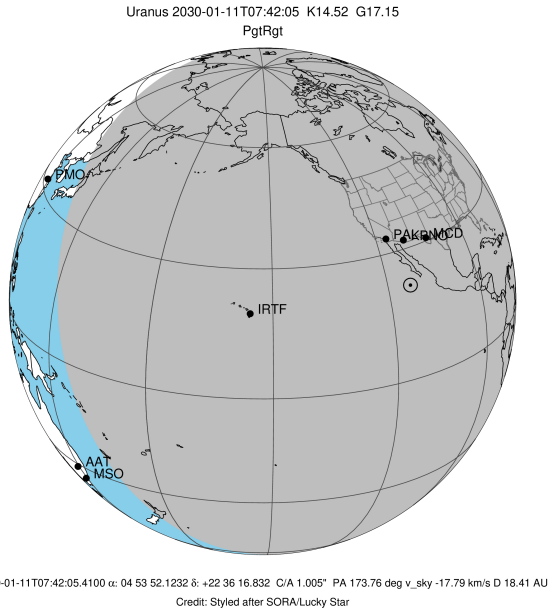
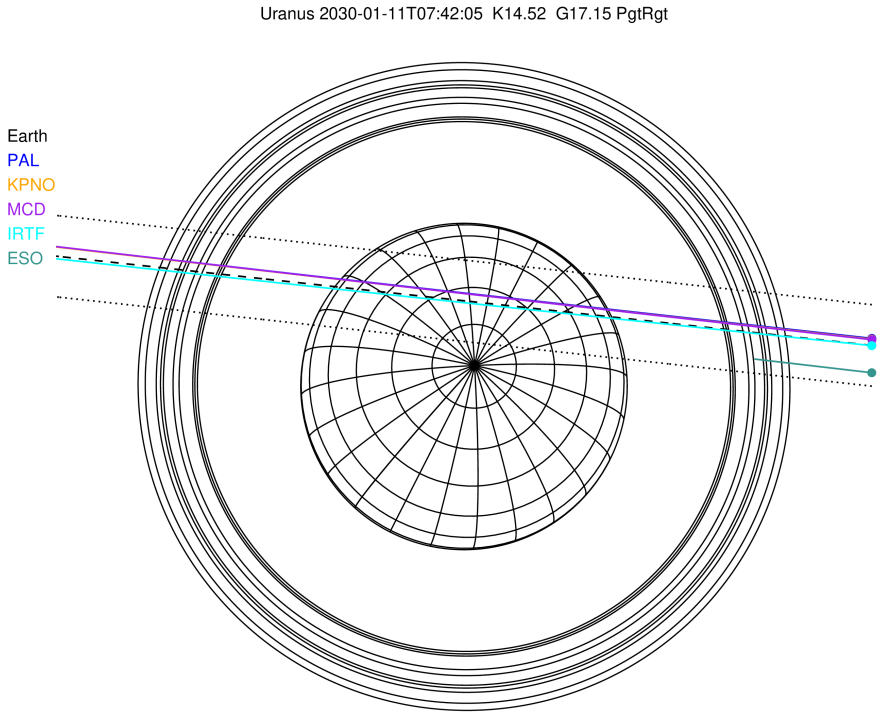
Stellar occultation prediction by rfrench@wellesley.edu Sat Jun 24 23:49:19 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-01-11T07:42:05.410
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Gaia source ID : 3413209067022432512
2Mass ID (if available) : 04535212+2236169

ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor) : 0.98
K magnitude : 14.523
G magnitude : 17.148
RP magnitude : 16.342
BP magnitude : 17.830
DUPflag : 0
Distance (au) : 18.413
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -17.79
Sun-Target sep (deg) : 144.06
Sun-Moon sep (deg) : 57.12
B (ring opening deg) : 81.73
PA of pole (deg) : -26.73

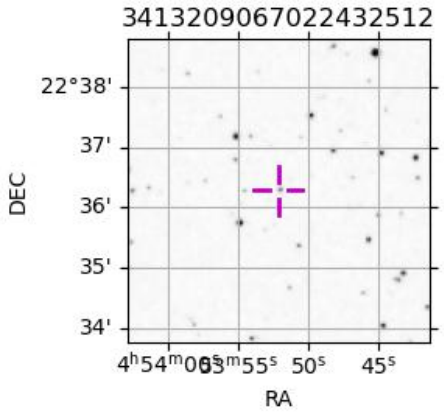
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon





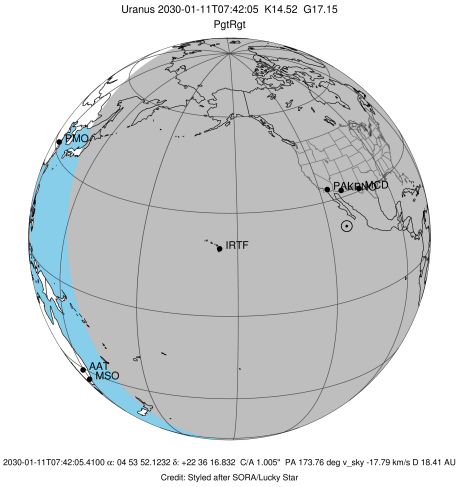
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

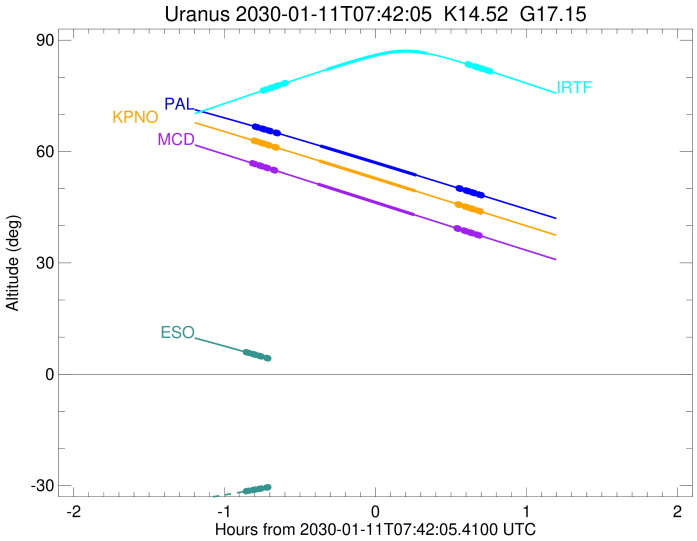
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	++++++++++	+ +	++++++++++	JAN 11 06:54 - JAN 11 08:24	PieRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	++++++++++	+ +	++++++++++	JAN 11 06:53 - JAN 11 08:23	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	++++++++++	+ +	++++++++++	JAN 11 06:52 - JAN 11 08:23	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	++++++++++	+ +	++++++++++	JAN 11 06:57 - JAN 11 08:27	PieRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European Southern Obs	-29.3	289.3	+++++			JAN 11 06:50 - JAN 11 06:54	PnnRin
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



Uranus_2030-01-11T07_42_05.4100_PAL.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:17:41 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-01-11T07:39:03.600
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code : PAL
Location : Palomar Mt (200")
Latitude (deg) : 33.35622
E. Longitude (deg) : 243.13601
Altitude (km) : 1.706
Gaia source ID : 3413209067022432512
2Mass ID (if available) : 04535212+2236169
ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor) : 0.98
K magnitude : 14.523
G magnitude : 17.148
RP magnitude : 16.342
BP magnitude : 17.830
DUPflag : 0
Distance (au) : 18.413
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -17.79
Sun-Target sep (deg) : 144.06
Sun-Moon sep (deg) : 58.00
B (ring opening deg) : 81.73
PA of pole (deg) : -26.73
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.089
C/A sky separation (km) : 14547.2
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	2030-01-11T06:53:59.621		66.76	-72.29	51376.48	-17.46		
lambda	I	2030-01-11T06:55:17.186		66.50	-72.51	50026.71	-17.38		
delta	I	2030-01-11T06:56:56.692		66.18	-72.79	48300.35	-17.32		
gamma	I	2030-01-11T06:57:35.657		66.05	-72.89	47626.05	-17.29		
eta	I	2030-01-11T06:58:01.690		65.96	-72.96	47176.12	-17.27		
beta	I	2030-01-11T06:59:28.445		65.68	-73.20	45680.47	-17.21		
alpha	I	2030-01-11T07:00:26.374		65.48	-73.36	44685.54	-17.16		
4	I	2030-01-11T07:02:27.760		65.08	-73.68	42609.28	-17.06		
5	I	2030-01-11T07:02:46.630		65.02	-73.73	42281.87	-17.05		
6	I	2030-01-11T07:03:12.394		64.93	-73.79	41850.95	-17.02		
Uranus	I	2030-01-11T07:20:11.045		61.51	-76.20	25163.62		6.82	7.14
Uranus	E	2030-01-11T07:58:21.678		53.63	-78.57	25522.15		2.06	2.15
6	E	2030-01-11T08:15:11.074		50.11	-77.78	41853.43	16.95		
5	E	2030-01-11T08:15:33.998		50.03	-77.75	42241.98	16.97		
4	E	2030-01-11T08:15:52.638		49.96	-77.72	42558.31	16.98		
alpha	E	2030-01-11T08:18:00.688		49.52	-77.54	44739.39	17.08		
beta	E	2030-01-11T08:18:53.489		49.33	-77.46	45642.50	17.13		
eta	E	2030-01-11T08:20:22.884		49.02	-77.32	47176.12	17.19		
gamma	E	2030-01-11T08:20:48.893		48.93	-77.28	47623.32	17.20		
delta	E	2030-01-11T08:21:28.221		48.79	-77.21	48300.35	17.23		
lambda	E	2030-01-11T08:23:08.263		48.44	-77.04	50026.71	17.28		
epsilon	E	2030-01-11T08:24:12.589		48.22	-76.93	51139.68	17.36		

Uranus_2030-01-11T07_42_05.4100_KPNO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:21:59 2023

```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-01-11T07:38:38.840
Event type              : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code           : KPNO
Location                : Kitt Peak Natl Obs
Latitude (deg)          :  31.96333
E. Longitude (deg)      : 248.40000
Altitude (km)           :   2.120
Gaia source ID          : 3413209067022432512
2Mass ID (if available) : 04535212+2236169
ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor)     :   0.98
K magnitude             : 14.523
G magnitude             : 17.148
RP magnitude            : 16.342
BP magnitude            : 17.830
DUPflag                 : 0
Distance (au)           : 18.413
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -17.79
Sun-Target sep (deg)    :  144.06
Sun-Moon sep (deg)      :   58.00
B (ring opening deg)    :   81.73
PA of pole (deg)        :  -26.73
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   1.083
C/A sky separation (km) :  14469.2
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
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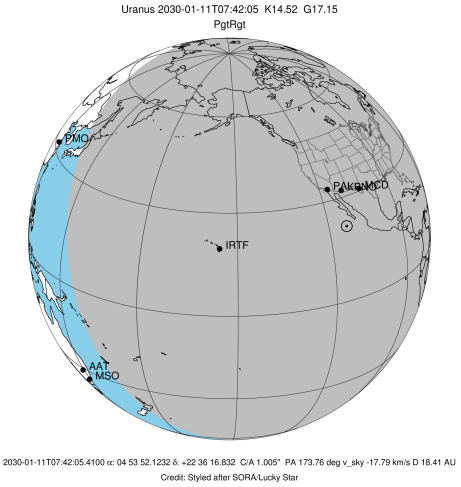

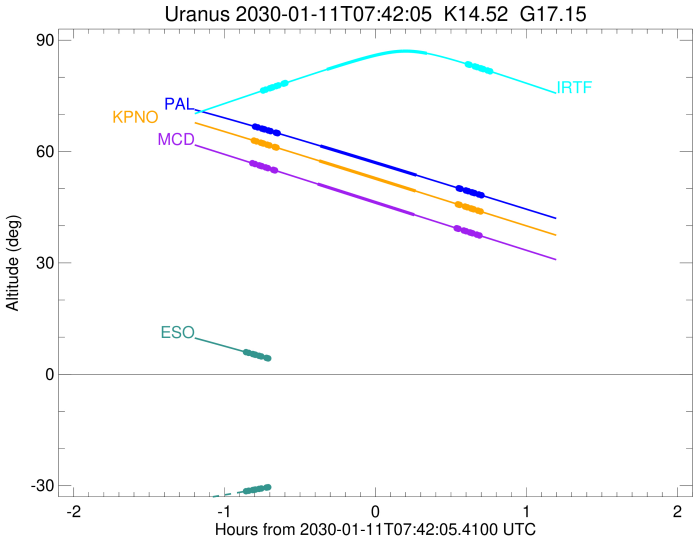

b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-01-11T06:53:31.801	62.99	-76.49	51375.68	-17.46			
lambda	I	2030-01-11T06:54:49.319	62.72	-76.69	50026.71	-17.38			
delta	I	2030-01-11T06:56:28.821	62.38	-76.93	48300.35	-17.32			
gamma	I	2030-01-11T06:57:07.784	62.24	-77.02	47626.06	-17.29			
eta	I	2030-01-11T06:57:33.816	62.15	-77.08	47176.12	-17.28			
beta	I	2030-01-11T06:59:00.563	61.85	-77.28	45680.49	-17.21			
alpha	I	2030-01-11T06:59:58.485	61.65	-77.41	44685.56	-17.17			
4	I	2030-01-11T07:01:59.859	61.23	-77.68	42609.21	-17.07			
5	I	2030-01-11T07:02:18.733	61.16	-77.72	42281.69	-17.05			
6	I	2030-01-11T07:02:44.487	61.07	-77.77	41850.84	-17.03			
Uranus	I	2030-01-11T07:19:42.228	57.50	-79.48	25166.07		6.80	7.12	
Uranus	E	2030-01-11T07:58:01.017	49.36	-78.67	25522.99		2.03	2.13	
6	E	2030-01-11T08:14:50.034	45.78	-76.51	41853.38	16.94			
5	E	2030-01-11T08:15:12.964	45.70	-76.46	42241.88	16.97			
4	E	2030-01-11T08:15:31.614	45.63	-76.41	42558.26	16.98			
alpha	E	2030-01-11T08:17:39.728	45.18	-76.09	44739.42	17.07			
beta	E	2030-01-11T08:18:32.554	44.99	-75.95	45642.50	17.12			
eta	E	2030-01-11T08:20:01.999	44.67	-75.71	47176.12	17.18			
gamma	E	2030-01-11T08:20:28.024	44.58	-75.64	47623.32	17.19			
delta	E	2030-01-11T08:21:07.376	44.44	-75.54	48300.35	17.22			
lambda	E	2030-01-11T08:22:47.483	44.09	-75.27	50026.71	17.27			
epsilon	E	2030-01-11T08:23:51.834	43.86	-75.09	51139.33	17.35			

Uranus_2030-01-11T07_42_05.4100_MCD.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:24:12 2023

```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2030-01-11T07:38:06.180
Event type              : PgtRgt
: Uranus occs: geocentric, topocentric
: 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          : 3413209067022432512
2Mass ID (if available) : 04535212+2236169
ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor)     :   0.98
K magnitude             : 14.523
G magnitude             : 17.148
RP magnitude            : 16.342
BP magnitude            : 17.830
DUPflag                 : 0
Distance (au)           : 18.413
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -17.79
Sun-Target sep (deg)    :  144.06
Sun-Moon sep (deg)      :   57.99
B (ring opening deg)    :   81.73
PA of pole (deg)        :  -26.73
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   1.083
C/A sky separation (km) :  14464.4
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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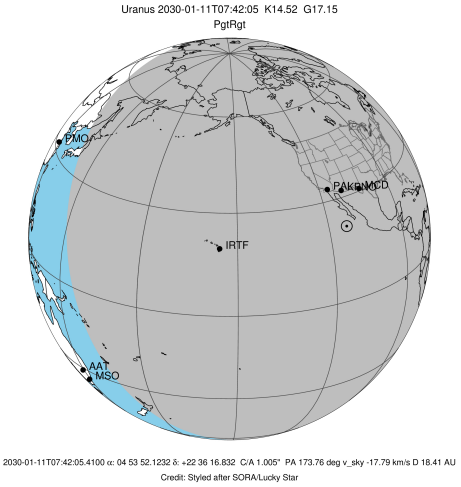
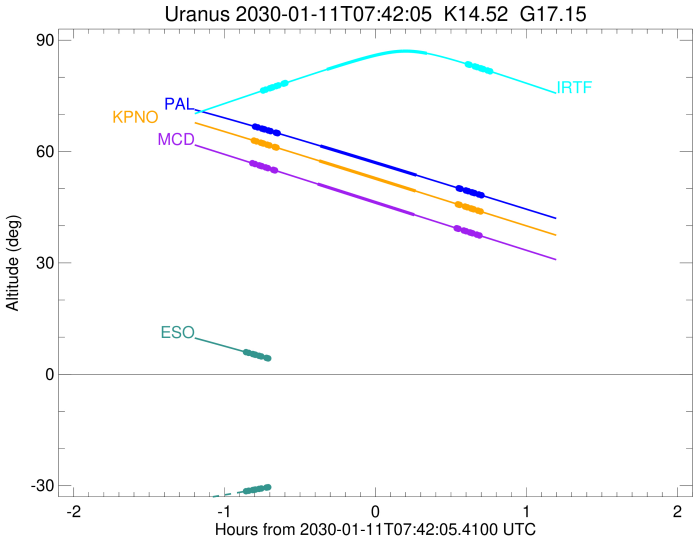


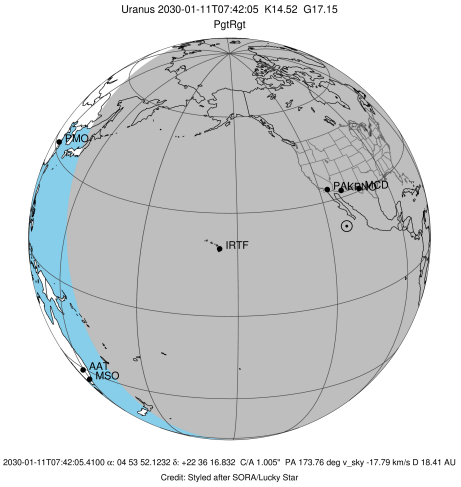


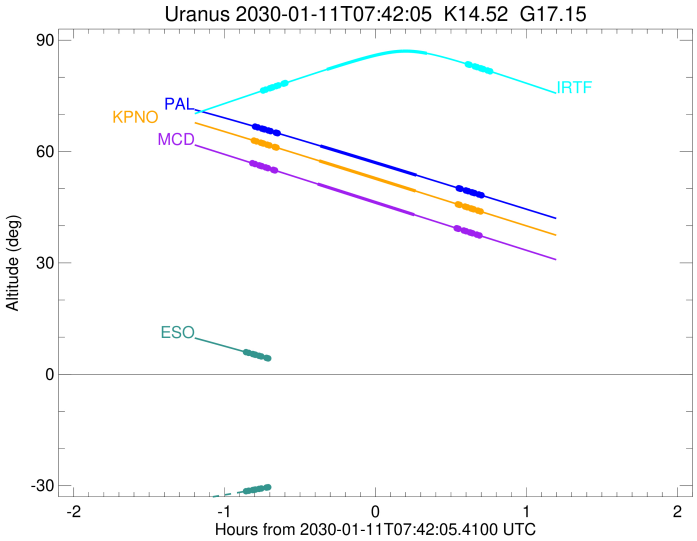
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-01-11T06:52:55.229		56.90	-80.93	51375.27	-17.44		
lambda	I	2030-01-11T06:54:12.813		56.63	-81.01	50026.71	-17.36		
delta	I	2030-01-11T06:55:52.431		56.27	-81.09	48300.35	-17.30		
gamma	I	2030-01-11T06:56:31.438		56.13	-81.12	47626.07	-17.27		
eta	I	2030-01-11T06:56:57.501		56.04	-81.14	47176.12	-17.26		
beta	I	2030-01-11T06:58:24.350		55.72	-81.19	45680.49	-17.19		
alpha	I	2030-01-11T06:59:22.342		55.52	-81.22	44685.57	-17.15		
4	I	2030-01-11T07:01:23.864		55.08	-81.26	42609.18	-17.04		
5	I	2030-01-11T07:01:42.765		55.01	-81.26	42281.61	-17.03		
6	I	2030-01-11T07:02:08.547		54.92	-81.27	41850.79	-17.01		
Uranus	I	2030-01-11T07:19:07.561		51.25	-80.64	25166.77		6.79	7.11
Uranus	E	2030-01-11T07:57:30.568		42.97	-75.17	25522.76		2.04	2.14
6	E	2030-01-11T08:14:21.471		39.34	-71.98	41853.41	16.91		
5	E	2030-01-11T08:14:44.448		39.26	-71.91	42241.95	16.93		
4	E	2030-01-11T08:15:03.134		39.19	-71.85	42558.30	16.94		
alpha	E	2030-01-11T08:17:11.500		38.73	-71.43	44739.39	17.04		
beta	E	2030-01-11T08:18:04.434		38.54	-71.25	45642.50	17.08		
eta	E	2030-01-11T08:19:34.061		38.22	-70.96	47176.12	17.14		
gamma	E	2030-01-11T08:20:00.138		38.12	-70.87	47623.32	17.16		
delta	E	2030-01-11T08:20:39.571		37.98	-70.74	48300.35	17.18		
lambda	E	2030-01-11T08:22:19.884		37.62	-70.41	50026.71	17.24		
epsilon	E	2030-01-11T08:23:24.390		37.39	-70.19	51139.70	17.31		

Uranus_2030-01-11T07_42_05.4100_IRTF.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:28:27 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-01-11T07:42:26.610
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 : 3413209067022432512
2Mass ID (if available) : 04535212+2236169
ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor) : 0.98
K magnitude : 14.523
G magnitude : 17.148
RP magnitude : 16.342
BP magnitude : 17.830
DUPflag : 0
Distance (au) : 18.413
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -17.79
Sun-Target sep (deg) : 144.06
Sun-Moon sep (deg) : 57.86
B (ring opening deg) : 81.73
PA of pole (deg) : -26.73
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.977
C/A sky separation (km) : 13053.9
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



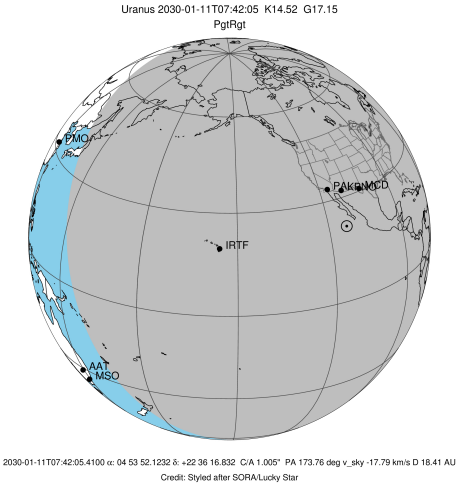


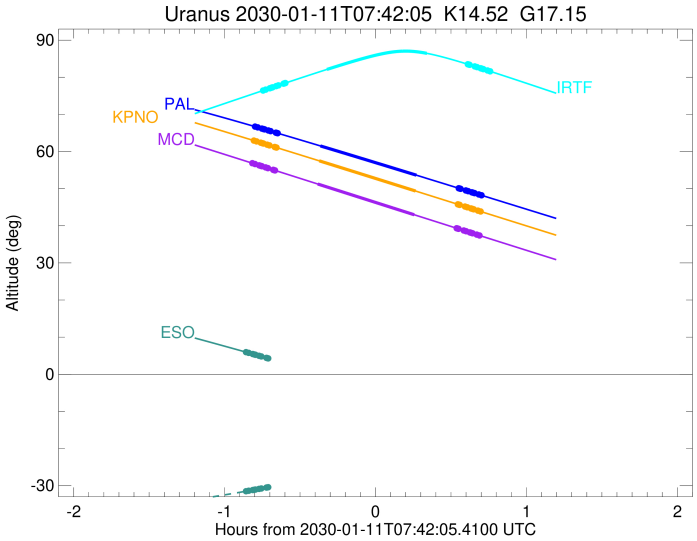
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2030-01-11T06:57:11.572		76.39	-40.51	51368.11	-17.66		
lambda	I	2030-01-11T06:58:27.737		76.68	-40.80	50026.71	-17.59		
delta	I	2030-01-11T07:00:05.986		77.05	-41.18	48300.35	-17.55		
gamma	I	2030-01-11T07:00:44.428		77.20	-41.32	47626.19	-17.53		
eta	I	2030-01-11T07:01:10.117		77.29	-41.42	47176.12	-17.51		
beta	I	2030-01-11T07:02:35.646		77.62	-41.75	45680.62	-17.46		
alpha	I	2030-01-11T07:03:32.713		77.83	-41.97	44685.79	-17.43		
4	I	2030-01-11T07:05:32.244		78.28	-42.43	42608.48	-17.35		
5	I	2030-01-11T07:05:50.890		78.35	-42.50	42279.76	-17.34		
6	I	2030-01-11T07:06:16.155		78.45	-42.60	41849.64	-17.32		
Uranus	I	2030-01-11T07:22:43.983		82.11	-46.39	25199.30		6.50	6.80
Uranus	E	2030-01-11T08:02:31.148		86.45	-55.59	25540.76		1.45	1.51
6	E	2030-01-11T08:18:47.577		83.51	-59.36	41851.69	17.31		
5	E	2030-01-11T08:19:09.938		83.43	-59.45	42238.50	17.34		
4	E	2030-01-11T08:19:28.266		83.37	-59.52	42556.45	17.35		
alpha	E	2030-01-11T08:21:33.904		82.93	-60.01	44740.47	17.42		
beta	E	2030-01-11T08:22:25.606		82.74	-60.21	45642.22	17.46		
eta	E	2030-01-11T08:23:53.338		82.43	-60.55	47176.12	17.51		
gamma	E	2030-01-11T08:24:18.878		82.34	-60.65	47623.49	17.52		
delta	E	2030-01-11T08:24:57.483		82.20	-60.79	48300.35	17.54		
lambda	E	2030-01-11T08:26:35.753		81.84	-61.17	50026.71	17.59		
epsilon	E	2030-01-11T08:27:38.138		81.62	-61.42	51124.97	17.66		

Uranus_2030-01-11T07_42_05.4100_ESO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:34:48 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2030-01-11T07:37:12.940
Event type : PgtRgt
: Uranus occs: geocentric, topocentric
: 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 : 3413209067022432512
2Mass ID (if available) : 04535212+2236169
ICRS Star Coord at Epoch: 04h 53m 52.12320s +22:36:16.83235s
RUWE (>1.4 is poor) : 0.98
K magnitude : 14.523
G magnitude : 17.148
RP magnitude : 16.342
BP magnitude : 17.830
DUPflag : 0
Distance (au) : 18.413
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -17.79
Sun-Target sep (deg) : 144.06
Sun-Moon sep (deg) : 57.49
B (ring opening deg) : 81.73
PA of pole (deg) : -26.73
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.716
C/A sky separation (km) : 9567.8
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	2030-01-11T06:50:26.828		5.99	-31.53	51339.34	-17.68		
lambda	I	2030-01-11T06:51:41.201		5.76	-31.38	50026.71	-17.64		
delta	I	2030-01-11T06:53:19.148		5.45	-31.18	48300.35	-17.61		
gamma	I	2030-01-11T06:53:57.414		5.33	-31.11	47626.66	-17.60		
eta	I	2030-01-11T06:54:23.020		5.25	-31.05	47176.12	-17.59		
beta	I	2030-01-11T06:55:48.096		4.98x	-30.88	45680.99	-17.56		
alpha	I	2030-01-11T06:56:44.778		4.80x	-30.77	44686.75	-17.54		
4	I	2030-01-11T06:58:43.613		4.42x	-30.52	42605.80	-17.50		
5	I	2030-01-11T06:59:02.370		4.36x	-30.48	42273.04	-17.49		
6	I	2030-01-11T06:59:27.193		4.28x	-30.43	41845.57	-17.48		
Uranus	I	2030-01-11T07:15:24.437		1.19x	-28.35	25294.73		5.55	5.81
Uranus	E	2030-01-11T07:59:20.522		-7.58x	-21.82	25558.29		0.28	0.30
6	E	2030-01-11T08:15:15.702		-10.84x	-19.21	41848.58	17.34		
5	E	2030-01-11T08:15:37.910		-10.92x	-19.15	42232.42	17.35		
4	E	2030-01-11T08:15:56.362		-10.98x	-19.10	42553.28	17.35		
alpha	E	2030-01-11T08:18:02.405		-11.41x	-18.75	44742.24	17.39		
beta	E	2030-01-11T08:18:54.124		-11.59x	-18.60	45641.80	17.40		
eta	E	2030-01-11T08:20:22.229		-11.89x	-18.35	47176.12	17.43		
gamma	E	2030-01-11T08:20:47.912		-11.98x	-18.28	47623.79	17.43		
delta	E	2030-01-11T08:21:26.709		-12.12x	-18.17	48300.35	17.44		
lambda	E	2030-01-11T08:23:05.618		-12.46x	-17.89	50026.71	17.46		
epsilon	E	2030-01-11T08:24:07.096		-12.67x	-17.72	51100.79	17.50		