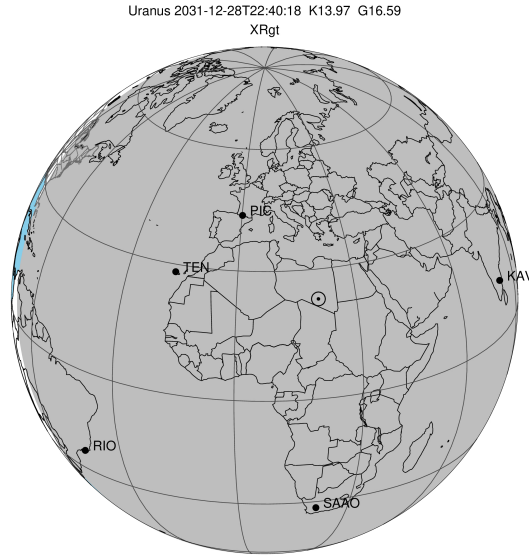


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-28T22:40:18.160
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3404548115148617344
 2Mass ID (if available) : 05350364+2328075

ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s

RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.974
 G magnitude : 16.588
 RP magnitude : 15.769
 BP magnitude : 17.333
 DUPflag : 0
 Distance (au) : 18.123
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.75
 Sun-Target sep (deg) : 167.73
 Sun-Moon sep (deg) : 15.17
 B (ring opening deg) : 79.71
 PA of pole (deg) : 37.42

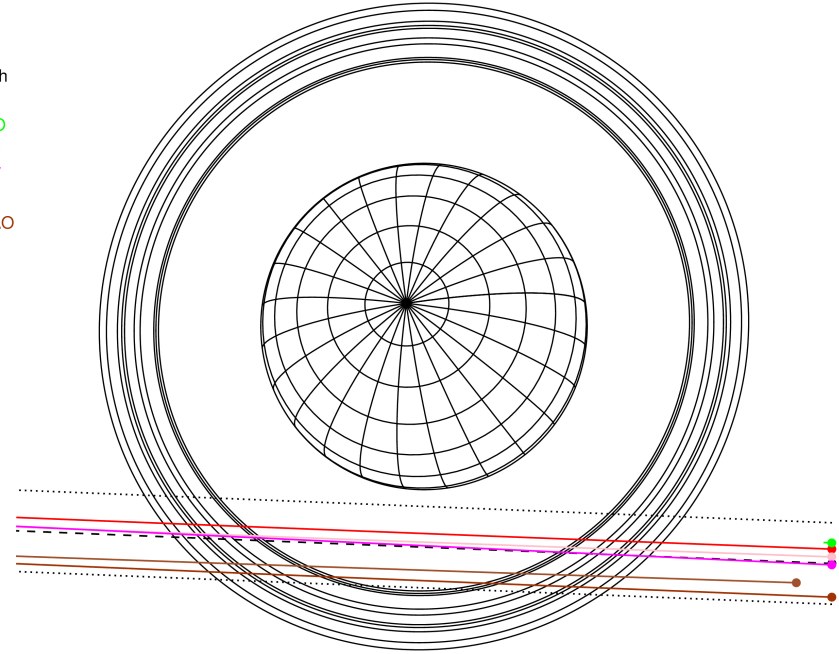
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-12-28T22:40:18.1600 ra: 05 35 03.66040 s: +23 28 07.392 C/A 2.620° PA 357.70 deg v_sky -22.75 km/s D 18.12 AU
 Credit: Styled after SORA/Lucky Star

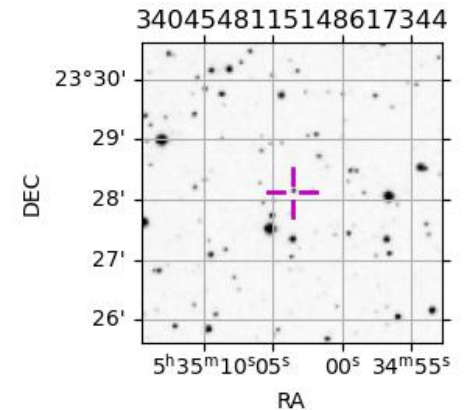
Uranus 2031-12-28T22:40:18 K13.97 G16.59 XRgt

Earth
 PIC
 PMO
 TEN
 KAV
 RIO
 SAAO

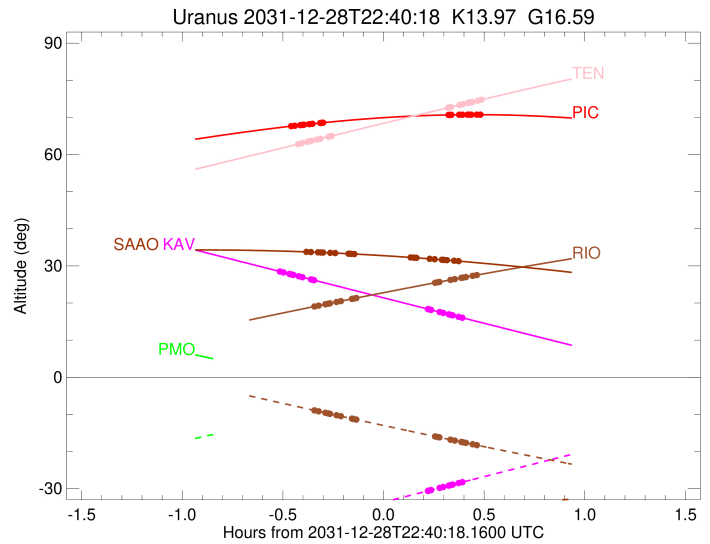
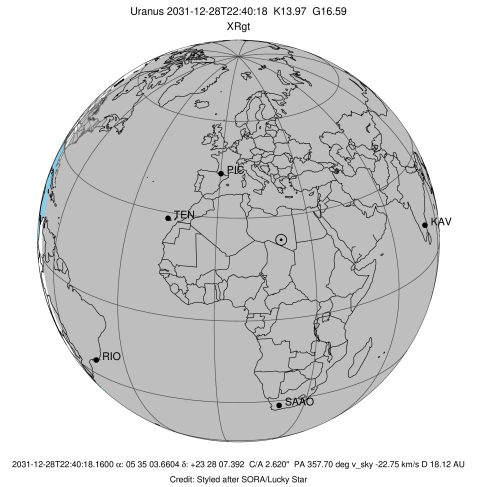


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 28 22:12 - DEC 28 23:09	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 28 22:14 - DEC 28 23:09	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 28 22:09 - DEC 28 23:03	PnnRie
RIO	Rio de Janeiro	-22.9	316.8	+++++		+++++	DEC 28 22:19 - DEC 28 23:08	PnnRie
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 28 22:16 - DEC 28 23:02	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-28T22:40:37.160
 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 : 3404548115148617344
 2Mass ID (if available) : 05350364+2328075
 ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.974
 G magnitude : 16.588
 RP magnitude : 15.769
 BP magnitude : 17.333
 DUPflag : 0
 Distance (au) : 18.123
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.75
 Sun-Target sep (deg) : 167.73
 Sun-Moon sep (deg) : 15.54
 B (ring opening deg) : 79.71
 PA of pole (deg) : 37.42
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.465
 C/A sky separation (km) : 32396.8
 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

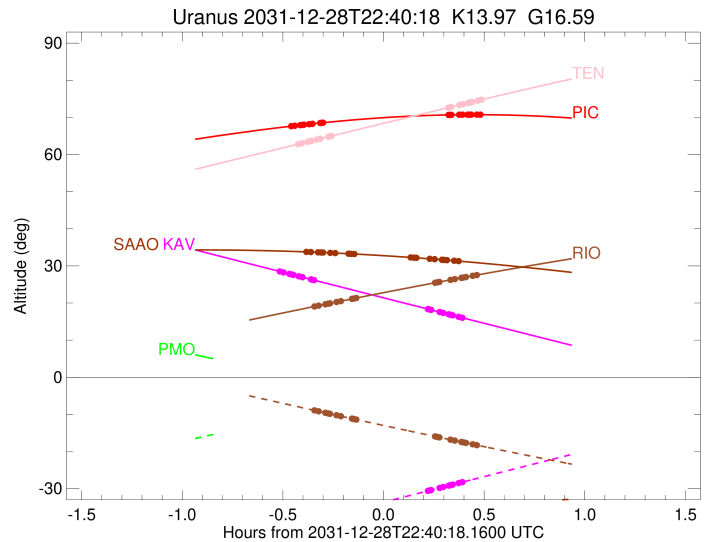
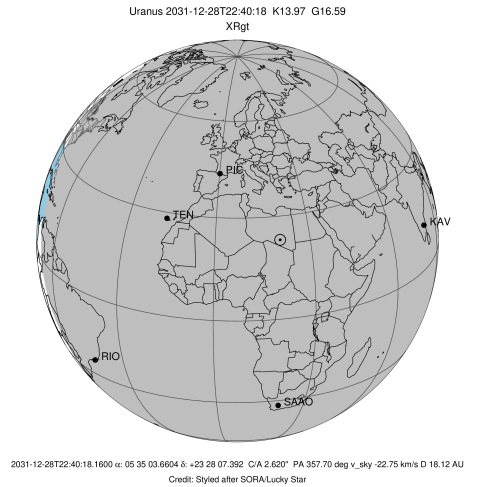


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T22:12:25.364		67.60	-60.26	51550.68	-17.93		
lambda	I	2031-12-28T22:13:51.167		67.75	-60.48	50026.71	-17.57		
delta	I	2031-12-28T22:15:30.777		67.92	-60.74	48300.35	-17.08		
gamma	I	2031-12-28T22:16:10.727		67.99	-60.84	47621.97	-16.87		
eta	I	2031-12-28T22:16:37.261		68.03	-60.91	47176.12	-16.73		
beta	I	2031-12-28T22:18:08.658		68.18	-61.14	45669.96	-16.20		
alpha	I	2031-12-28T22:19:06.136		68.28	-61.28	44749.10	-15.84		
4	I	2031-12-28T22:21:30.601		68.50	-61.65	42527.44	-14.83		
5	I	2031-12-28T22:21:53.931		68.54	-61.70	42194.59	-14.69		
6	I	2031-12-28T22:22:15.912		68.57	-61.76	41870.87	-14.50		

No planet occultations

6	E	2031-12-28T22:59:43.433		70.67	-66.73	41869.96	14.51		
5	E	2031-12-28T23:00:12.398		70.68	-66.78	42294.93	14.69		
4	E	2031-12-28T23:00:29.840		70.69	-66.81	42551.85	14.83		
alpha	E	2031-12-28T23:02:50.154		70.72	-67.07	44705.99	15.84		
beta	E	2031-12-28T23:03:48.664		70.73	-67.18	45643.33	16.20		
eta	E	2031-12-28T23:05:21.725		70.74	-67.34	47176.12	16.74		
gamma	E	2031-12-28T23:05:48.336		70.74	-67.39	47623.40	16.88		
delta	E	2031-12-28T23:06:28.190		70.74	-67.46	48300.35	17.09		
lambda	E	2031-12-28T23:08:07.771		70.74	-67.63	50026.71	17.57		
epsilon	E	2031-12-28T23:09:03.423		70.74	-67.72	51011.78	17.94		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-28T22:41:48.890
 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 : 3404548115148617344
 2Mass ID (if available) : 05350364+2328075
 ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.974
 G magnitude : 16.588
 RP magnitude : 15.769
 BP magnitude : 17.333
 DUPflag : 0
 Distance (au) : 18.123
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.75
 Sun-Target sep (deg) : 167.73
 Sun-Moon sep (deg) : 15.71
 B (ring opening deg) : 79.71
 PA of pole (deg) : 37.42
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.568
 C/A sky separation (km) : 33753.9
 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

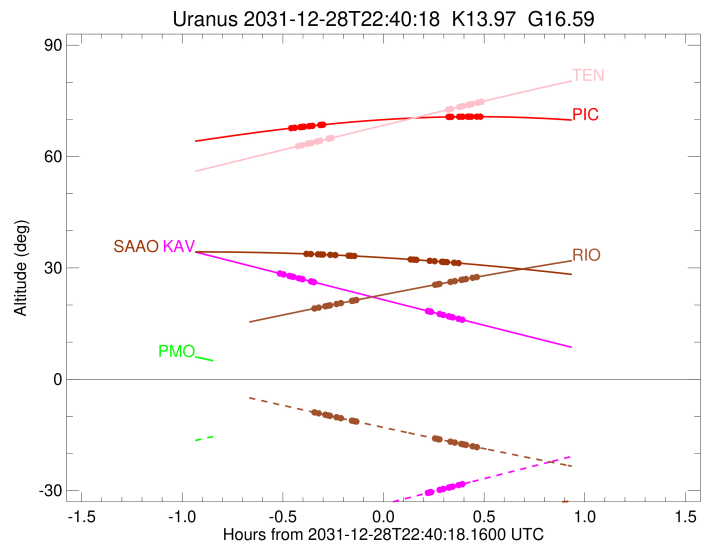
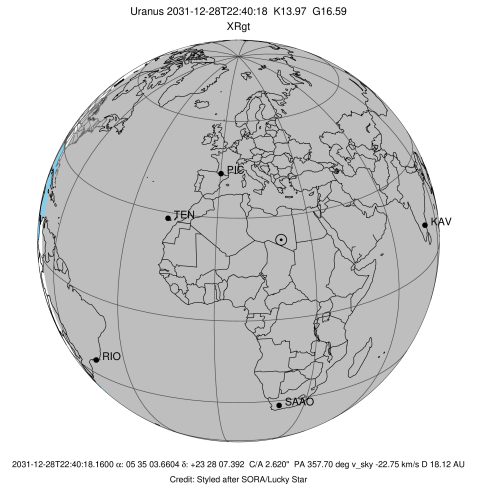


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T22:14:30.337		62.73	-50.90	51548.44	-17.41		
lambda	I	2031-12-28T22:15:58.660		63.05	-51.22	50026.71	-17.01		
delta	I	2031-12-28T22:17:41.748		63.43	-51.60	48300.35	-16.47		
gamma	I	2031-12-28T22:18:23.241		63.58	-51.76	47621.86	-16.23		
eta	I	2031-12-28T22:18:50.837		63.69	-51.86	47176.12	-16.07		
beta	I	2031-12-28T22:20:26.315		64.04	-52.21	45669.20	-15.46		
alpha	I	2031-12-28T22:21:26.631		64.26	-52.43	44748.43	-15.05		
4	I	2031-12-28T22:23:59.632		64.82	-52.99	42526.92	-13.90		
5	I	2031-12-28T22:24:24.276		64.91	-53.08	42198.18	-13.73		
6	I	2031-12-28T22:24:47.967		65.00	-53.17	41872.18	-13.51		

No planet occultations

6	E	2031-12-28T22:59:36.339		72.62	-60.84	41871.44	13.53		
5	E	2031-12-28T23:00:06.977		72.73	-60.95	42291.89	13.75		
4	E	2031-12-28T23:00:25.687		72.80	-61.02	42549.66	13.91		
alpha	E	2031-12-28T23:02:54.432		73.34	-61.56	44707.53	15.07		
beta	E	2031-12-28T23:03:55.715		73.56	-61.79	45643.77	15.48		
eta	E	2031-12-28T23:05:32.760		73.91	-62.14	47176.12	16.09		
gamma	E	2031-12-28T23:06:00.402		74.01	-62.25	47623.21	16.25		
delta	E	2031-12-28T23:06:41.755		74.15	-62.40	48300.35	16.49		
lambda	E	2031-12-28T23:08:24.696		74.52	-62.77	50026.71	17.04		
epsilon	E	2031-12-28T23:09:22.858		74.73	-62.99	51026.12	17.44		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-28T22:36:09.990
 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 : 3404548115148617344
 2Mass ID (if available) : 05350364+2328075
 ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.974
 G magnitude : 16.588
 RP magnitude : 15.769
 BP magnitude : 17.333
 DUPflag : 0
 Distance (au) : 18.123
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.75
 Sun-Target sep (deg) : 167.73
 Sun-Moon sep (deg) : 14.48
 B (ring opening deg) : 79.71
 PA of pole (deg) : 37.42
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.609
 C/A sky separation (km) : 34296.1
 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_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

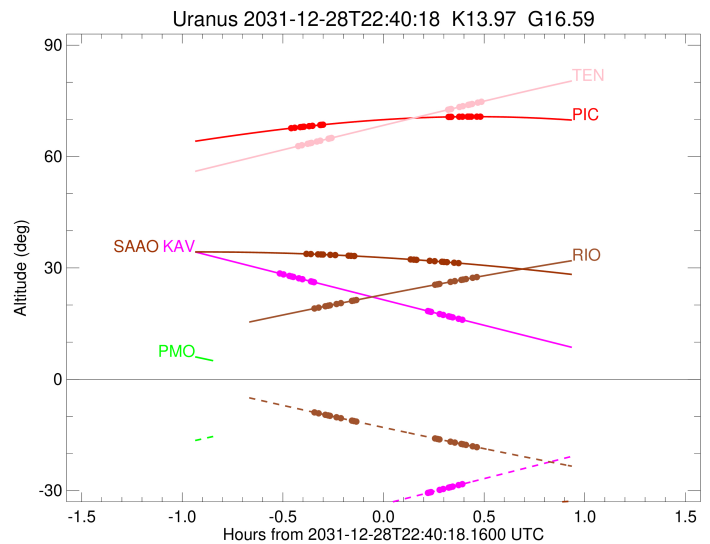
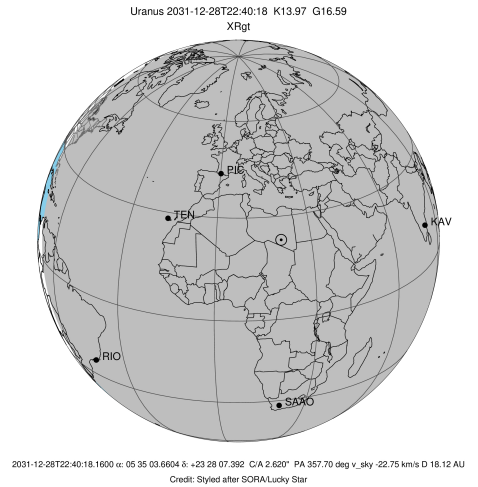


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T22:09:00.433		28.59	-40.83	51546.46	-17.09		
lambda	I	2031-12-28T22:10:30.382		28.24	-40.49	50026.71	-16.67		
delta	I	2031-12-28T22:12:15.707		27.84	-40.09	48300.35	-16.10		
gamma	I	2031-12-28T22:12:58.177		27.68	-39.92	47621.78	-15.85		
eta	I	2031-12-28T22:13:26.441		27.57	-39.82	47176.12	-15.68		
beta	I	2031-12-28T22:15:04.457		27.19	-39.44	45668.67	-15.04		
alpha	I	2031-12-28T22:16:06.509		26.96	-39.20	44747.95	-14.61		
4	I	2031-12-28T22:18:44.637		26.35	-38.60	42526.64	-13.39		
5	I	2031-12-28T22:19:10.032		26.25	-38.50	42200.52	-13.22		
6	I	2031-12-28T22:19:34.763		26.16	-38.41	41872.97	-12.98		

No planet occultations

6	E	2031-12-28T22:53:34.912		18.36	-30.60	41871.75	12.95		
5	E	2031-12-28T22:54:06.805		18.24	-30.48	42291.22	13.18		
4	E	2031-12-28T22:54:26.328		18.17	-30.40	42549.20	13.35		
alpha	E	2031-12-28T22:57:00.781		17.58	-29.81	44707.81	14.57		
beta	E	2031-12-28T22:58:04.120		17.34	-29.57	45643.85	14.99		
eta	E	2031-12-28T22:59:44.201		16.96	-29.19	47176.12	15.62		
gamma	E	2031-12-28T23:00:12.663		16.85	-29.08	47623.18	15.79		
delta	E	2031-12-28T23:00:55.213		16.69	-28.92	48300.35	16.04		
lambda	E	2031-12-28T23:02:40.980		16.28	-28.51	50026.71	16.60		
epsilon	E	2031-12-28T23:03:40.749		16.06	-28.28	51027.68	17.01		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-28T22:43:30.110
 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 : 3404548115148617344
 2Mass ID (if available) : 05350364+2328075
 ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.974
 G magnitude : 16.588
 RP magnitude : 15.769
 BP magnitude : 17.333
 DUPflag : 0
 Distance (au) : 18.123
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.75
 Sun-Target sep (deg) : 167.73
 Sun-Moon sep (deg) : 15.75
 B (ring opening deg) : 79.71
 PA of pole (deg) : 37.42
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.903
 C/A sky separation (km) : 38151.2
 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_itrfr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



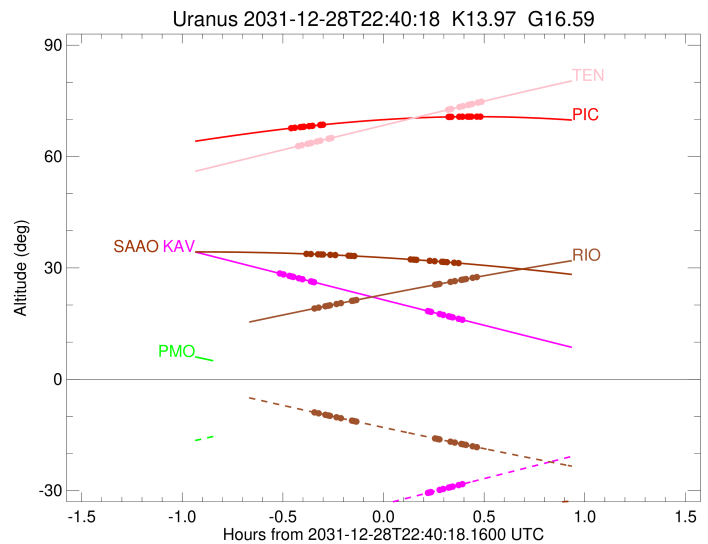
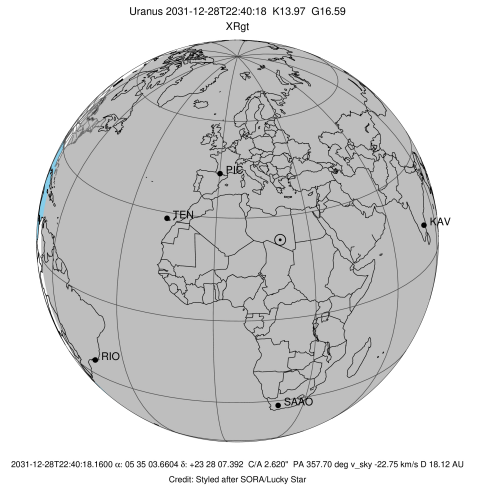
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T22:19:18.784		18.99	-8.84	51536.63	-15.32		
lambda	I	2031-12-28T22:20:59.028		19.30	-9.18	50026.71	-14.75		
delta	I	2031-12-28T22:22:59.255		19.67	-9.58	48300.35	-13.95		
gamma	I	2031-12-28T22:23:48.541		19.82	-9.74	47621.48	-13.59		
eta	I	2031-12-28T22:24:21.598		19.92	-9.85	47176.12	-13.35		
beta	I	2031-12-28T22:26:18.676		20.28	-10.24	45666.18	-12.41		
alpha	I	2031-12-28T22:27:34.798		20.51	-10.49	44745.32	-11.75		
4	I	2031-12-28T22:30:59.936		21.13	-11.16	42525.93	-9.79		
5	I	2031-12-28T22:31:33.576		21.23	-11.27	42213.63	-9.48		
6	I	2031-12-28T22:32:09.416		21.33	-11.39	41876.54	-9.07		

No planet occultations

6	E	2031-12-28T22:55:43.562		25.46	-15.95	41876.13	9.08		
5	E	2031-12-28T22:56:26.351		25.58	-16.09	42278.67	9.50		
4	E	2031-12-28T22:56:53.902		25.66	-16.17	42541.94	9.81		
alpha	E	2031-12-28T23:00:14.631		26.22	-16.81	44713.26	11.78		
beta	E	2031-12-28T23:01:31.635		26.44	-17.05	45645.66	12.44		
eta	E	2031-12-28T23:03:30.160		26.77	-17.42	47176.12	13.38		
gamma	E	2031-12-28T23:04:03.222		26.86	-17.52	47622.60	13.63		
delta	E	2031-12-28T23:04:52.307		26.99	-17.68	48300.35	13.98		
lambda	E	2031-12-28T23:06:52.225		27.32	-18.05	50026.71	14.79		
epsilon	E	2031-12-28T23:08:02.093		27.52	-18.27	51075.61	15.36		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-28T22:39:32.380
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      : 3404548115148617344
2Mass ID (if available) : 05350364+2328075
ICRS Star Coord at Epoch: 05h 35m 03.66040s +23:28:07.39241s
RUWE (>1.4 is poor) : 0.98
K magnitude         : 13.974
G magnitude         : 16.588
RP magnitude        : 15.769
BP magnitude        : 17.333
DUPflag            : 0
Distance (au)       : 18.123
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -22.75
Sun-Target sep (deg) : 167.73
Sun-Moon sep (deg)  : 14.97
B (ring opening deg) : 79.71
PA of pole (deg)    : 37.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.026
C/A sky separation (km) : 39777.2
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.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	2031-12-28T22:16:54.059		33.79	-34.31	51529.09	-14.53		
lambda	I	2031-12-28T22:18:39.599		33.73	-34.35	50026.71	-13.88		
delta	I	2031-12-28T22:20:48.334		33.65	-34.39	48300.35	-12.93		
gamma	I	2031-12-28T22:21:41.731		33.62	-34.40	47621.34	-12.50		
eta	I	2031-12-28T22:22:17.764		33.60	-34.41	47176.12	-12.21		
beta	I	2031-12-28T22:24:27.475		33.51	-34.45	45664.65	-11.06		
alpha	I	2031-12-28T22:25:53.811		33.46	-34.47	44743.47	-10.24		
4	I	2031-12-28T22:30:00.431		33.28	-34.51	42526.17	-7.64		
5	I	2031-12-28T22:30:42.922		33.25	-34.52	42222.63	-7.20		
6	I	2031-12-28T22:31:32.190		33.21	-34.52	41878.23	-6.58		

No planet occultations

6	E	2031-12-28T22:48:28.025		32.28	-34.50	41877.77	6.58		
5	E	2031-12-28T22:49:24.319		32.22	-34.49	42271.67	7.19		
4	E	2031-12-28T22:50:00.799		32.18	-34.48	42538.78	7.64		
alpha	E	2031-12-28T22:54:03.467		31.91	-34.42	44715.63	10.24		
beta	E	2031-12-28T22:55:30.893		31.81	-34.40	45646.51	11.05		
eta	E	2031-12-28T22:57:42.380		31.65	-34.36	47176.12	12.20		
gamma	E	2031-12-28T22:58:18.524		31.61	-34.34	47622.40	12.49		
delta	E	2031-12-28T22:59:11.872		31.55	-34.33	48300.35	12.92		
lambda	E	2031-12-28T23:01:20.706		31.39	-34.28	50026.71	13.87		
epsilon	E	2031-12-28T23:02:36.186		31.29	-34.25	51092.74	14.52		