

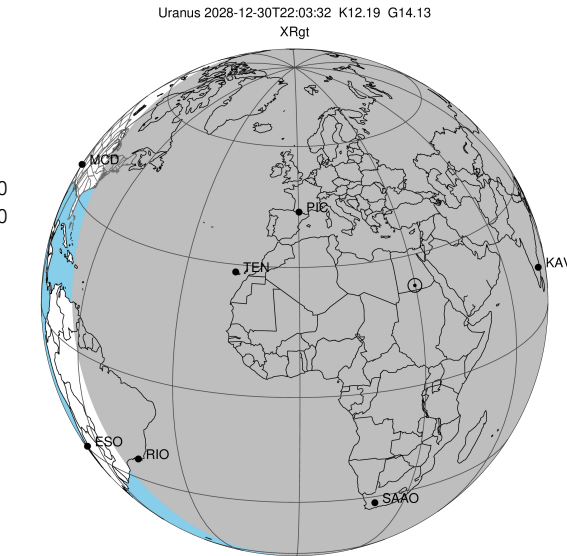
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-30T22:03:32.950
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 144910551595750016
 2Mass ID (if available) : 04363031+2201362

ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s

RUWE (>1.4 is poor) : 1.08
 K magnitude : 12.191
 G magnitude : 14.134
 RP magnitude : 13.476
 BP magnitude : 14.625
 DUPflag : 0
 Distance (au) : 18.420
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.81
 Sun-Target sep (deg) : 151.37
 Sun-Moon sep (deg) : 18.89
 B (ring opening deg) : 79.66
 PA of pole (deg) : -49.92

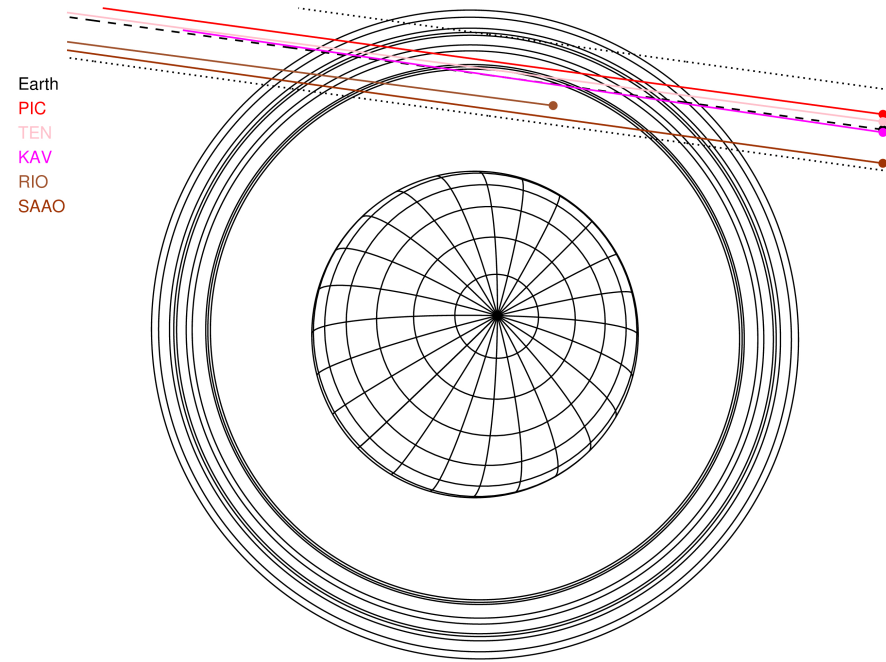
a(km) ring

- 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



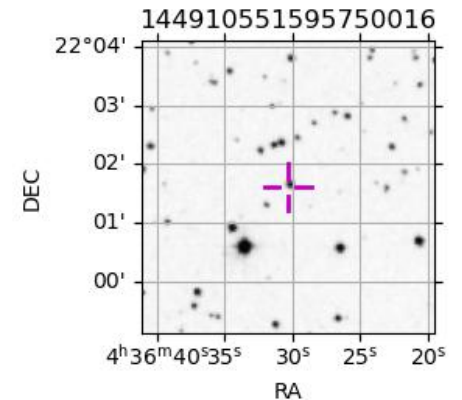
2028-12-30T22:03:32.9500 ra: 04 36 30.3278 s: +22 01 36.146 C/A 3.039° PA 172.13 deg v_sky -19.81 km/s D 18.42 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2028-12-30T22:03:32 K12.19 G14.13 XRgt

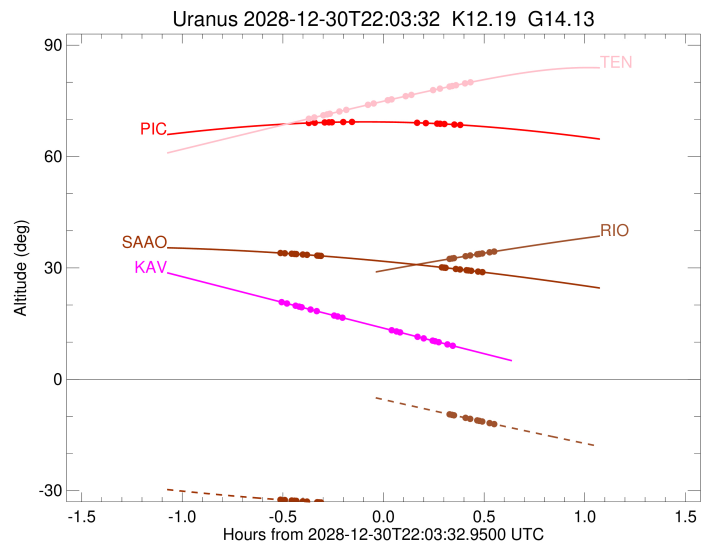
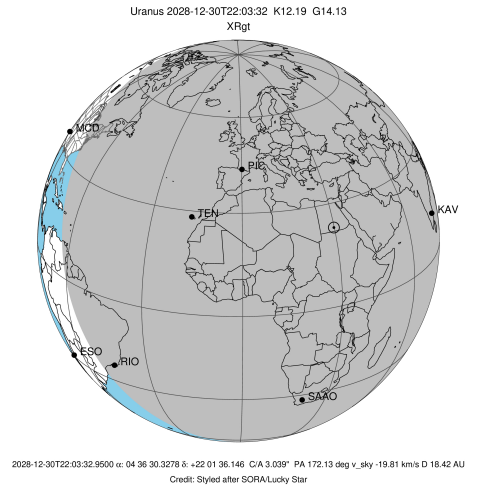


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++++		+++++++	DEC 30 21:41 - DEC 30 22:25	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
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 30 21:41 - DEC 30 22:28	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++++		+++++++	DEC 30 21:33 - DEC 30 22:23	PnnRie
RIO	Rio de Janeiro	-22.9	316.8			+++++++	DEC 30 22:23 - DEC 30 22:36	PnnRne
ESO	European Southern Obs	-29.3	289.3					PnnRnn
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8	+++++++		+++++++	DEC 30 21:33 - DEC 30 22:32	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-30T22:03:17.130
 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 : 144910551595750016
 2Mass ID (if available) : 04363031+2201362
 ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s
 RUWE (>1.4 is poor) : 1.08
 K magnitude : 12.191
 G magnitude : 14.134
 RP magnitude : 13.476
 BP magnitude : 14.625
 DUPflag : 0
 Distance (au) : 18.420
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.81
 Sun-Target sep (deg) : 151.37
 Sun-Moon sep (deg) : 19.10
 B (ring opening deg) : 79.66
 PA of pole (deg) : -49.92
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.199
 C/A sky separation (km) : 42743.1
 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



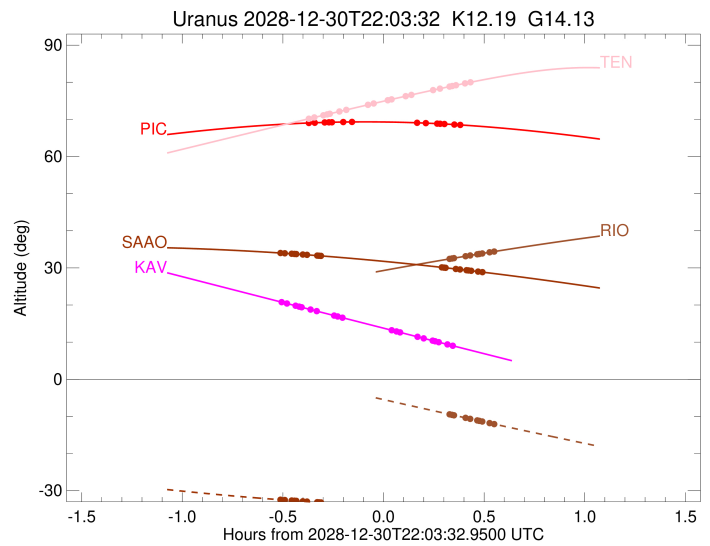
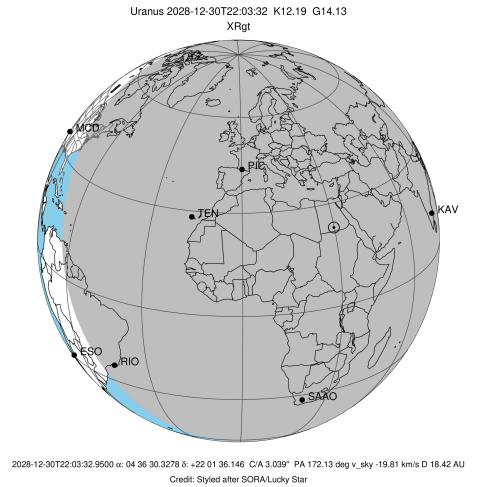
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-30T21:41:47.391		69.06	-54.93	50840.42	-10.65		
lambda	I	2028-12-30T21:43:04.784		69.10	-55.15	50026.71	-10.28		
delta	I	2028-12-30T21:46:02.472		69.18	-55.65	48300.35	-9.13		
gamma	I	2028-12-30T21:47:18.365		69.21	-55.86	47627.30	-8.60		
eta	I	2028-12-30T21:48:12.013		69.23	-56.01	47176.12	-8.22		
beta	I	2028-12-30T21:51:36.707		69.29	-56.58	45653.42	-6.63		
alpha	I	2028-12-30T21:54:07.670		69.32	-56.99	44746.21	-5.39		

No planet occultations

alpha	E	2028-12-30T22:13:37.151		69.09	-60.11	44752.33	5.39		
beta	E	2028-12-30T22:16:05.472		69.00	-60.49	45643.63	6.63		
eta	E	2028-12-30T22:19:31.615		68.86	-61.01	47176.12	8.21		
gamma	E	2028-12-30T22:20:24.766		68.82	-61.15	47622.94	8.60		
delta	E	2028-12-30T22:21:41.183		68.76	-61.34	48300.35	9.13		
lambda	E	2028-12-30T22:24:38.915		68.61	-61.78	50026.71	10.28		
epsilon	E	2028-12-30T22:25:50.251		68.55	-61.95	50775.24	10.65		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-30T22:04:50.210
 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 : 144910551595750016
 2Mass ID (if available) : 04363031+2201362
 ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s
 RUWE (>1.4 is poor) : 1.08
 K magnitude : 12.191
 G magnitude : 14.134
 RP magnitude : 13.476
 BP magnitude : 14.625
 DUPflag : 0
 Distance (au) : 18.420
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.81
 Sun-Target sep (deg) : 151.37
 Sun-Moon sep (deg) : 19.38
 B (ring opening deg) : 79.66
 PA of pole (deg) : -49.92
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.103
 C/A sky separation (km) : 41460.9
 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

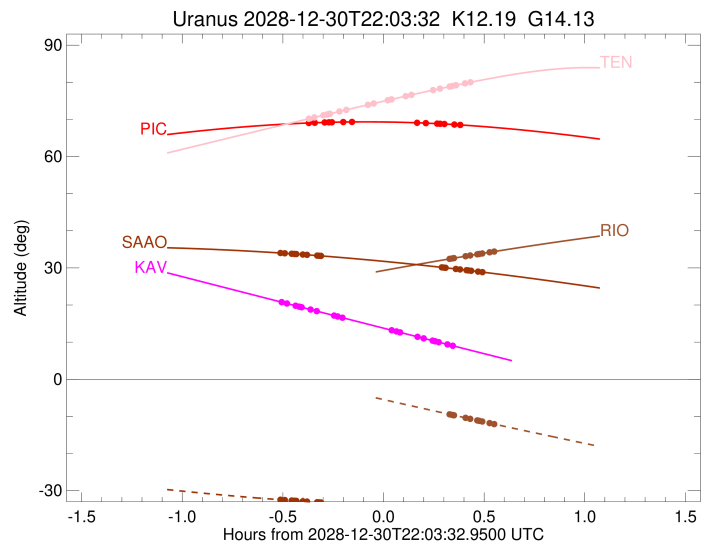
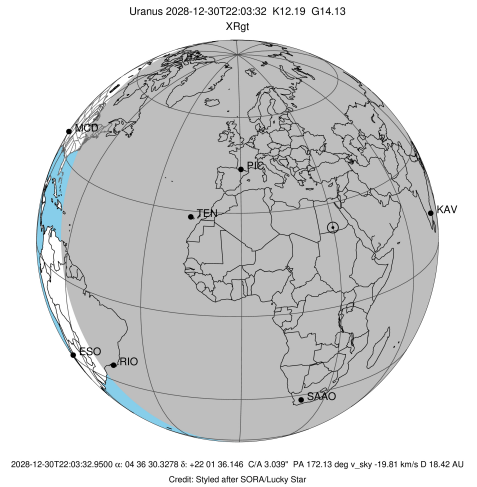


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-30T21:41:44.382		70.28	-43.36	50852.30	-11.47		
lambda	I	2028-12-30T21:42:57.090		70.54	-43.62	50026.71	-11.15		
delta	I	2028-12-30T21:45:39.003		71.12	-44.21	48300.35	-10.16		
gamma	I	2028-12-30T21:46:46.695		71.36	-44.46	47627.60	-9.71		
eta	I	2028-12-30T21:47:33.948		71.53	-44.63	47176.12	-9.39		
beta	I	2028-12-30T21:50:27.399		72.14	-45.27	45654.84	-8.13		
alpha	I	2028-12-30T21:52:26.266		72.56	-45.70	44744.32	-7.21		
4	I	2028-12-30T21:58:56.467		73.94	-47.13	42582.57	-3.79		
5	I	2028-12-30T22:00:33.900		74.28	-47.49	42266.75	-2.88		
6	I	2028-12-30T22:04:17.803		75.05	-48.31	41868.85	-0.68		

No planet occultations

6	E	2028-12-30T22:06:32.753		75.52	-48.80	41871.30	0.69		
5	E	2028-12-30T22:10:20.245		76.29	-49.64	42286.07	2.88		
4	E	2028-12-30T22:11:54.757		76.61	-49.98	42597.81	3.79		
alpha	E	2028-12-30T22:18:22.378		77.90	-51.40	44752.43	7.21		
beta	E	2028-12-30T22:20:18.537		78.28	-51.83	45642.89	8.13		
eta	E	2028-12-30T22:23:13.288		78.84	-52.47	47176.12	9.40		
gamma	E	2028-12-30T22:24:00.003		78.99	-52.64	47622.68	9.72		
delta	E	2028-12-30T22:25:08.151		79.20	-52.89	48300.35	10.17		
lambda	E	2028-12-30T22:27:49.935		79.70	-53.49	50026.71	11.16		
epsilon	E	2028-12-30T22:28:56.613		79.91	-53.73	50783.37	11.48		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-30T21:58:06.170
 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 : 144910551595750016
 2Mass ID (if available) : 04363031+2201362
 ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s
 RUWE (>1.4 is poor) : 1.08
 K magnitude : 12.191
 G magnitude : 14.134
 RP magnitude : 13.476
 BP magnitude : 14.625
 DUPflag : 0
 Distance (au) : 18.420
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.81
 Sun-Target sep (deg) : 151.37
 Sun-Moon sep (deg) : 18.08
 B (ring opening deg) : 79.66
 PA of pole (deg) : -49.92
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.033
 C/A sky separation (km) : 40522.4
 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

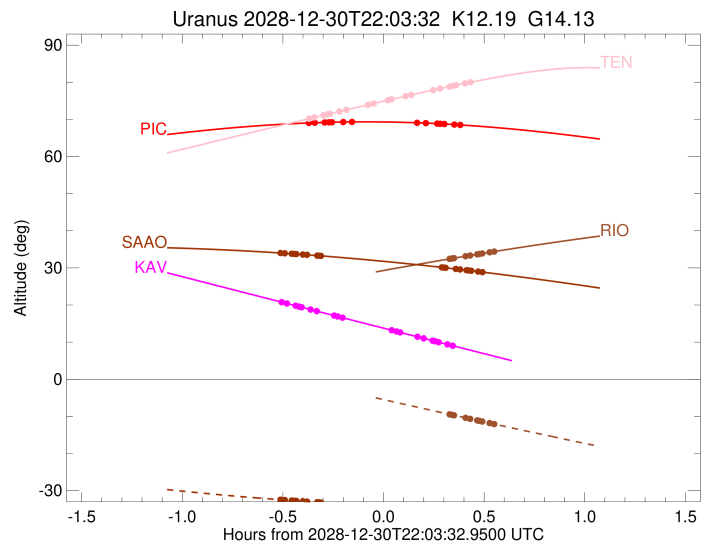
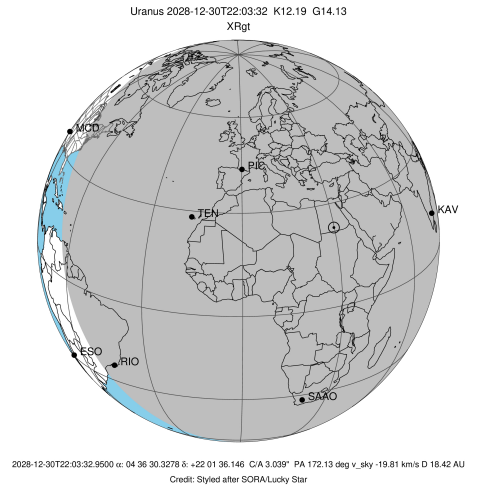


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-30T21:33:35.515		20.68	-49.26	50864.79	-11.87		
lambda	I	2028-12-30T21:34:46.709		20.40	-48.99	50026.71	-11.58		
delta	I	2028-12-30T21:37:21.600		19.81	-48.40	48300.35	-10.69		
gamma	I	2028-12-30T21:38:25.655		19.56	-48.15	47627.86	-10.30		
eta	I	2028-12-30T21:39:10.123		19.39	-47.98	47176.12	-10.02		
beta	I	2028-12-30T21:41:50.523		18.77	-47.37	45656.02	-8.92		
alpha	I	2028-12-30T21:43:37.643		18.36	-46.97	44742.78	-8.15		
4	I	2028-12-30T21:48:51.137		17.15	-45.77	42577.82	-5.59		
5	I	2028-12-30T21:49:52.735		16.92	-45.54	42257.32	-5.06		
6	I	2028-12-30T21:51:16.754		16.59	-45.22	41861.79	-4.28		

No planet occultations

6	E	2028-12-30T22:06:05.295		13.19	-41.82	41874.00	4.28		
5	E	2028-12-30T22:07:33.132		12.85	-41.49	42292.04	5.05		
4	E	2028-12-30T22:08:31.908		12.62	-41.26	42600.76	5.58		
alpha	E	2028-12-30T22:13:43.752		11.43	-40.07	44752.37	8.12		
beta	E	2028-12-30T22:15:28.497		11.03	-39.67	45642.60	8.89		
eta	E	2028-12-30T22:18:10.964		10.41	-39.05	47176.12	9.98		
gamma	E	2028-12-30T22:18:55.104		10.24	-38.88	47622.58	10.25		
delta	E	2028-12-30T22:19:59.958		9.99	-38.63	48300.35	10.65		
lambda	E	2028-12-30T22:22:35.594		9.40	-38.03	50026.71	11.52		
epsilon	E	2028-12-30T22:23:40.602		9.15	-37.78	50786.91	11.80		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-30T22:07:26.650
 Event type : XRgt
 : No Uranus occs
 : 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 : 144910551595750016
 2Mass ID (if available) : 04363031+2201362
 ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s
 RUWE (>1.4 is poor) : 1.08
 K magnitude : 12.191
 G magnitude : 14.134
 RP magnitude : 13.476
 BP magnitude : 14.625
 DUPflag : 0
 Distance (au) : 18.420
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.81
 Sun-Target sep (deg) : 151.37
 Sun-Moon sep (deg) : 19.71
 B (ring opening deg) : 79.66
 PA of pole (deg) : -49.92
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.779
 C/A sky separation (km) : 37131.4
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl1.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



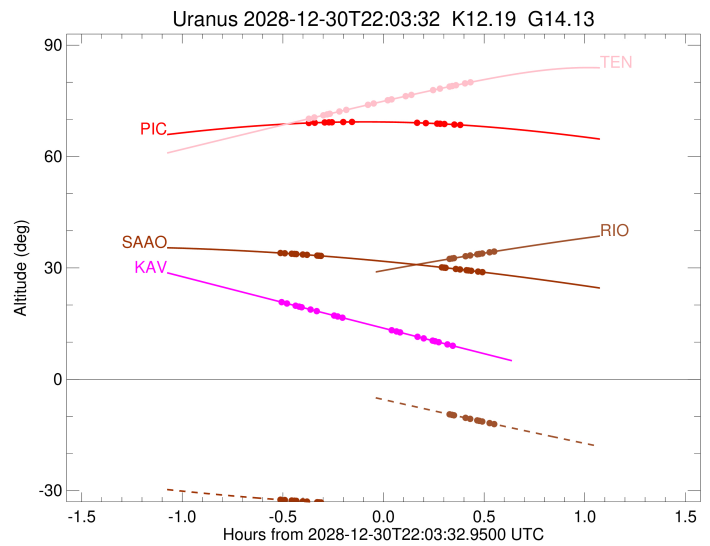
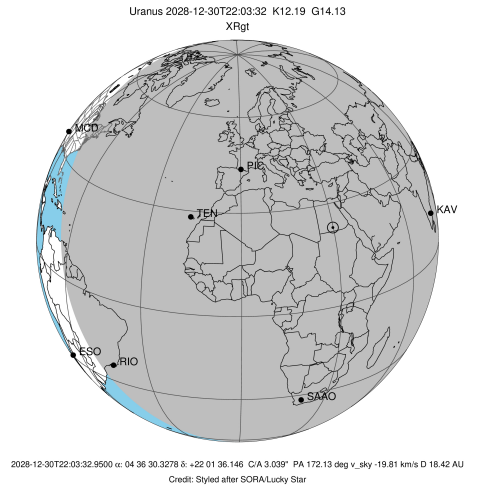
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-30T21:39:37.217		25.22	-0.54x	50892.34	-13.60		
lambda	I	2028-12-30T21:40:41.106		25.40	-0.76x	50026.71	-13.40		
delta	I	2028-12-30T21:42:52.970		25.79	-1.22x	48300.35	-12.77		
gamma	I	2028-12-30T21:43:46.170		25.94	-1.40x	47628.42	-12.49		
eta	I	2028-12-30T21:44:22.667		26.05	-1.53x	47176.12	-12.29		
beta	I	2028-12-30T21:46:29.871		26.42	-1.97x	45658.64	-11.56		
alpha	I	2028-12-30T21:47:51.255		26.65	-2.25x	44739.07	-11.07		
4	I	2028-12-30T21:51:20.424		27.25	-2.97x	42568.87	-9.62		
5	I	2028-12-30T21:51:55.603		27.35	-3.09x	42240.66	-9.37		
6	I	2028-12-30T21:52:37.579		27.47	-3.23x	41853.14	-9.03		

No planet occultations

6	E	2028-12-30T22:23:18.213		32.43	-9.46	41878.28	9.05		
5	E	2028-12-30T22:24:03.801		32.55	-9.61	42303.86	9.39		
4	E	2028-12-30T22:24:36.027		32.63	-9.71	42607.76	9.64		
alpha	E	2028-12-30T22:28:02.266		33.15	-10.40	44751.49	11.09		
beta	E	2028-12-30T22:29:20.821		33.35	-10.66	45641.59	11.58		
eta	E	2028-12-30T22:31:29.117		33.66	-11.08	47176.12	12.33		
gamma	E	2028-12-30T22:32:05.009		33.75	-11.20	47622.07	12.52		
delta	E	2028-12-30T22:32:58.568		33.88	-11.37	48300.35	12.80		
lambda	E	2028-12-30T22:35:10.042		34.20	-11.81	50026.71	13.45		
epsilon	E	2028-12-30T22:36:07.848		34.34	-12.00	50811.62	13.64		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2028-12-30T22:02:26.650
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      : 144910551595750016
2Mass ID (if available) : 04363031+2201362
ICRS Star Coord at Epoch: 04h 36m 30.32782s +22:01:36.14595s
RUWE (>1.4 is poor) : 1.08
K magnitude          : 12.191
G magnitude          : 14.134
RP magnitude         : 13.476
BP magnitude         : 14.625
DUPflag             : 0
Distance (au)       : 18.420
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -19.81
Sun-Target sep (deg) : 151.37
Sun-Moon sep (deg)  : 18.94
B (ring opening deg) : 79.66
PA of pole (deg)    : -49.92
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.640
C/A sky separation (km) : 35275.3
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.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	2028-12-30T21:33:07.147		34.00	-32.47	50911.68	-14.46		
lambda	I	2028-12-30T21:34:08.507		33.93	-32.54	50026.71	-14.30		
delta	I	2028-12-30T21:36:11.575		33.81	-32.67	48300.35	-13.75		
gamma	I	2028-12-30T21:37:00.835		33.76	-32.72	47628.75	-13.51		
eta	I	2028-12-30T21:37:34.532		33.72	-32.76	47176.12	-13.35		
beta	I	2028-12-30T21:39:30.765		33.60	-32.88	45660.15	-12.73		
alpha	I	2028-12-30T21:40:44.527		33.52	-32.95	44736.86	-12.33		
4	I	2028-12-30T21:43:48.975		33.31	-33.13	42564.68	-11.16		
5	I	2028-12-30T21:44:19.402		33.28	-33.16	42233.00	-10.97		
6	I	2028-12-30T21:44:54.822		33.24	-33.19	41849.17	-10.71		

No planet occultations

6	E	2028-12-30T22:20:59.195		30.14	-34.54	41879.06	10.69		
5	E	2028-12-30T22:21:38.343		30.07	-34.55	42306.95	10.95		
4	E	2028-12-30T22:22:05.934		30.02	-34.56	42609.74	11.15		
alpha	E	2028-12-30T22:25:08.150		29.71	-34.61	44750.91	12.31		
beta	E	2028-12-30T22:26:19.371		29.59	-34.63	45641.35	12.71		
eta	E	2028-12-30T22:28:17.237		29.38	-34.65	47176.12	13.32		
gamma	E	2028-12-30T22:28:50.489		29.32	-34.66	47621.90	13.49		
delta	E	2028-12-30T22:29:40.351		29.23	-34.67	48300.35	13.72		
lambda	E	2028-12-30T22:31:43.667		29.01	-34.69	50026.71	14.27		
epsilon	E	2028-12-30T22:32:38.981		28.91	-34.69	50822.10	14.42		