	2049-09-29T16:48:34.069		-59.87x	36.34x	74490.58	2.05		
B (IER)	E	2049-09-29T18:59:49.130		-32.50x	52.93x	91984.69	2.33		
B (OER)	E	2049-09-29T22:02:48.960		3.86x	40.23x	117571.16	2.29		
A (IER)	E	2049-09-29T22:35:34.952		9.70	34.63x	122050.38	2.27		
Encke (IEG)	E	2049-09-30T00:00:20.066		22.95	18.41x	133423.31	2.21		
Encke (OEG)	E	2049-09-30T00:02:45.651		23.28	17.92x	133744.89	2.21		
A (OER)	E	2049-09-30T00:25:41.163		26.20	13.26x	136774.40	2.20		
F ring	E	2049-09-30T00:53:43.125		29.30	7.49x	140461.00	2.19		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:50:27.860  
 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 : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.09  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.395  
 C/A sky separation (km) : 23896.9  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-09-28T19:46:06.610	-19.08x	55.07x	140461.00	-1.76			
A (OER)	I	2049-09-28T20:21:42.156	-11.81x	52.44x	136774.40	-1.69			
Encke (OEG)	I	2049-09-28T20:52:04.533	-5.75x	48.95x	133744.89	-1.63			
Encke (IEG)	I	2049-09-28T20:55:21.650	-5.10x	48.51x	133423.31	-1.63			
A (IER)	I	2049-09-28T22:58:52.584	17.31	27.22x	122050.38	-1.46			
B (OER)	I	2049-09-28T23:50:42.147	25.03	16.74x	117571.16	-1.43			
B (IER)	I	2049-09-29T04:39:51.142	b	27.04	-43.00	91984.69	-1.60		
C (IER)	I	2049-09-29T07:35:30.887	b	-2.13x	-60.50	74490.58	-1.66		
Saturn	I	2049-09-29T04:04:35.419		31.01	-36.29	59981.86		30.10	35.30
Saturn	E	2049-09-29T16:13:49.180		-63.03x	34.61x	60197.05		14.42	17.51
C (IER)	E	2049-09-29T16:46:27.397	-56.21x	40.40x	74490.58	2.06			
B (IER)	E	2049-09-29T18:57:57.560	-28.30x	55.12x	91984.69	2.31			
B (OER)	E	2049-09-29T22:03:16.114	8.46	37.38x	117571.16	2.25			
A (IER)	E	2049-09-29T22:36:34.133	14.27	31.24x	122050.38	2.23			
Encke (IEG)	E	2049-09-30T00:02:40.538	27.09	13.97x	133423.31	2.18			
Encke (OEG)	E	2049-09-30T00:05:08.291	27.39	13.46x	133744.89	2.18			
A (OER)	E	2049-09-30T00:28:23.527	30.07	8.60x	136774.40	2.17			
F ring	E	2049-09-30T00:56:47.327	32.76	2.60x	140461.00	2.16			

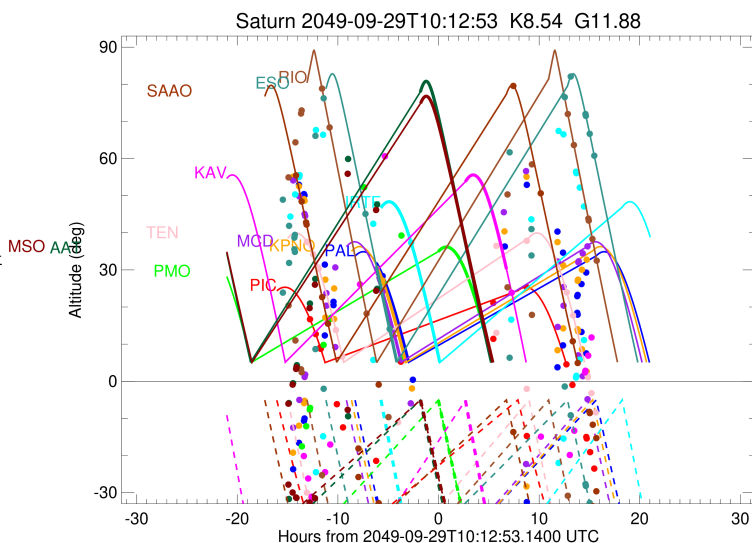
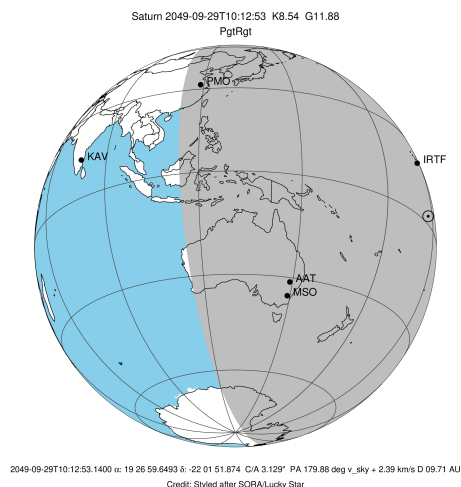
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:47:06.940  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.00  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.350  
 C/A sky separation (km) : 23581.5  
 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	2049-09-28T19:46:59.007		-12.32x	54.03x	140461.00	-1.70		
A (OER)	I	2049-09-28T20:23:49.381		-4.86x	49.68x	136774.40	-1.63		
Encke (OEG)	I	2049-09-28T20:55:14.634		1.31x	44.95x	133744.89	-1.58		
Encke (IEG)	I	2049-09-28T20:58:38.396		1.96x	44.39x	133423.31	-1.58		
A (IER)	I	2049-09-28T23:05:20.262		23.87	20.19x	122050.38	-1.44		
B (OER)	I	2049-09-28T23:57:34.234		30.68	9.18x	117571.16	-1.42		
B (IER)	I	2049-09-29T04:39:05.605	b	24.04	-48.98	91984.69	-1.67		
C (IER)	I	2049-09-29T07:28:12.411	b	-6.15x	-60.41	74490.58	-1.72		
Saturn	I	2049-09-29T04:09:14.794		28.13	-43.58	59985.81		29.86	35.05
Saturn	E	2049-09-29T16:10:00.578		-57.69x	40.10x	60197.10		14.41	17.50
C (IER)	E	2049-09-29T16:42:37.660		-50.67x	45.57x	74490.58	2.06		
B (IER)	E	2049-09-29T18:55:16.108		-22.25x	56.61x	91984.69	2.27		
B (OER)	E	2049-09-29T22:04:31.261		14.74	32.14x	117571.16	2.20		
A (IER)	E	2049-09-29T22:38:38.198		20.39	25.38x	122050.38	2.18		
Encke (IEG)	E	2049-09-30T00:06:40.553		32.08	6.96x	133423.31	2.13		
Encke (OEG)	E	2049-09-30T00:09:11.199		32.33	6.42x	133744.89	2.13		
A (OER)	E	2049-09-30T00:32:52.089		34.47	1.35x	136774.40	2.13		
F ring	E	2049-09-30T01:01:42.617		36.35	-4.87x	140461.00	2.13		

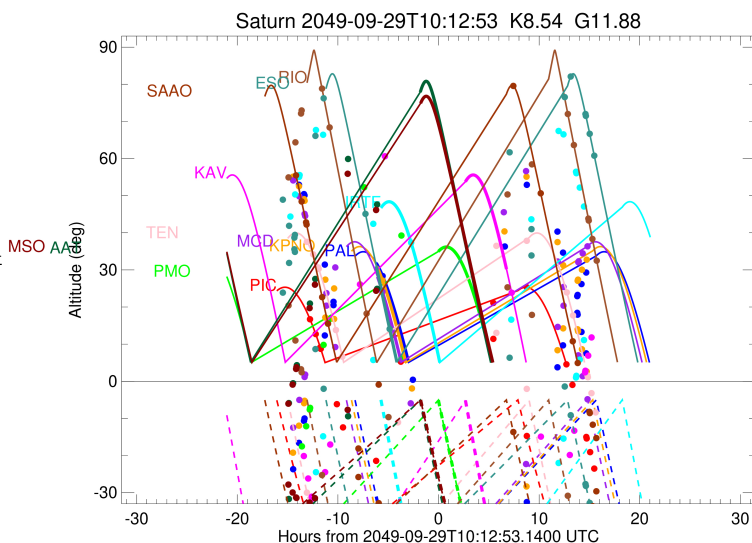
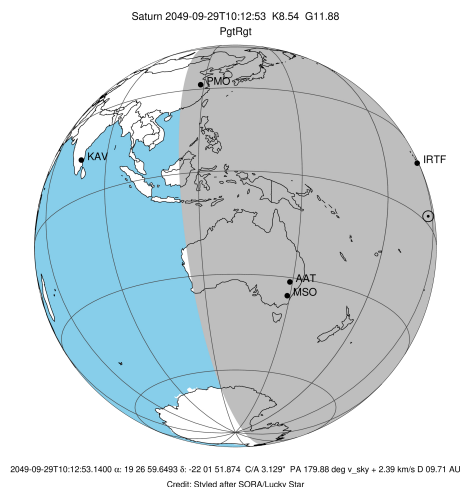
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T09:50:34.210  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 75.54  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.262  
 C/A sky separation (km) : 22961.6  
 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\_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	2049-09-28T21:09:03.812		37.50	-30.18	140461.00	-1.62		
A (OER)	I	2049-09-28T21:46:22.125		34.11	-38.02	136774.40	-1.68		
Encke (OEG)	I	2049-09-28T22:15:56.809		30.58	-43.99	133744.89	-1.74		
Encke (IEG)	I	2049-09-28T22:19:01.834		30.18	-44.60	133423.31	-1.74		
A (IER)	I	2049-09-29T00:01:49.517		13.69	-61.28	122050.38	-1.95		
B (OER)	I	2049-09-29T00:39:25.914		6.62	-64.07	117571.16	-2.02		
B (IER)	I	2049-09-29T03:56:48.566		-34.60x	-39.97	91984.69	-2.23		
C (IER)	I	2049-09-29T06:12:12.517	b	-64.43x	-10.91	74490.58	-2.00		
Saturn	I	2049-09-29T04:10:48.803		-37.66x	-37.09	60032.84		27.02	31.95
Saturn	E	2049-09-29T15:50:21.651		11.62	37.97x	60172.95		16.76	20.27
C (IER)	E	2049-09-29T15:58:21.280		13.10	36.42x	74490.58	1.55		
B (IER)	E	2049-09-29T18:59:34.631		37.87	-2.13x	91984.69	1.65		
B (OER)	E	2049-09-29T22:58:37.658		23.83	-52.34	117571.16	1.99		
A (IER)	E	2049-09-29T23:35:20.284		17.72	-58.28	122050.38	2.08		
Encke (IEG)	E	2049-09-30T01:01:29.942		1.54x	-64.74	133423.31	2.33		
Encke (OEG)	E	2049-09-30T01:03:48.023		1.08x	-64.71	133744.89	2.33		
A (OER)	E	2049-09-30T01:25:09.106		-3.22x	-63.84	136774.40	2.40		
F ring	E	2049-09-30T01:50:22.380		-8.39x	-61.64	140461.00	2.48		

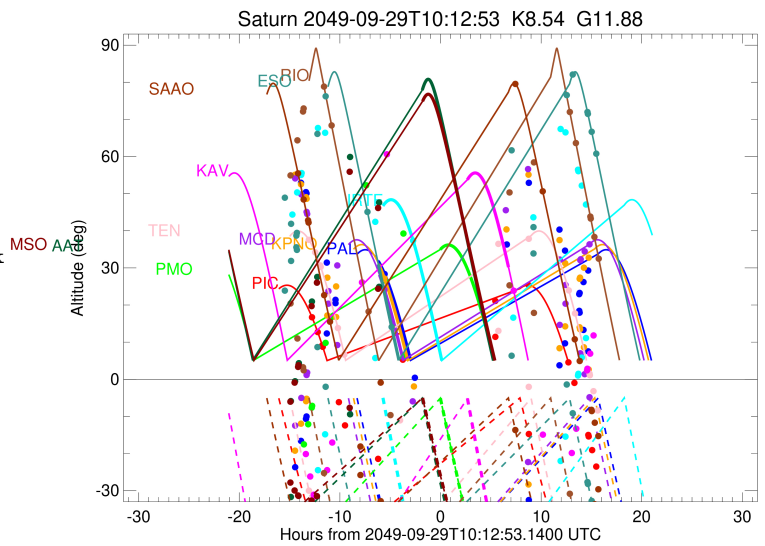
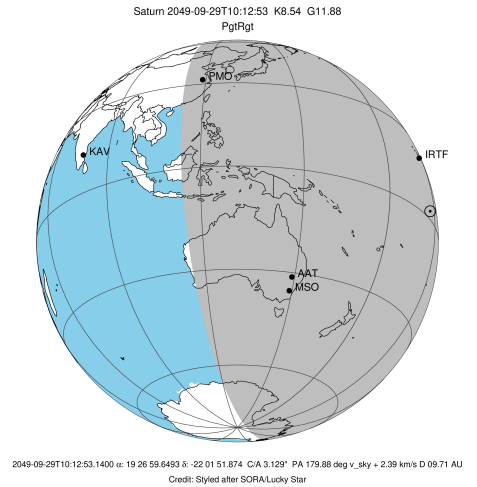
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T09:21:24.040  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.705  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.72  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.464  
 C/A sky separation (km) : 24383.4  
 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	2049-09-28T20:50:27.561		-20.27x	-54.99	140461.00	-2.33		
A (OER)	I	2049-09-28T21:16:32.315		-26.32x	-48.78	136774.40	-2.38		
Encke (OEG)	I	2049-09-28T21:37:38.782		-31.22x	-43.70	133744.89	-2.41		
Encke (IEG)	I	2049-09-28T21:39:52.320		-31.74x	-43.16	133423.31	-2.41		
A (IER)	I	2049-09-28T22:57:17.406		-49.71x	-24.36	122050.38	-2.48		
B (OER)	I	2049-09-28T23:27:24.097		-56.64x	-17.02	117571.16	-2.48		
B (IER)	I	2049-09-29T02:25:10.668		-75.92x	26.22x	91984.69	-2.23		
C (IER)	I	2049-09-29T04:54:05.200	b	-43.10x	60.79x	74490.58	-1.63		
Saturn	I	2049-09-29T03:10:09.182		-66.79x	37.00x	60069.54		24.65	29.32
Saturn	E	2049-09-29T16:58:28.862		30.18	-64.29	60184.40		15.69	19.01
C (IER)	E	2049-09-29T17:29:36.575		23.79	-71.20	74490.58	1.26		
B (IER)	E	2049-09-29T20:23:30.971		-14.95x	-61.38	91984.69	2.10		
B (OER)	E	2049-09-29T23:16:05.758		-54.94x	-19.78	117571.16	2.79		
A (IER)	E	2049-09-29T23:42:29.639		-60.95x	-13.33	122050.38	2.86		
Encke (IEG)	E	2049-09-30T00:46:57.871		-74.67x	2.39x	133423.31	3.01		
Encke (OEG)	E	2049-09-30T00:48:44.788		-75.00x	2.83x	133744.89	3.01		
A (OER)	E	2049-09-30T01:05:26.923		-77.84x	6.89x	136774.40	3.04		
F ring	E	2049-09-30T01:25:35.472		-80.15x	11.79x	140461.00	3.06		

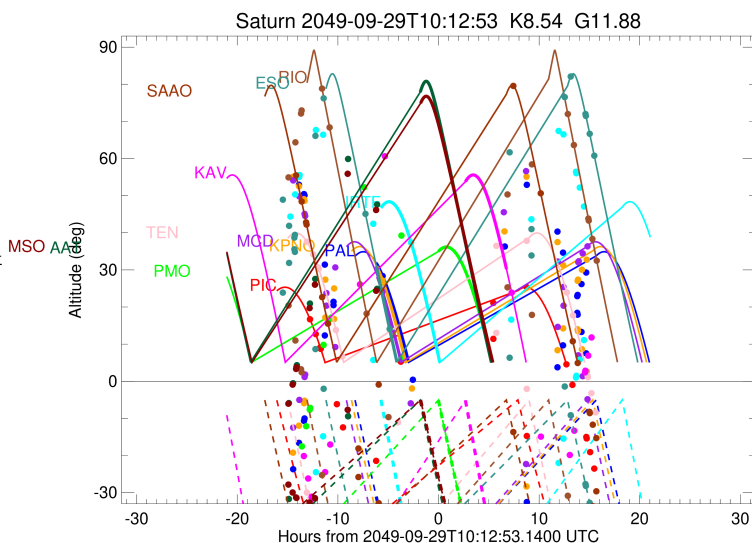
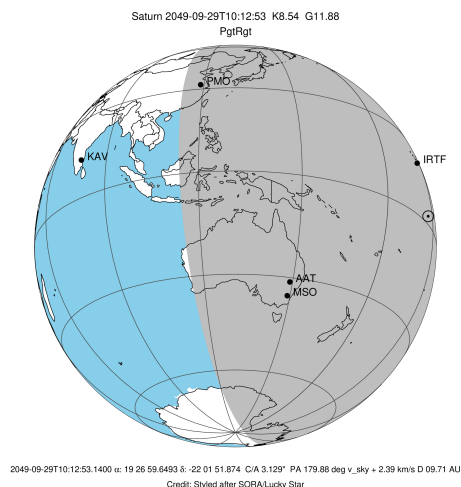
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:08:19.740  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 75.73  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.492  
 C/A sky separation (km) : 17542.9  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2049-09-28T19:19:27.415		55.12	20.21x	140461.00	-1.50		
A (OER)	I	2049-09-28T20:00:26.899		64.56	10.79x	136774.40	-1.50		
Encke (OEG)	I	2049-09-28T20:34:03.864		72.32	3.04x	133744.89	-1.51		
Encke (IEG)	I	2049-09-28T20:37:37.052		73.14	2.22x	133423.31	-1.51		
A (IER)	I	2049-09-28T22:39:01.069		78.67	-25.44	122050.38	-1.63		
B (OER)	I	2049-09-28T23:23:40.860		68.35	-35.24	117571.16	-1.71		
B (IER)	I	2049-09-29T03:04:28.816		18.13	-64.16	91984.69	-2.15		
C (IER)	I	2049-09-29T05:15:13.571	b	-9.77x	-45.08	74490.58	-2.27		
Saturn	I	2049-09-29T04:06:37.244		4.57x	-57.49	60090.56		23.22	27.71
Saturn	E	2049-09-29T16:00:39.200		11.20	62.53x	60224.72		11.21	13.68
C (IER)	E	2049-09-29T17:04:31.256		25.33	50.31x	74490.58	2.02		
B (IER)	E	2049-09-29T19:30:04.302		58.46	17.85x	91984.69	1.98		
B (OER)	E	2049-09-29T23:04:26.618		71.89	-30.95	117571.16	2.06		
A (IER)	E	2049-09-29T23:40:11.176		63.64	-38.63	122050.38	2.12		
Encke (IEG)	E	2049-09-30T01:06:24.995		43.84	-55.20	133423.31	2.29		
Encke (OEG)	E	2049-09-30T01:08:45.255		43.31	-55.58	133744.89	2.30		
A (OER)	E	2049-09-30T01:30:30.181		38.35	-58.86	136774.40	2.35		
F ring	E	2049-09-30T01:56:18.542		32.51	-61.93	140461.00	2.41		

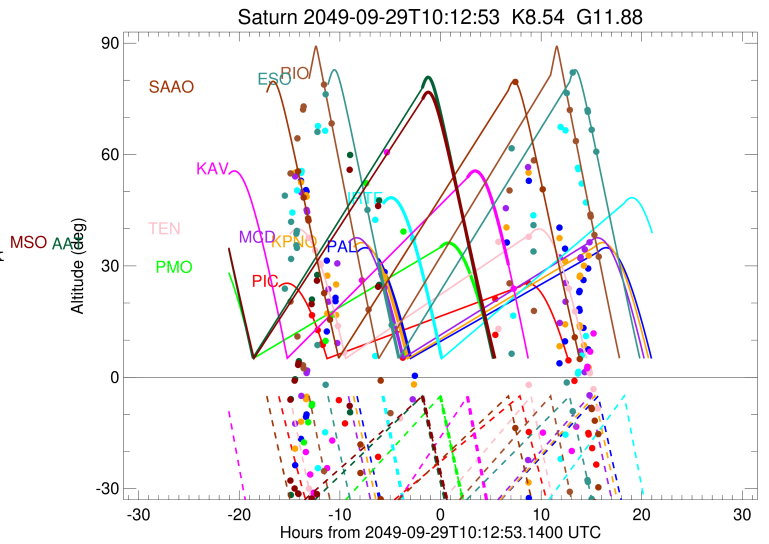
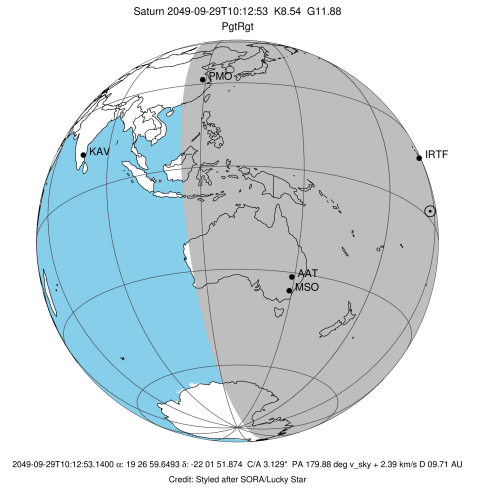


target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T10:26:32.610  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : ESO  
 Location : European Southern Obs. (3.6m)  
 Latitude (deg) : -29.26097  
 E. Longitude (deg) : 289.26831  
 Altitude (km) : 2.400  
 Gaia source ID : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 75.94  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.436  
 C/A sky separation (km) : 17148.2  
 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\_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	2049-09-28T18:45:29.424		24.04	48.78x	140461.00	-1.68		
A (OER)	I	2049-09-28T19:22:44.235		32.05	41.72x	136774.40	-1.63		
Encke (OEG)	I	2049-09-28T19:54:09.387		38.87	35.38x	133744.89	-1.59		
Encke (IEG)	I	2049-09-28T19:57:31.815		39.61	34.69x	133423.31	-1.59		
A (IER)	I	2049-09-28T21:59:47.541		66.28	8.49x	122050.38	-1.54		
B (OER)	I	2049-09-28T22:48:08.141		76.26	-2.06x	117571.16	-1.56		
B (IER)	I	2049-09-29T02:57:59.579		44.96	-51.00	91984.69	-1.91		
C (IER)	I	2049-09-29T05:22:12.187	b	13.96	-56.20	74490.58	-2.11		
Saturn	I	2049-09-29T04:01:59.748		31.03	-57.47	60084.85		23.62	28.16
Saturn	E	2049-09-29T16:08:42.459		-7.13x	63.04x	60234.64		9.83	12.01
C (IER)	E	2049-09-29T17:17:01.702		6.35	61.67x	74490.58	2.25		
B (IER)	E	2049-09-29T19:27:22.912		33.90	40.97x	91984.69	2.20		
B (OER)	E	2049-09-29T22:46:08.781		76.63	-1.51x	117571.16	2.12		
A (IER)	E	2049-09-29T23:21:20.105		82.09	-9.14	122050.38	2.13		
Encke (IEG)	E	2049-09-30T00:49:12.747		72.00	-27.69	133423.31	2.20		
Encke (OEG)	E	2049-09-30T00:51:38.952		71.50	-28.18	133744.89	2.20		
A (OER)	E	2049-09-30T01:14:26.344		66.68	-32.75	136774.40	2.23		
F ring	E	2049-09-30T01:41:43.987		60.79	-38.02	140461.00	2.27		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2049-09-29T09:33:28.180  
 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 : 6772510698145393024  
 2Mass ID (if available) : 19265965-2201518  
 ICRS Star Coord at Epoch: 19h 26m 59.64929s -22:01:51.87403s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 8.540  
 G magnitude : 11.879  
 RP magnitude : 10.922  
 BP magnitude : 12.815  
 DUPflag : 0  
 Distance (au) : 9.706  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 2.39  
 Sun-Target sep (deg) : 104.06  
 Sun-Moon sep (deg) : 76.17  
 B (ring opening deg) : 23.99  
 PA of pole (deg) : 6.74  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 2.545  
 C/A sky separation (km) : 17918.0  
 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\_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	2049-09-28T20:04:07.731		55.32	-41.57	140461.00	-1.81		
A (OER)	I	2049-09-28T20:37:27.504		48.28	-46.70	136774.40	-1.88		
Encke (OEG)	I	2049-09-28T21:03:57.303		42.66	-50.14	133744.89	-1.93		
Encke (IEG)	I	2049-09-28T21:06:43.352		42.08	-50.46	133423.31	-1.94		
A (IER)	I	2049-09-28T22:39:40.685		22.54	-55.18	122050.38	-2.14		
B (OER)	I	2049-09-28T23:14:02.774		15.48	-53.56	117571.16	-2.21		
B (IER)	I	2049-09-29T02:15:55.501		-18.19x	-25.71	91984.69	-2.43		
C (IER)	I	2049-09-29T04:16:42.516	b	-32.87x	-0.79x	74490.58	-2.35		
Saturn	I	2049-09-29T03:36:36.128		-29.11x	-9.23	60121.36		21.00	25.18
Saturn	E	2049-09-29T16:27:45.979		72.59	1.26x	60218.30		12.03	14.66
C (IER)	E	2049-09-29T17:39:12.382		79.56	-13.70	74490.58	1.64		
B (IER)	E	2049-09-29T20:22:32.900		50.61	-44.25	91984.69	1.96		
B (OER)	E	2049-09-29T23:33:47.769		10.71	-51.47	117571.16	2.52		
A (IER)	E	2049-09-30T00:02:56.320		4.94x	-48.13	122050.38	2.61		
Encke (IEG)	E	2049-09-30T01:12:57.153		-8.21x	-37.24	133423.31	2.81		
Encke (OEG)	E	2049-09-30T01:14:51.677		-8.55x	-36.90	133744.89	2.81		
A (OER)	E	2049-09-30T01:32:40.676		-11.68x	-33.68	136774.40	2.86		
F ring	E	2049-09-30T01:53:59.022		-15.28x	-29.67	140461.00	2.91		