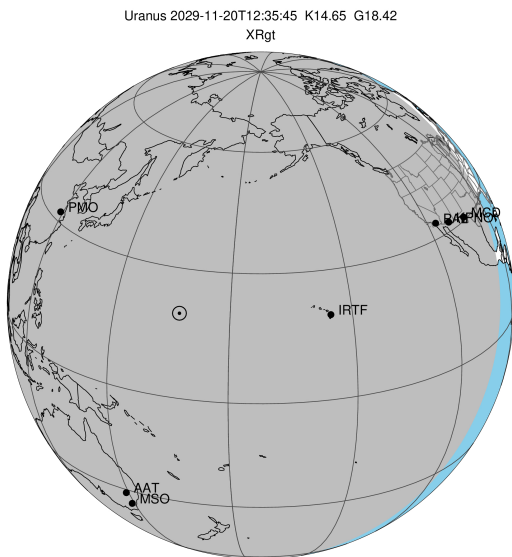


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-20T12:35:45.080  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3418331897854503808  
 2Mass ID (if available) : 05024642+2248486

ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s

RUWE (>1.4 is poor) : 1.00  
 K magnitude : 14.646  
 G magnitude : 18.415  
 RP magnitude : 17.302  
 BP magnitude : 19.589  
 DUPflag : 0  
 Distance (au) : 18.290  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.86  
 Sun-Target sep (deg) : 161.23  
 Sun-Moon sep (deg) : 25.94  
 B (ring opening deg) : 82.21  
 PA of pole (deg) : -11.60

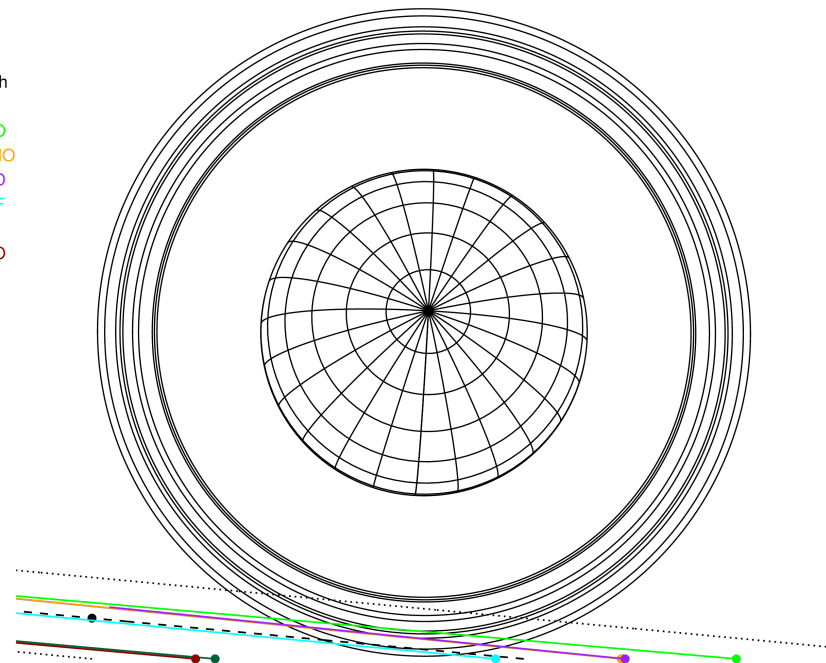
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2029-11-20T12:35:45.0800 ra: 05 02 46.4686 s: +22 48 48.3889 C/A 3.720° PA 354.61 deg v\_sky -21.86 km/s D 18.29 AU  
 Credit: Styled after SORA/Lucky Star

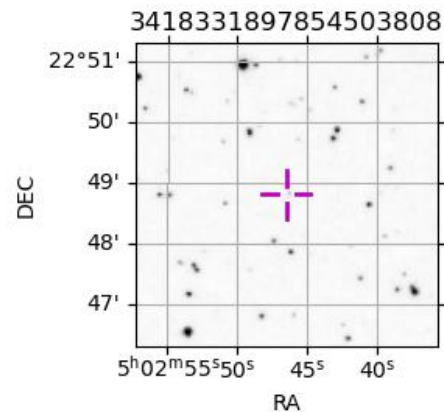
Uranus 2029-11-20T12:35:45 K14.65 G18.42 XRgt

Earth  
 PAL  
 PMO  
 KPNO  
 MCD  
 IRTF  
 AAT  
 MSO



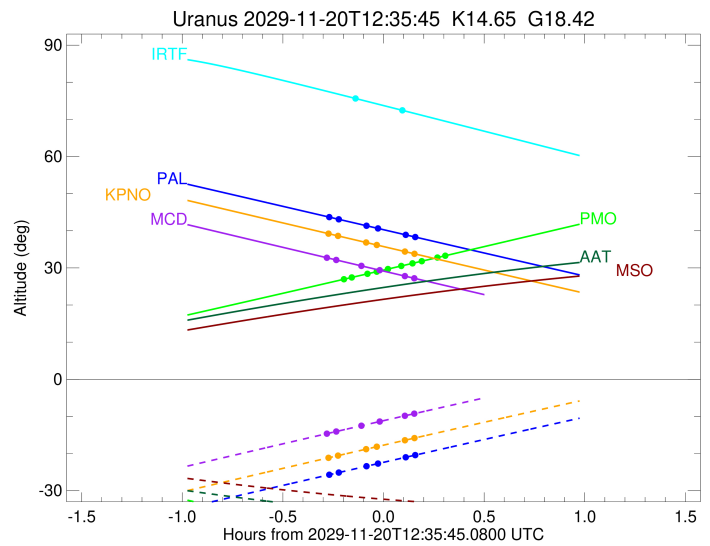
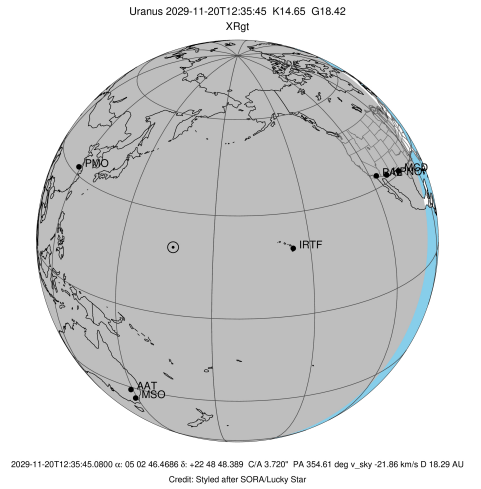
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++		+++	NOV 20 12:19 - NOV 20 12:44	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++		+++++	NOV 20 12:23 - NOV 20 12:53	PnnRie
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++		+++	NOV 20 12:19 - NOV 20 12:44	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++		+++	NOV 20 12:18 - NOV 20 12:44	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+		+	NOV 20 12:27 - NOV 20 12:40	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					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            : 2029-11-20T12:32:27.980
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      : 3418331897854503808
2Mass ID (if available) : 05024642+2248486
ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s
RUWE (>1.4 is poor) : 1.00
K magnitude          : 14.646
G magnitude          : 18.415
RP magnitude         : 17.302
BP magnitude         : 19.589
DUPflag             : 0
Distance (au)        : 18.290
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -21.86
Sun-Target sep (deg) : 161.23
Sun-Moon sep (deg)   : 26.75
B (ring opening deg) : 82.21
PA of pole (deg)     : -11.60
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.604
C/A sky separation (km) : 47805.9
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.bsp
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
  
```

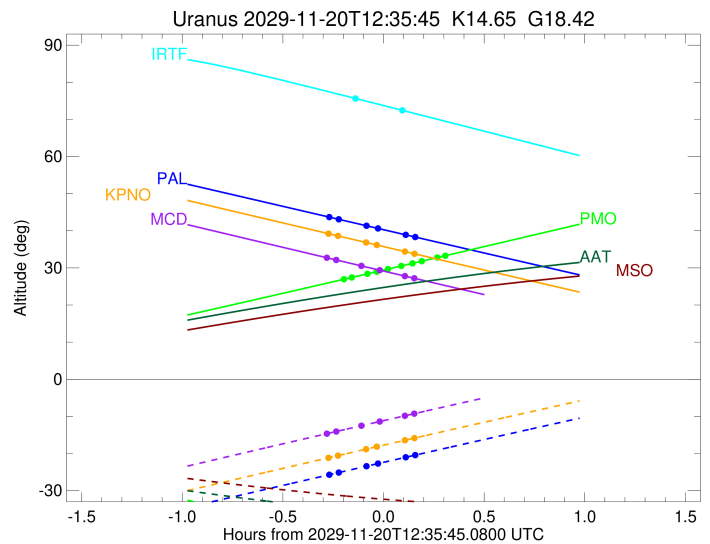
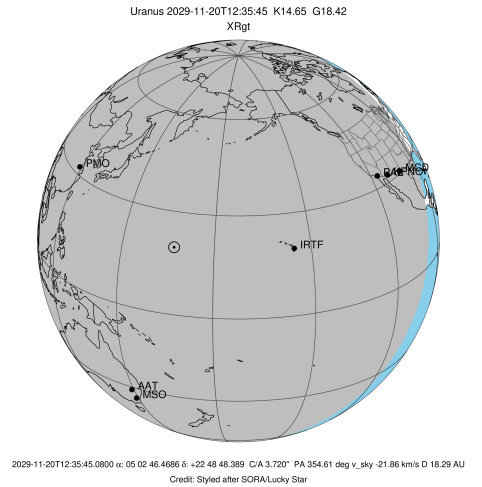


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-20T12:19:20.409		43.73	-25.77	51271.65	-7.30		
lambda	I	2029-11-20T12:22:27.594		43.08	-25.12	50026.71	-5.82		
delta	I	2029-11-20T12:30:55.839		41.30	-23.37	48300.35	-0.89		

No planet occultations

delta	E	2029-11-20T12:33:51.801		40.69	-22.77	48300.36	0.89		
lambda	E	2029-11-20T12:42:20.365		38.91	-21.02	50026.71	5.81		
epsilon	E	2029-11-20T12:44:50.986		38.39	-20.51	51003.15	7.29		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-11-20T12:39:08.530  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3418331897854503808  
 2Mass ID (if available) : 05024642+2248486  
 ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s  
 RUWE (>1.4 is poor) : 1.00  
 K magnitude : 14.646  
 G magnitude : 18.415  
 RP magnitude : 17.302  
 BP magnitude : 19.589  
 DUPflag : 0  
 Distance (au) : 18.290  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.86  
 Sun-Target sep (deg) : 161.23  
 Sun-Moon sep (deg) : 25.48  
 B (ring opening deg) : 82.21  
 PA of pole (deg) : -11.60  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.519  
 C/A sky separation (km) : 46673.8  
 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



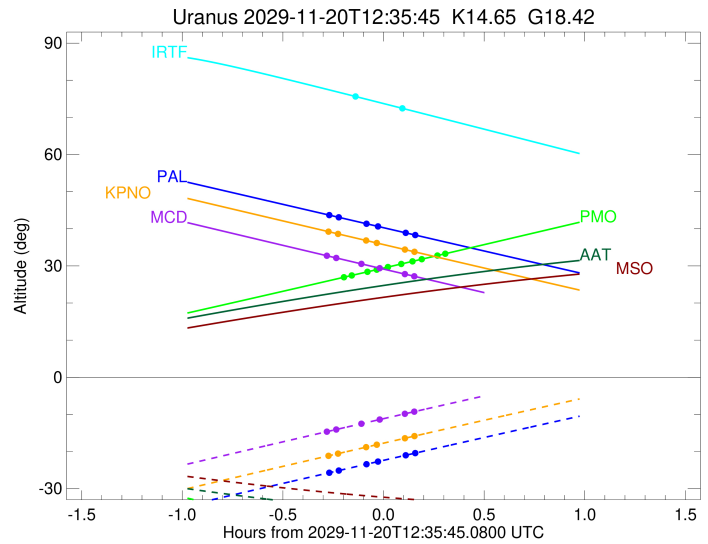
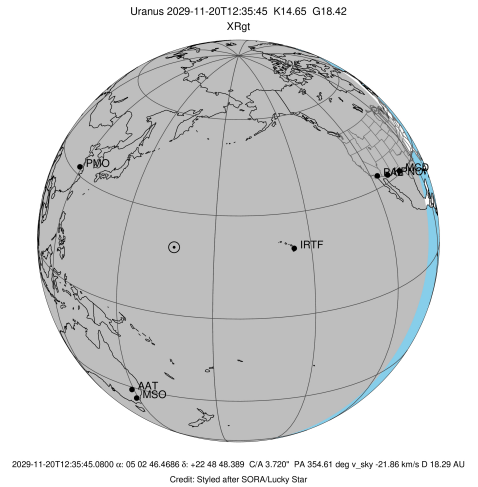
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-20T12:23:41.226		26.89	-42.41	51299.94	-8.54		
lambda	I	2029-11-20T12:26:19.482		27.44	-42.97	50026.71	-7.38		
delta	I	2029-11-20T12:31:00.994		28.42	-43.96	48300.35	-4.83		
gamma	I	2029-11-20T12:33:48.273		29.00	-44.55	47626.82	-3.21		
eta	I	2029-11-20T12:37:17.460		29.73	-45.29	47176.12	-1.09		

No planet occultations

eta	E	2029-11-20T12:40:50.519		30.48	-46.05	47176.12	1.09		
gamma	E	2029-11-20T12:44:20.059		31.21	-46.78	47628.33	3.21		
delta	E	2029-11-20T12:47:06.700		31.80	-47.37	48300.35	4.84		
lambda	E	2029-11-20T12:51:47.762		32.78	-48.36	50026.71	7.40		
epsilon	E	2029-11-20T12:53:48.794		33.21	-48.79	50984.16	8.56		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch             : 2029-11-20T12:32:13.920
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        : 3418331897854503808
2Mass ID (if available) : 05024642+2248486
ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s
RUWE (>1.4 is poor) : 1.00
K magnitude           : 14.646
G magnitude           : 18.415
RP magnitude          : 17.302
BP magnitude          : 19.589
DUPflag               : 0
Distance (au)         : 18.290
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -21.86
Sun-Target sep (deg) : 161.23
Sun-Moon sep (deg)   : 26.77
B (ring opening deg) : 82.21
PA of pole (deg)     : -11.60
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.604
C/A sky separation (km) : 47813.5
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



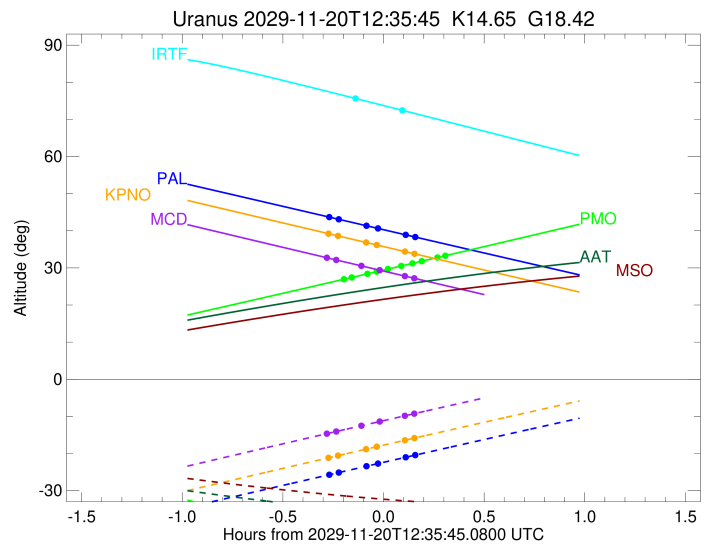
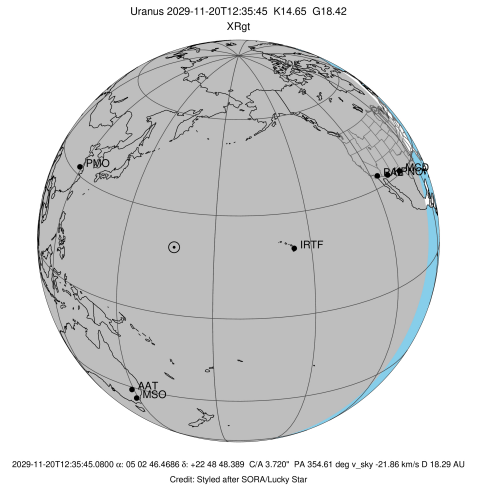
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-20T12:19:06.516		39.28	-21.21	51271.26	-7.29		
lambda	I	2029-11-20T12:22:14.158		38.61	-20.56	50026.71	-5.80		
delta	I	2029-11-20T12:30:50.839		36.79	-18.77	48300.36	-0.80		

No planet occultations

delta	E	2029-11-20T12:33:28.697		36.23	-18.22	48300.36	0.80		
lambda	E	2029-11-20T12:42:05.726		34.41	-16.44	50026.71	5.79		
epsilon	E	2029-11-20T12:44:36.782		33.88	-15.92	51003.13	7.28		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-11-20T12:31:57.500
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       : 3418331897854503808
2Mass ID (if available) : 05024642+2248486
ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s
RUWE (>1.4 is poor) : 1.00
K magnitude          : 14.646
G magnitude           : 18.415
RP magnitude         : 17.302
BP magnitude         : 19.589
DUPflag              : 0
Distance (au)        : 18.290
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -21.86
Sun-Target sep (deg) : 161.23
Sun-Moon sep (deg)   : 26.78
B (ring opening deg) : 82.21
PA of pole (deg)     : -11.60
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.598
C/A sky separation (km) : 47725.2
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_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



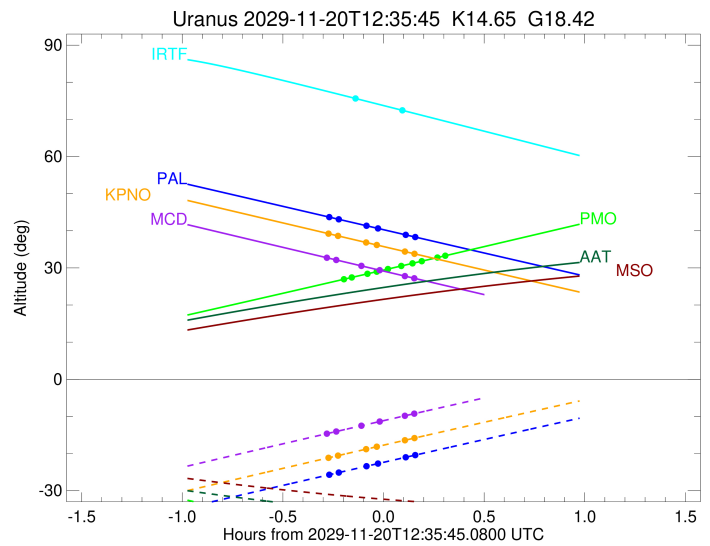
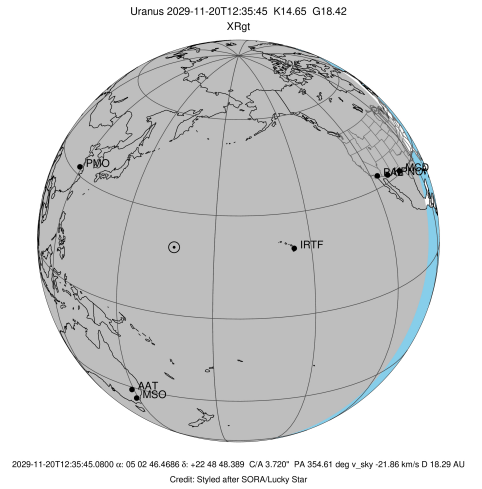
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-11-20T12:18:37.239		32.79	-14.71	51273.01	-7.38		
lambda	I	2029-11-20T12:21:42.002		32.13	-14.07	50026.71	-5.93		
delta	I	2029-11-20T12:29:18.577		30.51	-12.49	48300.35	-1.55		

No planet occultations

delta	E	2029-11-20T12:34:28.203		29.42	-11.42	48300.35	1.55		
lambda	E	2029-11-20T12:42:05.160		27.80	-9.85	50026.71	5.92		
epsilon	E	2029-11-20T12:44:33.295		27.28	-9.34	51000.90	7.37		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-11-20T12:34:28.090
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      : 3418331897854503808
2Mass ID (if available) : 05024642+2248486
ICRS Star Coord at Epoch: 05h 02m 46.46864s +22:48:48.38892s
RUWE (>1.4 is poor) : 1.00
K magnitude          : 14.646
G magnitude          : 18.415
RP magnitude         : 17.302
BP magnitude         : 19.589
DUPflag             : 0
Distance (au)        : 18.290
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -21.86
Sun-Target sep (deg) : 161.23
Sun-Moon sep (deg)  : 26.55
B (ring opening deg) : 82.21
PA of pole (deg)    : -11.60
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.757
C/A sky separation (km) : 49831.6
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.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  2029-11-20T12:27:12.780  75.68 -57.21  51211.56  -4.00
  
```

No planet occultations

```

epsilon   E  2029-11-20T12:40:58.003  72.54 -53.99  51065.55  4.00
  
```