

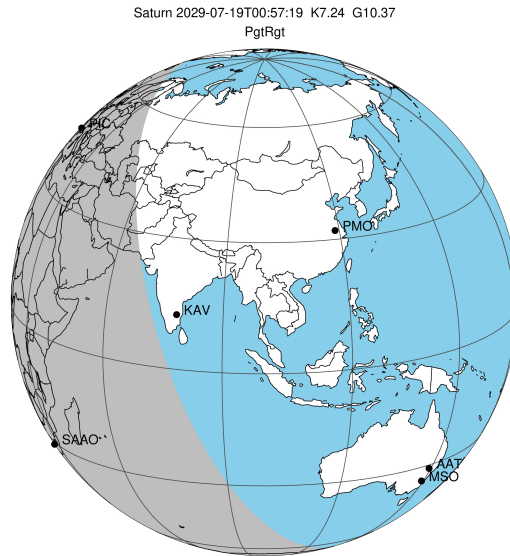
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2029-07-19T00:57:19.090
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 54522689973491584
 2Mass ID (if available) : 03225143+1617156

Saturn 2029-07-19T00:57:19 K7.24 G10.37 PgtRgt

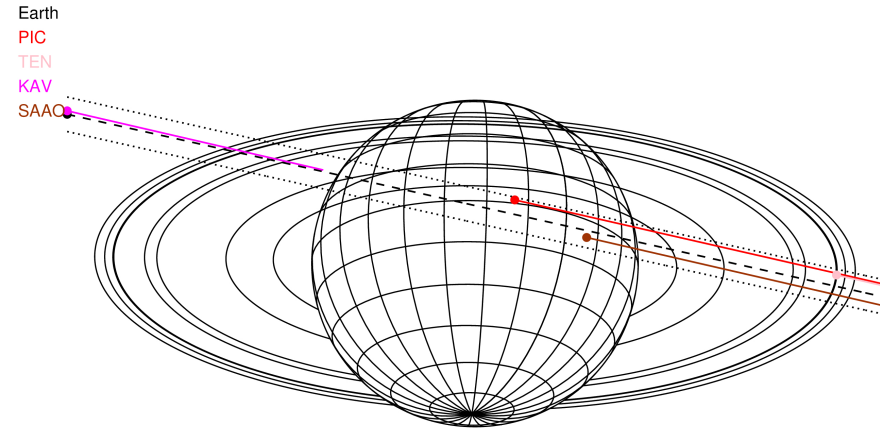
ICRS Star Coord at Epoch: 03h 22m 51.43793s +16:17:15.28944s

RUWE (>1.4 is poor) : 1.40
 K magnitude : 7.241
 G magnitude : 10.369
 RP magnitude : 9.477
 BP magnitude : 11.212
 DUPflag : 0
 Distance (au) : 9.562
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 22.88
 Sun-Target sep (deg) : 63.74
 Sun-Moon sep (deg) : 158.54
 B (ring opening deg) : -22.68
 PA of pole (deg) : -1.24

#	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

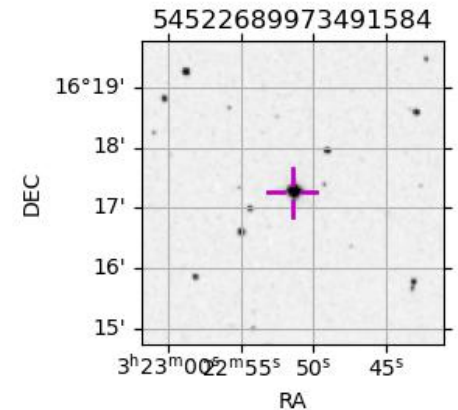


2029-07-19T00:57:19.0900 ex: 03 22 51.4379 8: +16 17 15.289 C/A 3.010° PA 167.39 deg v_sky +22.88 km/s D 09.56 AU
 Credit: Styled after SORA/Lucky Star

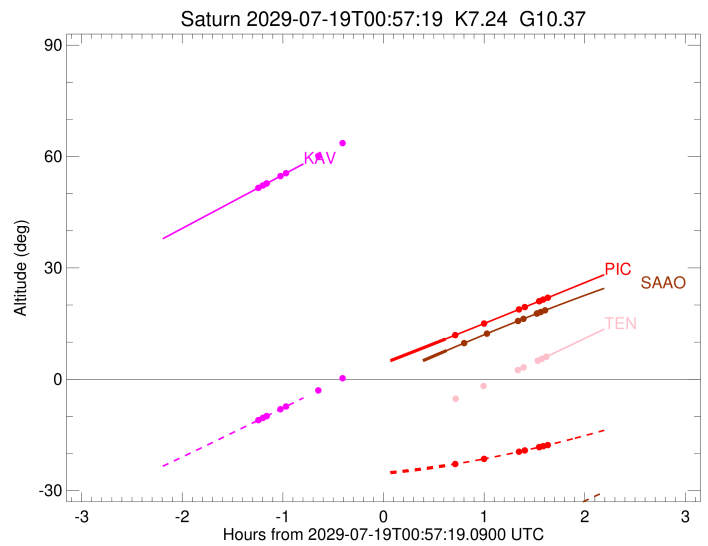
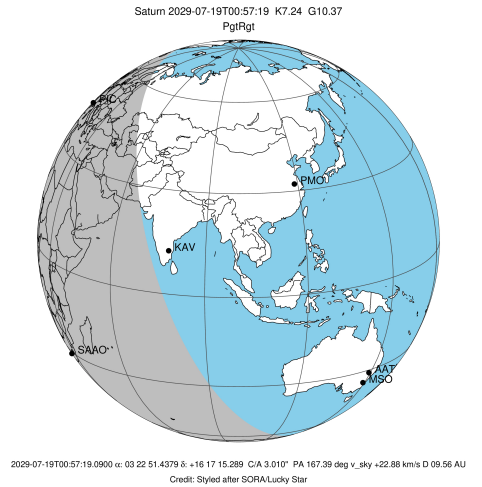


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1		+	+	JUL 19 01:34 - JUL 19 02:35	PneRne
PAL	Palomar Mt (20	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4					PnnRnn
MCD	McDonald Obs.	30.7	256.0					PnnRnn
TEN	Teide Obs./Ten	28.3	343.5			+	JUL 19 02:29 - JUL 19 02:34	PnnRne
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observ	12.6	78.8	+	+	+	JUL 18 23:42 - JUL 18 23:59	PnnRin
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European South	-29.3	289.3					PnnRnn
AAT	Siding Spring	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro	-32.4	20.8		+	+	JUL 19 01:34 - JUL 19 02:33	PneRne
MSO	Mt. Stromlo Ob	-35.3	149.0					PnnRnn



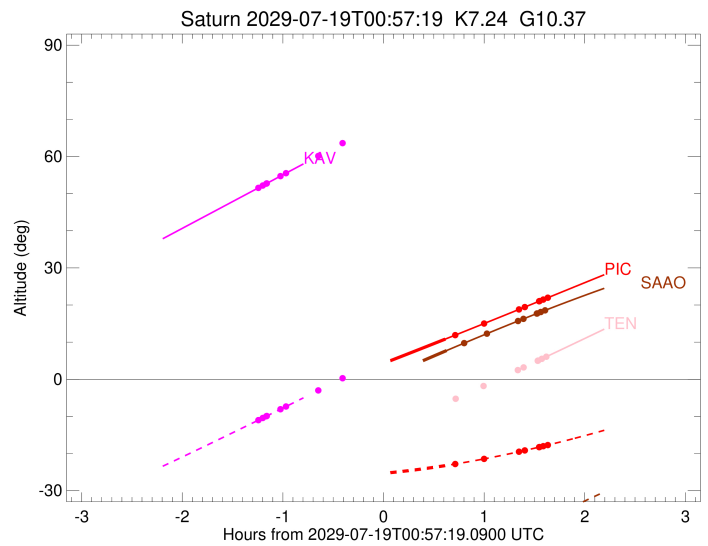
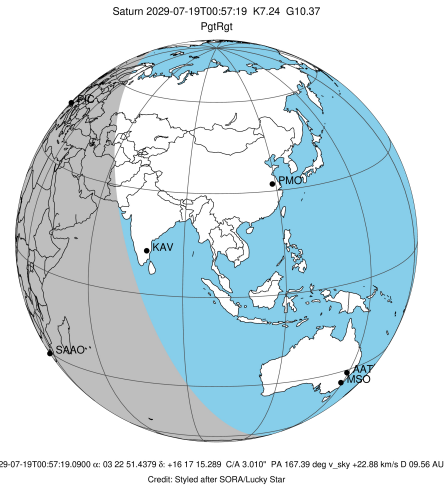
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2029-07-19T00:54:47.910
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 54522689973491584
 2Mass ID (if available) : 03225143+1617156
 ICRS Star Coord at Epoch: 03h 22m 51.43793s +16:17:15.28944s
 RUWE (>1.4 is poor) : 1.40
 K magnitude : 7.241
 G magnitude : 10.369
 RP magnitude : 9.477
 BP magnitude : 11.212
 DUPflag : 0
 Distance (au) : 9.562
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 22.88
 Sun-Target sep (deg) : 63.74
 Sun-Moon sep (deg) : 157.86
 B (ring opening deg) : -22.68
 PA of pole (deg) : -1.24
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 3.771
 C/A sky separation (km) : 26152.3
 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	2029-07-18T23:49:30.554	-7.08x	-26.32	140461.00	-22.98			
A (OER)	I	2029-07-18T23:52:11.495	-6.65x	-26.36	136774.40	-22.83			
Encke (OEG)	I	2029-07-18T23:54:24.584	-6.30x	-26.38	133744.89	-22.69			
Encke (IEG)	I	2029-07-18T23:54:38.758	-6.26x	-26.38	133423.31	-22.68			
A (IER)	I	2029-07-19T00:03:06.766	-4.89x	-26.43	122050.38	-22.07			
B (OER)	I	2029-07-19T00:06:31.090	-4.33x	-26.43	117571.16	-21.77			
B (IER)	I	2029-07-19T00:27:16.831	b	-0.88x	-26.24	91984.69	-18.97		
C (IER)	I	2029-07-19T00:44:31.684	b	2.07x	-25.81	74490.58	-14.39		
Saturn	I	2029-07-19T00:15:41.330	-2.82x	-26.39	59954.35			34.11	39.57
Saturn	E	2029-07-19T01:34:14.104	10.84	-23.26	60216.95			13.03	15.86
C (IER)	E	2029-07-19T01:40:03.862	11.88	-22.83	74490.58	14.47			
B (IER)	E	2029-07-19T01:57:16.664	15.00	-21.45	91984.69	18.93			
B (OER)	E	2029-07-19T02:18:08.178	18.82	-19.52	117571.16	21.62			
A (IER)	E	2029-07-19T02:21:33.965	19.44	-19.17	122050.38	21.90			
Encke (IEG)	E	2029-07-19T02:30:06.081	21.01	-18.29	133423.31	22.48			
Encke (OEG)	E	2029-07-19T02:30:20.379	21.06	-18.26	133744.89	22.50			
A (OER)	E	2029-07-19T02:32:34.653	21.47	-18.02	136774.40	22.62			
F ring	E	2029-07-19T02:35:17.082	21.96	-17.73	140461.00	22.77			

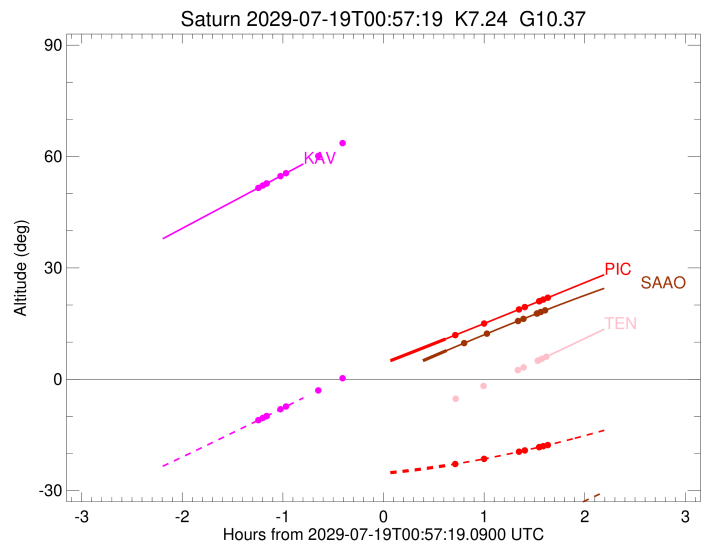
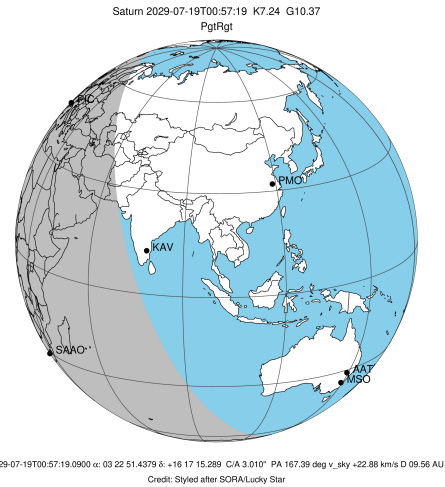
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2029-07-19T00:54:22.110
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : TEN
 Location : Teide Obs./Tenerife
 Latitude (deg) : 28.30050
 E. Longitude (deg) : 343.48909
 Altitude (km) : 2.395
 Gaia source ID : 54522689973491584
 2Mass ID (if available) : 03225143+1617156
 ICRS Star Coord at Epoch: 03h 22m 51.43793s +16:17:15.28944s
 RUWE (>1.4 is poor) : 1.40
 K magnitude : 7.241
 G magnitude : 10.369
 RP magnitude : 9.477
 BP magnitude : 11.212
 DUPflag : 0
 Distance (au) : 9.562
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 22.88
 Sun-Target sep (deg) : 63.74
 Sun-Moon sep (deg) : 157.69
 B (ring opening deg) : -22.68
 PA of pole (deg) : -1.24
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 3.674
 C/A sky separation (km) : 25479.3
 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	2029-07-18T23:48:23.251	-26.67x	-37.01	140461.00	-23.21			
A (OER)	I	2029-07-18T23:51:02.594	-26.21x	-37.26	136774.40	-23.06			
Encke (OEG)	I	2029-07-18T23:53:14.309	-25.83x	-37.45	133744.89	-22.94			
Encke (IEG)	I	2029-07-18T23:53:28.334	-25.79x	-37.47	133423.31	-22.92			
A (IER)	I	2029-07-19T00:01:50.558	-24.31x	-38.17	122050.38	-22.34			
B (OER)	I	2029-07-19T00:05:12.278	-23.71x	-38.43	117571.16	-22.06			
B (IER)	I	2029-07-19T00:25:36.298	b	-19.98x	-39.77	91984.69	-19.42		
C (IER)	I	2029-07-19T00:42:15.224	b	-16.82x	-40.52	74490.58	-15.18		
Saturn	I	2029-07-19T00:15:13.715	-21.90x	-39.14	59965.29			33.43	38.85
Saturn	E	2029-07-19T01:33:50.039	-6.59x	-40.78	60221.59			12.42	15.12
C (IER)	E	2029-07-19T01:40:19.772	-5.26x	-40.59	74490.58	15.26			
B (IER)	E	2029-07-19T01:56:57.106	-1.82x	-39.89	91984.69	19.38			
B (OER)	E	2029-07-19T02:17:26.887	2.48x	-38.60	117571.17	21.91			
A (IER)	E	2029-07-19T02:20:50.032	3.19x	-38.34	122050.38	22.18			
Encke (IEG)	E	2029-07-19T02:29:16.252	4.98x	-37.65	133423.31	22.73			
Encke (OEG)	E	2029-07-19T02:29:30.398	5.03	-37.63	133744.89	22.74			
A (OER)	E	2029-07-19T02:31:43.263	5.50	-37.44	136774.40	22.86			
F ring	E	2029-07-19T02:34:24.050	6.07	-37.20	140461.00	22.99			

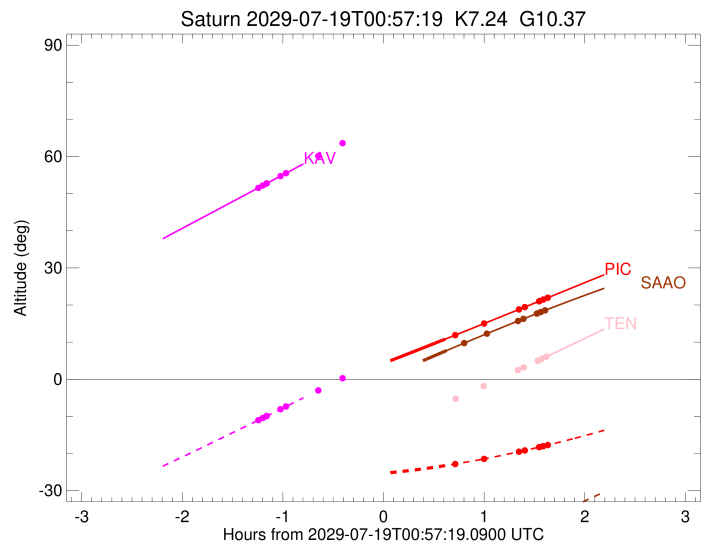
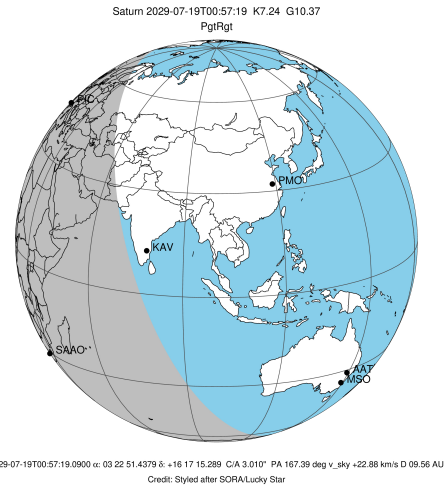
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2029-07-19T00:55:45.440
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : KAV
 Location : Kavalur Observatory
 Latitude (deg) : 12.57556
 E. Longitude (deg) : 78.83167
 Altitude (km) : 0.722
 Gaia source ID : 54522689973491584
 2Mass ID (if available) : 03225143+1617156
 ICRS Star Coord at Epoch: 03h 22m 51.43793s +16:17:15.28944s
 RUWE (>1.4 is poor) : 1.40
 K magnitude : 7.241
 G magnitude : 10.369
 RP magnitude : 9.477
 BP magnitude : 11.212
 DUPflag : 0
 Distance (au) : 9.562
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 22.88
 Sun-Target sep (deg) : 63.74
 Sun-Moon sep (deg) : 158.56
 B (ring opening deg) : -22.68
 PA of pole (deg) : -1.24
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 3.037
 C/A sky separation (km) : 21059.9
 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	2029-07-18T23:42:37.435		51.54	-11.03	140461.00	-23.54		
A (OER)	I	2029-07-18T23:45:14.369		52.17	-10.45	136774.40	-23.44		
Encke (OEG)	I	2029-07-18T23:47:23.828		52.69	-9.97	133744.89	-23.36		
Encke (IEG)	I	2029-07-18T23:47:37.597		52.74	-9.92	133423.31	-23.35		
A (IER)	I	2029-07-18T23:55:48.478		54.71	-8.09	122050.38	-22.97		
B (OER)	I	2029-07-18T23:59:04.227		55.49	-7.36	117571.16	-22.79		
B (IER)	I	2029-07-19T00:18:23.663	b	60.13	-3.01x	91984.69	-21.15		
C (IER)	I	2029-07-19T00:32:55.963	b	63.62	0.29x	74490.58	-18.71		
Saturn	I	2029-07-19T00:14:08.017		59.11	-3.97x	60025.22		29.54	34.69
Saturn	E	2029-07-19T01:37:38.629		78.89	15.14x	60248.19		8.07	9.88
C (IER)	E	2029-07-19T01:47:29.281		81.09	17.43x	74490.58	18.73		
B (IER)	E	2029-07-19T02:02:03.259		84.06	20.81x	91984.69	21.06		
B (OER)	E	2029-07-19T02:21:29.801		86.09	25.33x	117571.17	22.62		
A (IER)	E	2029-07-19T02:24:47.106		85.97	26.10x	122050.38	22.78		
Encke (IEG)	E	2029-07-19T02:33:02.269		85.06	28.02x	133423.31	23.14		
Encke (OEG)	E	2029-07-19T02:33:16.167		85.02	28.08x	133744.89	23.14		
A (OER)	E	2029-07-19T02:35:26.846		84.68	28.58x	136774.40	23.22		
F ring	E	2029-07-19T02:38:05.306		84.22	29.20x	140461.00	23.31		

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2029-07-19T00:53:03.550
 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 : 54522689973491584
 2Mass ID (if available) : 03225143+1617156
 ICRS Star Coord at Epoch: 03h 22m 51.43793s +16:17:15.28944s
 RUWE (>1.4 is poor) : 1.40
 K magnitude : 7.241
 G magnitude : 10.369
 RP magnitude : 9.477
 BP magnitude : 11.212
 DUPflag : 0
 Distance (au) : 9.562
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 22.88
 Sun-Target sep (deg) : 63.74
 Sun-Moon sep (deg) : 157.81
 B (ring opening deg) : -22.68
 PA of pole (deg) : -1.24
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 2.680
 C/A sky separation (km) : 18584.8
 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	2029-07-18T23:37:58.768		-15.90x	-73.29	140461.00	-24.25		
A (OER)	I	2029-07-18T23:40:31.043		-15.37x	-72.87	136774.40	-24.17		
Encke (OEG)	I	2029-07-18T23:42:36.543		-14.94x	-72.52	133744.89	-24.11		
Encke (IEG)	I	2029-07-18T23:42:49.885		-14.89x	-72.48	133423.31	-24.10		
A (IER)	I	2029-07-18T23:50:44.598		-13.24x	-71.11	122050.38	-23.80		
B (OER)	I	2029-07-18T23:53:53.321		-12.59x	-70.54	117571.16	-23.66		
B (IER)	I	2029-07-19T00:12:20.647	b	-8.77x	-67.09	91984.69	-22.40		
C (IER)	I	2029-07-19T00:25:51.222	b	-6.00x	-64.44	74490.58	-20.57		
Saturn	I	2029-07-19T00:11:27.267		-8.95x	-67.26	60059.00		27.21	32.15
Saturn	E	2029-07-19T01:34:57.989		7.74	-50.19	60257.81		5.78	7.09
C (IER)	E	2029-07-19T01:45:23.646		9.73	-47.99	74490.58	20.53		
B (IER)	E	2029-07-19T01:58:57.975		12.28	-45.12	91984.69	22.25		
B (OER)	E	2029-07-19T02:17:34.646		15.70	-41.18	117571.17	23.43		
A (IER)	E	2029-07-19T02:20:45.327		16.27	-40.51	122050.38	23.55		
Encke (IEG)	E	2029-07-19T02:28:45.386		17.70	-38.82	133423.31	23.82		
Encke (OEG)	E	2029-07-19T02:28:58.887		17.74	-38.77	133744.89	23.82		
A (OER)	E	2029-07-19T02:31:05.903		18.11	-38.32	136774.40	23.88		
F ring	E	2029-07-19T02:33:40.071		18.56	-37.78	140461.00	23.94		