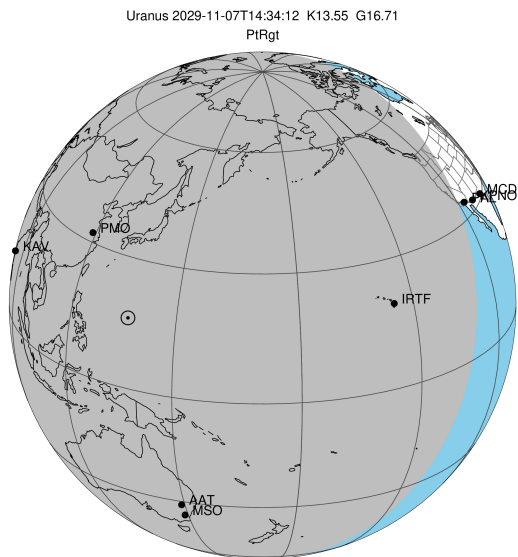


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-07T14:34:12.670  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3418299775796596352  
 2Mass ID (if available) : 05045032+2251322

ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s

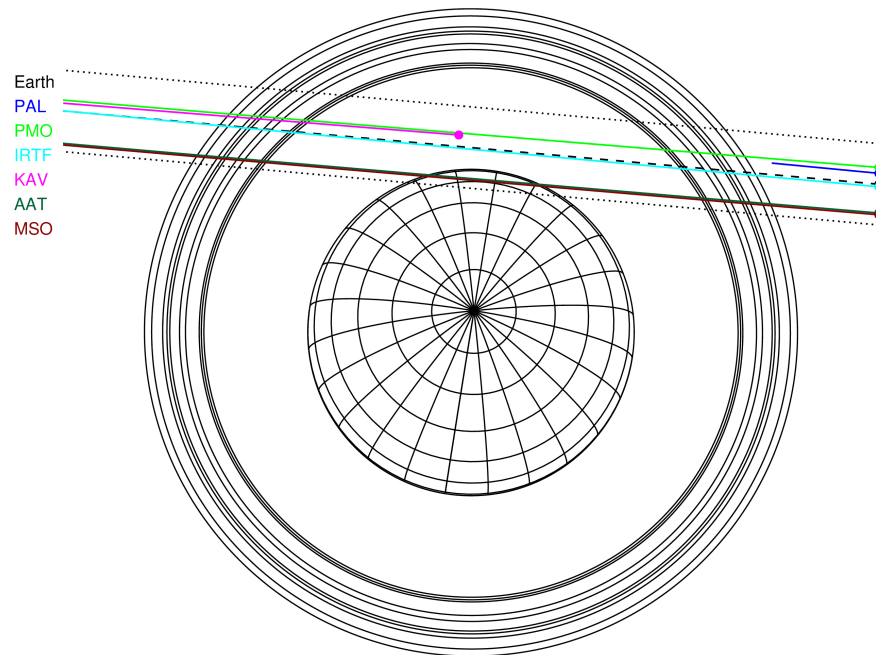
RUWE (>1.4 is poor) : 1.00  
 K magnitude : 13.546  
 G magnitude : 16.715  
 RP magnitude : 15.771  
 BP magnitude : 17.627  
 DUPflag : 0  
 Distance (au) : 18.385  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.87  
 Sun-Target sep (deg) : 147.75  
 Sun-Moon sep (deg) : 167.80  
 B (ring opening deg) : 82.25  
 PA of pole (deg) : -7.90

#	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



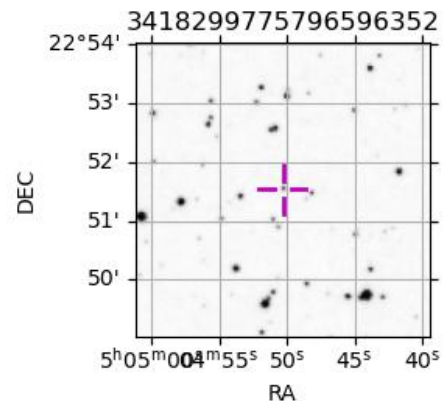
2029-11-07T14:34:12.6700 ra: 05 04 50.32029 s: +22 51 32.114 C/A 2.169 PA 174.86 deg v\_sky -18.87 km/s D 18.38 AU  
 Credit: Styled after SORA/Lucky Star

Uranus 2029-11-07T14:34:12 K13.55 G16.71 PtRgt

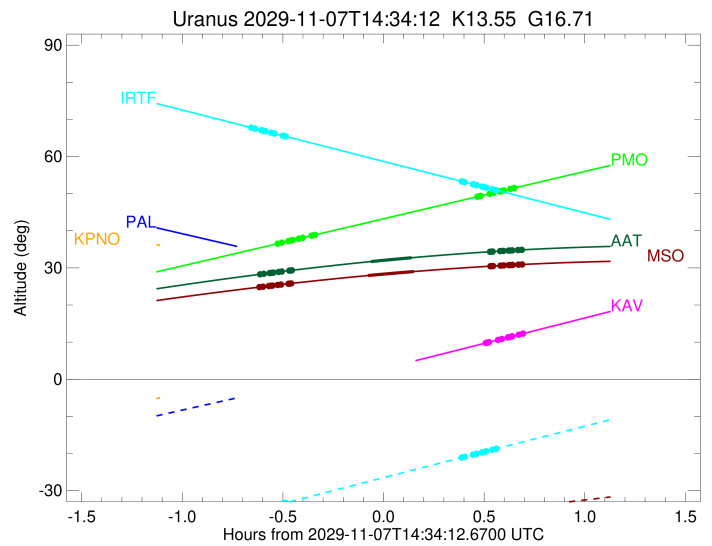
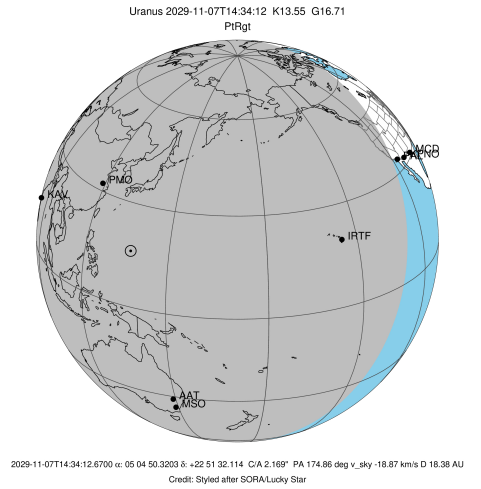


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++		+++++	NOV 07 14:02 - NOV 07 15:12	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	+++++		+++++	NOV 07 13:54 - NOV 07 15:07	PnnRie
KAV	Kavalur Observatory	12.6	78.8			+++++	NOV 07 15:04 - NOV 07 15:15	PnnRne
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	+++++	+ +	+++++	NOV 07 13:57 - NOV 07 15:15	PieRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	+++++	+ +	+++++	NOV 07 13:56 - NOV 07 15:15	PieRie



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-07T14:37:59.340  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 3418299775796596352  
 2Mass ID (if available) : 05045032+2251322  
 ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 13.546  
 G magnitude : 16.715  
 RP magnitude : 15.771  
 BP magnitude : 17.627  
 DUPflag : 0  
 Distance (au) : 18.385  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.87  
 Sun-Target sep (deg) : 147.75  
 Sun-Moon sep (deg) : 167.27  
 B (ring opening deg) : 82.25  
 PA of pole (deg) : -7.90  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.324  
 C/A sky separation (km) : 30984.9  
 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



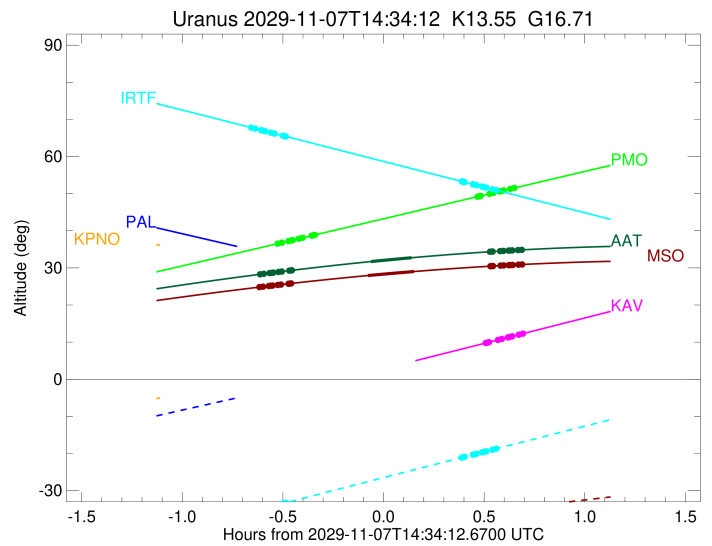
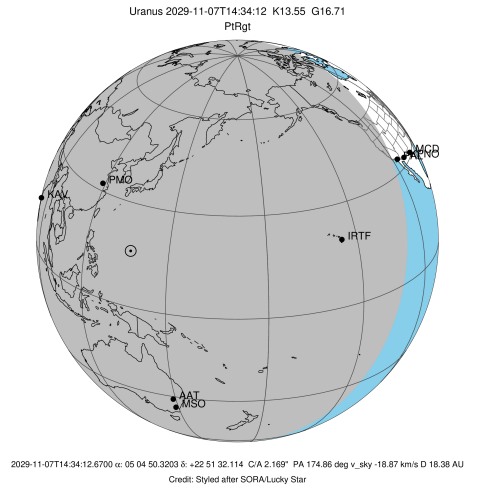
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-07T14:02:25.473		36.48	-61.46	51385.27	-15.04		
lambda	I	2029-11-07T14:03:56.082		36.80	-61.74	50026.71	-14.87		
delta	I	2029-11-07T14:05:53.541		37.22	-62.11	48300.35	-14.52		
gamma	I	2029-11-07T14:06:40.445		37.38	-62.26	47622.81	-14.37		
eta	I	2029-11-07T14:07:11.642		37.49	-62.36	47176.12	-14.27		
beta	I	2029-11-07T14:09:00.696		37.88	-62.70	45641.23	-13.88		
alpha	I	2029-11-07T14:10:05.541		38.11	-62.90	44748.92	-13.63		
4	I	2029-11-07T14:12:52.672		38.70	-63.41	42527.91	-12.91		
5	I	2029-11-07T14:13:21.111		38.80	-63.50	42167.83	-12.77		
6	I	2029-11-07T14:13:48.911		38.90	-63.59	41806.62	-12.64		

No planet occultations

6	E	2029-11-07T15:02:09.524		49.18	-71.35	41804.23	12.69		
5	E	2029-11-07T15:02:39.543		49.28	-71.42	42184.44	12.82		
4	E	2029-11-07T15:03:08.002		49.38	-71.48	42554.37	12.97		
alpha	E	2029-11-07T15:05:51.334		49.96	-71.81	44732.89	13.70		
beta	E	2029-11-07T15:06:58.439		50.20	-71.94	45659.63	13.95		
eta	E	2029-11-07T15:08:45.644		50.58	-72.15	47176.12	14.34		
gamma	E	2029-11-07T15:09:17.229		50.69	-72.21	47630.73	14.45		
delta	E	2029-11-07T15:10:03.338		50.86	-72.30	48300.35	14.60		
lambda	E	2029-11-07T15:12:00.153		51.27	-72.51	50026.71	14.95		
epsilon	E	2029-11-07T15:12:49.718		51.45	-72.60	50771.38	15.13		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-07T14:31:16.280  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 3418299775796596352  
 2Mass ID (if available) : 05045032+2251322  
 ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 13.546  
 G magnitude : 16.715  
 RP magnitude : 15.771  
 BP magnitude : 17.627  
 DUPflag : 0  
 Distance (au) : 18.385  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.87  
 Sun-Target sep (deg) : 147.75  
 Sun-Moon sep (deg) : 168.49  
 B (ring opening deg) : 82.25  
 PA of pole (deg) : -7.90  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.143  
 C/A sky separation (km) : 28577.3  
 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

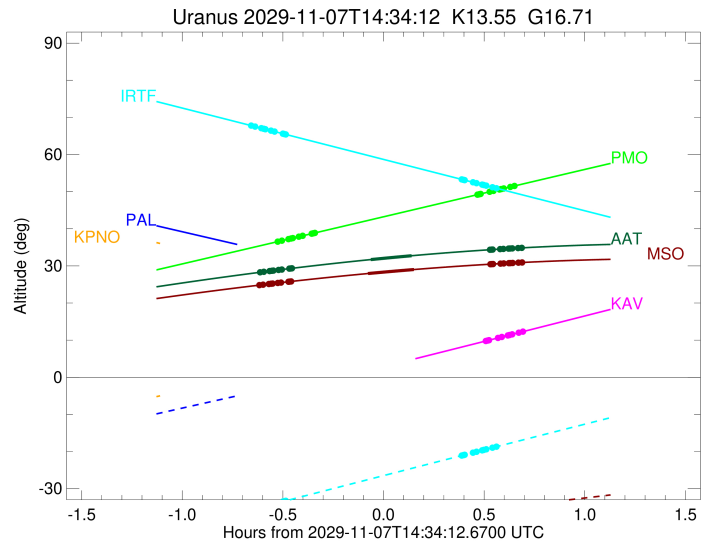
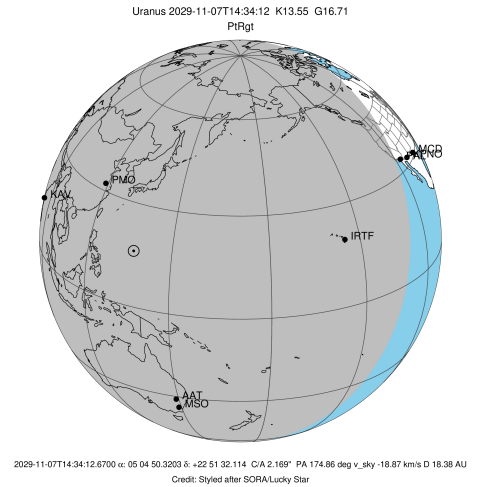
Ring	I/E	UTC	b? alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-07T13:54:29.992	67.85	-35.75	51407.47	-15.89		
lambda	I	2029-11-07T13:55:57.094	67.52	-35.41	50026.71	-15.75		
delta	I	2029-11-07T13:57:47.724	67.10	-34.98	48300.35	-15.46		
gamma	I	2029-11-07T13:58:31.750	66.93	-34.81	47622.51	-15.33		
eta	I	2029-11-07T13:59:00.943	66.81	-34.70	47176.12	-15.25		
beta	I	2029-11-07T14:00:42.626	66.42	-34.30	45641.52	-14.93		
alpha	I	2029-11-07T14:01:42.876	66.19	-34.07	44747.56	-14.73		
4	I	2029-11-07T14:04:16.312	65.60	-33.47	42529.29	-14.15		
5	I	2029-11-07T14:04:42.003	65.50	-33.37	42172.15	-14.04		
6	I	2029-11-07T14:05:07.379	65.41	-33.27	41809.51	-13.93		

No planet occultations

6	E	2029-11-07T14:57:28.685	53.32	-21.10	41806.27	13.90		
5	E	2029-11-07T14:57:56.329	53.21	-21.00	42189.02	14.01		
4	E	2029-11-07T14:58:22.304	53.11	-20.90	42557.36	14.12		
alpha	E	2029-11-07T15:00:53.114	52.53	-20.32	44730.94	14.70		
beta	E	2029-11-07T15:01:56.012	52.29	-20.07	45660.84	14.89		
eta	E	2029-11-07T15:03:36.671	51.90	-19.69	47176.12	15.21		
gamma	E	2029-11-07T15:04:06.489	51.79	-19.57	47630.88	15.29		
delta	E	2029-11-07T15:04:50.088	51.62	-19.40	48300.35	15.42		
lambda	E	2029-11-07T15:06:41.030	51.19	-18.98	50026.71	15.70		
epsilon	E	2029-11-07T15:07:27.864	51.01	-18.80	50764.71	15.84		

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-11-07T14:39:50.490
Event type            : PtRgt
: Uranus occs: topocentric, not geocentric
: 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        : 3418299775796596352
2Mass ID (if available) : 05045032+2251322
ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s
RUWE (>1.4 is poor) : 1.00
K magnitude           : 13.546
G magnitude           : 16.715
RP magnitude          : 15.771
BP magnitude          : 17.627
DUPflag              : 0
Distance (au)         : 18.385
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -18.87
Sun-Target sep (deg)  : 147.75
Sun-Moon sep (deg)    : 166.83
B (ring opening deg) : 82.25
PA of pole (deg)     : -7.90
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.301
C/A sky separation (km) : 30680.6
NAIF SPICE kernels    : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ural11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ural11.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
    
```

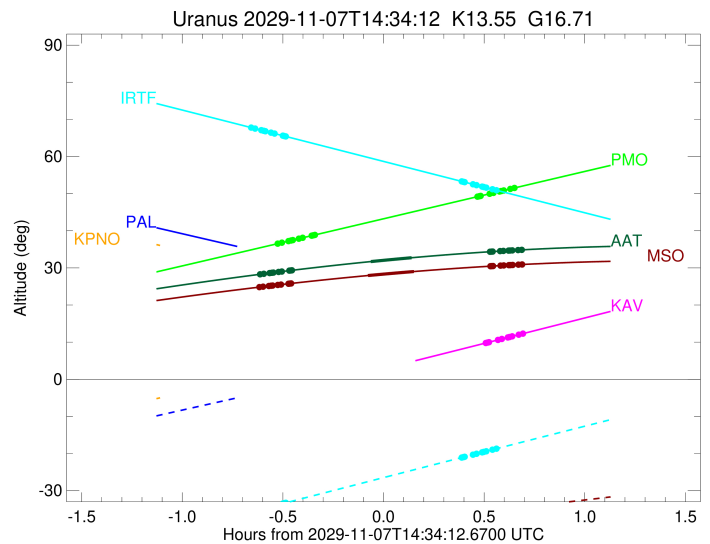
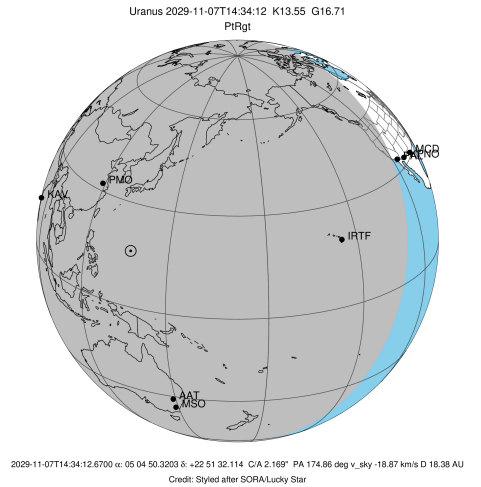


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-07T14:03:33.065	-4.02x	-26.05	51387.27	-14.90			
lambda	I	2029-11-07T14:05:04.626	-3.68x	-26.41	50026.71	-14.74			
delta	I	2029-11-07T14:07:03.062	-3.24x	-26.88	48300.35	-14.41			
gamma	I	2029-11-07T14:07:50.330	-3.07x	-27.07	47622.78	-14.26			
eta	I	2029-11-07T14:08:21.756	-2.95x	-27.19	47176.12	-14.16			
beta	I	2029-11-07T14:10:11.545	-2.54x	-27.63	45641.26	-13.79			
alpha	I	2029-11-07T14:11:16.782	-2.30x	-27.89	44748.80	-13.56			
4	I	2029-11-07T14:14:04.641	-1.67x	-28.56	42528.03	-12.87			
5	I	2029-11-07T14:14:33.145	-1.57x	-28.67	42168.24	-12.73			
6	I	2029-11-07T14:15:01.029	-1.46x	-28.78	41806.90	-12.61			

No planet occultations

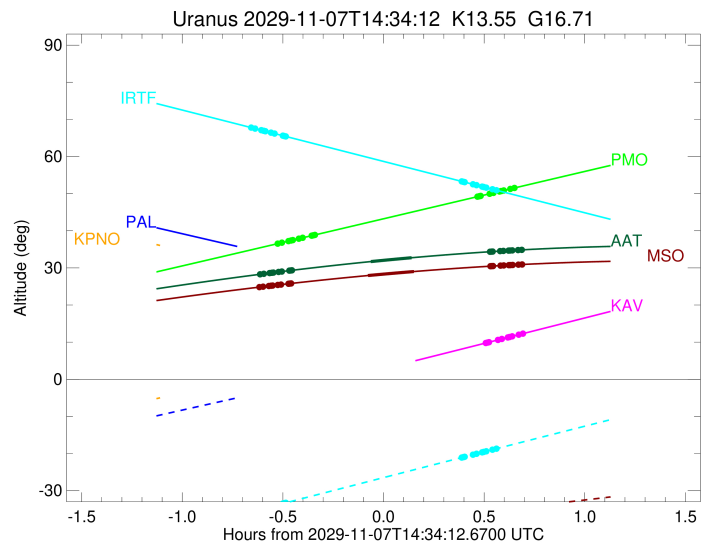
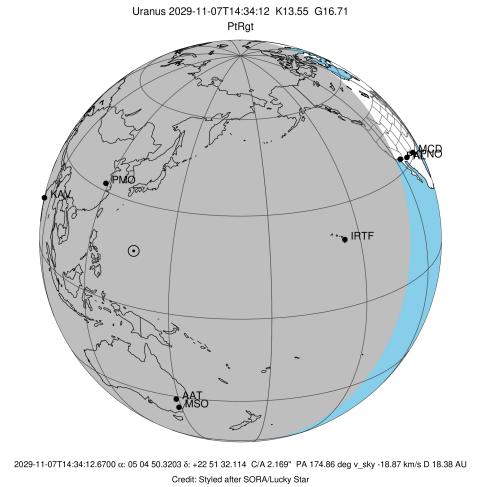
6	E	2029-11-07T15:04:38.430	9.75	-40.65	41804.59	12.68
5	E	2029-11-07T15:05:08.514	9.87	-40.77	42185.25	12.81
4	E	2029-11-07T15:05:36.986	9.97	-40.88	42554.91	12.95
alpha	E	2029-11-07T15:08:20.664	10.60	-41.53	44732.53	13.65
beta	E	2029-11-07T15:09:28.068	10.85	-41.80	45659.86	13.89
eta	E	2029-11-07T15:11:15.749	11.26	-42.23	47176.12	14.27
gamma	E	2029-11-07T15:11:47.499	11.38	-42.36	47630.76	14.37
delta	E	2029-11-07T15:12:33.855	11.56	-42.55	48300.35	14.52
lambda	E	2029-11-07T15:14:31.364	12.00	-43.01	50026.71	14.86
epsilon	E	2029-11-07T15:15:21.149	12.19	-43.21	50769.93	15.03

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-07T14:36:26.570  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 3418299775796596352  
 2Mass ID (if available) : 05045032+2251322  
 ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 13.546  
 G magnitude : 16.715  
 RP magnitude : 15.771  
 BP magnitude : 17.627  
 DUPflag : 0  
 Distance (au) : 18.385  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.87  
 Sun-Target sep (deg) : 147.75  
 Sun-Moon sep (deg) : 167.61  
 B (ring opening deg) : 82.25  
 PA of pole (deg) : -7.90  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.802  
 C/A sky separation (km) : 24022.7  
 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	2029-11-07T13:57:08.952		28.25	-42.37	51436.82	-16.88		
lambda	I	2029-11-07T13:58:32.571		28.41	-42.35	50026.71	-16.79		
delta	I	2029-11-07T14:00:15.937		28.61	-42.33	48300.35	-16.61		
gamma	I	2029-11-07T14:00:56.876		28.68	-42.32	47622.13	-16.53		
eta	I	2029-11-07T14:01:23.909		28.74	-42.31	47176.12	-16.47		
beta	I	2029-11-07T14:02:57.609		28.91	-42.28	45642.15	-16.27		
alpha	I	2029-11-07T14:03:52.935		29.02	-42.26	44745.25	-16.14		
4	I	2029-11-07T14:06:11.525		29.27	-42.21	42531.89	-15.77		
5	I	2029-11-07T14:06:34.217		29.31	-42.21	42179.31	-15.70		
6	I	2029-11-07T14:06:57.080		29.35	-42.20	41814.10	-15.64		
Uranus	I	2029-11-07T14:30:24.489		31.70	-41.32	25012.56		7.55	7.90
Uranus	E	2029-11-07T14:42:34.687		32.74	-40.61	25045.71		7.31	7.65
6	E	2029-11-07T15:05:55.524		34.35	-38.82	41810.98	15.68		
5	E	2029-11-07T15:06:20.441		34.38	-38.78	42199.22	15.74		
4	E	2029-11-07T15:06:43.354		34.40	-38.75	42563.79	15.82		
alpha	E	2029-11-07T15:08:58.486		34.52	-38.54	44726.56	16.19		
beta	E	2029-11-07T15:09:56.164		34.58	-38.45	45663.48	16.32		
eta	E	2029-11-07T15:11:28.270		34.66	-38.31	47176.12	16.52		
gamma	E	2029-11-07T15:11:55.760		34.68	-38.27	47631.17	16.58		
delta	E	2029-11-07T15:12:36.019		34.72	-38.20	48300.35	16.66		
lambda	E	2029-11-07T15:14:19.033		34.80	-38.04	50026.71	16.85		
epsilon	E	2029-11-07T15:15:02.009		34.84	-37.97	50752.56	16.94		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-07T14:36:23.000  
 Event type : PtRgt  
 : Uranus occs: topocentric, not geocentric  
 : 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 : 3418299775796596352  
 2Mass ID (if available) : 05045032+2251322  
 ICRS Star Coord at Epoch: 05h 04m 50.32029s +22:51:32.11371s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 13.546  
 G magnitude : 16.715  
 RP magnitude : 15.771  
 BP magnitude : 17.627  
 DUPflag : 0  
 Distance (au) : 18.385  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.87  
 Sun-Target sep (deg) : 147.75  
 Sun-Moon sep (deg) : 167.61  
 B (ring opening deg) : 82.25  
 PA of pole (deg) : -7.90  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.782  
 C/A sky separation (km) : 23761.6  
 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\_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	2029-11-07T13:56:55.967		24.79	-38.35	51438.55	-16.92		
lambda	I	2029-11-07T13:58:19.490		24.94	-38.34	50026.71	-16.84		
delta	I	2029-11-07T14:00:02.583		25.12	-38.31	48300.35	-16.65		
gamma	I	2029-11-07T14:00:43.407		25.20	-38.30	47622.11	-16.58		
eta	I	2029-11-07T14:01:10.357		25.24	-38.30	47176.12	-16.52		
beta	I	2029-11-07T14:02:43.754		25.41	-38.27	45642.19	-16.32		
alpha	I	2029-11-07T14:03:38.898		25.50	-38.26	44745.10	-16.20		
4	I	2029-11-07T14:05:56.918		25.74	-38.21	42532.06	-15.84		
5	I	2029-11-07T14:06:19.490		25.78	-38.21	42179.76	-15.77		
6	I	2029-11-07T14:06:42.263		25.82	-38.20	41814.39	-15.71		
Uranus	I	2029-11-07T14:29:35.061		27.94	-37.44	25022.30		7.48	7.83
Uranus	E	2029-11-07T14:43:16.876		29.02	-36.73	25059.02		7.21	7.55
6	E	2029-11-07T15:06:03.226		30.46	-35.14	41811.23	15.75		
5	E	2029-11-07T15:06:28.050		30.48	-35.10	42199.76	15.81		
4	E	2029-11-07T15:06:50.852		30.50	-35.07	42564.12	15.88		
alpha	E	2029-11-07T15:09:05.423		30.61	-34.89	44726.34	16.25		
beta	E	2029-11-07T15:10:02.925		30.66	-34.81	45663.61	16.37		
eta	E	2029-11-07T15:11:34.735		30.74	-34.68	47176.12	16.57		
gamma	E	2029-11-07T15:12:02.147		30.76	-34.64	47631.18	16.63		
delta	E	2029-11-07T15:12:42.293		30.79	-34.58	48300.35	16.71		
lambda	E	2029-11-07T15:14:25.045		30.87	-34.43	50026.71	16.89		
epsilon	E	2029-11-07T15:15:07.893		30.90	-34.37	50752.08	16.98		