

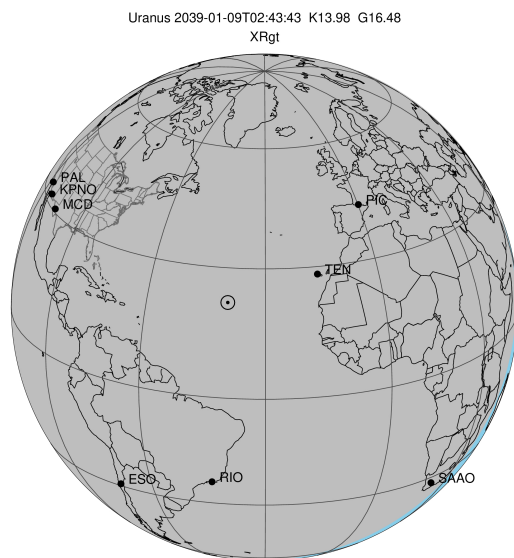
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-09T02:43:43.280  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 673757949292181888  
 2Mass ID (if available) : 07544285+2122503

ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s

RUWE (>1.4 is poor) : 1.38  
 K magnitude : 13.980  
 G magnitude : 16.480  
 RP magnitude : 15.689  
 BP magnitude : 17.102  
 DUPflag : 0  
 Distance (au) : 17.673  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.93  
 Sun-Target sep (deg) : 171.57  
 Sun-Moon sep (deg) : 24.11  
 B (ring opening deg) : 50.34  
 PA of pole (deg) : 88.18

# a(km) ring

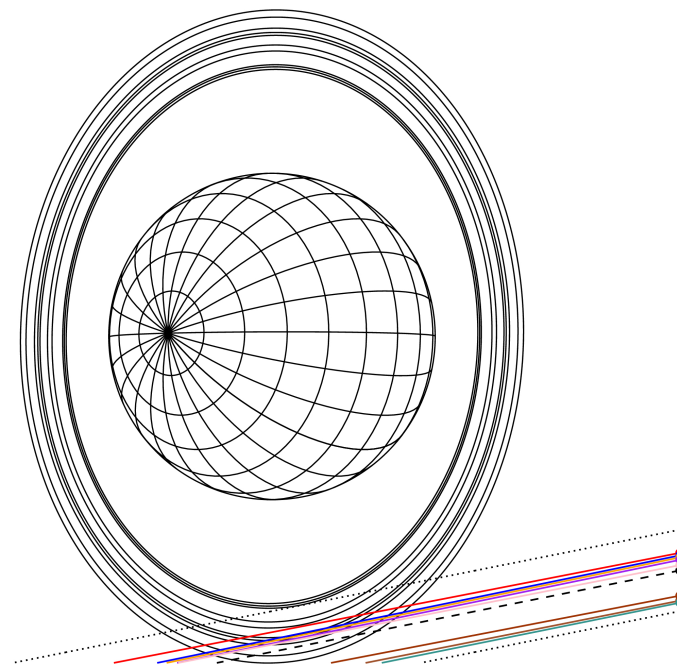
-----  
 1 41837.2 6  
 2 42235.0 5  
 3 42571.2 4  
 4 44718.5 alpha  
 5 45661.1 beta  
 6 47176.1 eta  
 7 47626.3 gamma  
 8 48300.3 delta  
 9 50026.7 lambda  
 10 51149.4 epsilon



2039-01-09T02:43:43.2800 α: 07 54 42.8475 s: +21 22 50.219 C/A 3.770° PA 11.29 deg v\_sky -22.93 km/s D 17.67 AU  
 Credit: Styled after SORA/Lucky Star

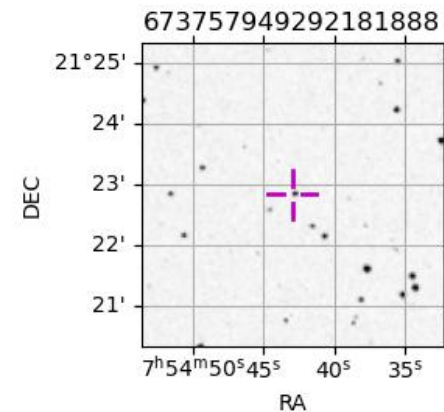
Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 RIO  
 ESO  
 SAAO

Uranus 2039-01-09T02:43:43 K13.98 G16.48 XRgt



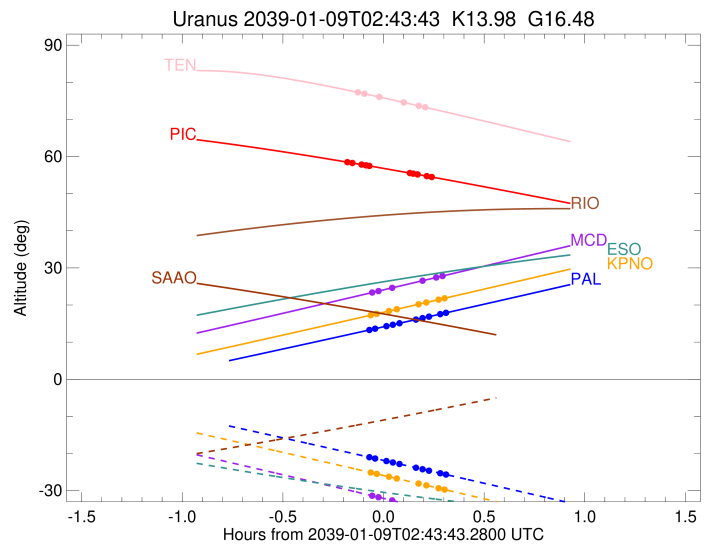
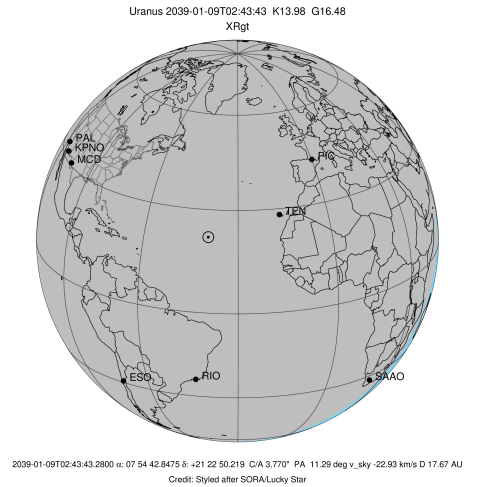
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	JAN 09 02:32 - JAN 09 02:58	PnnRie
PAL	Palomar Mt (200")	33.4	243.1	+++++		+++++	JAN 09 02:39 - JAN 09 03:02	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	++++		++++	JAN 09 02:39 - JAN 09 03:02	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++		+++	JAN 09 02:40 - JAN 09 03:01	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++		+++	JAN 09 02:35 - JAN 09 02:56	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
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					PnnRnn
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



```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2039-01-09T02:42:35.560
Event type           : XRgt
: No Uranus occs
: 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       : 673757949292181888
2Mass ID (if available) : 07544285+2122503
ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s
RUWE (>1.4 is poor) : 1.38
K magnitude          : 13.980
G magnitude          : 16.480
RP magnitude         : 15.689
BP magnitude         : 17.102
DUPflag             : 0
Distance (au)        : 17.673
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -22.93
Sun-Target sep (deg) : 171.57
Sun-Moon sep (deg)   : 24.68
B (ring opening deg) : 50.34
PA of pole (deg)     : 88.18
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.547
C/A sky separation (km) : 45460.7
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.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
  
```

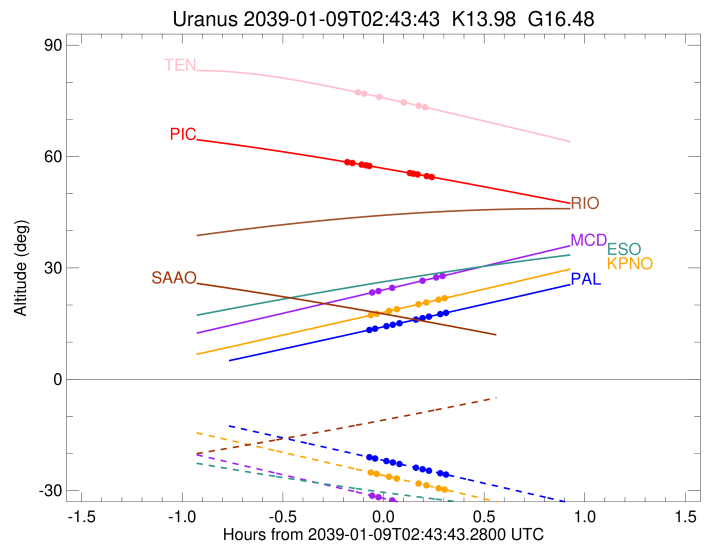
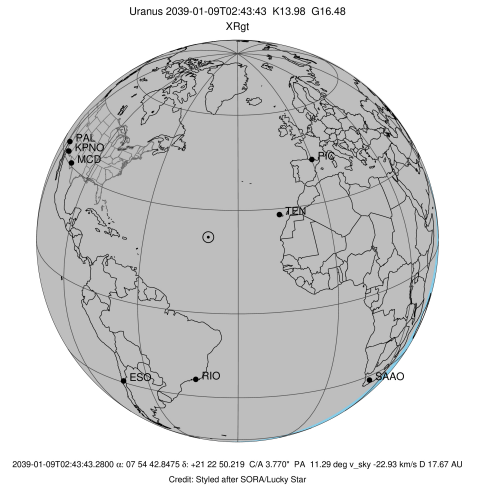


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-09T02:32:45.303		58.51	-53.29	51317.35	-13.50		
lambda	I	2039-01-09T02:34:27.979		58.25	-53.00	50026.71	-11.82		
delta	I	2039-01-09T02:37:11.751		57.83	-52.53	48300.35	-9.22		
gamma	I	2039-01-09T02:38:29.901		57.63	-52.31	47631.55	-7.89		
eta	I	2039-01-09T02:39:31.929		57.47	-52.13	47176.12	-6.79		

No planet occultations

eta	E	2039-01-09T02:51:31.660		55.56	-50.05	47176.12	6.79		
gamma	E	2039-01-09T02:52:33.657		55.39	-49.87	47631.10	7.88		
delta	E	2039-01-09T02:53:51.901		55.18	-49.64	48300.35	9.22		
lambda	E	2039-01-09T02:56:35.772		54.73	-49.16	50026.71	11.81		
epsilon	E	2039-01-09T02:58:35.633		54.40	-48.81	51546.79	13.49		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-09T02:47:45.920  
 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 : 673757949292181888  
 2Mass ID (if available) : 07544285+2122503  
 ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 13.980  
 G magnitude : 16.480  
 RP magnitude : 15.689  
 BP magnitude : 17.102  
 DUPflag : 0  
 Distance (au) : 17.673  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.93  
 Sun-Target sep (deg) : 171.57  
 Sun-Moon sep (deg) : 23.44  
 B (ring opening deg) : 50.34  
 PA of pole (deg) : 88.18  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.624  
 C/A sky separation (km) : 46455.0  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ura111.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ura111.bsp  
 ura161.bsp  
 vgr2.ura161.bsp  
 peph.ura160.bsp  
 earthstns\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

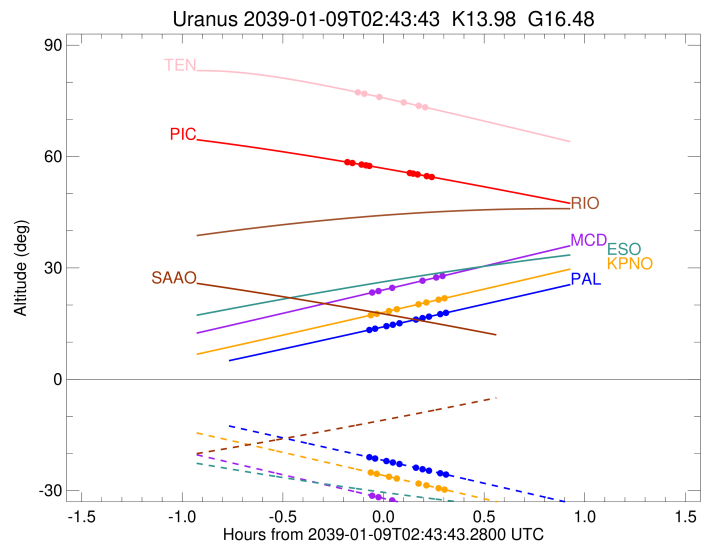
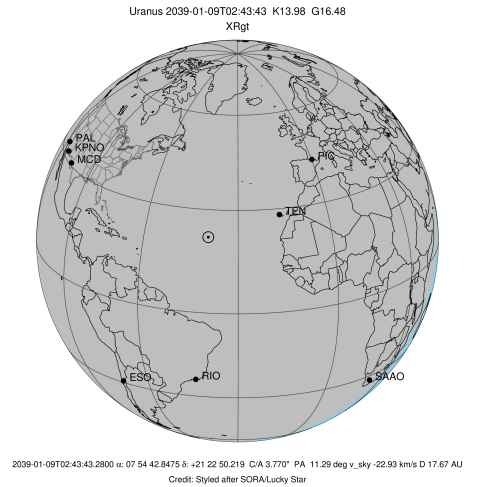


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-09T02:39:16.288		13.23	-20.95	51331.76	-12.07		
lambda	I	2039-01-09T02:41:14.784		13.63	-21.35	50026.71	-10.13		
delta	I	2039-01-09T02:44:37.686		14.31	-22.04	48300.35	-6.83		
gamma	I	2039-01-09T02:46:32.217		14.69	-22.43	47631.58	-4.83		
eta	I	2039-01-09T02:48:34.154		15.10	-22.84	47176.12	-2.63		

No planet occultations

eta	E	2039-01-09T02:53:18.355		16.06	-23.81	47176.12	2.63		
gamma	E	2039-01-09T02:55:20.177		16.47	-24.23	47631.32	4.84		
delta	E	2039-01-09T02:57:14.668		16.86	-24.62	48300.35	6.84		
lambda	E	2039-01-09T03:00:37.325		17.55	-25.31	50026.71	10.14		
epsilon	E	2039-01-09T03:02:53.076		18.01	-25.78	51541.52	12.09		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-09T02:47:44.810  
 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 : 673757949292181888  
 2Mass ID (if available) : 07544285+2122503  
 ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 13.980  
 G magnitude : 16.480  
 RP magnitude : 15.689  
 BP magnitude : 17.102  
 DUPflag : 0  
 Distance (au) : 17.673  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.93  
 Sun-Target sep (deg) : 171.57  
 Sun-Moon sep (deg) : 23.46  
 B (ring opening deg) : 50.34  
 PA of pole (deg) : 88.18  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.648  
 C/A sky separation (km) : 46755.8  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ura111.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ura111.bsp  
 ura161.bsp  
 vgr2.ura161.bsp  
 peph.ura160.bsp  
 earthstns\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



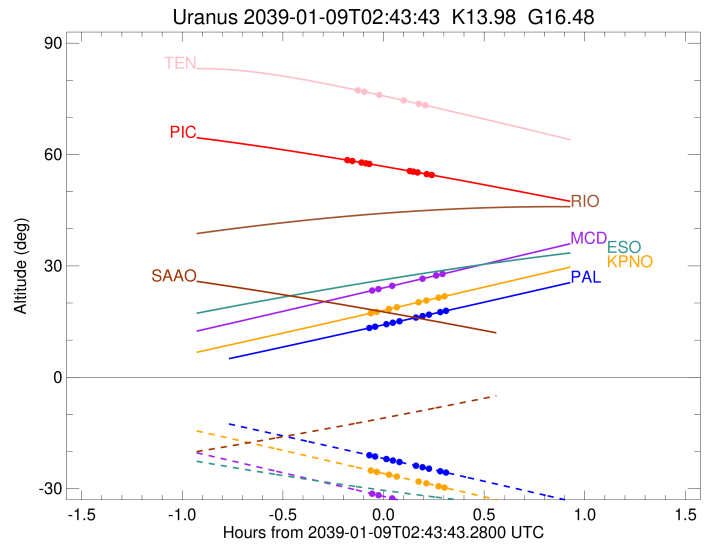
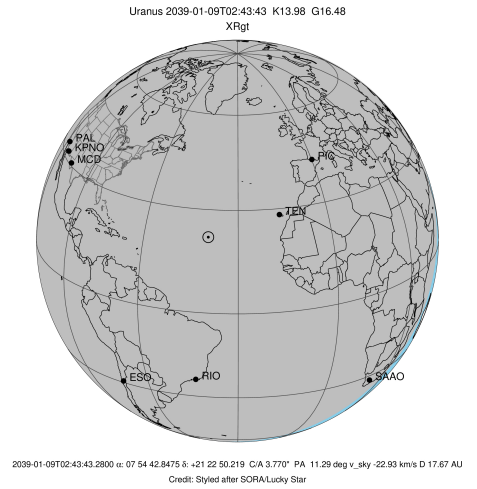
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-09T02:39:40.282		17.21	-25.07	51337.16	-11.69		
lambda	I	2039-01-09T02:41:44.131		17.63	-25.50	50026.71	-9.64		
delta	I	2039-01-09T02:45:23.855		18.39	-26.26	48300.35	-6.01		
gamma	I	2039-01-09T02:47:43.857		18.87	-26.75	47631.58	-3.52		

No planet occultations

gamma	E	2039-01-09T02:54:07.775		20.20	-28.09	47631.39	3.53		
delta	E	2039-01-09T02:56:27.739		20.68	-28.57	48300.35	6.02		
lambda	E	2039-01-09T03:00:07.219		21.44	-29.34	50026.71	9.65		
epsilon	E	2039-01-09T03:02:28.292		21.93	-29.83	51539.96	11.71		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2039-01-09T02:47:38.620  
 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 : 673757949292181888  
 2Mass ID (if available) : 07544285+2122503  
 ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s  
 RUWE (>1.4 is poor) : 1.38  
 K magnitude : 13.980  
 G magnitude : 16.480  
 RP magnitude : 15.689  
 BP magnitude : 17.102  
 DUPflag : 0  
 Distance (au) : 17.673  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.93  
 Sun-Target sep (deg) : 171.57  
 Sun-Moon sep (deg) : 23.52  
 B (ring opening deg) : 50.34  
 PA of pole (deg) : 88.18  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.675  
 C/A sky separation (km) : 47103.4  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ura111.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ura111.bsp  
 ura161.bsp  
 vgr2.ura161.bsp  
 peph.ura160.bsp  
 earthstns\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



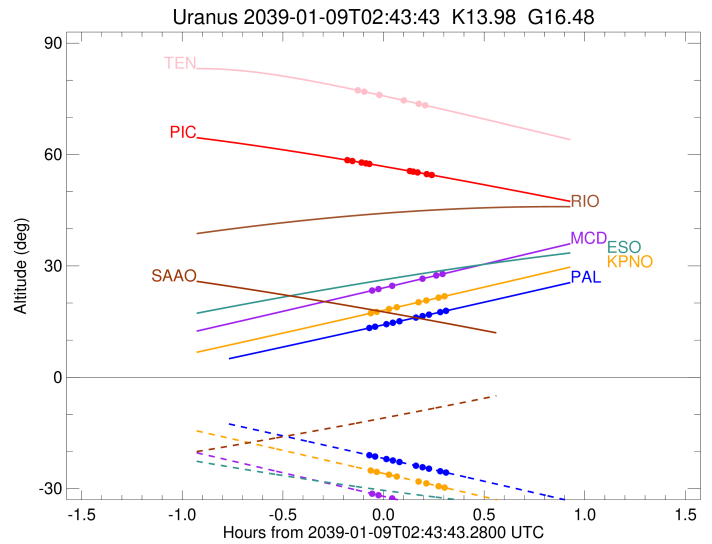
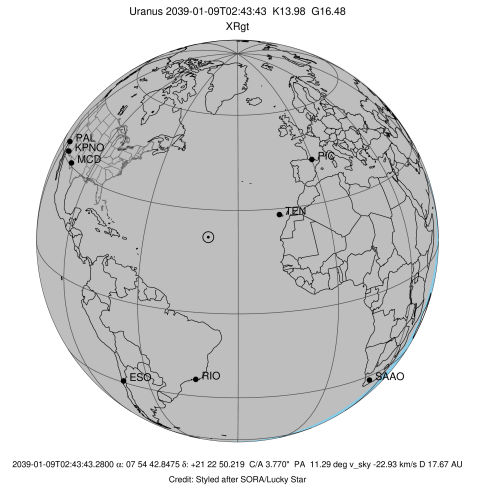
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2039-01-09T02:40:04.154		23.31	-31.31	51343.63	-11.24		
lambda	I	2039-01-09T02:42:15.117		23.77	-31.77	50026.71	-9.04		
delta	I	2039-01-09T02:46:21.823		24.64	-32.65	48300.35	-4.88		

No planet occultations

delta	E	2039-01-09T02:55:18.564		26.54	-34.56	48300.35	4.89		
lambda	E	2039-01-09T02:59:25.034		27.41	-35.44	50026.71	9.05		
epsilon	E	2039-01-09T03:01:53.179		27.94	-35.96	51538.01	11.26		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2039-01-09T02:43:04.170
Event type          : XRgt
: No Uranus occs
: 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      : 673757949292181888
2Mass ID (if available) : 07544285+2122503
ICRS Star Coord at Epoch: 07h 54m 42.84752s +21:22:50.21945s
RUWE (>1.4 is poor) : 1.38
K magnitude          : 13.980
G magnitude          : 16.480
RP magnitude         : 15.689
BP magnitude         : 17.102
DUPflag             : 0
Distance (au)       : 17.673
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -22.93
Sun-Target sep (deg) : 171.57
Sun-Moon sep (deg)  : 24.64
B (ring opening deg) : 50.34
PA of pole (deg)    : 88.18
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.696
C/A sky separation (km) : 47372.7
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.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  2039-01-09T02:35:47.221  77.35 -70.31  51350.53 -11.04
lambda    I  2039-01-09T02:38:02.414  76.91 -69.83  50026.71 -8.71
delta     I  2039-01-09T02:42:32.482  76.03 -68.86  48300.35 -3.99

No planet occultations

delta     E  2039-01-09T02:49:42.046  74.59 -67.31  48300.35  4.00
lambda    E  2039-01-09T02:54:12.171  73.67 -66.33  50026.71  8.71
epsilon   E  2039-01-09T02:56:44.447  73.15 -65.77  51537.50 11.04
  
```