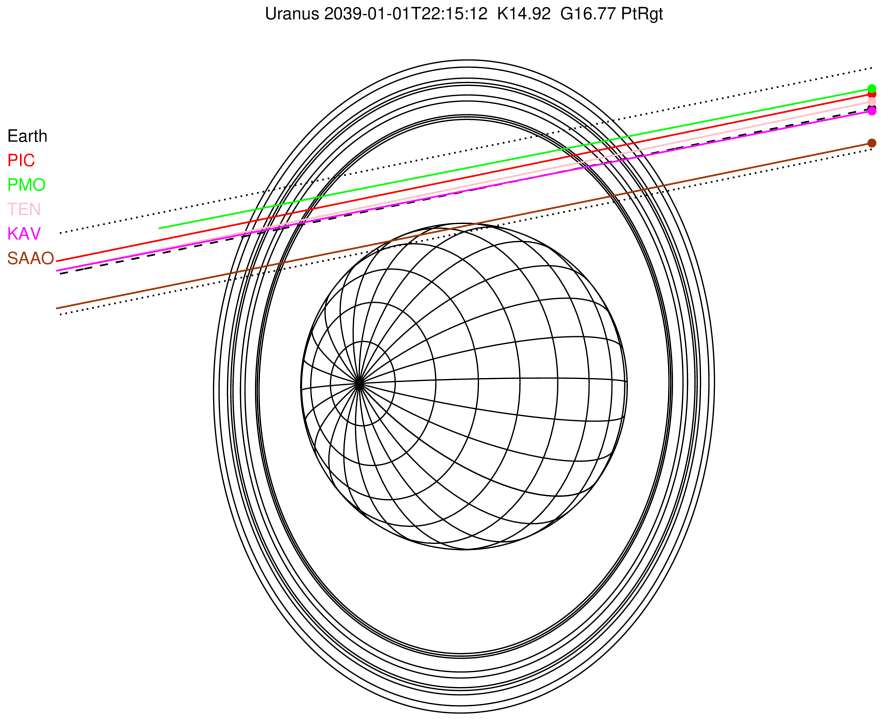
Stellar occultation prediction by rfrench@wellesley.edu Sun Jun 25 02:16:27 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2039-01-01T22:15:12.630
Event type : PtRgt
: Uranus occs: topocentric, not geoecetric
: Ring occs: geocentric, topocentric
Gaia source ID : 6739407774600222 72
2Mass ID (if available) : 07555956+2119206

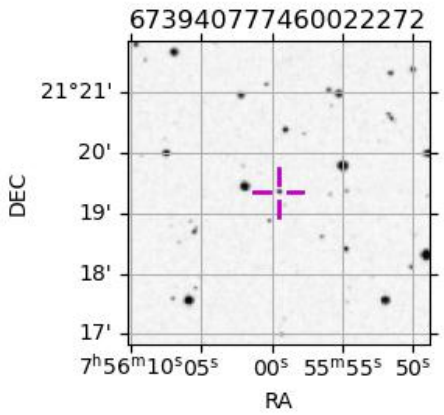
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor) : 1.03
K magnitude : 14.923
G magnitude : 16.774
RP magnitude : 16.141
BP magnitude : 17.254
DUPflag : 0
Distance (au) : 17.700
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.10
Sun-Target sep (deg) : 163.96
Sun-Moon sep (deg) : 110.36
B (ring opening deg) : 50.05
PA of pole (deg) : 88.37

#	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

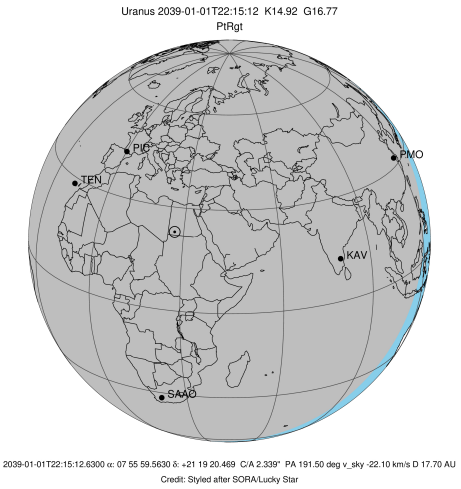


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	++++++++++		++++++++++	JAN 01 21:53 - JAN 01 22:38	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	++++++++++		++++++++++	JAN 01 21:47 - JAN 01 22:31	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	++++++++++		++++++++++	JAN 01 21:53 - JAN 01 22:40	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	++++++++++		++++++++++	JAN 01 21:47 - JAN 01 22:34	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					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8	++++++++++	+ +	++++++++++	JAN 01 21:48 - JAN 01 22:40	PieRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



Uranus_2039-01-01T22_15_12.6300_PIC.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:16:57 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2039-01-01T22:18:03.070
Event type              : PtRgt
: Uranus occs: topocentric, not geoecetric
: Ring occs: geocentric, topocentric
Observer code           : PIC
Location                : Pic du Midi
Latitude (deg)          :  42.93656
E. Longitude (deg)      :   0.14231
Altitude (km)           :   2.890
Gaia source ID          : 673940777460022272
2Mass ID (if available) : 07555956+2119206
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor)     :   1.03
K magnitude             : 14.923
G magnitude             : 16.774
RP magnitude            : 16.141
BP magnitude            : 17.254
DUPflag                 : 0
Distance (au)           : 17.700
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -22.10
Sun-Target sep (deg)    :  163.96
Sun-Moon sep (deg)      :  111.17
B (ring opening deg)    :   50.05
PA of pole (deg)        :   88.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.493
C/A sky separation (km) :  31999.9
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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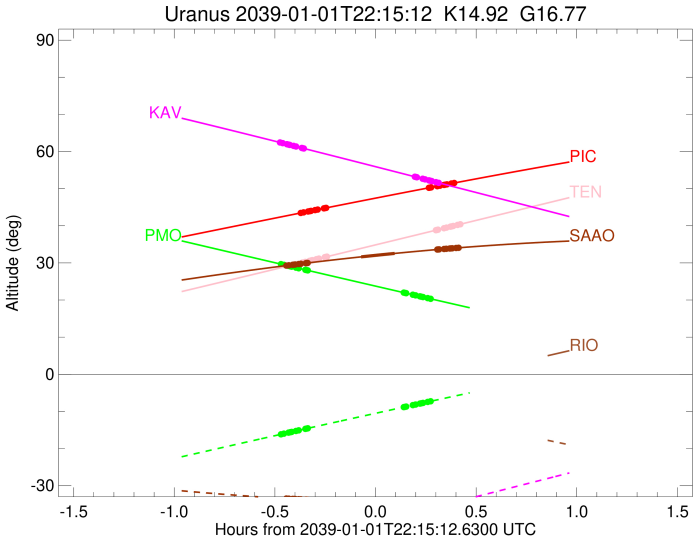


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

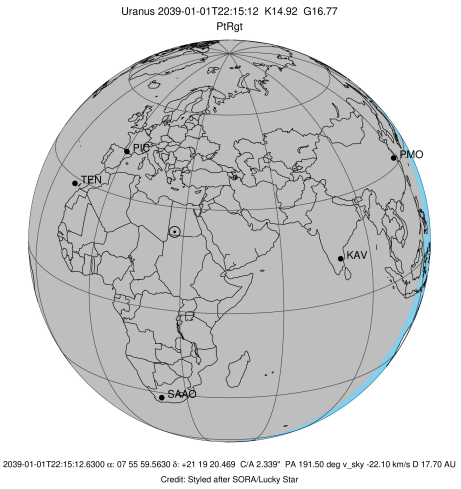
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-01T21:53:14.353		43.51	-56.65	50743.65	-22.20		
lambda	I	2039-01-01T21:53:46.806		43.61	-56.74	50026.71	-21.98		
delta	I	2039-01-01T21:55:06.381		43.85	-56.96	48300.35	-21.40		
gamma	I	2039-01-01T21:55:38.249		43.95	-57.05	47622.40	-21.15		
eta	I	2039-01-01T21:55:59.438		44.01	-57.10	47176.12	-20.97		
beta	I	2039-01-01T21:57:13.509		44.23	-57.31	45647.16	-20.34		
alpha	I	2039-01-01T21:58:00.408		44.37	-57.43	44697.21	-19.89		
4	I	2039-01-01T21:59:51.950		44.71	-57.74	42548.04	-18.70		
5	I	2039-01-01T22:00:11.853		44.77	-57.79	42172.70	-18.52		
6	I	2039-01-01T22:00:30.345		44.82	-57.84	41834.32	-18.28		

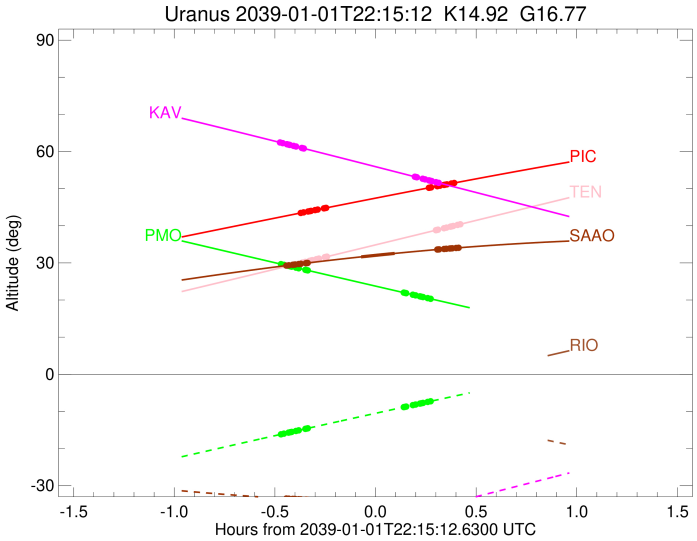
No planet occultations

6	E	2039-01-01T22:31:10.304		50.24	-62.54	41878.24	18.31		
5	E	2039-01-01T22:31:28.894		50.29	-62.58	42273.67	18.54		
4	E	2039-01-01T22:31:43.192		50.33	-62.61	42529.11	18.73		
alpha	E	2039-01-01T22:33:38.400		50.66	-62.89	44743.83	19.93		
beta	E	2039-01-01T22:34:24.539		50.80	-62.99	45675.48	20.37		
eta	E	2039-01-01T22:35:37.134		51.00	-63.16	47176.12	21.01		
gamma	E	2039-01-01T22:35:58.309		51.06	-63.21	47622.93	21.19		
delta	E	2039-01-01T22:36:30.090		51.16	-63.29	48300.35	21.44		
lambda	E	2039-01-01T22:37:49.506		51.38	-63.47	50026.71	22.03		
epsilon	E	2039-01-01T22:38:42.966		51.53	-63.59	51214.03	22.25		

Uranus_2039-01-01T22_15_12.6300_PMO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:21:12 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2039-01-01T22:11:35.740
Event type : PtRgt
: Uranus occs: topocentric, not geoecetric
: 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 : 673940777460022272
2Mass ID (if available) : 07555956+2119206
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor) : 1.03
K magnitude : 14.923
G magnitude : 16.774
RP magnitude : 16.141
BP magnitude : 17.254
DUPflag : 0
Distance (au) : 17.700
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.10
Sun-Target sep (deg) : 163.96
Sun-Moon sep (deg) : 110.45
B (ring opening deg) : 50.05
PA of pole (deg) : 88.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.609
C/A sky separation (km) : 33494.2
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

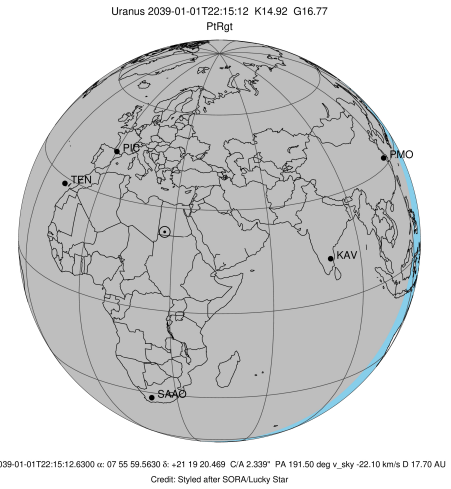
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-01T21:47:21.277		29.60	-16.11	50743.52	-21.38		
lambda	I	2039-01-01T21:47:55.002		29.48	-16.00	50026.71	-21.13		
delta	I	2039-01-01T21:49:17.983		29.19	-15.72	48300.35	-20.47		
gamma	I	2039-01-01T21:49:51.344		29.07	-15.60	47622.27	-20.18		
eta	I	2039-01-01T21:50:13.559		28.99	-15.53	47176.12	-19.98		
beta	I	2039-01-01T21:51:31.506		28.72	-15.27	45647.75	-19.25		
alpha	I	2039-01-01T21:52:21.160		28.55	-15.10	44698.35	-18.74		
4	I	2039-01-01T21:54:20.500		28.13	-14.70	42546.17	-17.36		
5	I	2039-01-01T21:54:41.721		28.05	-14.63	42175.30	-17.14		
6	I	2039-01-01T21:55:01.842		27.98	-14.56	41836.49	-16.87		

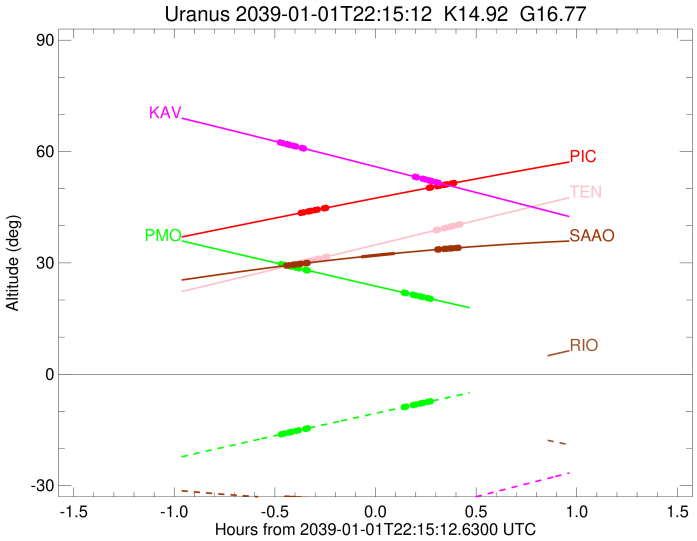
No planet occultations

6	E	2039-01-01T22:23:41.107		21.98	-8.84	41877.44	16.83		
5	E	2039-01-01T22:24:01.277		21.91	-8.78	42269.17	17.10		
4	E	2039-01-01T22:24:16.945		21.86	-8.72	42528.16	17.32		
alpha	E	2039-01-01T22:26:20.471		21.43	-8.32	44742.53	18.70		
beta	E	2039-01-01T22:27:09.584		21.26	-8.16	45674.71	19.21		
eta	E	2039-01-01T22:28:26.386		20.99	-7.91	47176.12	19.93		
gamma	E	2039-01-01T22:28:48.686		20.92	-7.83	47622.73	20.12		
delta	E	2039-01-01T22:29:22.120		20.80	-7.72	48300.35	20.41		
lambda	E	2039-01-01T22:30:45.353		20.51	-7.45	50026.71	21.06		
epsilon	E	2039-01-01T22:31:40.346		20.32	-7.27	51196.07	21.31		

Uranus_2039-01-01T22_15_12.6300_TEN.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:27:43 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2039-01-01T22:19:09.500
Event type : PtRgt
: Uranus occs: topocentric, not geoecetric
: Ring occs: geocentric, topocentric
Observer code : TEN
Location : Teide Obs./Tenerife
Latitude (deg) : 28.30050
E. Longitude (deg) : 343.48909
Altitude (km) : 2.395
Gaia source ID : 673940777460022272
2Mass ID (if available) : 07555956+2119206
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor) : 1.03
K magnitude : 14.923
G magnitude : 16.774
RP magnitude : 16.141
BP magnitude : 17.254
DUPflag : 0
Distance (au) : 17.700
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.10
Sun-Target sep (deg) : 163.96
Sun-Moon sep (deg) : 111.11
B (ring opening deg) : 50.05
PA of pole (deg) : 88.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.389
C/A sky separation (km) : 30665.7
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

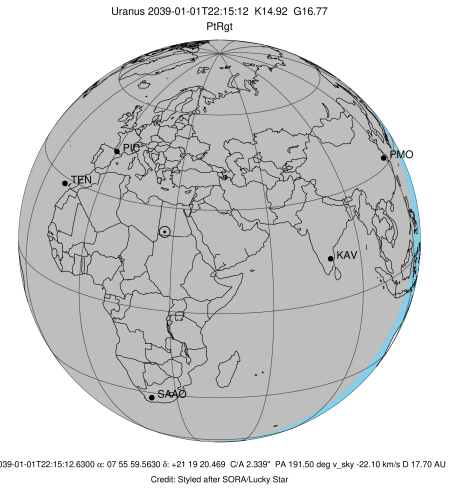
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-01T21:53:45.039		30.16	-45.81	50744.19	-22.75		
lambda	I	2039-01-01T21:54:16.700		30.27	-45.93	50026.71	-22.56		
delta	I	2039-01-01T21:55:34.086		30.55	-46.21	48300.35	-22.05		
gamma	I	2039-01-01T21:56:04.987		30.67	-46.32	47622.53	-21.82		
eta	I	2039-01-01T21:56:25.515		30.74	-46.40	47176.12	-21.67		
beta	I	2039-01-01T21:57:37.080		31.00	-46.66	45646.61	-21.11		
alpha	I	2039-01-01T21:58:22.193		31.17	-46.83	44696.16	-20.72		
4	I	2039-01-01T22:00:08.682		31.55	-47.22	42549.83	-19.68		
5	I	2039-01-01T22:00:27.785		31.62	-47.29	42170.43	-19.52		
6	I	2039-01-01T22:00:45.210		31.69	-47.35	41832.32	-19.31		

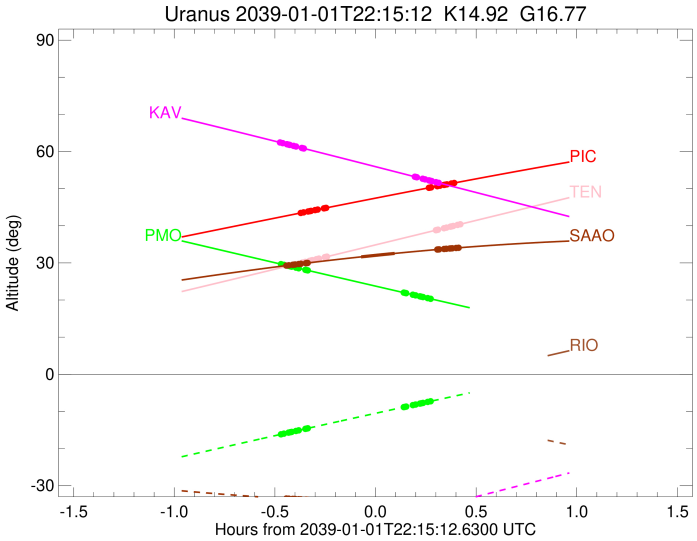
No planet occultations

6	E	2039-01-01T22:33:16.174		38.82	-54.51	41878.76	19.35		
5	E	2039-01-01T22:33:33.803		38.88	-54.57	42277.12	19.56		
4	E	2039-01-01T22:33:47.245		38.93	-54.62	42529.97	19.72		
alpha	E	2039-01-01T22:35:37.293		39.34	-55.03	44744.80	20.77		
beta	E	2039-01-01T22:36:21.591		39.50	-55.19	45676.07	21.17		
eta	E	2039-01-01T22:37:31.609		39.76	-55.45	47176.12	21.73		
gamma	E	2039-01-01T22:37:52.103		39.83	-55.52	47623.10	21.89		
delta	E	2039-01-01T22:38:22.886		39.94	-55.64	48300.35	22.11		
lambda	E	2039-01-01T22:39:40.030		40.23	-55.92	50026.71	22.64		
epsilon	E	2039-01-01T22:40:32.723		40.42	-56.11	51228.14	22.83		

Uranus_2039-01-01T22_15_12.6300_KAV.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:31:56 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2039-01-01T22:12:23.750
Event type : PtRgt
: Uranus occs: topocentric, not geoecetric
: 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 : 673940777460022272
2Mass ID (if available) : 07555956+2119206
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor) : 1.03
K magnitude : 14.923
G magnitude : 16.774
RP magnitude : 16.141
BP magnitude : 17.254
DUPflag : 0
Distance (au) : 17.700
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -22.10
Sun-Target sep (deg) : 163.96
Sun-Moon sep (deg) : 110.88
B (ring opening deg) : 50.05
PA of pole (deg) : 88.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.340
C/A sky separation (km) : 30038.2
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





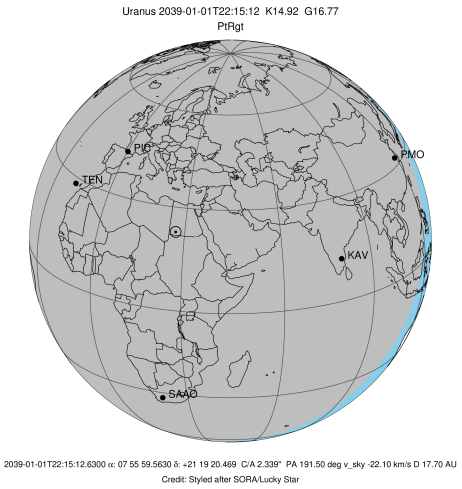
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-01T21:47:02.255		62.38	-46.35	50744.91	-23.25		
lambda	I	2039-01-01T21:47:33.250		62.26	-46.23	50026.71	-23.08		
delta	I	2039-01-01T21:48:48.861		61.97	-45.94	48300.35	-22.58		
gamma	I	2039-01-01T21:49:19.016		61.86	-45.82	47622.64	-22.37		
eta	I	2039-01-01T21:49:39.045		61.78	-45.75	47176.12	-22.22		
beta	I	2039-01-01T21:50:48.797		61.52	-45.48	45646.22	-21.68		
alpha	I	2039-01-01T21:51:32.683		61.35	-45.31	44695.42	-21.31		
4	I	2039-01-01T21:53:15.938		60.96	-44.92	42551.09	-20.32		
5	I	2039-01-01T21:53:34.560		60.89	-44.85	42168.96	-20.17		
6	I	2039-01-01T21:53:51.342		60.82	-44.78	41830.97	-19.97		

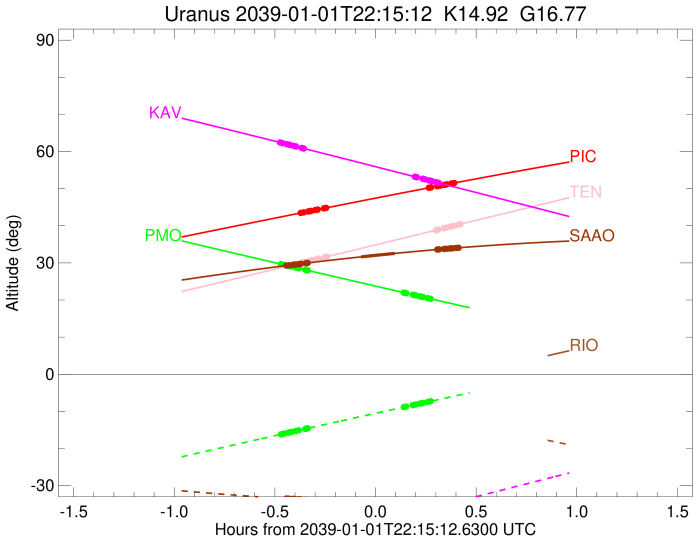
No planet occultations

6	E	2039-01-01T22:26:58.873		53.20	-37.17	41878.89	19.94		
5	E	2039-01-01T22:27:16.000		53.14	-37.11	42278.11	20.14		
4	E	2039-01-01T22:27:29.028		53.09	-37.06	42530.24	20.29		
alpha	E	2039-01-01T22:29:16.275		52.67	-36.65	44745.05	21.27		
beta	E	2039-01-01T22:29:59.557		52.50	-36.48	45676.22	21.64		
eta	E	2039-01-01T22:31:08.105		52.24	-36.22	47176.12	22.18		
gamma	E	2039-01-01T22:31:28.197		52.16	-36.14	47623.14	22.32		
delta	E	2039-01-01T22:31:58.393		52.04	-36.03	48300.35	22.53		
lambda	E	2039-01-01T22:33:14.170		51.75	-35.74	50026.71	23.02		
epsilon	E	2039-01-01T22:34:06.133		51.55	-35.54	51231.24	23.20		

Uranus_2039-01-01T22_15_12.6300_SAAO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:40:33 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2039-01-01T22:16:00.770
Event type              : PtRgt
: Uranus occs: topocentric, not geoecetric
: Ring occs: geocentric, topocentric
Observer code           : SAAO
Location                : So. Afr. Astro. Obs. (Sutherland)
Latitude (deg)          : -32.37953
E. Longitude (deg)      :  20.81070
Altitude (km)           :   1.768
Gaia source ID          : 673940777460022272
2Mass ID (if available) : 07555956+2119206
ICRS Star Coord at Epoch: 07h 55m 59.56301s +21:19:20.46900s
RUWE (>1.4 is poor)     :   1.03
K magnitude             : 14.923
G magnitude             : 16.774
RP magnitude            : 16.141
BP magnitude            : 17.254
DUPflag                 : 0
Distance (au)           : 17.700
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -22.10
Sun-Target sep (deg)    :  163.96
Sun-Moon sep (deg)      :  110.89
B (ring opening deg)    :   50.05
PA of pole (deg)        :   88.37
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   1.918
C/A sky separation (km) :  24619.8
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	2039-01-01T21:48:54.033		29.31	-33.49	50752.03	-25.22		
lambda	I	2039-01-01T21:49:22.829		29.36	-33.52	50026.71	-25.13		
delta	I	2039-01-01T21:50:31.935		29.49	-33.57	48300.35	-24.83		
gamma	I	2039-01-01T21:50:59.279		29.54	-33.60	47623.19	-24.70		
eta	I	2039-01-01T21:51:17.412		29.58	-33.61	47176.12	-24.61		
beta	I	2039-01-01T21:52:20.134		29.69	-33.66	45644.43	-24.29		
alpha	I	2039-01-01T21:52:59.163		29.77	-33.70	44691.96	-24.07		
4	I	2039-01-01T21:54:29.294		29.93	-33.77	42557.99	-23.49		
5	I	2039-01-01T21:54:45.971		29.96	-33.78	42162.34	-23.41		
6	I	2039-01-01T21:55:00.056		29.99	-33.79	41823.98	-23.28		
Uranus	I	2039-01-01T22:10:55.426		31.63	-34.40	25558.35		-1.60	-1.67
Uranus	E	2039-01-01T22:20:53.193		32.55	-34.65	25482.14		17.56	18.34
6	E	2039-01-01T22:33:40.462		33.60	-34.82	41879.73	23.31		
5	E	2039-01-01T22:33:55.329		33.62	-34.83	42289.33	23.43		
4	E	2039-01-01T22:34:06.231		33.64	-34.83	42534.21	23.52		
alpha	E	2039-01-01T22:35:39.967		33.76	-34.84	44748.09	24.10		
beta	E	2039-01-01T22:36:18.208		33.80	-34.84	45678.09	24.32		
eta	E	2039-01-01T22:37:19.498		33.88	-34.84	47176.12	24.64		
gamma	E	2039-01-01T22:37:37.630		33.90	-34.84	47623.80	24.73		
delta	E	2039-01-01T22:38:04.912		33.93	-34.85	48300.35	24.86		
lambda	E	2039-01-01T22:39:13.916		34.02	-34.85	50026.71	25.17		
epsilon	E	2039-01-01T22:40:03.634		34.08	-34.85	51283.04	25.26		