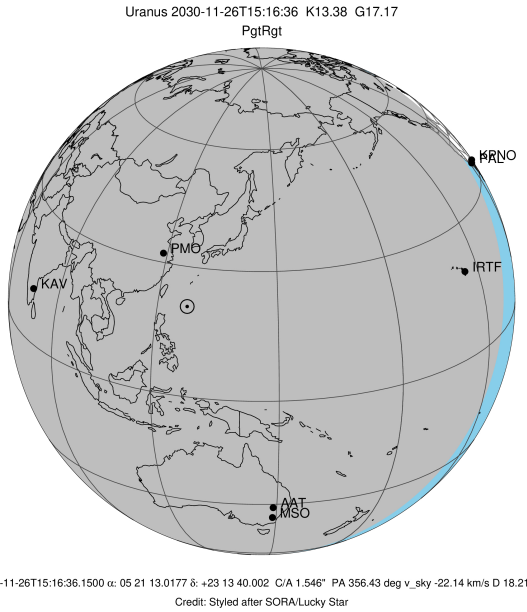
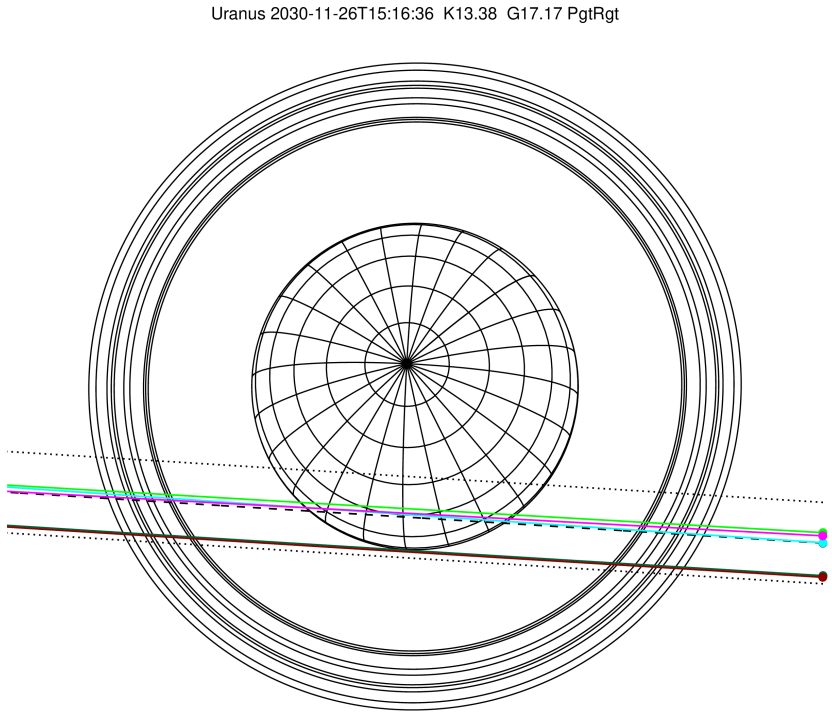
Stellar occultation prediction by rfrench@wellesley.edu Sat Jun 24 23:57:29 2023

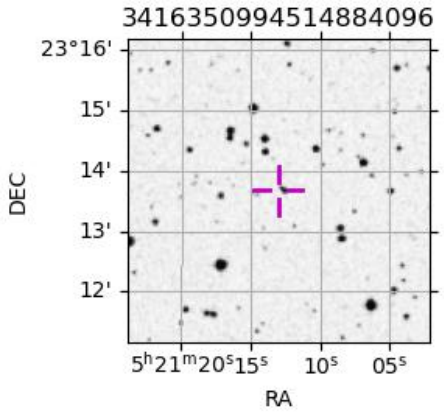
```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-11-26T15:16:36.150
Event type              : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Gaia source ID          : 3416350994514884096
2Mass ID (if available) : 05211298+2313408

ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor)     :   1.01
K magnitude             : 13.384
G magnitude             : 17.169
RP magnitude            : 16.021
BP magnitude            : 18.484
DUPflag                 : 0
Distance (au)           : 18.213
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -22.14
Sun-Target sep (deg)    :  162.88
Sun-Moon sep (deg)      :  177.41
B (ring opening deg)    :   81.47
PA of pole (deg)        :   19.85
#     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
```





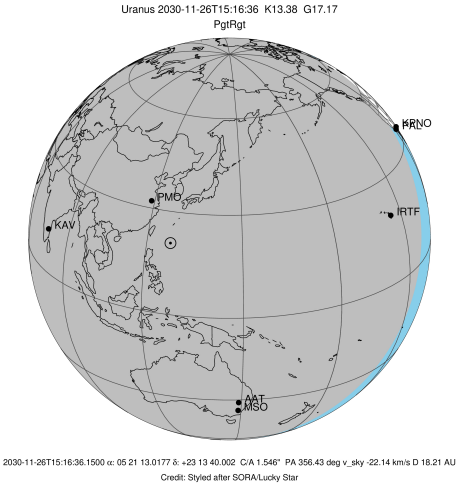
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

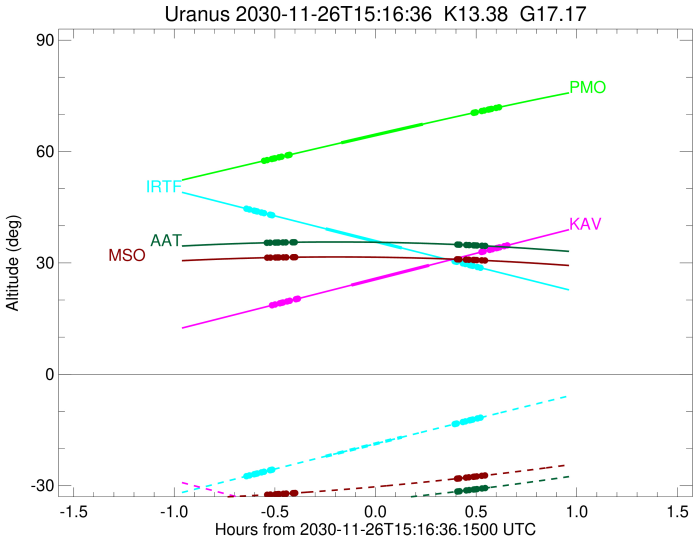
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	++++++++++	+ +	++++++++++	NOV 26 14:43 - NOV 26 15:53	PieRie
KPNO	Kitt Peak Natl Obs	32.0	248.4					PnnRnn
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 26 14:38 - NOV 26 15:48	PieRie
KAV	Kavalur Observatory	12.6	78.8	++++++++++	+ +	++++++++++	NOV 26 14:46 - NOV 26 15:56	PieRie
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 26 14:44 - NOV 26 15:49	PnnRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	++++++++++		++++++++++	NOV 26 14:44 - NOV 26 15:49	PnnRie



Uranus_2030-11-26T15_16_36.1500_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 : 2030-11-26T15:18:19.360
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3416350994514884096
2Mass ID (if available) : 05211298+2313408
ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor) : 1.01
K magnitude : 13.384
G magnitude : 17.169
RP magnitude : 16.021
BP magnitude : 18.484
DUPflag : 0
Distance (au) : 18.213
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.14
Sun-Target sep (deg) : 162.88
Sun-Moon sep (deg) : 177.88
B (ring opening deg) : 81.47
PA of pole (deg) : 19.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.451
C/A sky separation (km) : 19172.6
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



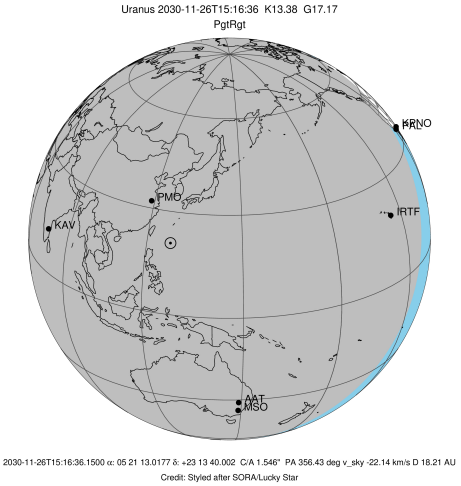


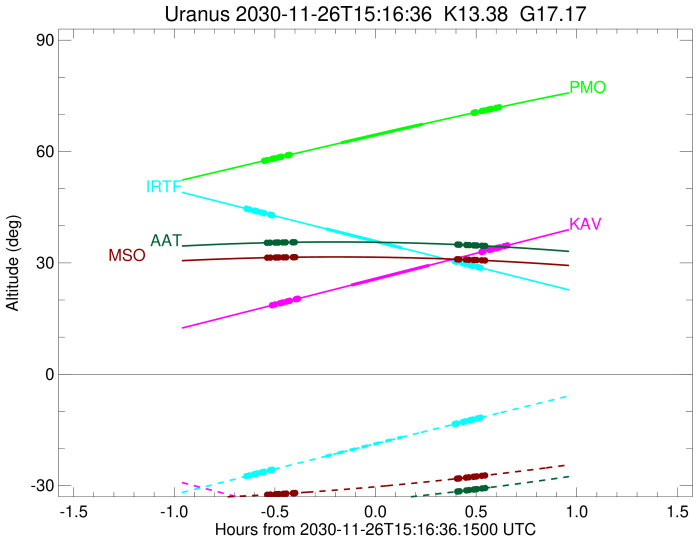
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-26T14:43:42.664		57.57	-71.28	50750.04	-20.77		
lambda	I	2030-11-26T14:44:17.509		57.70	-71.38	50026.71	-20.73		
delta	I	2030-11-26T14:45:41.038		57.99	-71.63	48300.35	-20.60		
gamma	I	2030-11-26T14:46:14.024		58.11	-71.73	47621.74	-20.54		
eta	I	2030-11-26T14:46:35.735		58.18	-71.79	47176.12	-20.51		
beta	I	2030-11-26T14:47:49.148		58.44	-72.01	45675.62	-20.37		
alpha	I	2030-11-26T14:48:37.569		58.61	-72.16	44690.99	-20.27		
4	I	2030-11-26T14:50:25.023		58.99	-72.47	42526.54	-20.03		
5	I	2030-11-26T14:50:42.052		59.05	-72.52	42188.41	-20.00		
6	I	2030-11-26T14:50:59.293		59.11	-72.57	41845.19	-19.95		
Uranus	I	2030-11-26T15:06:23.430		62.35	-75.10	25032.62		-8.17	-8.55
Uranus	E	2030-11-26T15:30:43.355		67.38	-78.13	25448.35		-3.69	-3.86
6	E	2030-11-26T15:45:52.714		70.44	-79.04	41866.81	19.99		
5	E	2030-11-26T15:46:15.089		70.51	-79.05	42315.25	20.04		
4	E	2030-11-26T15:46:29.476		70.56	-79.06	42603.52	20.07		
alpha	E	2030-11-26T15:48:15.765		70.91	-79.10	44751.21	20.32		
beta	E	2030-11-26T15:49:00.504		71.05	-79.11	45662.50	20.42		
eta	E	2030-11-26T15:50:14.380		71.30	-79.12	47176.12	20.56		
gamma	E	2030-11-26T15:50:36.302		71.37	-79.13	47627.24	20.60		
delta	E	2030-11-26T15:51:08.934		71.47	-79.13	48300.35	20.66		
lambda	E	2030-11-26T15:52:32.237		71.74	-79.13	50026.71	20.79		
epsilon	E	2030-11-26T15:53:37.233		71.96	-79.13	51381.17	20.83		

Uranus_2030-11-26T15_16_36.1500_IRTF.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:28:32 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-26T15:12:51.080
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3416350994514884096
2Mass ID (if available) : 05211298+2313408
ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor) : 1.01
K magnitude : 13.384
G magnitude : 17.169
RP magnitude : 16.021
BP magnitude : 18.484
DUPflag : 0
Distance (au) : 18.213
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.14
Sun-Target sep (deg) : 162.88
Sun-Moon sep (deg) : 176.78
B (ring opening deg) : 81.47
PA of pole (deg) : 19.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.521
C/A sky separation (km) : 20096.3
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	2030-11-26T14:38:26.851		44.53	-27.38	50748.06	-20.58		
lambda	I	2030-11-26T14:39:01.933		44.39	-27.25	50026.71	-20.53		
delta	I	2030-11-26T14:40:26.314		44.07	-26.93	48300.35	-20.38		
gamma	I	2030-11-26T14:40:59.663		43.94	-26.80	47621.66	-20.32		
eta	I	2030-11-26T14:41:21.613		43.86	-26.72	47176.12	-20.28		
beta	I	2030-11-26T14:42:35.872		43.58	-26.44	45676.07	-20.12		
alpha	I	2030-11-26T14:43:24.894		43.39	-26.25	44691.66	-20.01		
4	I	2030-11-26T14:45:13.851		42.97	-25.84	42526.82	-19.73		
5	I	2030-11-26T14:45:31.047		42.91	-25.77	42190.71	-19.70		
6	I	2030-11-26T14:45:48.579		42.84	-25.71	41846.65	-19.65		
Uranus	I	2030-11-26T15:01:45.913		39.19	-22.08	25013.25		-8.32	-8.71
Uranus	E	2030-11-26T15:24:27.232		34.01	-16.95	25425.46		-4.05	-4.25
6	E	2030-11-26T15:40:12.578		30.43	-13.41	41867.28	19.58		
5	E	2030-11-26T15:40:35.392		30.35	-13.33	42315.25	19.63		
4	E	2030-11-26T15:40:50.060		30.29	-13.27	42603.04	19.66		
alpha	E	2030-11-26T15:42:38.490		29.88	-12.87	44751.08	19.94		
beta	E	2030-11-26T15:43:24.103		29.71	-12.70	45662.76	20.04		
eta	E	2030-11-26T15:44:39.333		29.42	-12.42	47176.12	20.19		
gamma	E	2030-11-26T15:45:01.647		29.34	-12.33	47627.18	20.23		
delta	E	2030-11-26T15:45:34.863		29.21	-12.21	48300.35	20.30		
lambda	E	2030-11-26T15:46:59.611		28.89	-11.89	50026.71	20.44		
epsilon	E	2030-11-26T15:48:05.539		28.64	-11.65	51377.87	20.49		

Uranus_2030-11-26T15_16_36.1500_KAV.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:30:39 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-26T15:20:45.140
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3416350994514884096
2Mass ID (if available) : 05211298+2313408
ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor) : 1.01
K magnitude : 13.384
G magnitude : 17.169
RP magnitude : 16.021
BP magnitude : 18.484
DUPflag : 0
Distance (au) : 18.213
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.14
Sun-Target sep (deg) : 162.88
Sun-Moon sep (deg) : 178.15
B (ring opening deg) : 81.47
PA of pole (deg) : 19.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.506
C/A sky separation (km) : 19891.9
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
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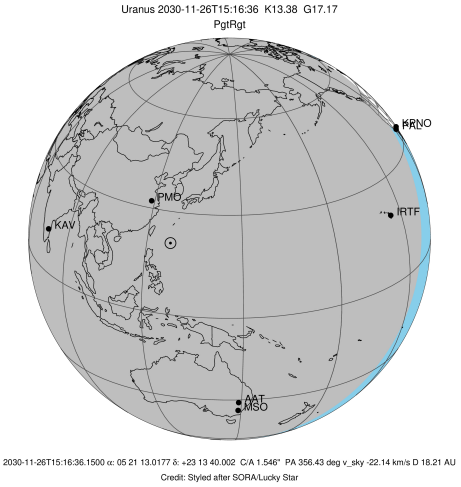
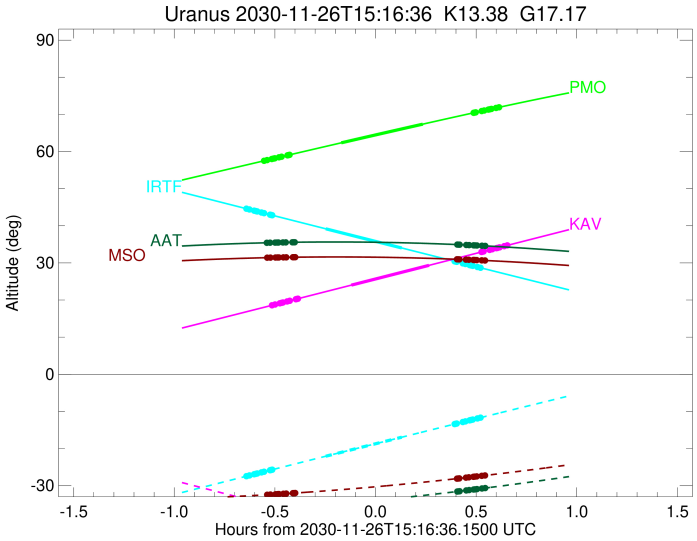
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk



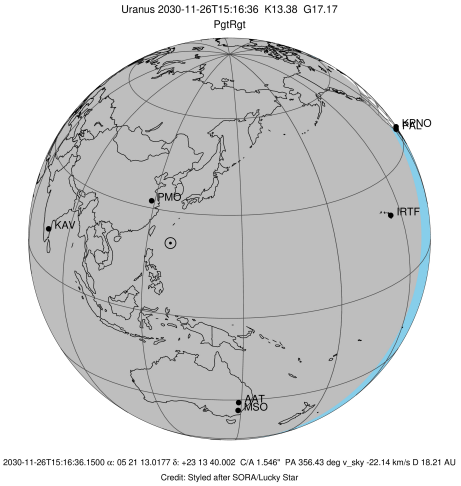


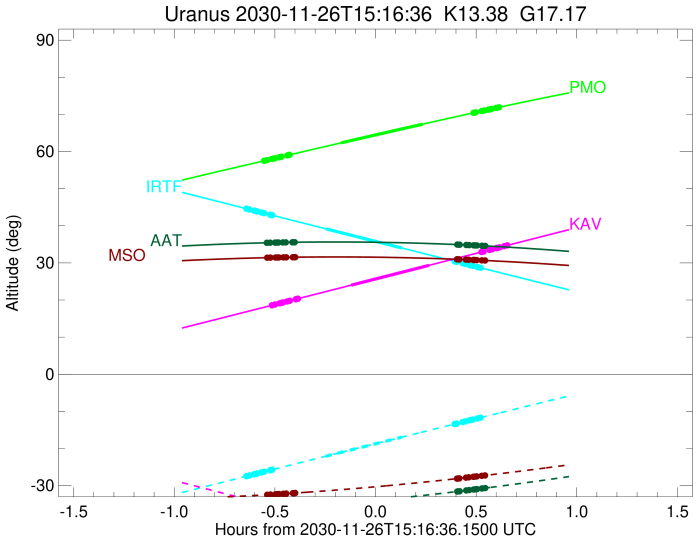
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-26T14:46:04.885		18.66	-35.52	50749.20	-20.45		
lambda	I	2030-11-26T14:46:40.244		18.80	-35.65	50026.71	-20.41		
delta	I	2030-11-26T14:48:05.134		19.12	-35.98	48300.35	-20.26		
gamma	I	2030-11-26T14:48:38.673		19.25	-36.11	47621.71	-20.20		
eta	I	2030-11-26T14:49:00.749		19.33	-36.20	47176.12	-20.16		
beta	I	2030-11-26T14:50:15.420		19.62	-36.49	45675.82	-20.02		
alpha	I	2030-11-26T14:51:04.697		19.81	-36.68	44691.28	-19.91		
4	I	2030-11-26T14:52:54.151		20.22	-37.11	42526.66	-19.65		
5	I	2030-11-26T14:53:11.468		20.29	-37.17	42189.46	-19.62		
6	I	2030-11-26T14:53:29.057		20.36	-37.24	41845.87	-19.57		
Uranus	I	2030-11-26T15:09:24.734		24.02	-40.96	25020.24		-8.26	-8.65
Uranus	E	2030-11-26T15:32:34.370		29.34	-46.36	25425.08		-4.06	-4.25
6	E	2030-11-26T15:48:13.044		32.95	-49.99	41867.52	19.66		
5	E	2030-11-26T15:48:35.746		33.03	-50.08	42315.23	19.71		
4	E	2030-11-26T15:48:50.343		33.09	-50.14	42602.77	19.74		
alpha	E	2030-11-26T15:50:38.340		33.51	-50.55	44751.00	20.02		
beta	E	2030-11-26T15:51:23.783		33.68	-50.73	45662.94	20.12		
eta	E	2030-11-26T15:52:38.701		33.97	-51.02	47176.12	20.27		
gamma	E	2030-11-26T15:53:00.923		34.05	-51.11	47627.13	20.32		
delta	E	2030-11-26T15:53:34.007		34.18	-51.23	48300.35	20.38		
lambda	E	2030-11-26T15:54:58.411		34.50	-51.56	50026.71	20.53		
epsilon	E	2030-11-26T15:56:03.912		34.75	-51.81	51374.63	20.57		

Uranus_2030-11-26T15_16_36.1500_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 : 2030-11-26T15:16:36.090
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3416350994514884096
2Mass ID (if available) : 05211298+2313408
ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor) : 1.01
K magnitude : 13.384
G magnitude : 17.169
RP magnitude : 16.021
BP magnitude : 18.484
DUPflag : 0
Distance (au) : 18.213
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.14
Sun-Target sep (deg) : 162.88
Sun-Moon sep (deg) : 176.87
B (ring opening deg) : 81.47
PA of pole (deg) : 19.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.944
C/A sky separation (km) : 25685.1
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

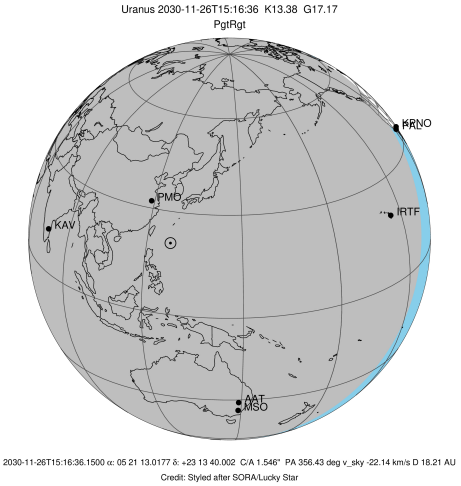
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-11-26T14:44:33.560		35.43	-36.32	50743.72	-19.39		
lambda	I	2030-11-26T14:45:10.628		35.44	-36.29	50026.71	-19.29		
delta	I	2030-11-26T14:46:40.706		35.47	-36.20	48300.35	-19.03		
gamma	I	2030-11-26T14:47:16.484		35.48	-36.16	47621.35	-18.92		
eta	I	2030-11-26T14:47:40.062		35.49	-36.14	47176.12	-18.85		
beta	I	2030-11-26T14:49:00.139		35.51	-36.06	45677.76	-18.57		
alpha	I	2030-11-26T14:49:53.302		35.52	-36.00	44694.84	-18.38		
4	I	2030-11-26T14:51:52.757		35.55	-35.87	42528.69	-17.89		
5	I	2030-11-26T14:52:11.340		35.56	-35.85	42201.46	-17.82		
6	I	2030-11-26T14:52:30.926		35.56	-35.83	41852.97	-17.72		

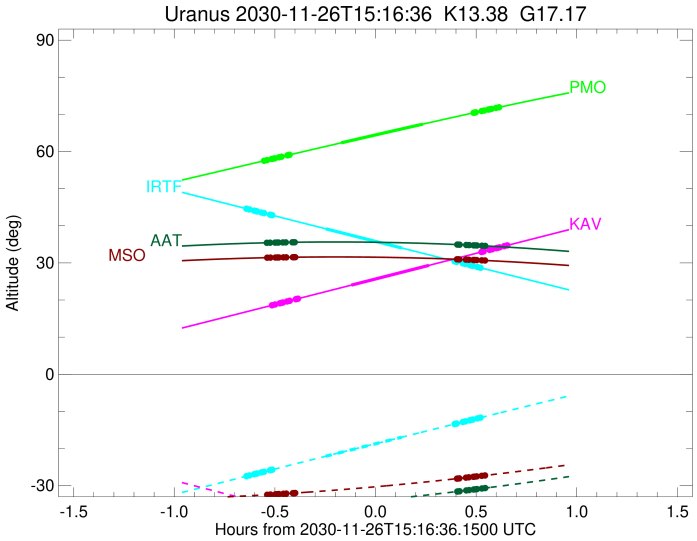
No planet occultations

6	E	2030-11-26T15:41:01.127	34.93	-31.58	41871.90	17.72		
5	E	2030-11-26T15:41:25.858	34.92	-31.54	42313.96	17.82		
4	E	2030-11-26T15:41:41.811	34.91	-31.51	42597.31	17.89		
alpha	E	2030-11-26T15:43:40.320	34.83	-31.29	44749.24	18.38		
beta	E	2030-11-26T15:44:29.925	34.79	-31.20	45665.74	18.58		
eta	E	2030-11-26T15:45:50.645	34.74	-31.05	47176.12	18.85		
gamma	E	2030-11-26T15:46:14.487	34.72	-31.00	47626.43	18.92		
delta	E	2030-11-26T15:46:49.991	34.69	-30.94	48300.35	19.04		
lambda	E	2030-11-26T15:48:20.054	34.62	-30.77	50026.71	19.30		
epsilon	E	2030-11-26T15:49:27.397	34.57	-30.64	51332.21	19.39		

Uranus_2030-11-26T15_16_36.1500_MSO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:41:22 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-11-26T15:16:37.570
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3416350994514884096
2Mass ID (if available) : 05211298+2313408
ICRS Star Coord at Epoch: 05h 21m 13.01769s +23:13:40.00232s
RUWE (>1.4 is poor) : 1.01
K magnitude : 13.384
G magnitude : 17.169
RP magnitude : 16.021
BP magnitude : 18.484
DUPflag : 0
Distance (au) : 18.213
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.14
Sun-Target sep (deg) : 162.88
Sun-Moon sep (deg) : 176.84
B (ring opening deg) : 81.47
PA of pole (deg) : 19.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.963
C/A sky separation (km) : 25930.7
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	2030-11-26T14:44:40.199		31.41	-32.44	50743.66	-19.31		
lambda	I	2030-11-26T14:45:17.422		31.42	-32.40	50026.71	-19.21		
delta	I	2030-11-26T14:46:47.907		31.45	-32.32	48300.35	-18.94		
gamma	I	2030-11-26T14:47:23.857		31.46	-32.29	47621.34	-18.83		
eta	I	2030-11-26T14:47:47.549		31.47	-32.27	47176.12	-18.75		
beta	I	2030-11-26T14:49:08.037		31.49	-32.19	45677.84	-18.47		
alpha	I	2030-11-26T14:50:01.490		31.50	-32.14	44695.01	-18.28		
4	I	2030-11-26T14:52:01.674		31.53	-32.03	42528.80	-17.77		
5	I	2030-11-26T14:52:20.359		31.53	-32.01	42202.00	-17.70		
6	I	2030-11-26T14:52:40.088		31.54	-31.99	41853.27	-17.60		

No planet occultations

6	E	2030-11-26T15:40:55.116		30.97	-28.11	41872.09	17.60		
5	E	2030-11-26T15:41:19.992		30.96	-28.07	42313.86	17.70		
4	E	2030-11-26T15:41:36.044		30.95	-28.05	42597.04	17.77		
alpha	E	2030-11-26T15:43:35.280		30.88	-27.85	44749.14	18.28		
beta	E	2030-11-26T15:44:25.172		30.85	-27.76	45665.87	18.48		
eta	E	2030-11-26T15:45:46.302		30.79	-27.62	47176.12	18.76		
gamma	E	2030-11-26T15:46:10.260		30.78	-27.58	47626.40	18.83		
delta	E	2030-11-26T15:46:45.935		30.75	-27.52	48300.35	18.95		
lambda	E	2030-11-26T15:48:16.403		30.69	-27.36	50026.71	19.21		
epsilon	E	2030-11-26T15:49:23.923		30.65	-27.24	51330.17	19.31		