

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-13T16:20:24.950
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3404584463454281856
 2Mass ID (if available) : 05375333+2329338

ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s

RUWE (>1.4 is poor) : 0.94
 K magnitude : 12.780
 G magnitude : 16.841
 RP magnitude : 15.731
 BP magnitude : 18.154
 DUPflag : 0
 Distance (au) : 18.105
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.38
 Sun-Target sep (deg) : 176.07
 Sun-Moon sep (deg) : 166.32
 B (ring opening deg) : 79.29
 PA of pole (deg) : 40.34

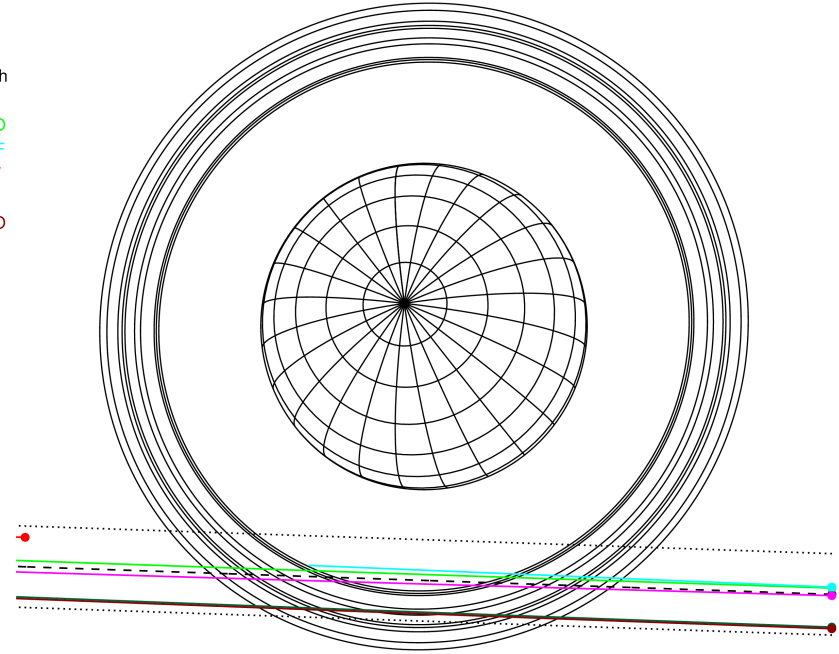
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-12-13T16:20:24.9500 ra: 05 37 53.3434 ra: +23 29 33.825 C/A 3.020° PA 358.04 deg v_sky -23.38 km/s D 18.11 AU
 Credit: Styled after SORA/Lucky Star

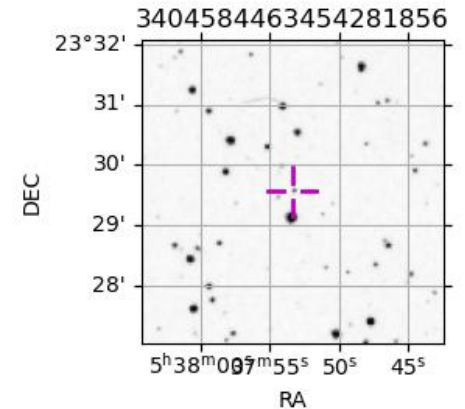
Uranus 2031-12-13T16:20:24 K12.78 G16.84 XRgt

Earth
 PIC
 PMO
 IRTF
 KAV
 AAT
 MSO

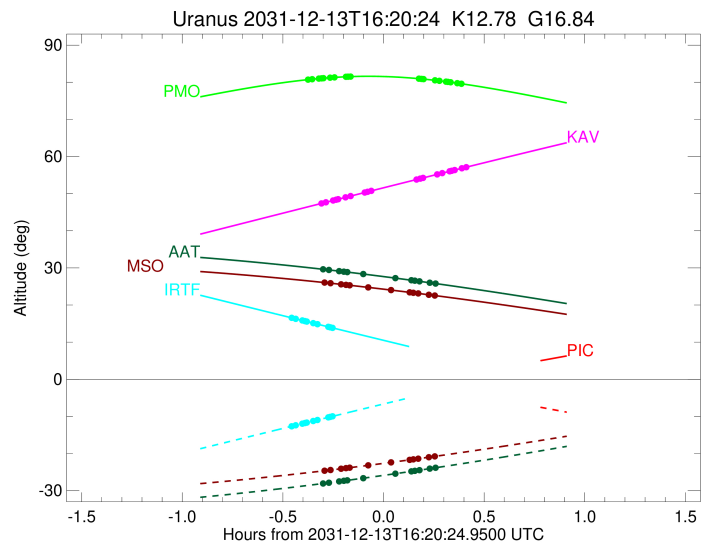
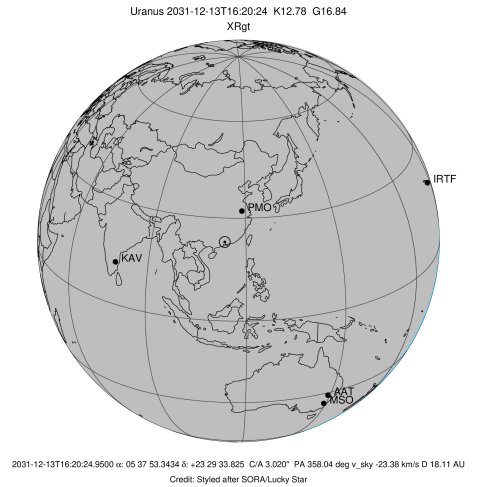


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++		+++++	DEC 13 15:57 - DEC 13 16:43	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					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++			DEC 13 15:52 - DEC 13 16:05	PnnRin
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 13 16:01 - DEC 13 16:45	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	+++++		+++++	DEC 13 16:01 - DEC 13 16:36	PnnRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	+++++		+++++	DEC 13 16:02 - DEC 13 16:35	PnnRie



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-13T16:20:18.640
 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 : 3404584463454281856
 2Mass ID (if available) : 05375333+2329338
 ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 12.780
 G magnitude : 16.841
 RP magnitude : 15.731
 BP magnitude : 18.154
 DUPflag : 0
 Distance (au) : 18.105
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.38
 Sun-Target sep (deg) : 176.07
 Sun-Moon sep (deg) : 166.60
 B (ring opening deg) : 79.29
 PA of pole (deg) : 40.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.956
 C/A sky separation (km) : 38817.8
 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_itrff93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



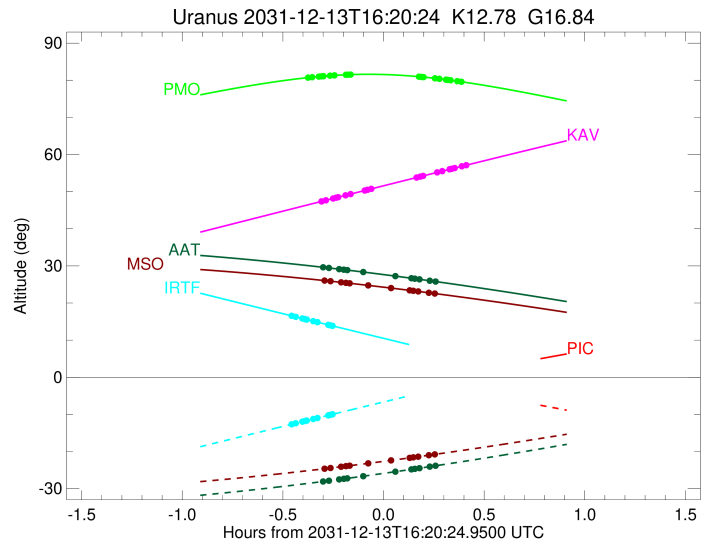
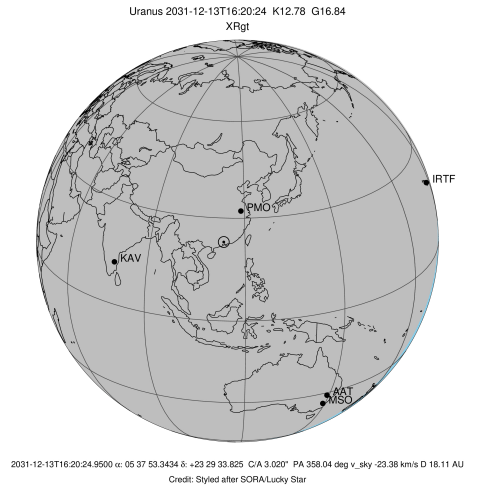
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-13T15:57:30.070		80.67	-81.26	51555.01	-15.56		
lambda	I	2031-12-13T15:59:10.466		80.83	-81.26	50026.71	-14.88		
delta	I	2031-12-13T16:01:09.995		81.00	-81.25	48300.35	-13.99		
gamma	I	2031-12-13T16:01:59.098		81.06	-81.24	47622.91	-13.60		
eta	I	2031-12-13T16:02:32.288		81.11	-81.23	47176.12	-13.32		
beta	I	2031-12-13T16:04:29.393		81.24	-81.17	45675.01	-12.28		
alpha	I	2031-12-13T16:05:46.654		81.32	-81.13	44752.22	-11.55		
4	I	2031-12-13T16:09:18.686		81.49	-80.96	42535.33	-9.27		
5	I	2031-12-13T16:09:59.901		81.51	-80.92	42170.58	-8.84		
6	I	2031-12-13T16:10:35.163		81.53	-80.89	41857.34	-8.42		

No planet occultations

6	E	2031-12-13T16:31:01.695		80.97	-78.73	41877.03	8.42		
5	E	2031-12-13T16:31:40.970		80.92	-78.64	42221.01	8.84		
4	E	2031-12-13T16:32:14.624		80.87	-78.56	42526.38	9.28		
alpha	E	2031-12-13T16:35:46.178		80.53	-78.04	44733.31	11.55		
beta	E	2031-12-13T16:37:03.504		80.39	-77.84	45654.90	12.28		
eta	E	2031-12-13T16:39:02.283		80.17	-77.54	47176.12	13.32		
gamma	E	2031-12-13T16:39:35.348		80.11	-77.45	47621.23	13.60		
delta	E	2031-12-13T16:40:24.572		80.01	-77.32	48300.35	13.99		
lambda	E	2031-12-13T16:42:24.094		79.76	-77.00	50026.71	14.88		
epsilon	E	2031-12-13T16:43:43.306		79.59	-76.78	51226.99	15.56		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-13T16:16:18.580
Event type          : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code       : IRTF
Location            : Mauna Kea/IRTF
Latitude (deg)      : 19.82622
E. Longitude (deg)  : 204.52800
Altitude (km)       : 4.168
Gaia source ID      : 3404584463454281856
2Mass ID (if available) : 05375333+2329338
ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s
RUWE (>1.4 is poor) : 0.94
K magnitude          : 12.780
G magnitude          : 16.841
RP magnitude         : 15.731
BP magnitude         : 18.154
DUPflag             : 0
Distance (au)       : 18.105
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.38
Sun-Target sep (deg) : 176.07
Sun-Moon sep (deg)  : 167.32
B (ring opening deg) : 79.29
PA of pole (deg)    : 40.34
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.904
C/A sky separation (km) : 38133.0
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
    
```

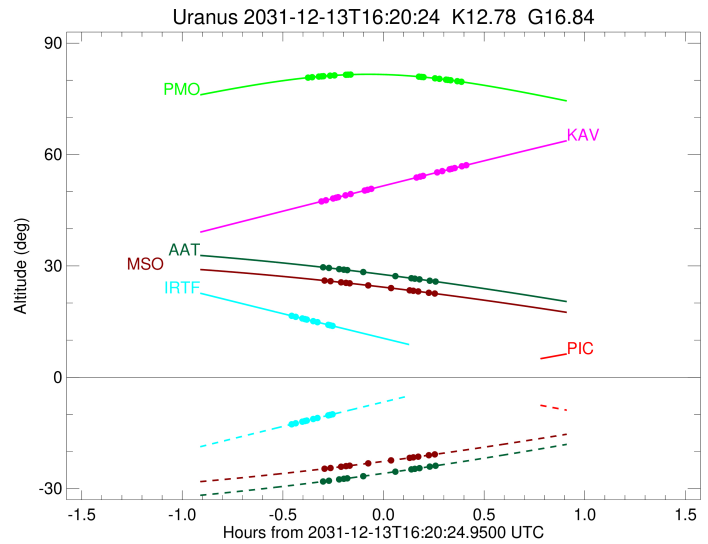
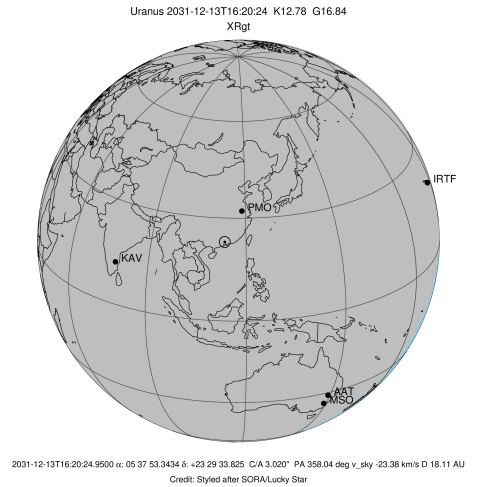


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-13T15:52:36.894		16.64	-12.76	51554.79	-15.73		
lambda	I	2031-12-13T15:54:16.019		16.27	-12.39	50026.71	-15.10		
delta	I	2031-12-13T15:56:13.527		15.84	-11.96	48300.35	-14.27		
gamma	I	2031-12-13T15:57:01.593		15.66	-11.79	47622.98	-13.91		
eta	I	2031-12-13T15:57:34.012		15.54	-11.67	47176.12	-13.66		
beta	I	2031-12-13T15:59:27.745		15.12	-11.25	45675.32	-12.70		
alpha	I	2031-12-13T16:00:42.180		14.84	-10.98	44752.30	-12.04		
4	I	2031-12-13T16:04:02.349		14.11	-10.24	42536.25	-10.02		
5	I	2031-12-13T16:04:40.608		13.96	-10.10	42168.97	-9.65		
6	I	2031-12-13T16:05:12.718		13.85	-9.99	41855.94	-9.28		

No planet occultations

6	E	2031-12-13T16:28:24.543		8.74	-4.93x	41877.76	9.27		
5	E	2031-12-13T16:29:00.834		8.61	-4.80x	42224.98	9.63		
4	E	2031-12-13T16:29:31.512		8.50	-4.68x	42526.73	10.00		
alpha	E	2031-12-13T16:32:51.603		7.77	-3.96x	44732.11	12.01		
beta	E	2031-12-13T16:34:06.319		7.49	-3.69x	45654.20	12.67		
eta	E	2031-12-13T16:36:02.087		7.07	-3.28x	47176.12	13.62		
gamma	E	2031-12-13T16:36:34.483		6.96	-3.16x	47621.29	13.87		
delta	E	2031-12-13T16:37:22.823		6.78	-2.99x	48300.35	14.23		
lambda	E	2031-12-13T16:39:20.730		6.35	-2.56x	50026.71	15.04		
epsilon	E	2031-12-13T16:40:38.487		6.07	-2.28x	51215.77	15.67		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-13T16:23:01.550
 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 : 3404584463454281856
 2Mass ID (if available) : 05375333+2329338
 ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 12.780
 G magnitude : 16.841
 RP magnitude : 15.731
 BP magnitude : 18.154
 DUPflag : 0
 Distance (au) : 18.105
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.38
 Sun-Target sep (deg) : 176.07
 Sun-Moon sep (deg) : 165.91
 B (ring opening deg) : 79.29
 PA of pole (deg) : 40.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.070
 C/A sky separation (km) : 40312.0
 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_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



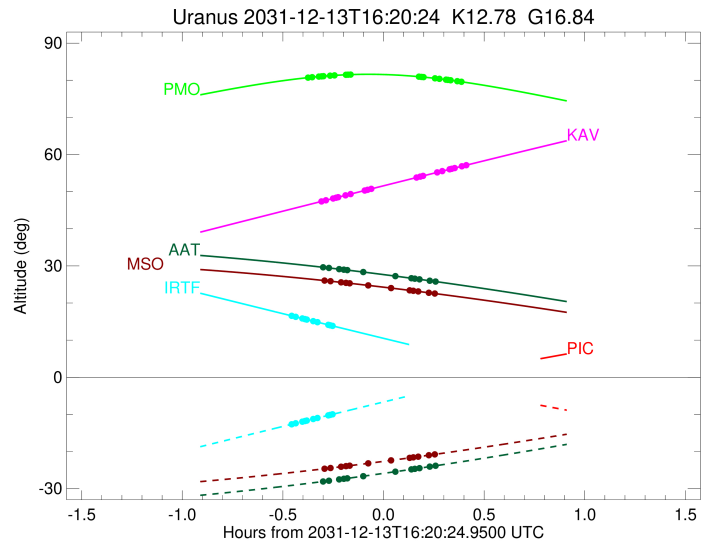
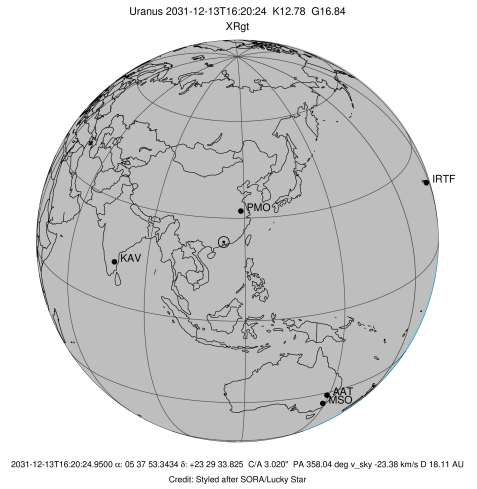
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-13T16:01:28.496		47.27	-51.21	51555.29	-14.65		
lambda	I	2031-12-13T16:03:15.605		47.68	-51.61	50026.71	-13.88		
delta	I	2031-12-13T16:05:24.688		48.17	-52.10	48300.35	-12.85		
gamma	I	2031-12-13T16:06:18.374		48.37	-52.30	47622.69	-12.39		
eta	I	2031-12-13T16:06:54.889		48.51	-52.44	47176.12	-12.07		
beta	I	2031-12-13T16:09:05.967		49.01	-52.94	45674.06	-10.82		
alpha	I	2031-12-13T16:10:34.690		49.34	-53.27	44751.87	-9.91		
4	I	2031-12-13T16:14:57.183		50.34	-54.26	42532.74	-6.89		
5	I	2031-12-13T16:15:52.590		50.55	-54.47	42176.16	-6.25		
6	I	2031-12-13T16:16:44.373		50.74	-54.66	41861.64	-5.58		

No planet occultations

6	E	2031-12-13T16:30:20.436		53.82	-57.71	41874.79	5.58		
5	E	2031-12-13T16:31:16.190		54.03	-57.92	42211.79	6.26		
4	E	2031-12-13T16:32:03.941		54.21	-58.10	42525.95	6.90		
alpha	E	2031-12-13T16:36:25.701		55.19	-59.07	44735.71	9.93		
beta	E	2031-12-13T16:37:54.355		55.52	-59.40	45656.31	10.84		
eta	E	2031-12-13T16:40:06.897		56.02	-59.88	47176.12	12.09		
gamma	E	2031-12-13T16:40:43.222		56.15	-60.02	47621.14	12.41		
delta	E	2031-12-13T16:41:36.931		56.35	-60.22	48300.35	12.88		
lambda	E	2031-12-13T16:43:45.750		56.83	-60.69	50026.71	13.91		
epsilon	E	2031-12-13T16:45:11.551		57.15	-61.01	51247.44	14.69		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-13T16:18:37.230
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : AAT
 Location : Siding Spring (AAT)
 Latitude (deg) : -31.27703
 E. Longitude (deg) : 149.06608
 Altitude (km) : 1.164
 Gaia source ID : 3404584463454281856
 2Mass ID (if available) : 05375333+2329338
 ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 12.780
 G magnitude : 16.841
 RP magnitude : 15.731
 BP magnitude : 18.154
 DUPflag : 0
 Distance (au) : 18.105
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.38
 Sun-Target sep (deg) : 176.07
 Sun-Moon sep (deg) : 166.68
 B (ring opening deg) : 79.29
 PA of pole (deg) : 40.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.405
 C/A sky separation (km) : 44715.0
 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_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

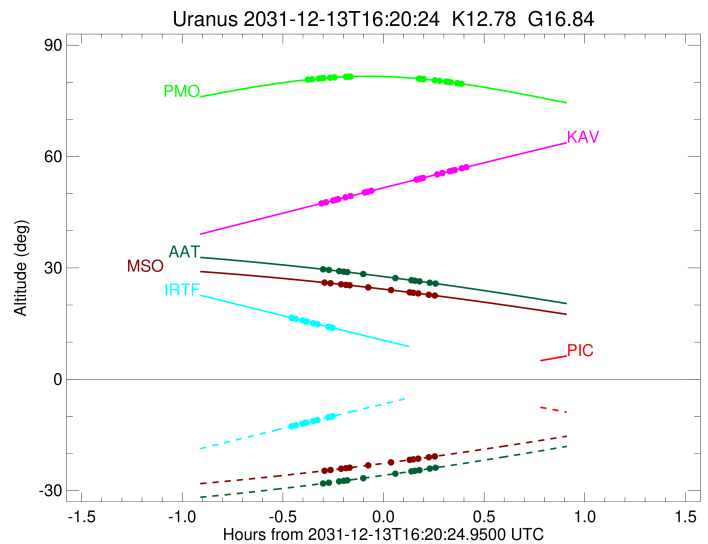
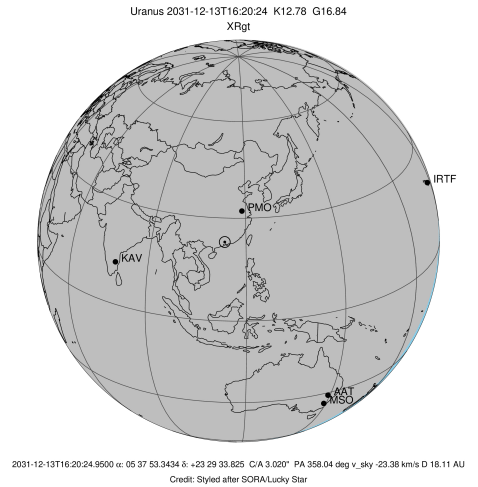


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-13T16:01:50.718		29.68	-28.14	51549.35	-11.51		
lambda	I	2031-12-13T16:04:10.081		29.45	-27.87	50026.71	-10.29		
delta	I	2031-12-13T16:07:13.599		29.13	-27.51	48300.35	-8.49		
gamma	I	2031-12-13T16:08:37.936		28.98	-27.35	47621.89	-7.59		
eta	I	2031-12-13T16:09:39.334		28.87	-27.22	47176.12	-6.92		
beta	I	2031-12-13T16:14:25.248		28.34	-26.64	45668.39	-3.56		

No planet occultations

beta	E	2031-12-13T16:23:53.767		27.26	-25.44	45662.55	3.56		
eta	E	2031-12-13T16:28:41.512		26.68	-24.81	47176.12	6.92		
gamma	E	2031-12-13T16:29:42.830		26.56	-24.68	47620.96	7.59		
delta	E	2031-12-13T16:31:07.354		26.38	-24.49	48300.35	8.48		
lambda	E	2031-12-13T16:34:11.042		26.00	-24.08	50026.71	10.28		
epsilon	E	2031-12-13T16:36:09.217		25.76	-23.81	51305.34	11.50		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-13T16:18:42.870
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Observer code : MSO
 Location : Mt. Stromlo Observatory
 Latitude (deg) : -35.32000
 E. Longitude (deg) : 149.00833
 Altitude (km) : 0.770
 Gaia source ID : 3404584463454281856
 2Mass ID (if available) : 05375333+2329338
 ICRS Star Coord at Epoch: 05h 37m 53.34339s +23:29:33.82477s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 12.780
 G magnitude : 16.841
 RP magnitude : 15.731
 BP magnitude : 18.154
 DUPflag : 0
 Distance (au) : 18.105
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.38
 Sun-Target sep (deg) : 176.07
 Sun-Moon sep (deg) : 166.64
 B (ring opening deg) : 79.29
 PA of pole (deg) : 40.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 3.425
 C/A sky separation (km) : 44970.6
 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



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	2031-12-13T16:02:15.812		26.10	-24.70	51548.61	-11.28		
lambda	I	2031-12-13T16:04:38.351		25.88	-24.45	50026.71	-10.02		
delta	I	2031-12-13T16:07:48.106		25.57	-24.10	48300.35	-8.14		
gamma	I	2031-12-13T16:09:16.592		25.42	-23.94	47621.84	-7.19		
eta	I	2031-12-13T16:10:21.830		25.31	-23.81	47176.12	-6.47		
beta	I	2031-12-13T16:15:55.430		24.75	-23.18	45667.55	-2.50		

No planet occultations

beta	E	2031-12-13T16:22:35.259		24.04	-22.40	45663.44	2.50		
eta	E	2031-12-13T16:28:10.684		23.42	-21.72	47176.12	6.47		
gamma	E	2031-12-13T16:29:15.840		23.30	-21.58	47620.96	7.19		
delta	E	2031-12-13T16:30:44.510		23.13	-21.40	48300.35	8.13		
lambda	E	2031-12-13T16:33:54.427		22.76	-21.00	50026.71	10.02		
epsilon	E	2031-12-13T16:35:55.762		22.53	-20.74	51309.35	11.27		