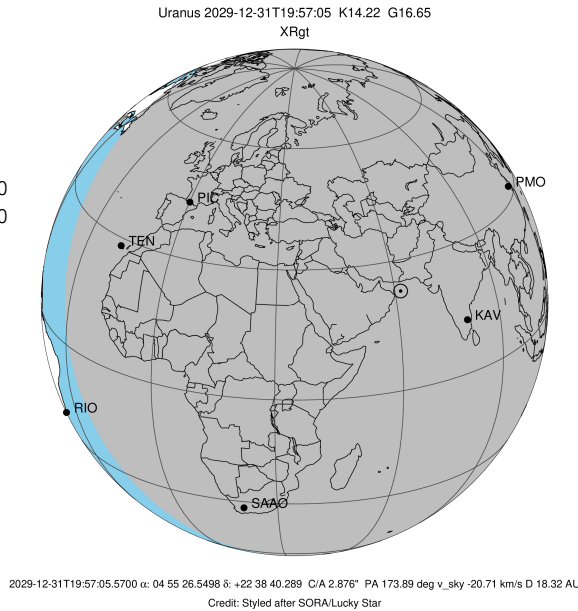


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T19:57:05.570
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404

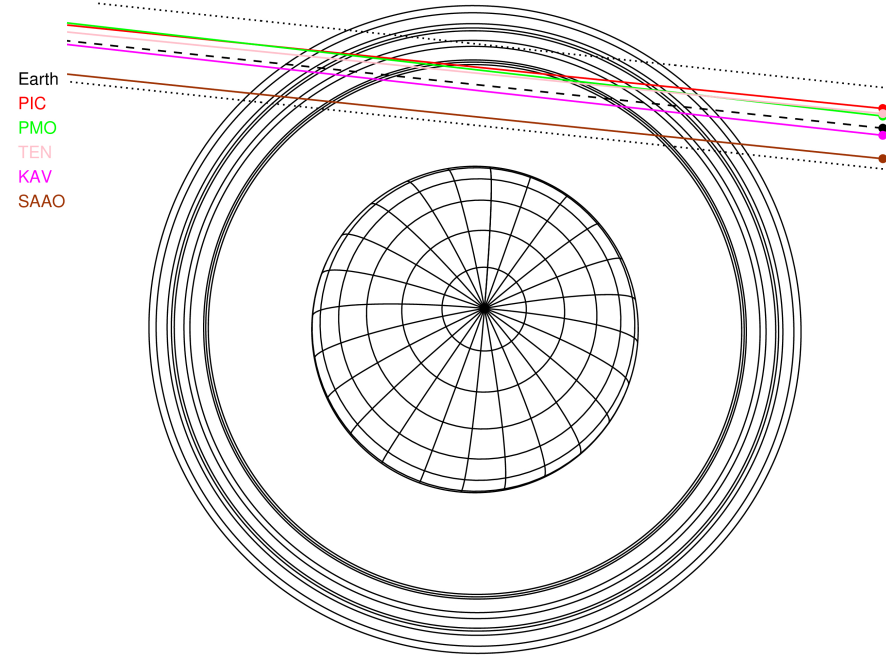
ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s

RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 160.24
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19

#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon

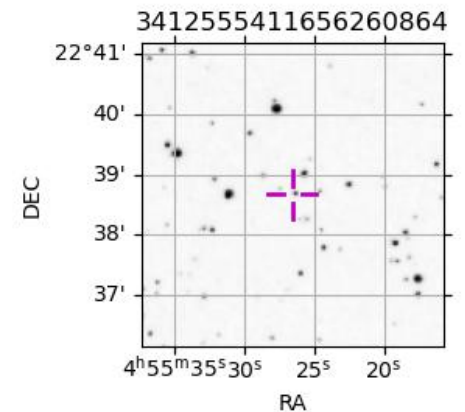


Uranus 2029-12-31T19:57:05 K14.22 G16.65 XRgt

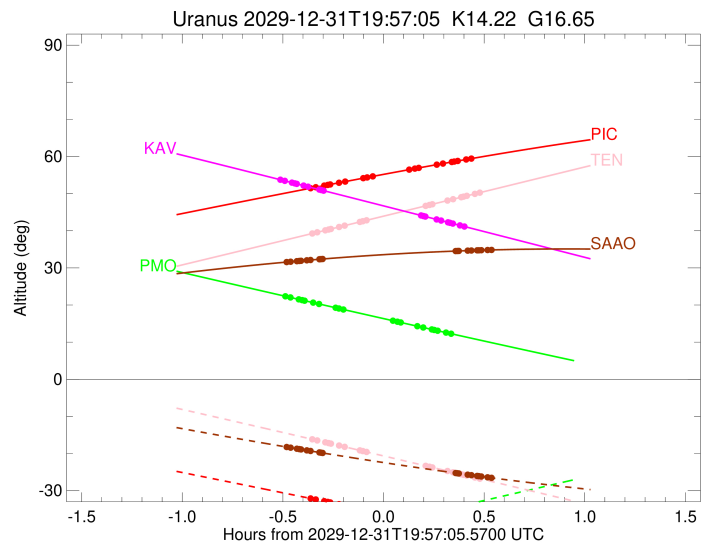
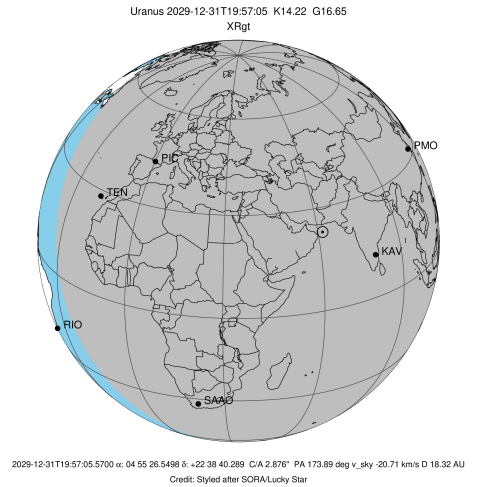


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEncode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 31 19:34 - DEC 31 20:23	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++		+++++	DEC 31 19:27 - DEC 31 20:17	PnnRie
KPNO	Kitt Peak Natl Obs	32.0	248.4					PnnRnn
MCD	McDonald Obs. 2.7m	30.7	256.0					PnnRnn
TEN	Teide Obs./Tenerife	28.3	343.5	+++++		+++++	DEC 31 19:35 - DEC 31 20:25	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 31 19:25 - DEC 31 20:21	PnnRie
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European Southern Obs	-29.3	289.3					PnnRnn
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAG	So. Afr. Astro. Obs.	-32.4	20.8	+++++		+++++	DEC 31 19:27 - DEC 31 20:29	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T19:59:07.950
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404
 ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 160.12
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.077
 C/A sky separation (km) : 40897.6
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

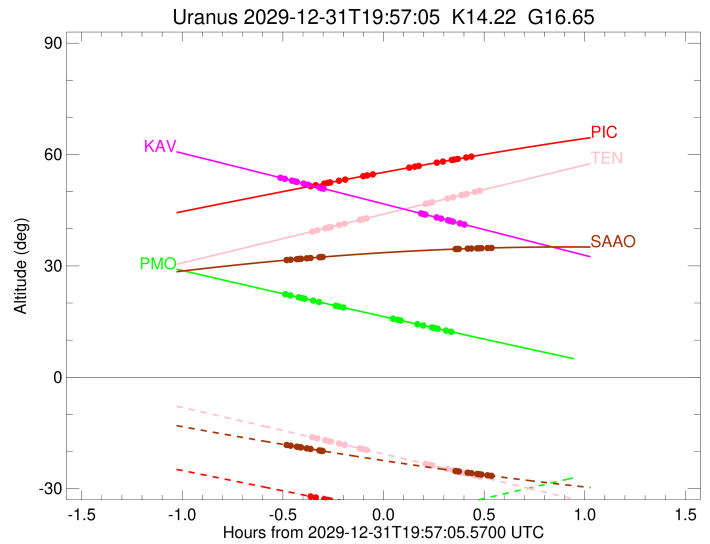
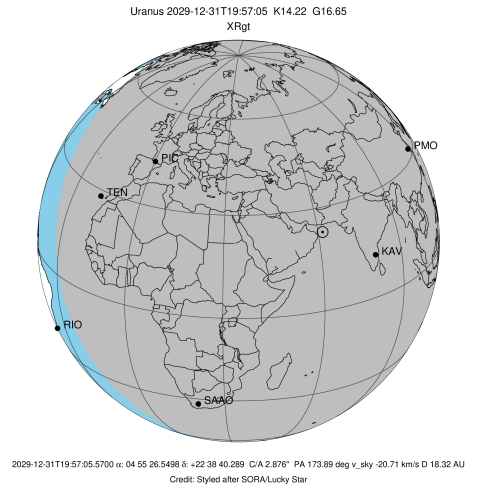


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-31T19:34:49.965		51.37	-32.00	51554.11	-12.58		
lambda	I	2029-12-31T19:36:54.996		51.74	-32.39	50026.71	-11.85		
delta	I	2029-12-31T19:39:26.680		52.18	-32.85	48300.35	-10.89		
gamma	I	2029-12-31T19:40:30.250		52.36	-33.04	47621.53	-10.46		
eta	I	2029-12-31T19:41:13.457		52.49	-33.18	47176.12	-10.16		
beta	I	2029-12-31T19:43:51.528		52.94	-33.66	45663.44	-8.96		
alpha	I	2029-12-31T19:45:44.781		53.27	-34.01	44700.59	-8.06		
4	I	2029-12-31T19:51:01.297		54.17	-34.97	42600.19	-5.15		
5	I	2029-12-31T19:52:00.534		54.33	-35.16	42303.59	-4.56		
6	I	2029-12-31T19:53:48.501		54.64	-35.49	41877.65	-3.49		

No planet occultations

6	E	2029-12-31T20:04:49.870		56.48	-37.51	41871.12	3.49		
5	E	2029-12-31T20:06:33.452		56.77	-37.82	42279.49	4.56		
4	E	2029-12-31T20:07:34.707		56.93	-38.01	42580.16	5.15		
alpha	E	2029-12-31T20:12:57.891		57.81	-39.00	44726.24	8.07		
beta	E	2029-12-31T20:14:45.933		58.10	-39.33	45647.21	8.97		
eta	E	2029-12-31T20:17:25.579		58.52	-39.81	47176.12	10.17		
gamma	E	2029-12-31T20:18:08.757		58.64	-39.95	47621.81	10.47		
delta	E	2029-12-31T20:19:12.213		58.81	-40.14	48300.35	10.91		
lambda	E	2029-12-31T20:21:43.671		59.20	-40.60	50026.71	11.87		
epsilon	E	2029-12-31T20:23:27.703		59.47	-40.92	51293.51	12.60		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T19:52:19.650
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404
 ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 161.12
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.043
 C/A sky separation (km) : 40436.0
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

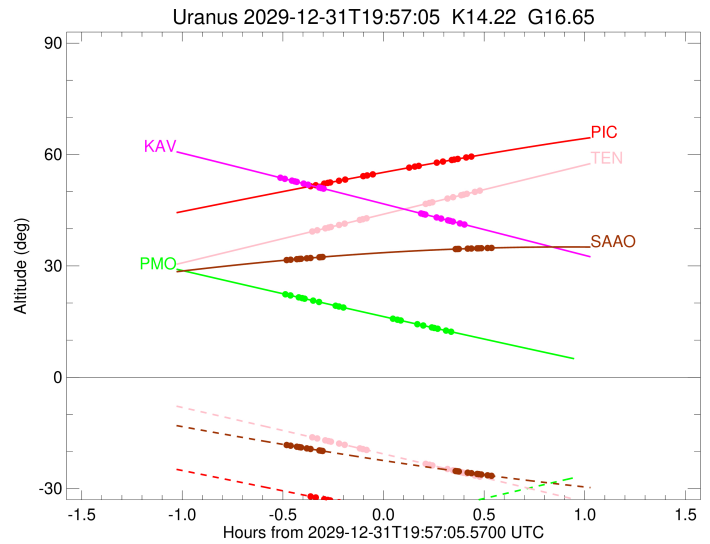
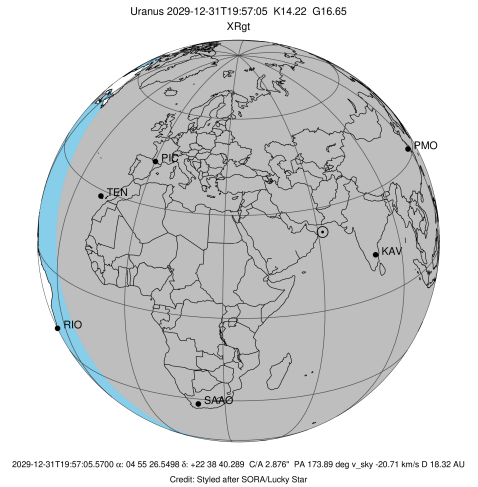


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-31T19:27:19.270		22.46	-45.29	51553.13	-12.74		
lambda	I	2029-12-31T19:29:22.471		22.04	-44.85	50026.71	-12.04		
delta	I	2029-12-31T19:31:51.354		21.52	-44.33	48300.35	-11.13		
gamma	I	2029-12-31T19:32:53.456		21.31	-44.11	47621.60	-10.72		
eta	I	2029-12-31T19:33:35.558		21.17	-43.96	47176.12	-10.44		
beta	I	2029-12-31T19:36:08.439		20.64	-43.42	45664.14	-9.32		
alpha	I	2029-12-31T19:37:56.855		20.27	-43.03	44699.51	-8.49		
4	I	2029-12-31T19:42:46.761		19.27	-42.01	42601.99	-5.93		
5	I	2029-12-31T19:43:37.267		19.10	-41.83	42305.87	-5.44		
6	I	2029-12-31T19:45:04.099		18.80	-41.53	41878.46	-4.62		

No planet occultations

6	E	2029-12-31T19:59:57.264		15.76	-38.38	41869.93	4.61		
5	E	2029-12-31T20:01:19.886		15.49	-38.09	42277.19	5.44		
4	E	2029-12-31T20:02:12.490		15.31	-37.90	42578.86	5.92		
alpha	E	2029-12-31T20:07:10.002		14.30	-36.86	44726.71	8.47		
beta	E	2029-12-31T20:08:53.565		13.95	-36.49	45647.05	9.29		
eta	E	2029-12-31T20:11:28.726		13.43	-35.95	47176.12	10.40		
gamma	E	2029-12-31T20:12:10.996		13.29	-35.80	47621.83	10.69		
delta	E	2029-12-31T20:13:13.303		13.08	-35.58	48300.35	11.09		
lambda	E	2029-12-31T20:15:42.777		12.58	-35.05	50026.71	11.99		
epsilon	E	2029-12-31T20:17:25.837		12.23	-34.69	51292.28	12.68		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T20:00:39.500
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404
 ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 159.83
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.008
 C/A sky separation (km) : 39972.6
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ural11.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ural11.bsp
 ural61.bsp
 vgr2.ural61.bsp
 peph.ural60.bsp
 earthstns_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

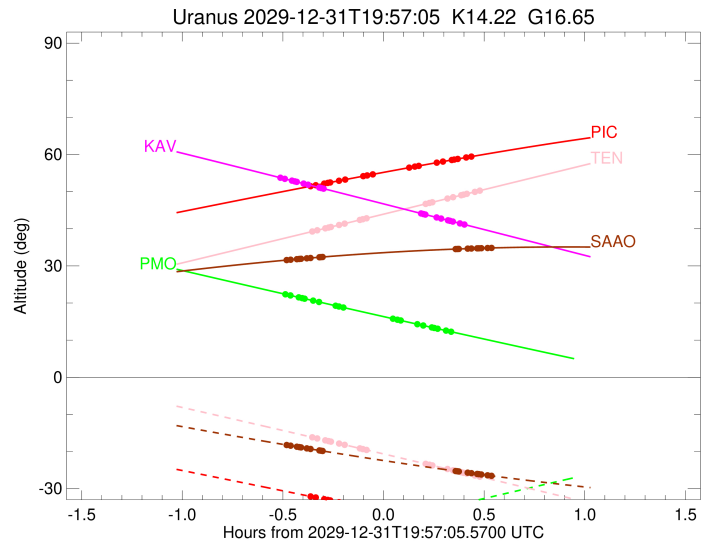
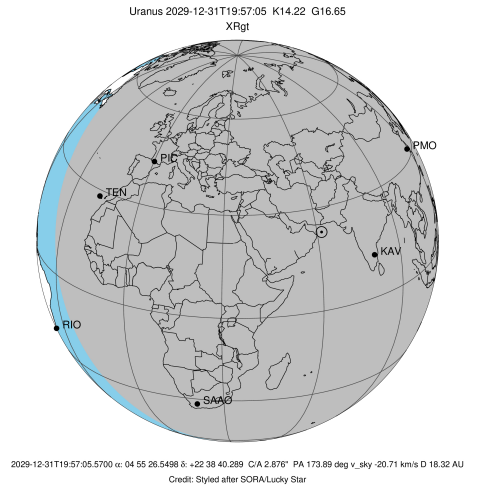


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-31T19:35:21.385		39.16	-16.06	51553.10	-13.05		
lambda	I	2029-12-31T19:37:21.447		39.60	-16.48	50026.71	-12.38		
delta	I	2029-12-31T19:39:45.854		40.12	-16.99	48300.35	-11.51		
gamma	I	2029-12-31T19:40:45.811		40.34	-17.20	47621.62	-11.12		
eta	I	2029-12-31T19:41:26.349		40.49	-17.34	47176.12	-10.85		
beta	I	2029-12-31T19:43:52.604		41.03	-17.86	45664.30	-9.80		
alpha	I	2029-12-31T19:45:35.235		41.40	-18.22	44699.20	-9.02		
4	I	2029-12-31T19:50:01.076		42.38	-19.15	42602.74	-6.70		
5	I	2029-12-31T19:50:45.298		42.54	-19.31	42306.81	-6.28		
6	I	2029-12-31T19:51:59.086		42.81	-19.57	41878.77	-5.59		

No planet occultations

6	E	2029-12-31T20:09:41.814		46.71	-23.33	41868.24	5.60		
5	E	2029-12-31T20:10:51.189		46.97	-23.58	42273.49	6.29		
4	E	2029-12-31T20:11:37.402		47.14	-23.74	42576.60	6.71		
alpha	E	2029-12-31T20:16:09.745		48.14	-24.71	44727.98	9.04		
beta	E	2029-12-31T20:17:47.076		48.50	-25.06	45646.54	9.82		
eta	E	2029-12-31T20:20:14.768		49.04	-25.58	47176.12	10.88		
gamma	E	2029-12-31T20:20:55.236		49.19	-25.73	47621.93	11.15		
delta	E	2029-12-31T20:21:55.013		49.41	-25.94	48300.35	11.54		
lambda	E	2029-12-31T20:24:19.026		49.94	-26.46	50026.71	12.42		
epsilon	E	2029-12-31T20:25:57.853		50.30	-26.81	51281.29	13.09		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T19:53:34.960
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404
 ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 161.13
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.802
 C/A sky separation (km) : 37238.8
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ural11.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ural11.bsp
 ural61.bsp
 vgr2.ural61.bsp
 peph.ural60.bsp
 earthstns_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

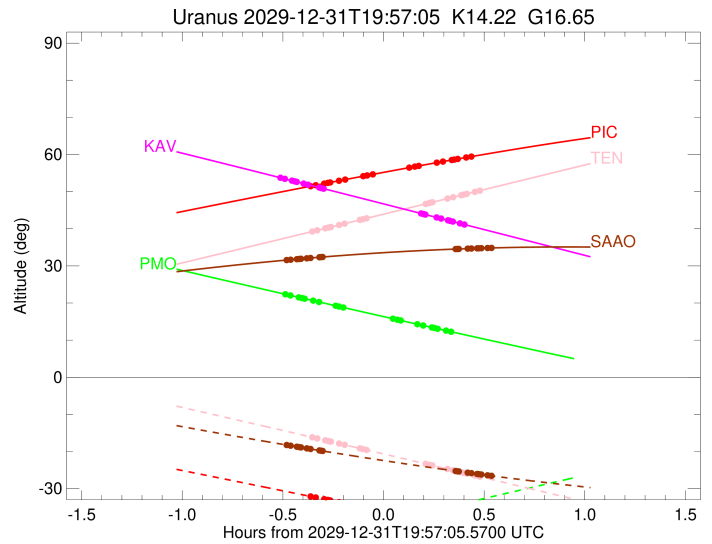
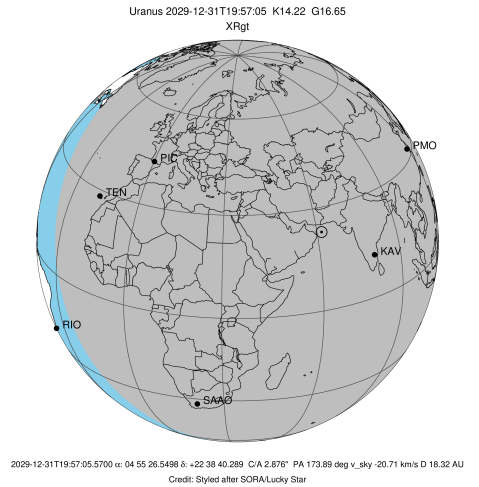


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-31T19:25:54.423		53.85	-76.13	51547.42	-14.47		
lambda	I	2029-12-31T19:27:41.585		53.45	-75.85	50026.71	-13.93		
delta	I	2029-12-31T19:29:48.563		52.96	-75.51	48300.35	-13.25		
gamma	I	2029-12-31T19:30:40.332		52.77	-75.37	47621.93	-12.95		
eta	I	2029-12-31T19:31:15.018		52.63	-75.27	47176.12	-12.75		
beta	I	2029-12-31T19:33:17.054		52.17	-74.93	45666.80	-11.97		
alpha	I	2029-12-31T19:34:40.177		51.85	-74.70	44695.56	-11.42		
4	I	2029-12-31T19:37:55.704		51.11	-74.13	42607.92	-9.91		
5	I	2029-12-31T19:38:25.024		51.00	-74.04	42312.12	-9.67		
6	I	2029-12-31T19:39:11.812		50.82	-73.90	41879.74	-9.29		

No planet occultations

6	E	2029-12-31T20:08:18.790		44.12	-68.20	41862.72	9.27		
5	E	2029-12-31T20:09:01.458		43.96	-68.05	42261.74	9.65		
4	E	2029-12-31T20:09:32.790		43.84	-67.94	42569.70	9.89		
alpha	E	2029-12-31T20:12:55.688		43.06	-67.23	44731.67	11.39		
beta	E	2029-12-31T20:14:13.963		42.76	-66.96	45645.17	11.94		
eta	E	2029-12-31T20:16:18.135		42.28	-66.52	47176.12	12.71		
gamma	E	2029-12-31T20:16:52.953		42.15	-66.40	47622.22	12.91		
delta	E	2029-12-31T20:17:44.870		41.95	-66.22	48300.35	13.21		
lambda	E	2029-12-31T20:19:52.291		41.46	-65.76	50026.71	13.88		
epsilon	E	2029-12-31T20:21:19.379		41.12	-65.45	51253.70	14.41		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-31T19:58:36.660
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412555411656260864
 2Mass ID (if available) : 04552651+2238404
 ICRS Star Coord at Epoch: 04h 55m 26.54984s +22:38:40.28851s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.224
 G magnitude : 16.651
 RP magnitude : 15.861
 BP magnitude : 17.314
 DUPflag : 0
 Distance (au) : 18.324
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.71
 Sun-Target sep (deg) : 155.12
 Sun-Moon sep (deg) : 160.25
 B (ring opening deg) : 81.85
 PA of pole (deg) : -24.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.494
 C/A sky separation (km) : 33147.9
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-31T19:27:49.849		31.54	-18.19	51537.02	-16.08		
lambda	I	2029-12-31T19:29:25.039		31.67	-18.43	50026.71	-15.68		
delta	I	2029-12-31T19:31:16.762		31.82	-18.71	48300.35	-15.21		
gamma	I	2029-12-31T19:32:01.624		31.87	-18.83	47622.34	-15.01		
eta	I	2029-12-31T19:32:31.489		31.91	-18.90	47176.12	-14.87		
beta	I	2029-12-31T19:34:14.586		32.05	-19.16	45669.38	-14.35		
alpha	I	2029-12-31T19:35:23.612		32.13	-19.33	44692.19	-13.99		
4	I	2029-12-31T19:37:57.442		32.33	-19.71	42611.90	-13.05		
5	I	2029-12-31T19:38:19.693		32.35	-19.76	42314.80	-12.91		
6	I	2029-12-31T19:38:54.599		32.40	-19.85	41879.18	-12.69		

No planet occultations

6	E	2029-12-31T20:18:36.134		34.53	-25.26	41855.59	12.69		
5	E	2029-12-31T20:19:06.882		34.55	-25.32	42247.01	12.92		
4	E	2029-12-31T20:19:31.031		34.56	-25.37	42561.39	13.06		
alpha	E	2029-12-31T20:22:11.665		34.65	-25.70	44736.50	14.00		
beta	E	2029-12-31T20:23:15.591		34.68	-25.83	45643.51	14.36		
eta	E	2029-12-31T20:25:00.373		34.73	-26.04	47176.12	14.88		
gamma	E	2029-12-31T20:25:30.241		34.75	-26.10	47622.74	15.02		
delta	E	2029-12-31T20:26:15.041		34.77	-26.19	48300.35	15.23		
lambda	E	2029-12-31T20:28:06.670		34.81	-26.41	50026.71	15.70		
epsilon	E	2029-12-31T20:29:21.138		34.84	-26.56	51206.40	16.09		