

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T00:21:55.730
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3412545099438845312
 2Mass ID (if available) : 04574879+2242080

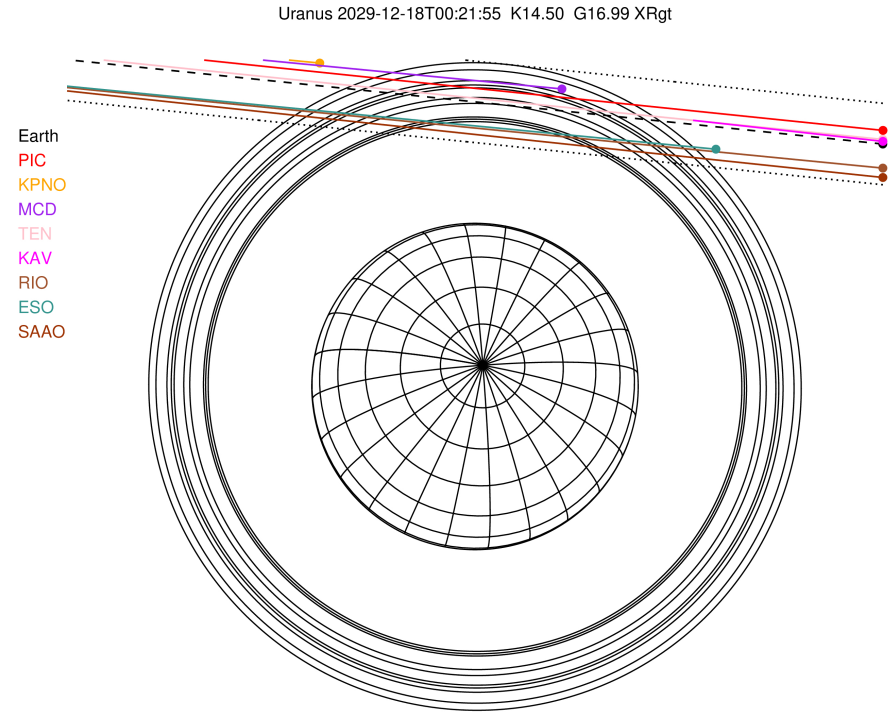
ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s

RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.503
 G magnitude : 16.994
 RP magnitude : 16.211
 BP magnitude : 17.639
 DUPflag : 0
 Distance (au) : 18.254
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.97
 Sun-Target sep (deg) : 169.74
 Sun-Moon sep (deg) : 22.32
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.24

#	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

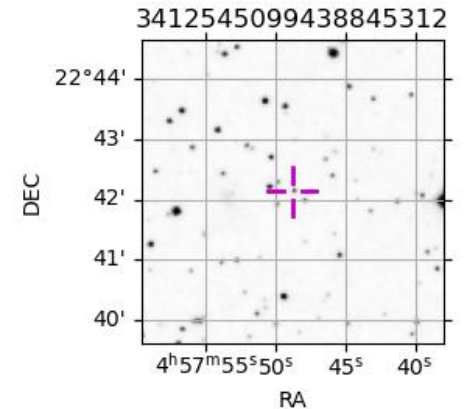


2029-12-18T00:21:55.7300 ra: 04 57 48.7840 s: +22 42 08.086 C/A 3.355 PA 174.10 deg v_sky -22.97 km/s D 18.25 AU
 Credit: Styled after SORA/Lucky Star



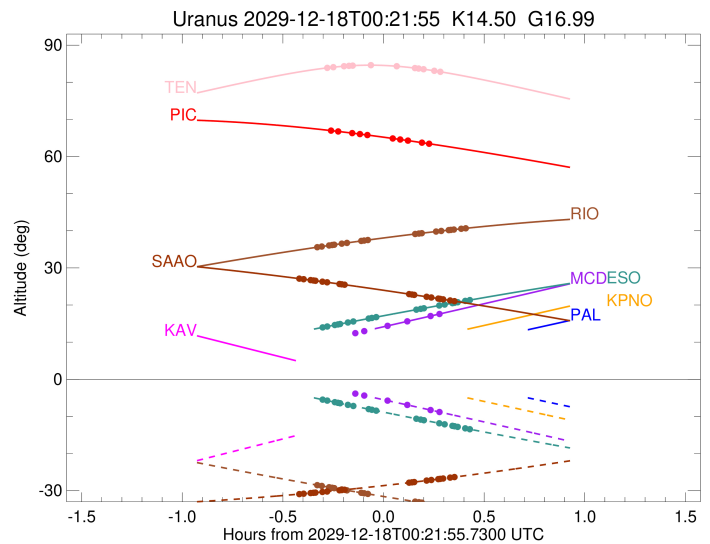
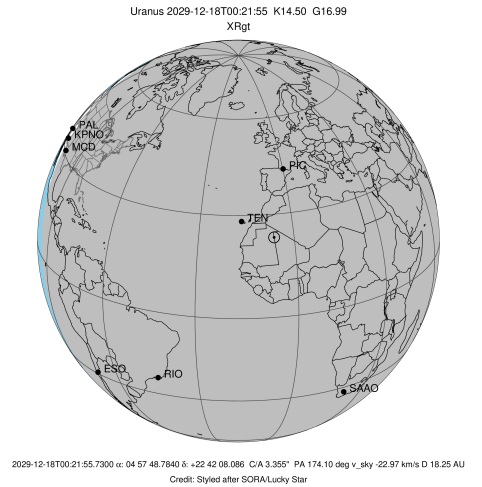
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 18 00:05 - DEC 18 00:35	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMT	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	+		+++	DEC 18 00:23 - DEC 18 00:38	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++		+++++	DEC 18 00:04 - DEC 18 00:38	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++		+++++	DEC 18 00:01 - DEC 18 00:46	PnnRie
ESO	European Southern Obs	-29.3	289.3	+++++		+++++	DEC 18 00:03 - DEC 18 00:47	PnnRie
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8	+++++		+++++	DEC 17 23:56 - DEC 18 00:43	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-12-18T00:20:44.950
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        : 3412545099438845312
2Mass ID (if available) : 04574879+2242080
ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
RUWE (>1.4 is poor)  : 1.01
K magnitude           : 14.503
G magnitude           : 16.994
RP magnitude          : 16.211
BP magnitude          : 17.639
DUPflag              : 0
Distance (au)         : 18.254
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -22.97
Sun-Target sep (deg)  : 169.74
Sun-Moon sep (deg)    : 22.82
B (ring opening deg)  : 82.00
PA of pole (deg)      : -20.24
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.509
C/A sky separation (km) : 46450.4
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_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```

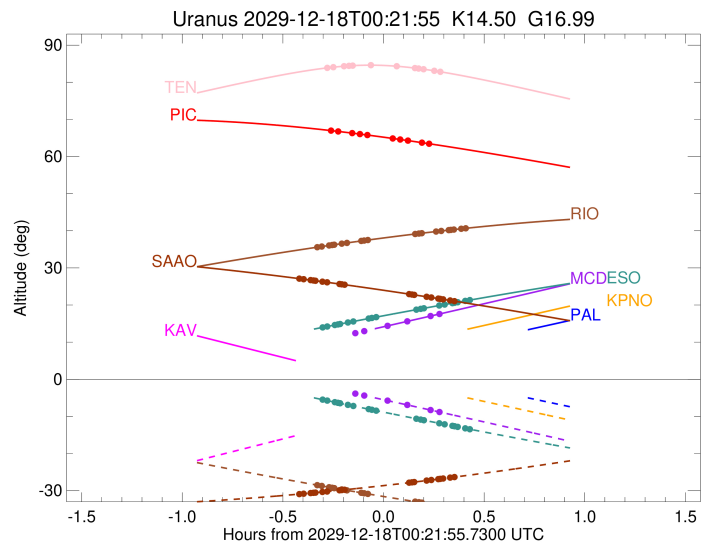
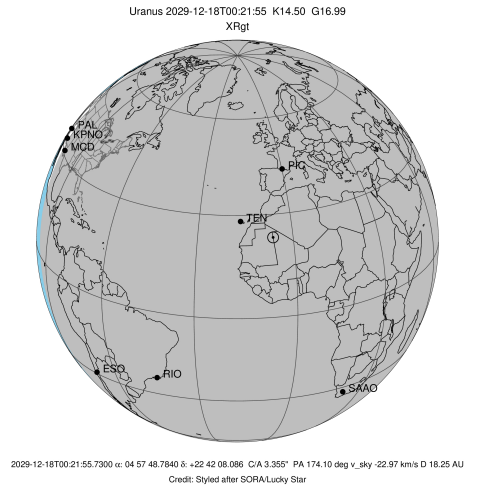


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-18T00:05:40.458		67.05	-70.54	51511.97	-9.58		
lambda	I	2029-12-18T00:08:27.306		66.76	-70.47	50026.71	-8.13		
delta	I	2029-12-18T00:12:38.238		66.30	-70.33	48300.35	-5.59		
gamma	I	2029-12-18T00:14:58.825		66.04	-70.24	47621.19	-4.06		
eta	I	2029-12-18T00:17:13.323		65.78	-70.14	47176.12	-2.55		

No planet occultations

eta	E	2029-12-18T00:24:35.412		64.88	-69.75	47176.12	2.55		
gamma	E	2029-12-18T00:26:50.142		64.60	-69.61	47622.03	4.06		
delta	E	2029-12-18T00:29:10.561		64.30	-69.45	48300.35	5.59		
lambda	E	2029-12-18T00:33:21.595		63.74	-69.15	50026.71	8.12		
epsilon	E	2029-12-18T00:35:41.394		63.43	-68.96	51253.34	9.57		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T00:25:54.820
 Event type : XRgt
 : No Uranus occs
 : 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 : 3412545099438845312
 2Mass ID (if available) : 04574879+2242080
 ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.503
 G magnitude : 16.994
 RP magnitude : 16.211
 BP magnitude : 17.639
 DUPflag : 0
 Distance (au) : 18.254
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.97
 Sun-Target sep (deg) : 169.74
 Sun-Moon sep (deg) : 21.68
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.24
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.602
 C/A sky separation (km) : 47691.8
 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



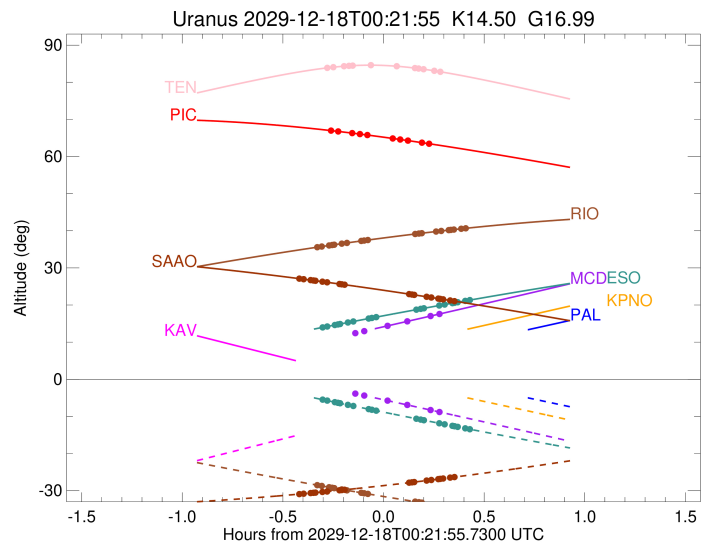
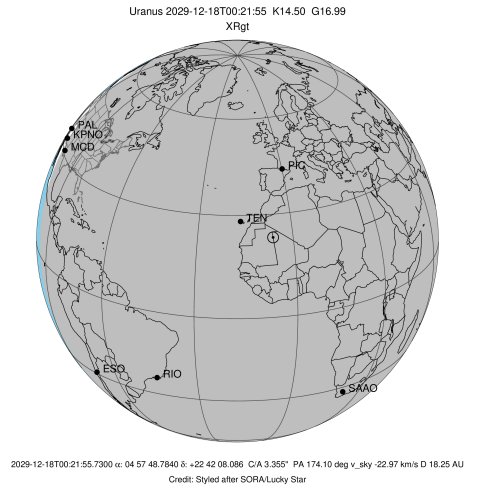
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-18T00:12:49.695		12.28	-3.73x	51498.09	-8.07		
lambda	I	2029-12-18T00:16:13.629		12.97	-4.39x	50026.71	-6.24		
delta	I	2029-12-18T00:23:16.206		14.42	-5.78	48300.35	-1.85		

No planet occultations

delta	E	2029-12-18T00:28:53.512		15.57	-6.89	48300.35	1.85		
lambda	E	2029-12-18T00:35:55.689		17.02	-8.28	50026.71	6.26		
epsilon	E	2029-12-18T00:38:51.616		17.63	-8.87	51275.51	8.09		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-12-18T00:21:52.180
 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 : 3412545099438845312
 2Mass ID (if available) : 04574879+2242080
 ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 14.503
 G magnitude : 16.994
 RP magnitude : 16.211
 BP magnitude : 17.639
 DUPflag : 0
 Distance (au) : 18.254
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.97
 Sun-Target sep (deg) : 169.74
 Sun-Moon sep (deg) : 22.68
 B (ring opening deg) : 82.00
 PA of pole (deg) : -20.24
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.393
 C/A sky separation (km) : 44925.9
 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_itrfr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



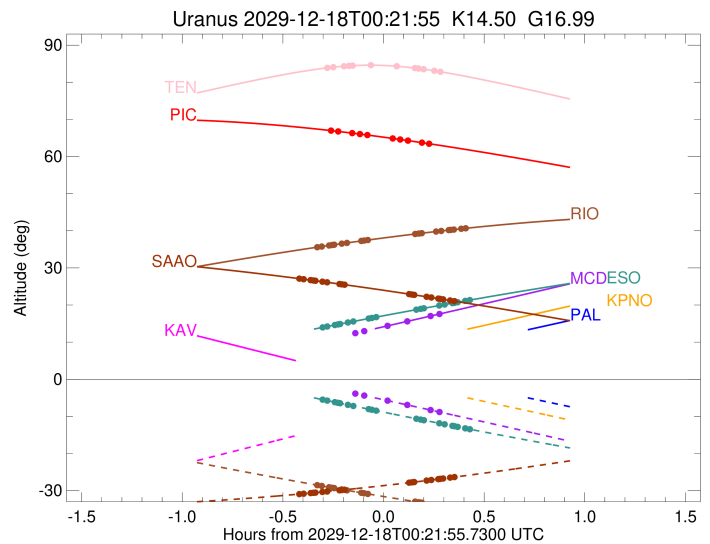
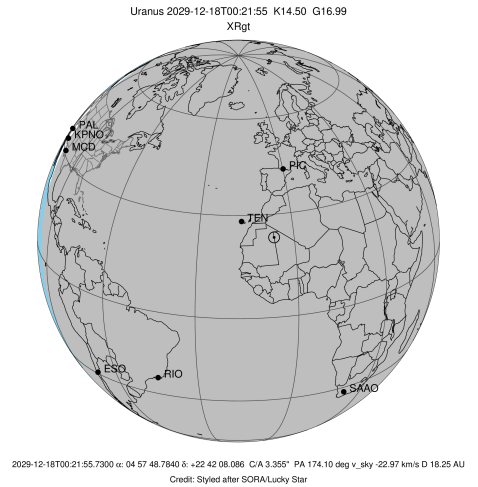
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-18T00:04:37.026		83.82	-76.15	51523.23	-11.04		
lambda	I	2029-12-18T00:06:59.578		84.07	-76.65	50026.71	-9.87		
delta	I	2029-12-18T00:10:11.897		84.33	-77.32	48300.35	-8.05		
gamma	I	2029-12-18T00:11:41.369		84.43	-77.63	47621.03	-7.13		
eta	I	2029-12-18T00:12:46.925		84.49	-77.86	47176.12	-6.44		
beta	I	2029-12-18T00:18:21.242		84.61	-79.00	45648.21	-2.63		

No planet occultations

beta	E	2029-12-18T00:25:40.357		84.34	-80.46	45645.10	2.63		
eta	E	2029-12-18T00:31:15.811		83.83	-81.52	47176.12	6.44		
gamma	E	2029-12-18T00:32:21.575		83.71	-81.73	47622.50	7.13		
delta	E	2029-12-18T00:33:50.842		83.53	-82.00	48300.35	8.05		
lambda	E	2029-12-18T00:37:03.165		83.10	-82.57	50026.71	9.87		
epsilon	E	2029-12-18T00:38:58.649		82.82	-82.89	51225.67	11.04		

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-12-18T00:24:11.010
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        : 3412545099438845312
2Mass ID (if available) : 04574879+2242080
ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
RUWE (>1.4 is poor)  : 1.01
K magnitude           : 14.503
G magnitude           : 16.994
RP magnitude          : 16.211
BP magnitude          : 17.639
DUPflag              : 0
Distance (au)         : 18.254
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -22.97
Sun-Target sep (deg)  : 169.74
Sun-Moon sep (deg)    : 22.22
B (ring opening deg)  : 82.00
PA of pole (deg)      : -20.24
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.043
C/A sky separation (km) : 40279.8
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
  
```



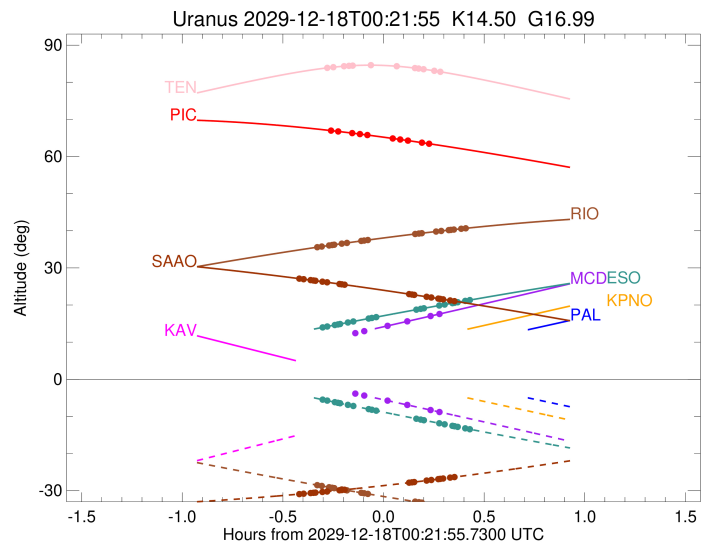
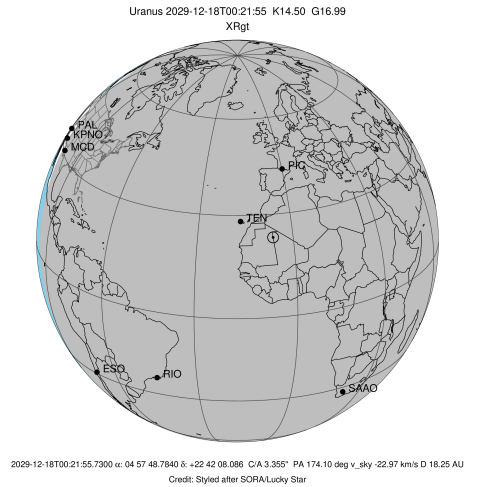
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-18T00:01:43.823		35.52	-28.45	51544.18	-14.31		
lambda	I	2029-12-18T00:03:32.361		35.76	-28.74	50026.71	-13.60		
delta	I	2029-12-18T00:05:44.036		36.05	-29.09	48300.35	-12.60		
gamma	I	2029-12-18T00:06:38.916		36.17	-29.23	47620.97	-12.15		
eta	I	2029-12-18T00:07:15.996		36.25	-29.33	47176.12	-11.84		
beta	I	2029-12-18T00:09:31.448		36.54	-29.69	45654.37	-10.61		
alpha	I	2029-12-18T00:11:03.815		36.73	-29.93	44716.26	-9.73		
4	I	2029-12-18T00:15:20.340		37.27	-30.58	42576.61	-6.89		
5	I	2029-12-18T00:16:05.398		37.36	-30.70	42268.98	-6.34		
6	I	2029-12-18T00:17:15.354		37.50	-30.88	41863.36	-5.51		

No planet occultations

6	E	2029-12-18T00:31:20.100	39.13	-32.95	41845.09	5.52
5	E	2029-12-18T00:32:26.303	39.25	-33.11	42226.04	6.35
4	E	2029-12-18T00:33:14.471	39.34	-33.22	42550.34	6.90
alpha	E	2029-12-18T00:37:37.235	39.80	-33.84	44742.65	9.74
beta	E	2029-12-18T00:39:05.561	39.95	-34.04	45641.86	10.62
eta	E	2029-12-18T00:41:21.999	40.17	-34.35	47176.12	11.85
gamma	E	2029-12-18T00:41:59.242	40.24	-34.43	47623.50	12.17
delta	E	2029-12-18T00:42:53.845	40.33	-34.56	48300.35	12.62
lambda	E	2029-12-18T00:45:05.342	40.54	-34.85	50026.71	13.62
epsilon	E	2029-12-18T00:46:26.570	40.67	-35.03	51156.49	14.34

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-12-18T00:25:36.160
Event type            : XRgt
: No Uranus occs
: 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       : 3412545099438845312
2Mass ID (if available) : 04574879+2242080
ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
RUWE (>1.4 is poor)  : 1.01
K magnitude           : 14.503
G magnitude           : 16.994
RP magnitude          : 16.211
BP magnitude          : 17.639
DUPflag              : 0
Distance (au)         : 18.254
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -22.97
Sun-Target sep (deg)  : 169.74
Sun-Moon sep (deg)    : 21.85
B (ring opening deg)  : 82.00
PA of pole (deg)      : -20.24
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.069
C/A sky separation (km) : 40625.5
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_itrfr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
    
```



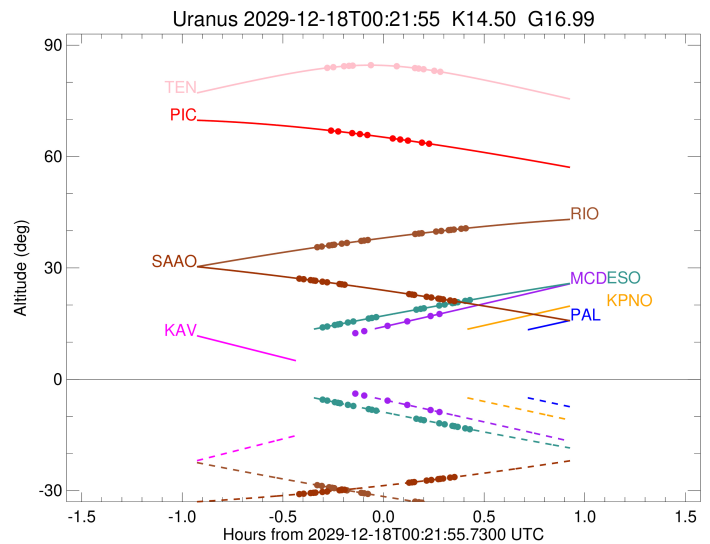
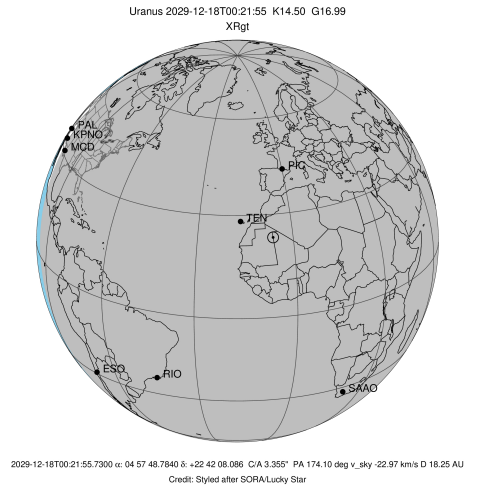
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-18T00:03:19.711		13.89	-5.40	51542.94	-14.01		
lambda	I	2029-12-18T00:05:10.635		14.22	-5.75	50026.71	-13.28		
delta	I	2029-12-18T00:07:25.771		14.61	-6.17	48300.35	-12.25		
gamma	I	2029-12-18T00:08:22.285		14.78	-6.35	47620.97	-11.79		
eta	I	2029-12-18T00:09:00.547		14.89	-6.47	47176.12	-11.46		
beta	I	2029-12-18T00:11:21.038		15.30	-6.90	45654.01	-10.18		
alpha	I	2029-12-18T00:12:57.548		15.58	-7.20	44716.96	-9.26		
4	I	2029-12-18T00:17:33.457		16.37	-8.05	42575.22	-6.20		
5	I	2029-12-18T00:18:24.237		16.51	-8.21	42266.50	-5.58		
6	I	2029-12-18T00:19:45.370		16.74	-8.46	41862.00	-4.61		

No planet occultations

6	E	2029-12-18T00:31:40.694		18.74	-10.62	41846.61	4.61		
5	E	2029-12-18T00:32:58.018		18.95	-10.85	42228.48	5.58		
4	E	2029-12-18T00:33:51.914		19.10	-11.02	42551.44	6.20		
alpha	E	2029-12-18T00:38:33.947		19.87	-11.86	44742.23	9.27		
beta	E	2029-12-18T00:40:06.326		20.12	-12.13	45641.95	10.20		
eta	E	2029-12-18T00:42:27.693		20.50	-12.55	47176.12	11.49		
gamma	E	2029-12-18T00:43:06.086		20.60	-12.66	47623.44	11.81		
delta	E	2029-12-18T00:44:02.269		20.75	-12.82	48300.35	12.28		
lambda	E	2029-12-18T00:46:17.088		21.11	-13.22	50026.71	13.31		
epsilon	E	2029-12-18T00:47:40.378		21.33	-13.46	51160.28	14.05		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-12-18T00:19:48.900
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      : 3412545099438845312
2Mass ID (if available) : 04574879+2242080
ICRS Star Coord at Epoch: 04h 57m 48.78405s +22:42:08.08576s
RUWE (>1.4 is poor) : 1.01
K magnitude         : 14.503
G magnitude         : 16.994
RP magnitude        : 16.211
BP magnitude        : 17.639
DUPflag            : 0
Distance (au)       : 18.254
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -22.97
Sun-Target sep (deg) : 169.74
Sun-Moon sep (deg)  : 22.92
B (ring opening deg) : 82.00
PA of pole (deg)    : -20.24
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.965
C/A sky separation (km) : 39253.0
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	2029-12-17T23:56:23.705		27.16	-30.97	51547.61	-14.89		
lambda	I	2029-12-17T23:58:07.978		26.95	-30.83	50026.71	-14.24		
delta	I	2029-12-18T00:00:13.116		26.71	-30.66	48300.35	-13.34		
gamma	I	2029-12-18T00:01:04.828		26.61	-30.58	47621.00	-12.93		
eta	I	2029-12-18T00:01:39.595		26.54	-30.53	47176.12	-12.66		
beta	I	2029-12-18T00:03:45.033		26.28	-30.36	45655.41	-11.57		
alpha	I	2029-12-18T00:05:09.215		26.11	-30.23	44714.25	-10.81		
4	I	2029-12-18T00:08:49.644		25.66	-29.91	42580.22	-8.50		
5	I	2029-12-18T00:09:25.361		25.59	-29.85	42275.12	-8.09		
6	I	2029-12-18T00:10:19.038		25.47	-29.77	41866.45	-7.49		

No planet occultations

6	E	2029-12-18T00:29:31.727		22.95	-27.86	41841.67	7.48		
5	E	2029-12-18T00:30:21.742		22.83	-27.77	42220.34	8.08		
4	E	2029-12-18T00:31:00.614		22.75	-27.70	42547.72	8.49		
alpha	E	2029-12-18T00:34:47.783		22.22	-27.29	44743.70	10.80		
beta	E	2029-12-18T00:36:08.105		22.03	-27.14	45641.65	11.56		
eta	E	2029-12-18T00:38:14.891		21.73	-26.90	47176.12	12.63		
gamma	E	2029-12-18T00:38:49.923		21.65	-26.84	47623.65	12.91		
delta	E	2029-12-18T00:39:41.522		21.53	-26.74	48300.35	13.31		
lambda	E	2029-12-18T00:41:46.898		21.23	-26.50	50026.71	14.21		
epsilon	E	2029-12-18T00:43:04.284		21.04	-26.35	51146.32	14.86		