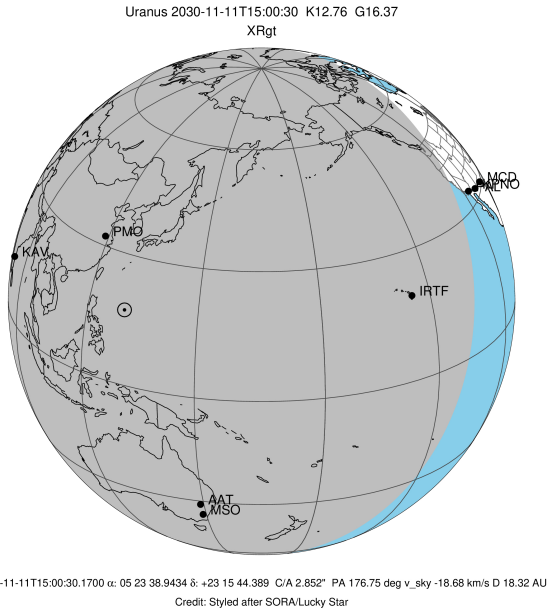
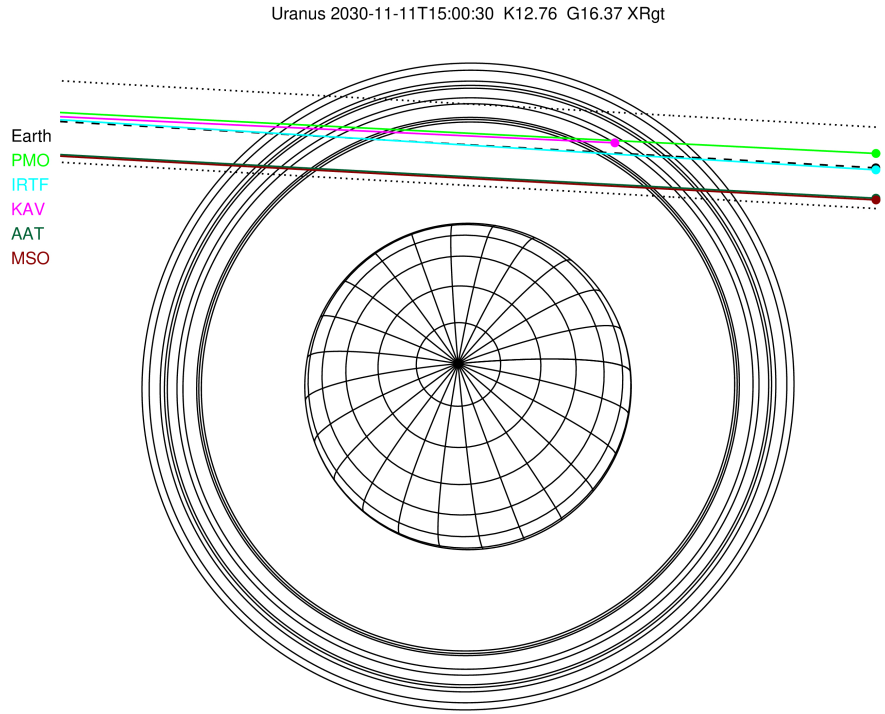
Stellar occultation prediction by rfrench@wellesley.edu Sat Jun 24 23:56:04 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-11T15:00:30.170
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Gaia source ID : 3416295774119400832
2Mass ID (if available) : 05233893+2315443

ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor) : 1.00
K magnitude : 12.757
G magnitude : 16.374
RP magnitude : 15.324
BP magnitude : 17.499
DUPflag : 0
Distance (au) : 18.322
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -18.68
Sun-Target sep (deg) : 147.18
Sun-Moon sep (deg) : 16.67
B (ring opening deg) : 81.23
PA of pole (deg) : 23.42

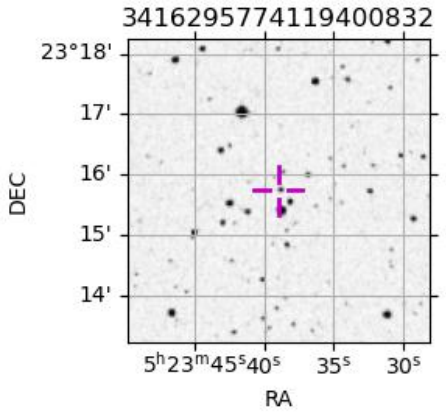
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



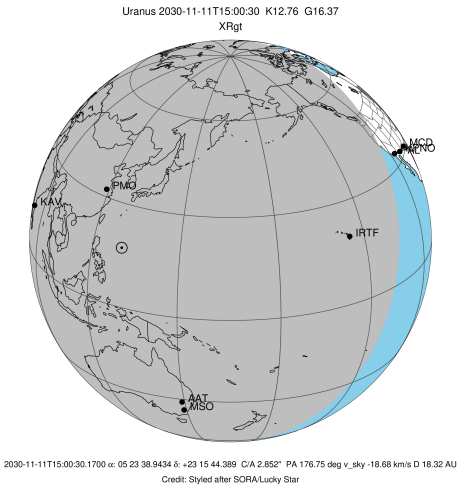


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

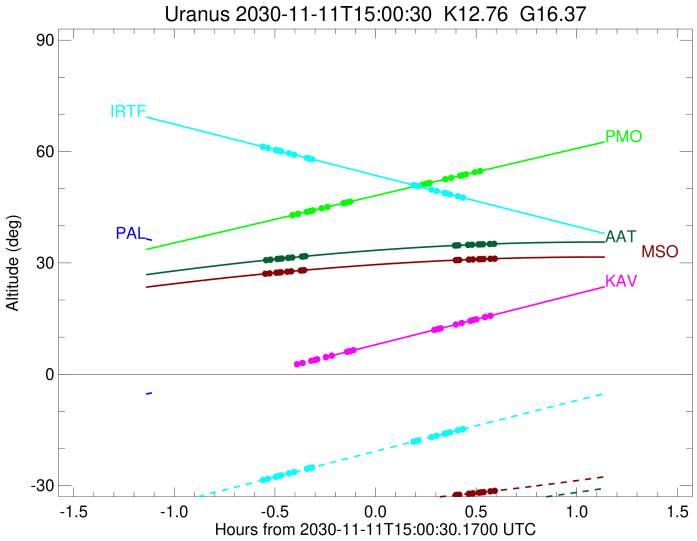
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	++++++++++		++++++++++	NOV 11 14:35 - NOV 11 15:32	PnnRie
KPNO	Kitt Peak Natl Obs	32.0	248.4					PnnRnn
MCD	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 11 14:26 - NOV 11 15:27	PnnRie
KAV	Kavalur Observatory	12.6	78.8	++++		++++++++++	NOV 11 14:47 - NOV 11 15:35	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	++++++++++		++++++++++	NOV 11 14:27 - NOV 11 15:36	PnnRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	++++++++++		++++++++++	NOV 11 14:27 - NOV 11 15:36	PnnRie



Uranus_2030-11-11T15_00_30.1700_PMO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:19:51 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-11-11T15:04:06.760
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          : 3416295774119400832
2Mass ID (if available) : 05233893+2315443
ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor)     :   1.00
K magnitude             : 12.757
G magnitude             : 16.374
RP magnitude            : 15.324
BP magnitude            : 17.499
DUPflag                 : 0
Distance (au)           : 18.322
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -18.68
Sun-Target sep (deg)    :  147.18
Sun-Moon sep (deg)      :   16.34
B (ring opening deg)    :   81.23
PA of pole (deg)        :   23.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.981
C/A sky separation (km) :  39613.2
NAIF SPICE kernels      : RAJobs_U111+rgf15.spk
URKALLv1.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
```



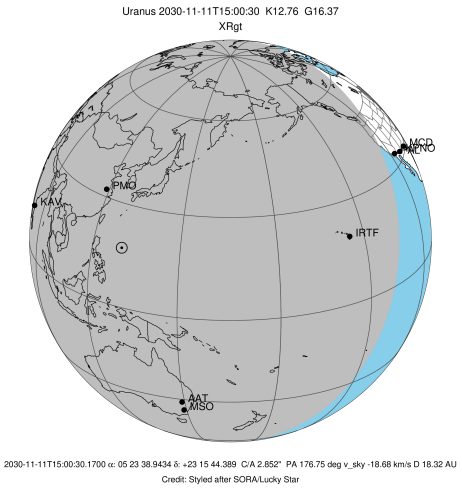
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-11T14:35:39.704		42.83	-68.12	51249.92	-11.96		
lambda	I	2030-11-11T14:37:24.962		43.20	-68.42	50026.71	-11.39		
delta	I	2030-11-11T14:40:01.714		43.75	-68.85	48300.35	-10.63		
gamma	I	2030-11-11T14:41:05.761		43.98	-69.03	47630.28	-10.30		
eta	I	2030-11-11T14:41:50.399		44.14	-69.15	47176.12	-10.05		
beta	I	2030-11-11T14:44:30.201		44.71	-69.58	45642.16	-9.13		
alpha	I	2030-11-11T14:46:15.393		45.08	-69.86	44716.37	-8.49		
4	I	2030-11-11T14:50:56.497		46.08	-70.59	42598.33	-6.54		
5	I	2030-11-11T14:51:56.120		46.29	-70.74	42227.07	-6.10		
6	I	2030-11-11T14:53:07.611		46.54	-70.92	41805.38	-5.53		

No planet occultations

6	E	2030-11-11T15:14:29.879		51.09	-73.69	41826.43	5.54		
5	E	2030-11-11T15:15:45.028		51.36	-73.83	42277.26	6.12		
4	E	2030-11-11T15:16:39.762		51.55	-73.92	42615.40	6.55		
alpha	E	2030-11-11T15:21:20.651		52.54	-74.37	44744.29	8.51		
beta	E	2030-11-11T15:23:02.568		52.91	-74.52	45645.39	9.16		
eta	E	2030-11-11T15:25:41.523		53.47	-74.73	47176.12	10.09		
gamma	E	2030-11-11T15:26:26.083		53.63	-74.79	47631.09	10.33		
delta	E	2030-11-11T15:27:29.820		53.85	-74.87	48300.35	10.67		
lambda	E	2030-11-11T15:30:05.961		54.41	-75.05	50026.71	11.43		
epsilon	E	2030-11-11T15:32:16.279		54.87	-75.18	51554.90	12.02		

Uranus_2030-11-11T15_00_30.1700_IRTF.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:28:31 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-11-11T14:57:01.900
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          : 3416295774119400832
2Mass ID (if available) : 05233893+2315443
ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor)     :   1.00
K magnitude             : 12.757
G magnitude             : 16.374
RP magnitude            : 15.324
BP magnitude            : 17.499
DUPflag                 : 0
Distance (au)           : 18.322
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -18.68
Sun-Target sep (deg)    :  147.18
Sun-Moon sep (deg)      :   17.39
B (ring opening deg)    :   81.23
PA of pole (deg)        :   23.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.839
C/A sky separation (km) :  37720.0
NAIF SPICE kernels      : RAJobs_U111+rgf15.spk
URKALLv1.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
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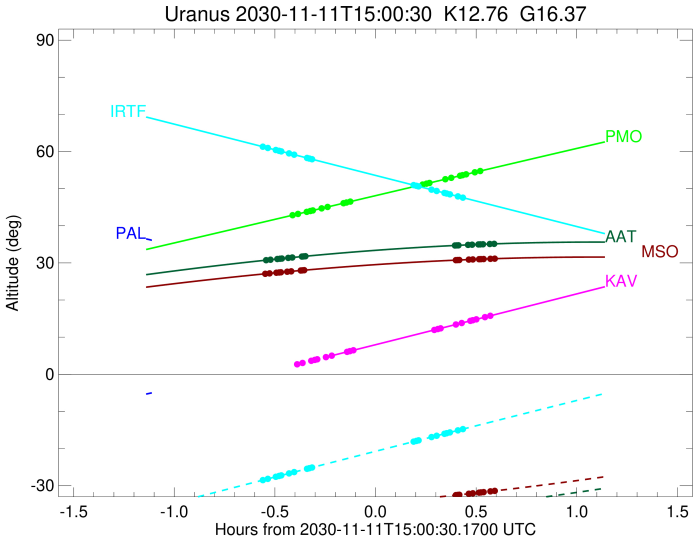


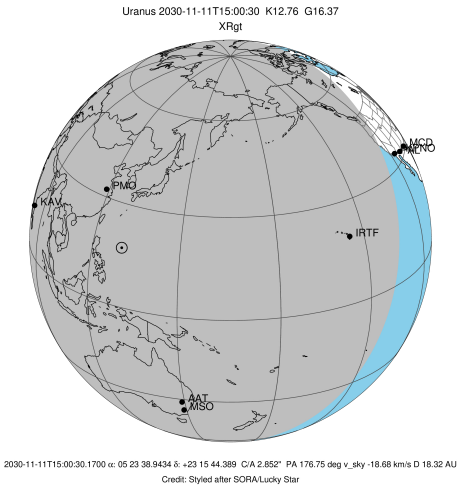
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-11T14:26:50.296		61.32	-28.53	51222.85	-12.89		
lambda	I	2030-11-11T14:28:25.321		60.96	-28.17	50026.71	-12.39		
delta	I	2030-11-11T14:30:48.273		60.41	-27.62	48300.35	-11.75		
gamma	I	2030-11-11T14:31:45.996		60.19	-27.39	47629.99	-11.47		
eta	I	2030-11-11T14:32:25.899		60.03	-27.24	47176.12	-11.27		
beta	I	2030-11-11T14:34:46.500		59.49	-26.70	45642.85	-10.52		
alpha	I	2030-11-11T14:36:17.113		59.15	-26.35	44713.03	-10.02		
4	I	2030-11-11T14:40:04.862		58.27	-25.47	42593.62	-8.57		
5	I	2030-11-11T14:40:50.137		58.10	-25.29	42216.71	-8.26		
6	I	2030-11-11T14:41:40.936		57.90	-25.10	41801.75	-7.88		

No planet occultations

6	E	2030-11-11T15:11:49.452		50.97	-18.15	41831.36	7.87		
5	E	2030-11-11T15:12:44.160		50.76	-17.94	42284.41	8.25		
4	E	2030-11-11T15:13:24.744		50.60	-17.79	42616.21	8.55		
alpha	E	2030-11-11T15:17:13.346		49.72	-16.91	44745.90	10.00		
beta	E	2030-11-11T15:18:41.153		49.39	-16.58	45646.30	10.50		
eta	E	2030-11-11T15:21:01.774		48.85	-16.04	47176.12	11.25		
gamma	E	2030-11-11T15:21:41.860		48.70	-15.89	47630.95	11.45		
delta	E	2030-11-11T15:22:39.649		48.47	-15.67	48300.35	11.72		
lambda	E	2030-11-11T15:25:02.993		47.93	-15.12	50026.71	12.36		
epsilon	E	2030-11-11T15:27:04.159		47.46	-14.66	51553.66	12.85		

Uranus_2030-11-11T15_00_30.1700_KAV.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:30:38 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-11-11T15:06:19.010
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          : 3416295774119400832
2Mass ID (if available) : 05233893+2315443
ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor)     :   1.00
K magnitude             : 12.757
G magnitude             : 16.374
RP magnitude            : 15.324
BP magnitude            : 17.499
DUPflag                 : 0
Distance (au)           : 18.322
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -18.68
Sun-Target sep (deg)    :  147.18
Sun-Moon sep (deg)      :   15.86
B (ring opening deg)    :   81.23
PA of pole (deg)        :   23.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.950
C/A sky separation (km) :  39199.9
NAIF SPICE kernels      : RAJobs_U111+rgf15.spk
URKALLv1.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
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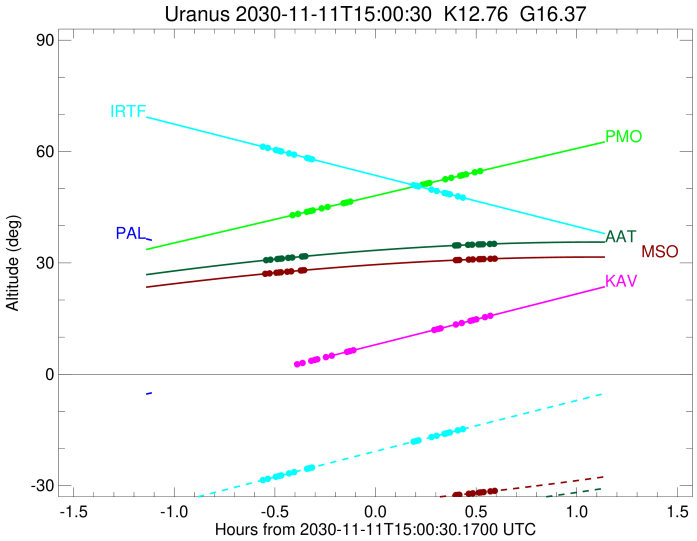


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

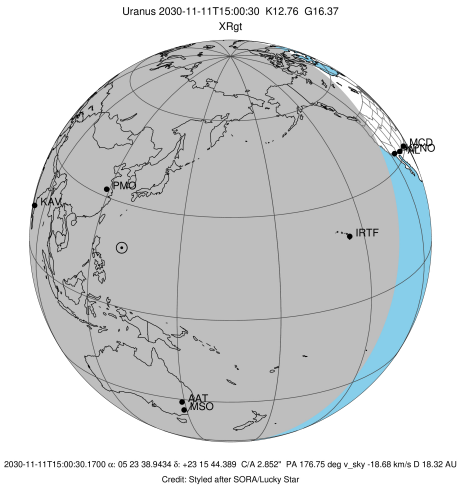
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-11T14:37:01.571		2.66x	-34.03	51245.91	-11.98		
lambda	I	2030-11-11T14:38:46.215		3.05x	-34.45	50026.71	-11.43		
delta	I	2030-11-11T14:41:22.066		3.63x	-35.07	48300.35	-10.71		
gamma	I	2030-11-11T14:42:25.544		3.87x	-35.32	47630.24	-10.40		
eta	I	2030-11-11T14:43:09.694		4.04x	-35.49	47176.12	-10.17		
beta	I	2030-11-11T14:45:47.072		4.63x	-36.12	45642.27	-9.31		
alpha	I	2030-11-11T14:47:30.013		5.02	-36.53	44715.77	-8.71		
4	I	2030-11-11T14:52:00.267		6.03	-37.60	42597.43	-6.93		
5	I	2030-11-11T14:52:56.371		6.25	-37.82	42224.95	-6.54		
6	I	2030-11-11T14:54:02.347		6.49	-38.08	41804.56	-6.03		

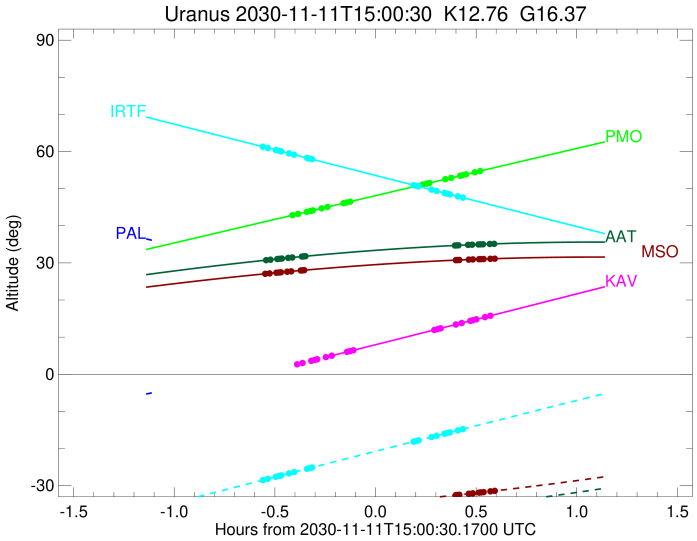
No planet occultations

6	E	2030-11-11T15:17:59.263		11.93	-43.79	41827.89	6.05		
5	E	2030-11-11T15:19:08.876		12.19	-44.07	42279.45	6.56		
4	E	2030-11-11T15:19:59.947		12.39	-44.27	42615.69	6.95		
alpha	E	2030-11-11T15:24:29.636		13.41	-45.34	44744.80	8.75		
beta	E	2030-11-11T15:26:09.107		13.79	-45.74	45645.66	9.35		
eta	E	2030-11-11T15:28:45.342		14.38	-46.36	47176.12	10.23		
gamma	E	2030-11-11T15:29:29.328		14.55	-46.53	47631.04	10.46		
delta	E	2030-11-11T15:30:32.370		14.79	-46.78	48300.35	10.78		
lambda	E	2030-11-11T15:33:07.271		15.38	-47.40	50026.71	11.50		
epsilon	E	2030-11-11T15:35:16.939		15.87	-47.91	51554.56	12.06		

Uranus_2030-11-11T15_00_30.1700_AAT.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:37:03 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-11T15:02:10.830
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 : 3416295774119400832
2Mass ID (if available) : 05233893+2315443
ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor) : 1.00
K magnitude : 12.757
G magnitude : 16.374
RP magnitude : 15.324
BP magnitude : 17.499
DUPflag : 0
Distance (au) : 18.322
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -18.68
Sun-Target sep (deg) : 147.18
Sun-Moon sep (deg) : 16.58
B (ring opening deg) : 81.23
PA of pole (deg) : 23.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.468
C/A sky separation (km) : 32797.2
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.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





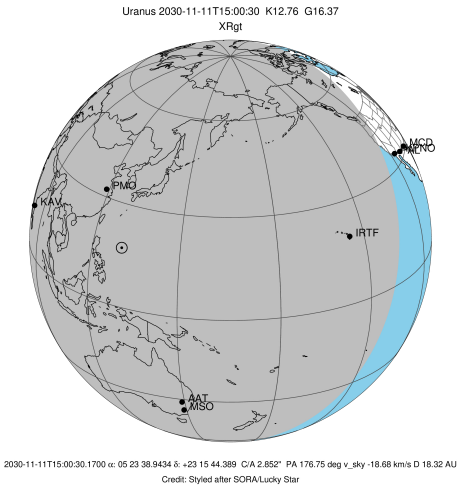
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-11T14:27:53.036		30.73	-40.42	51171.90	-14.65		
lambda	I	2030-11-11T14:29:12.410		30.86	-40.35	50026.71	-14.30		
delta	I	2030-11-11T14:31:14.827		31.05	-40.25	48300.35	-13.89		
gamma	I	2030-11-11T14:32:03.426		31.12	-40.21	47629.38	-13.72		
eta	I	2030-11-11T14:32:36.618		31.18	-40.18	47176.12	-13.59		
beta	I	2030-11-11T14:34:31.204		31.35	-40.08	45644.49	-13.13		
alpha	I	2030-11-11T14:35:43.447		31.46	-40.01	44707.23	-12.83		
4	I	2030-11-11T14:38:34.176		31.70	-39.85	42585.02	-12.02		
5	I	2030-11-11T14:39:06.556		31.75	-39.82	42200.53	-11.86		
6	I	2030-11-11T14:39:40.600		31.80	-39.79	41797.46	-11.65		

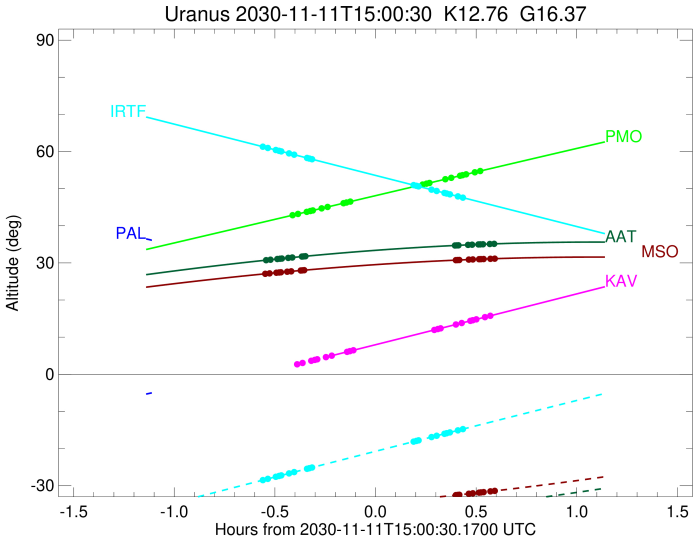
No planet occultations

6	E	2030-11-11T15:24:11.197		34.69	-36.12	41841.47	11.67		
5	E	2030-11-11T15:24:49.061		34.72	-36.05	42297.52	11.88		
4	E	2030-11-11T15:25:16.505		34.74	-36.01	42616.35	12.04		
alpha	E	2030-11-11T15:28:07.391		34.86	-35.71	44749.23	12.86		
beta	E	2030-11-11T15:29:16.527		34.90	-35.58	45649.00	13.16		
eta	E	2030-11-11T15:31:10.538		34.97	-35.38	47176.12	13.62		
gamma	E	2030-11-11T15:31:43.736		34.99	-35.32	47630.47	13.75		
delta	E	2030-11-11T15:32:32.145		35.02	-35.23	48300.35	13.93		
lambda	E	2030-11-11T15:34:34.268		35.09	-35.00	50026.71	14.34		
epsilon	E	2030-11-11T15:36:18.914		35.15	-34.80	51544.41	14.68		

Uranus_2030-11-11T15_00_30.1700_MSO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:41:21 2023



target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-11T15:02:07.960
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 : 3416295774119400832
2Mass ID (if available) : 05233893+2315443
ICRS Star Coord at Epoch: 05h 23m 38.94341s +23:15:44.38851s
RUWE (>1.4 is poor) : 1.00
K magnitude : 12.757
G magnitude : 16.374
RP magnitude : 15.324
BP magnitude : 17.499
DUPflag : 0
Distance (au) : 18.322
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -18.68
Sun-Target sep (deg) : 147.18
Sun-Moon sep (deg) : 16.57
B (ring opening deg) : 81.23
PA of pole (deg) : 23.42
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.449
C/A sky separation (km) : 32544.6
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.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



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	2030-11-11T14:27:37.320		27.06	-36.50	51169.21	-14.71		
lambda	I	2030-11-11T14:28:56.129		27.18	-36.44	50026.71	-14.38		
delta	I	2030-11-11T14:30:57.880		27.35	-36.35	48300.35	-13.97		
gamma	I	2030-11-11T14:31:46.189		27.42	-36.31	47629.35	-13.80		
eta	I	2030-11-11T14:32:19.168		27.47	-36.29	47176.12	-13.68		
beta	I	2030-11-11T14:34:12.946		27.63	-36.20	45644.58	-13.23		
alpha	I	2030-11-11T14:35:24.645		27.73	-36.14	44706.95	-12.94		
4	I	2030-11-11T14:38:13.785		27.96	-36.00	42584.61	-12.15		
5	I	2030-11-11T14:38:45.831		28.00	-35.97	42199.82	-11.99		
6	I	2030-11-11T14:39:19.447		28.04	-35.94	41797.32	-11.79		

No planet occultations

6	E	2030-11-11T15:24:26.827		30.74	-32.56	41841.89	11.81		
5	E	2030-11-11T15:25:04.272		30.77	-32.50	42298.00	12.01		
4	E	2030-11-11T15:25:31.374		30.78	-32.46	42616.31	12.17		
alpha	E	2030-11-11T15:28:20.681		30.89	-32.19	44749.34	12.96		
beta	E	2030-11-11T15:29:29.275		30.93	-32.07	45649.13	13.26		
eta	E	2030-11-11T15:31:22.485		30.99	-31.89	47176.12	13.71		
gamma	E	2030-11-11T15:31:55.472		31.01	-31.83	47630.45	13.84		
delta	E	2030-11-11T15:32:43.593		31.04	-31.75	48300.35	14.01		
lambda	E	2030-11-11T15:34:45.060		31.10	-31.54	50026.71	14.41		
epsilon	E	2030-11-11T15:36:29.175		31.15	-31.36	51543.81	14.75		