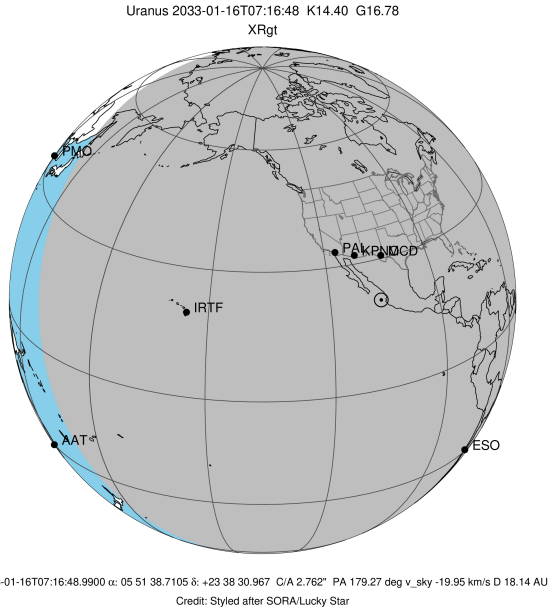
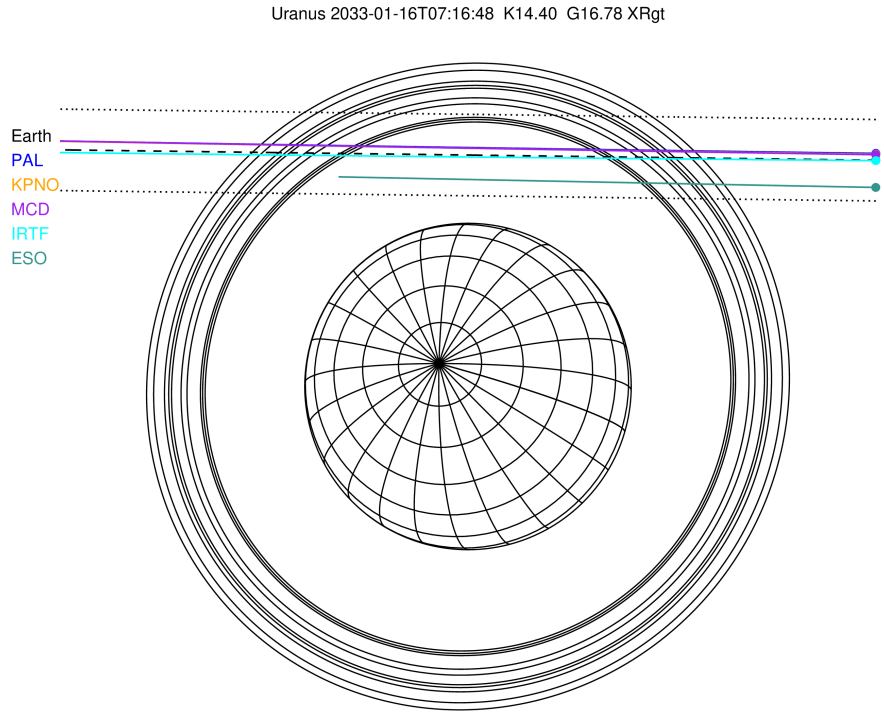
Stellar occultation prediction by rfrench@wellesley.edu Sun Jun 25 00:46:35 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:16:48.990
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Gaia source ID : 3427500175564467456
2Mass ID (if available) : 05513870+2338309

ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 36.86
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62

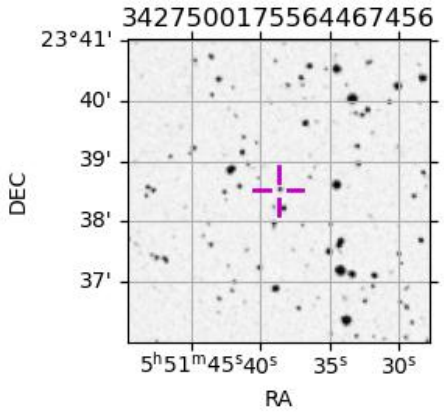
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon





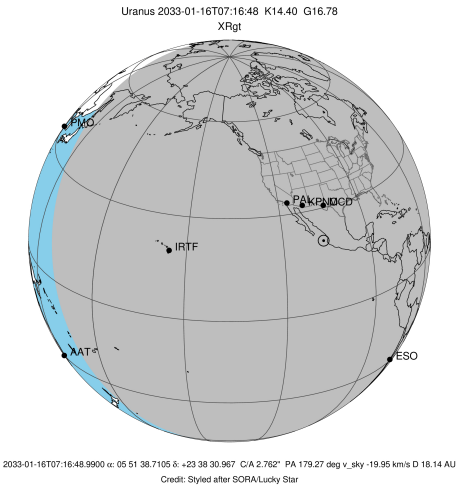
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

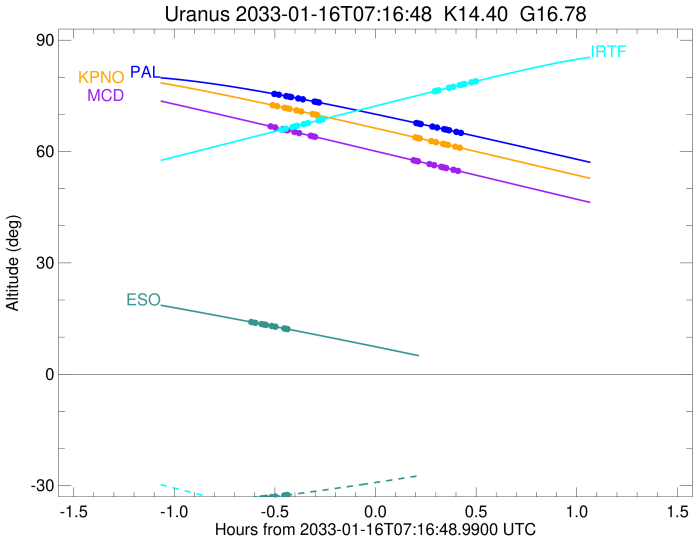
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	++++++++++		++++++++++	JAN 16 06:46 - JAN 16 07:42	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	++++++++++		++++++++++	JAN 16 06:46 - JAN 16 07:42	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	++++++++++		++++++++++	JAN 16 06:45 - JAN 16 07:41	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	++++++++++		++++++++++	JAN 16 06:48 - JAN 16 07:47	PnnRie
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 16 06:39 - JAN 16 06:50	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_2033-01-16T07_16_48.9900_PAL.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:18:13 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:15:14.330
Event type : XRgt
: No Uranus occs
: 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 : 3427500175564467456
2Mass ID (if available) : 05513870+2338309
ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 37.19
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.843
C/A sky separation (km) : 37408.6
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

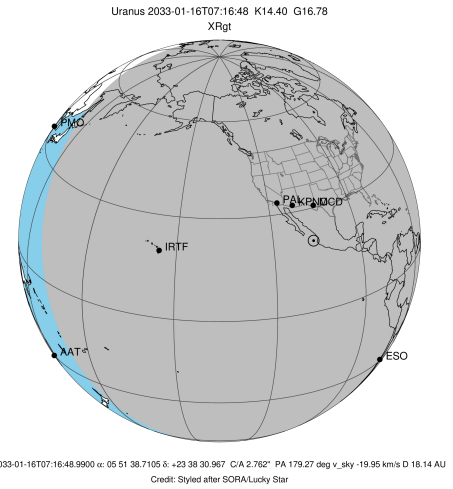
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-01-16T06:46:39.150		75.53	-70.09	51174.85	-14.07		
lambda	I	2033-01-16T06:48:02.611		75.29	-70.33	50026.71	-13.56		
delta	I	2033-01-16T06:50:13.133		74.93	-70.70	48300.35	-12.88		
gamma	I	2033-01-16T06:51:05.628		74.78	-70.85	47631.58	-12.59		
eta	I	2033-01-16T06:51:42.096		74.67	-70.95	47176.12	-12.38		
beta	I	2033-01-16T06:53:46.711		74.31	-71.30	45679.60	-11.62		
alpha	I	2033-01-16T06:55:09.143		74.07	-71.53	44744.02	-11.08		
4	I	2033-01-16T06:58:35.590		73.46	-72.09	42610.99	-9.55		
5	I	2033-01-16T06:59:12.920		73.35	-72.19	42258.73	-9.29		
6	I	2033-01-16T07:00:03.996		73.20	-72.32	41795.18	-8.84		

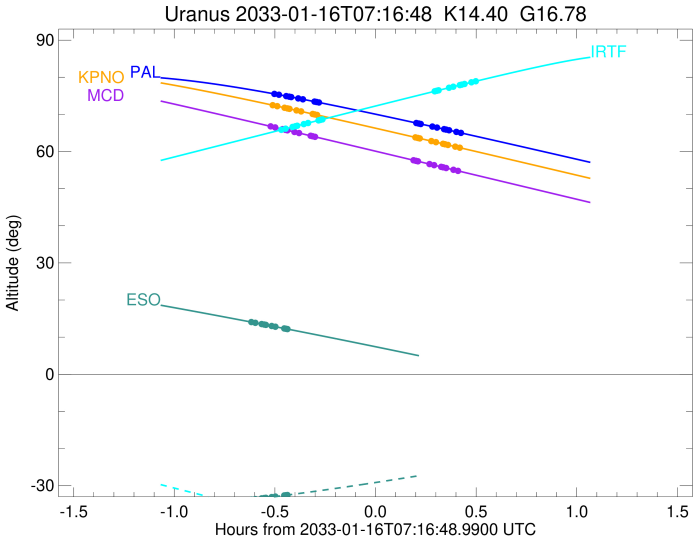
No planet occultations

6	E	2033-01-16T07:28:53.239		67.70	-76.16	41805.85	8.83		
5	E	2033-01-16T07:29:48.192		67.52	-76.25	42310.65	9.28		
4	E	2033-01-16T07:30:17.070		67.42	-76.30	42576.26	9.54		
alpha	E	2033-01-16T07:33:47.593		66.73	-76.62	44749.62	11.07		
beta	E	2033-01-16T07:35:09.554		66.45	-76.74	45675.33	11.61		
eta	E	2033-01-16T07:37:14.676		66.03	-76.90	47176.12	12.36		
gamma	E	2033-01-16T07:37:50.904		65.91	-76.94	47627.79	12.57		
delta	E	2033-01-16T07:38:43.790		65.74	-77.01	48300.35	12.86		
lambda	E	2033-01-16T07:40:54.551		65.30	-77.15	50026.71	13.53		
epsilon	E	2033-01-16T07:42:45.377		64.92	-77.26	51555.26	14.04		

Uranus_2033-01-16T07_16_48.9900_KPNO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:22:32 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:14:49.040
Event type : XRgt
: No Uranus occs
: 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 : 3427500175564467456
2Mass ID (if available) : 05513870+2338309
ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 37.12
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.837
C/A sky separation (km) : 37327.5
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

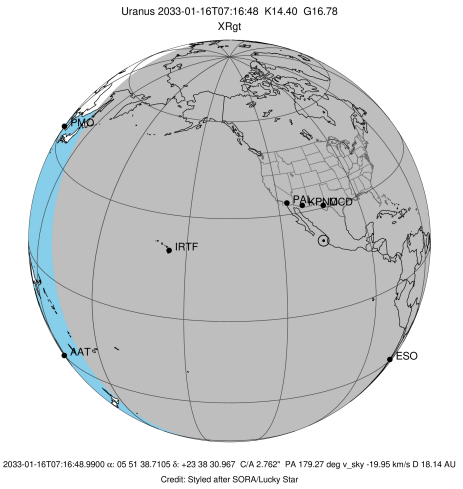
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-01-16T06:46:09.278		72.49	-74.37	51173.61	-14.11		
lambda	I	2033-01-16T06:47:32.433		72.22	-74.59	50026.71	-13.59		
delta	I	2033-01-16T06:49:42.564		71.79	-74.93	48300.35	-12.93		
gamma	I	2033-01-16T06:50:34.881		71.62	-75.06	47631.57	-12.64		
eta	I	2033-01-16T06:51:11.218		71.50	-75.15	47176.12	-12.43		
beta	I	2033-01-16T06:53:15.325		71.08	-75.46	45679.57	-11.68		
alpha	I	2033-01-16T06:54:37.362		70.81	-75.66	44743.93	-11.14		
4	I	2033-01-16T06:58:02.482		70.13	-76.14	42611.09	-9.62		
5	I	2033-01-16T06:58:39.566		70.00	-76.23	42258.34	-9.37		
6	I	2033-01-16T06:59:30.148		69.83	-76.34	41795.21	-8.92		

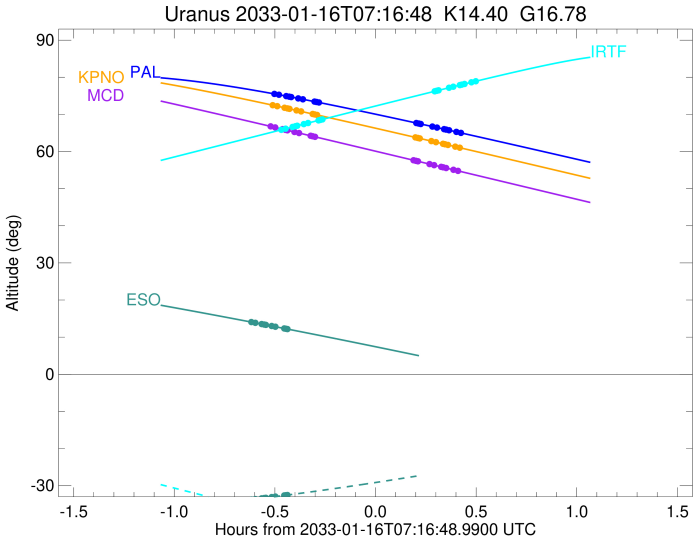
No planet occultations

6	E	2033-01-16T07:28:36.804		63.83	-78.93	41805.97	8.91		
5	E	2033-01-16T07:29:31.284		63.64	-78.96	42310.75	9.36		
4	E	2033-01-16T07:29:59.916		63.54	-78.97	42576.11	9.61		
alpha	E	2033-01-16T07:33:29.171		62.81	-79.04	44749.58	11.12		
beta	E	2033-01-16T07:34:50.761		62.52	-79.06	45675.30	11.66		
eta	E	2033-01-16T07:36:55.417		62.09	-79.06	47176.12	12.41		
gamma	E	2033-01-16T07:37:31.526		61.96	-79.06	47627.78	12.61		
delta	E	2033-01-16T07:38:24.253		61.78	-79.05	48300.35	12.90		
lambda	E	2033-01-16T07:40:34.674		61.32	-79.01	50026.71	13.56		
epsilon	E	2033-01-16T07:42:25.263		60.93	-78.97	51555.27	14.07		

Uranus_2033-01-16T07_16_48.9900_MCD.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:24:43 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:14:14.300
Event type : XRgt
: No Uranus occs
: 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 : 3427500175564467456
2Mass ID (if available) : 05513870+2338309
ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 37.02
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.837
C/A sky separation (km) : 37318.4
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





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

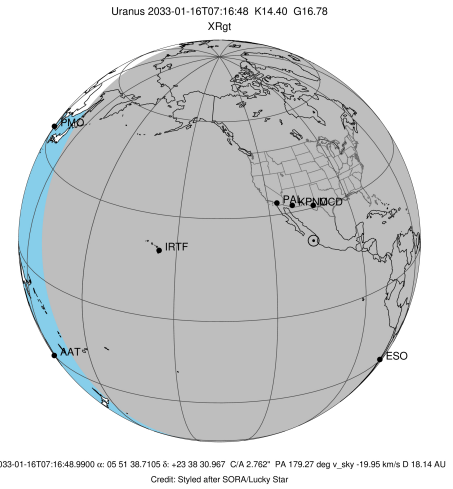
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-01-16T06:45:32.706		66.78	-79.33	51173.11	-14.10		
lambda	I	2033-01-16T06:46:55.852		66.49	-79.46	50026.71	-13.59		
delta	I	2033-01-16T06:49:06.021		66.03	-79.65	48300.35	-12.92		
gamma	I	2033-01-16T06:49:58.351		65.84	-79.72	47631.57	-12.63		
eta	I	2033-01-16T06:50:34.697		65.71	-79.76	47176.12	-12.43		
beta	I	2033-01-16T06:52:38.829		65.27	-79.91	45679.56	-11.68		
alpha	I	2033-01-16T06:54:00.878		64.98	-79.99	44743.90	-11.14		
4	I	2033-01-16T06:57:25.983		64.25	-80.17	42611.13	-9.62		
5	I	2033-01-16T06:58:03.075		64.12	-80.20	42258.23	-9.37		
6	I	2033-01-16T06:58:53.629		63.94	-80.23	41795.22	-8.92		

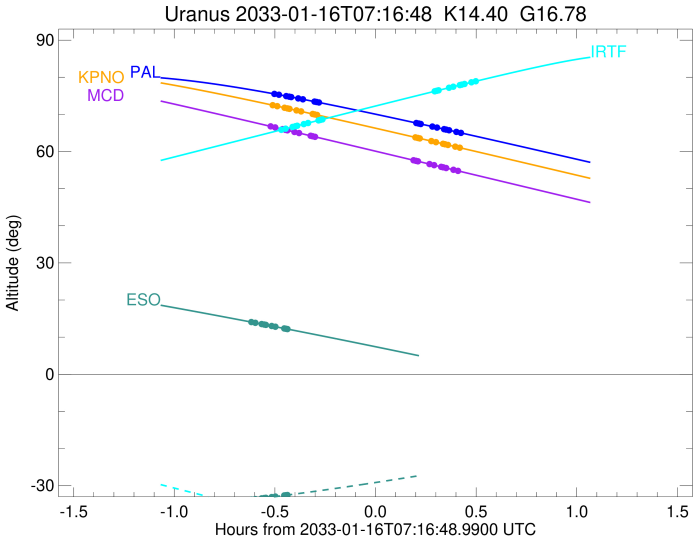
No planet occultations

6	E	2033-01-16T07:28:03.982		57.67	-79.13	41805.95	8.91		
5	E	2033-01-16T07:28:58.463		57.48	-79.04	42310.74	9.36		
4	E	2033-01-16T07:29:27.100		57.37	-78.98	42576.12	9.61		
alpha	E	2033-01-16T07:32:56.425		56.62	-78.59	44749.59	11.12		
beta	E	2033-01-16T07:34:18.060		56.33	-78.42	45675.30	11.65		
eta	E	2033-01-16T07:36:22.797		55.88	-78.15	47176.12	12.40		
gamma	E	2033-01-16T07:36:58.932		55.75	-78.08	47627.78	12.60		
delta	E	2033-01-16T07:37:51.700		55.56	-77.96	48300.35	12.89		
lambda	E	2033-01-16T07:40:02.229		55.09	-77.66	50026.71	13.55		
epsilon	E	2033-01-16T07:41:52.919		54.69	-77.40	51555.26	14.06		

Uranus_2033-01-16T07_16_48.9900_IRTF.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:28:59 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:18:28.440
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 : 3427500175564467456
2Mass ID (if available) : 05513870+2338309
ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 37.60
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.732
C/A sky separation (km) : 35945.3
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

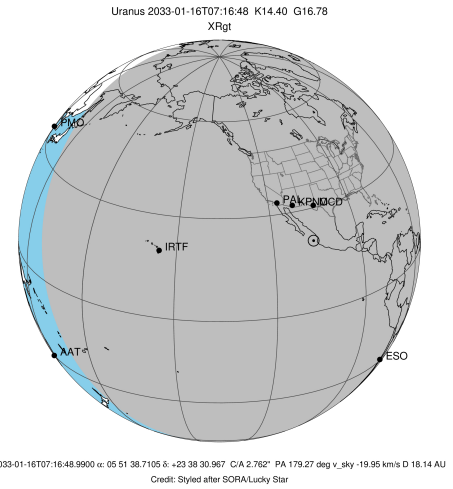
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-01-16T06:48:43.721		65.85	-37.99	51160.18	-14.70		
lambda	I	2033-01-16T06:50:02.376		66.15	-38.29	50026.71	-14.24		
delta	I	2033-01-16T06:52:06.146		66.63	-38.77	48300.35	-13.65		
gamma	I	2033-01-16T06:52:55.600		66.81	-38.96	47631.56	-13.40		
eta	I	2033-01-16T06:53:29.830		66.94	-39.09	47176.12	-13.21		
beta	I	2033-01-16T06:55:25.944		67.39	-39.53	45679.18	-12.56		
alpha	I	2033-01-16T06:56:41.898		67.68	-39.83	44742.79	-12.10		
4	I	2033-01-16T06:59:47.534		68.38	-40.54	42612.32	-10.82		
5	I	2033-01-16T07:00:20.969		68.51	-40.67	42253.53	-10.62		
6	I	2033-01-16T07:01:04.827		68.68	-40.84	41795.71	-10.25		

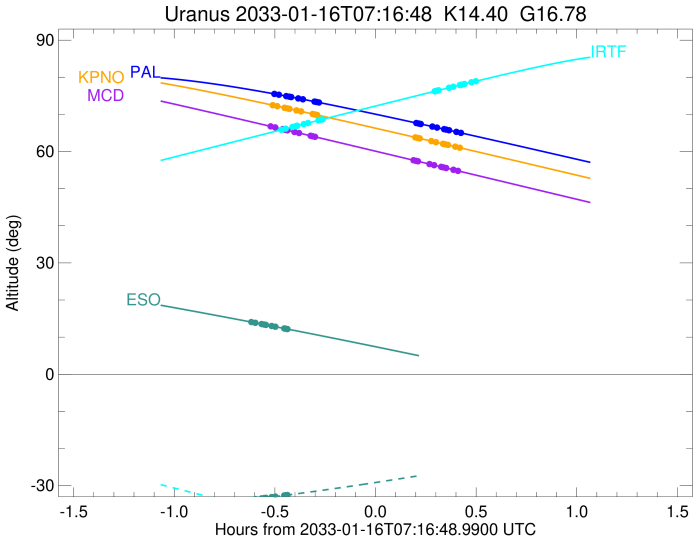
No planet occultations

6	E	2033-01-16T07:34:23.404		76.21	-48.55	41808.28	10.26		
5	E	2033-01-16T07:35:11.018		76.39	-48.74	42312.50	10.63		
4	E	2033-01-16T07:35:35.955		76.48	-48.83	42572.86	10.83		
alpha	E	2033-01-16T07:38:45.236		77.18	-49.56	44748.69	12.11		
beta	E	2033-01-16T07:40:00.523		77.46	-49.86	45674.45	12.57		
eta	E	2033-01-16T07:41:56.841		77.89	-50.31	47176.12	13.23		
gamma	E	2033-01-16T07:42:30.731		78.01	-50.44	47627.51	13.41		
delta	E	2033-01-16T07:43:20.432		78.19	-50.63	48300.35	13.66		
lambda	E	2033-01-16T07:45:24.054		78.65	-51.11	50026.71	14.26		
epsilon	E	2033-01-16T07:47:09.555		79.03	-51.52	51555.07	14.72		

Uranus_2033-01-16T07_16_48.9900_ESO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:35:21 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2033-01-16T07:12:25.860
Event type : XRgt
: No Uranus occs
: 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 : 3427500175564467456
2Mass ID (if available) : 05513870+2338309
ICRS Star Coord at Epoch: 05h 51m 38.71053s +23:38:30.96671s
RUWE (>1.4 is poor) : 1.04
K magnitude : 14.398
G magnitude : 16.782
RP magnitude : 16.045
BP magnitude : 17.353
DUPflag : 0
Distance (au) : 18.140
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 152.08
Sun-Moon sep (deg) : 36.29
B (ring opening deg) : 76.91
PA of pole (deg) : 51.62
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.464
C/A sky separation (km) : 32416.2
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	2033-01-16T06:39:50.664		14.05	-33.76	51117.91	-15.87		
lambda	I	2033-01-16T06:41:00.425		13.85	-33.63	50026.71	-15.52		
delta	I	2033-01-16T06:42:53.214		13.52	-33.42	48300.35	-15.09		
gamma	I	2033-01-16T06:43:37.819		13.39	-33.34	47631.48	-14.90		
eta	I	2033-01-16T06:44:08.508		13.30	-33.28	47176.12	-14.77		
beta	I	2033-01-16T06:45:51.539		13.00	-33.08	45677.89	-14.31		
alpha	I	2033-01-16T06:46:57.881		12.81	-32.95	44739.35	-13.99		
4	I	2033-01-16T06:49:34.511		12.35	-32.65	42614.77	-13.12		
5	I	2033-01-16T06:50:03.201		12.26	-32.59	42241.08	-12.99		
6	I	2033-01-16T06:50:37.711		12.16	-32.52	41797.71	-12.74		

No planet occultations

6	E	2033-01-16T07:32:56.378	4.40x	-26.86	41813.00	12.70		
5	E	2033-01-16T07:33:35.005	4.28x	-26.77	42314.62	12.94		
4	E	2033-01-16T07:33:55.092	4.22x	-26.72	42566.79	13.07		
alpha	E	2033-01-16T07:36:36.292	3.71x	-26.32	44746.70	13.93		
beta	E	2033-01-16T07:37:42.295	3.50x	-26.16	45672.72	14.24		
eta	E	2033-01-16T07:39:26.134	3.17x	-25.90	47176.12	14.70		
gamma	E	2033-01-16T07:39:56.673	3.07x	-25.82	47626.99	14.83		
delta	E	2033-01-16T07:40:41.809	2.93x	-25.71	48300.35	15.01		
lambda	E	2033-01-16T07:42:35.201	2.56x	-25.42	50026.71	15.43		
epsilon	E	2033-01-16T07:44:12.999	2.25x	-25.17	51552.50	15.78		