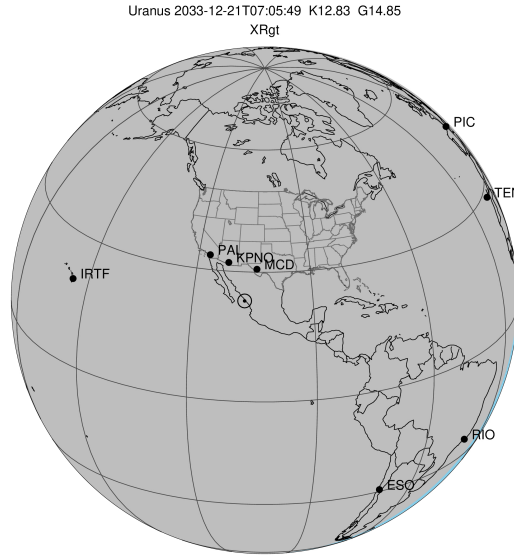


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-21T07:05:49.060  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3425571602105888256  
 2Mass ID (if available) : 06162676+2339237

ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s

RUWE (>1.4 is poor) : 1.02  
 K magnitude : 12.833  
 G magnitude : 14.847  
 RP magnitude : 14.167  
 BP magnitude : 15.379  
 DUPflag : 0  
 Distance (au) : 17.973  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.32  
 Sun-Target sep (deg) : 175.47  
 Sun-Moon sep (deg) : 168.58  
 B (ring opening deg) : 72.05  
 PA of pole (deg) : 64.85

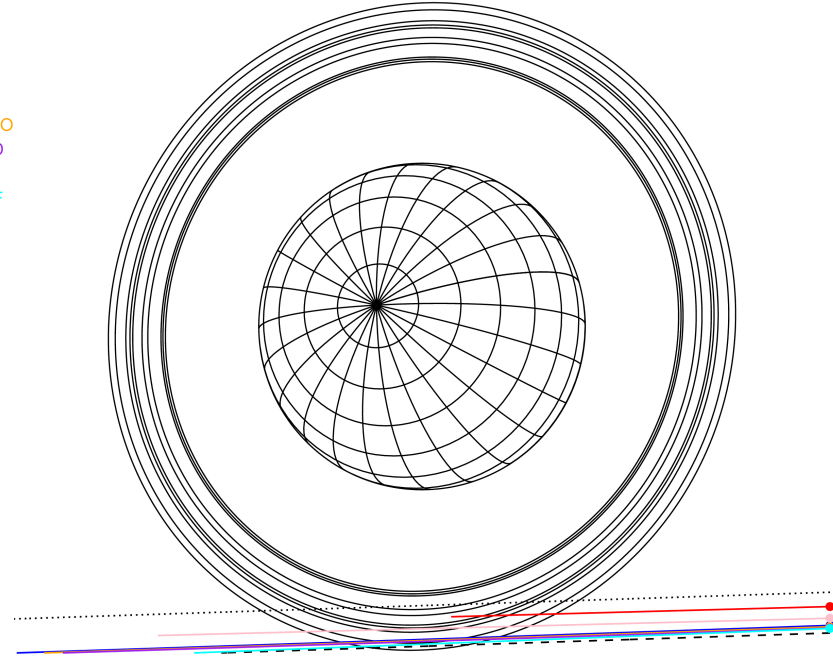
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2033-12-21T07:05:49.0600 au: 06 16 26.7606 s: +23 39 23.473 C/A 3.833° PA 1.87 deg v\_sky -23.32 km/s D 17.97 AU  
 Credit: Styled after SORA/Lucky Star

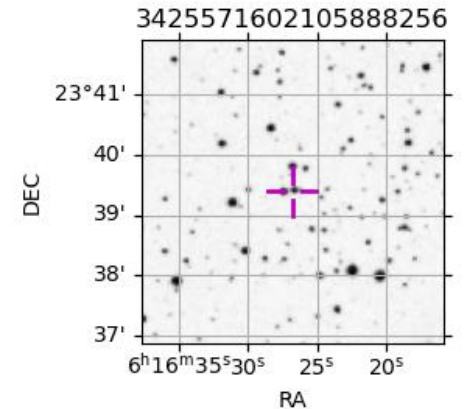
Uranus 2033-12-21T07:05:49 K12.83 G14.85 XRgt

PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF



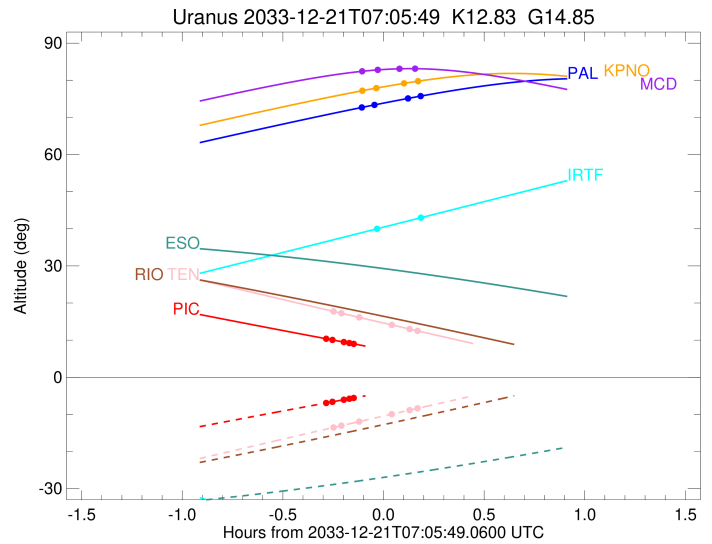
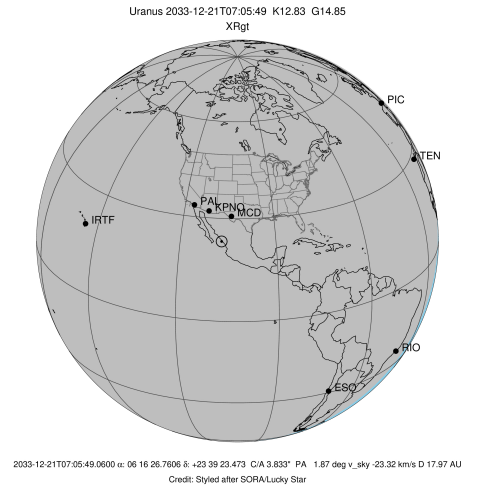
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++			DEC 21 06:48 - DEC 21 06:56	PnnRin
PAL	Palomar Mt (200")	33.4	243.1	++		++	DEC 21 06:58 - DEC 21 07:17	PnnRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	++		++	DEC 21 06:58 - DEC 21 07:17	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	++		++	DEC 21 06:58 - DEC 21 07:16	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++		+++	DEC 21 06:50 - DEC 21 07:16	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5	+		+	DEC 21 07:03 - DEC 21 07:18	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            : 2033-12-21T07:02:50.320
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      : 3425571602105888256
2Mass ID (if available) : 06162676+2339237
ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s
RUWE (>1.4 is poor) : 1.02
K magnitude         : 12.833
G magnitude         : 14.847
RP magnitude        : 14.167
BP magnitude        : 15.379
DUPflag            : 0
Distance (au)       : 17.973
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.32
Sun-Target sep (deg) : 175.47
Sun-Moon sep (deg)  : 169.46
B (ring opening deg) : 72.05
PA of pole (deg)    : 64.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.496
C/A sky separation (km) : 45567.2
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.bsp
earthstns_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



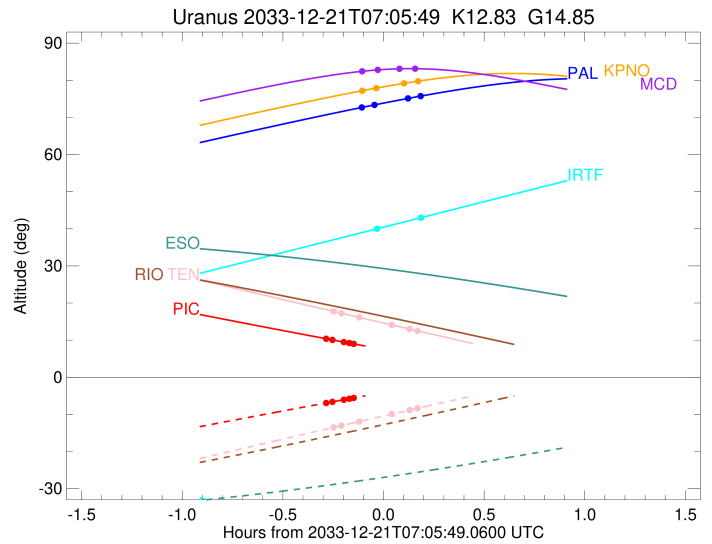
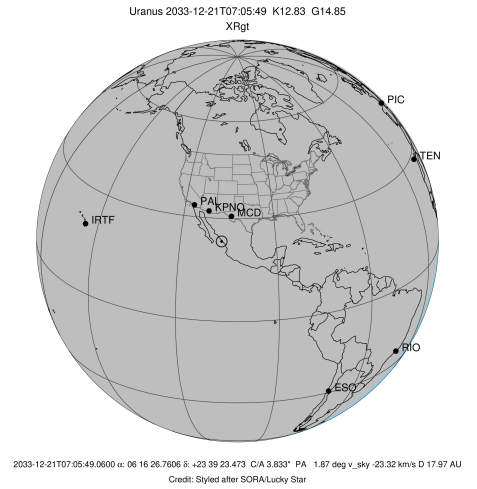
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-21T06:48:26.441		10.43	-6.97	51347.00	-10.89		
lambda	I	2033-12-21T06:50:36.860		10.06	-6.61	50026.71	-9.49		
delta	I	2033-12-21T06:54:01.489		9.48	-6.05	48300.35	-7.34		
gamma	I	2033-12-21T06:55:39.939		9.20	-5.78	47631.57	-6.23		
eta	I	2033-12-21T06:56:58.783		8.98	-5.57	47176.12	-5.31		

No planet occultations

eta	E	2033-12-21T07:11:14.470		6.61	-3.26x	47176.12	5.31		
gamma	E	2033-12-21T07:12:33.252		6.39	-3.05x	47630.73	6.23		
delta	E	2033-12-21T07:14:11.945		6.12	-2.79x	48300.35	7.34		
lambda	E	2033-12-21T07:17:36.862		5.56	-2.24x	50026.71	9.48		
epsilon	E	2033-12-21T07:20:06.472		5.15	-1.85x	51551.91	10.87		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-21T07:06:46.250
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      : 3425571602105888256
2Mass ID (if available) : 06162676+2339237
ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s
RUWE (>1.4 is poor) : 1.02
K magnitude         : 12.833
G magnitude         : 14.847
RP magnitude        : 14.167
BP magnitude        : 15.379
DUPflag            : 0
Distance (au)       : 17.973
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.32
Sun-Target sep (deg) : 175.47
Sun-Moon sep (deg)  : 168.64
B (ring opening deg) : 72.05
PA of pole (deg)    : 64.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.758
C/A sky separation (km) : 48986.5
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.bsp
earthstns_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```

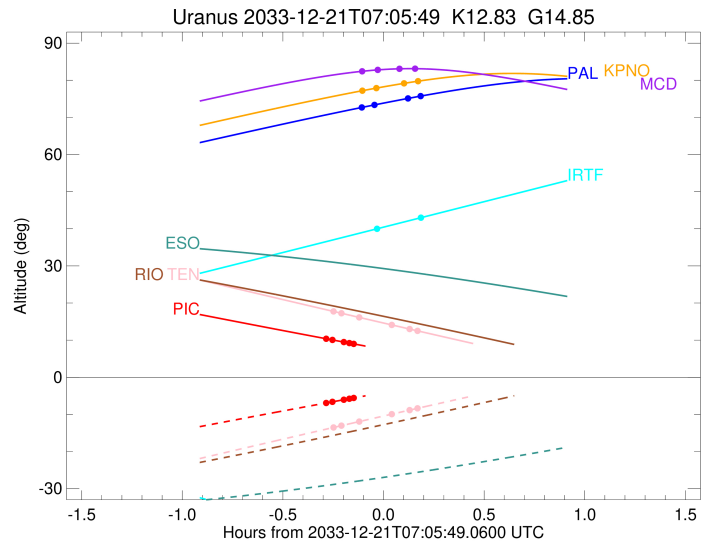
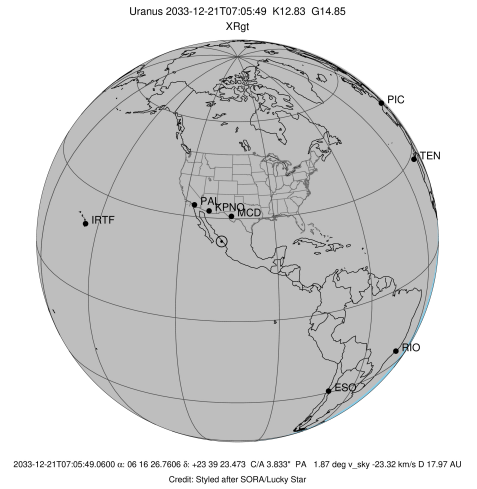


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-21T06:58:43.354		72.57	-75.84	51407.19	-6.81		
lambda	I	2033-12-21T07:03:11.145		73.38	-76.53	50026.71	-3.60		

No planet occultations

lambda	E	2033-12-21T07:13:03.942		75.10	-77.92	50026.71	3.60		
epsilon	E	2033-12-21T07:17:50.449		75.89	-78.51	51534.51	6.82		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-21T07:06:27.530  
 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 : 3425571602105888256  
 2Mass ID (if available) : 06162676+2339237  
 ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s  
 RUWE (>1.4 is poor) : 1.02  
 K magnitude : 12.833  
 G magnitude : 14.847  
 RP magnitude : 14.167  
 BP magnitude : 15.379  
 DUPflag : 0  
 Distance (au) : 17.973  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.32  
 Sun-Target sep (deg) : 175.47  
 Sun-Moon sep (deg) : 168.70  
 B (ring opening deg) : 72.05  
 PA of pole (deg) : 64.85  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.771  
 C/A sky separation (km) : 49162.1  
 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\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



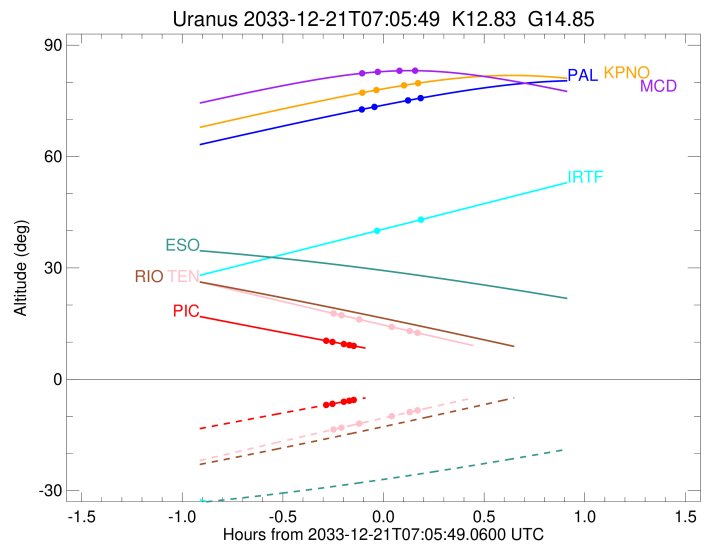
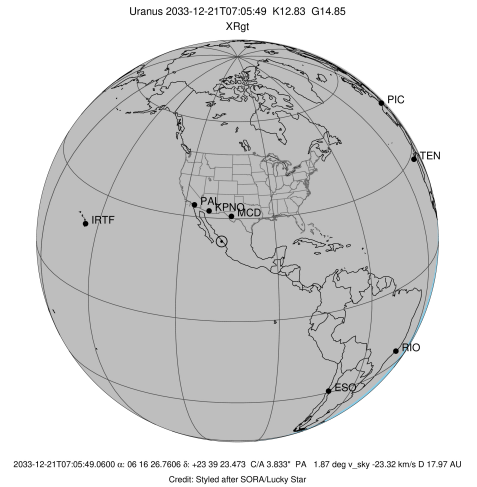
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-21T06:58:50.555		77.08	-79.90	51411.35	-6.51		
lambda	I	2033-12-21T07:03:46.026		77.91	-80.47	50026.71	-2.95		

No planet occultations

lambda	E	2033-12-21T07:11:52.002		79.17	-81.19	50026.71	2.96		
epsilon	E	2033-12-21T07:17:06.188		79.89	-81.48	51532.94	6.52		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-21T07:05:59.170
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       : 3425571602105888256
2Mass ID (if available) : 06162676+2339237
ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s
RUWE (>1.4 is poor) : 1.02
K magnitude           : 12.833
G magnitude           : 14.847
RP magnitude          : 14.167
BP magnitude          : 15.379
DUPflag              : 0
Distance (au)        : 17.973
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -23.32
Sun-Target sep (deg) : 175.47
Sun-Moon sep (deg)   : 168.78
B (ring opening deg) : 72.05
PA of pole (deg)     : 64.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.782
C/A sky separation (km) : 49306.7
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_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



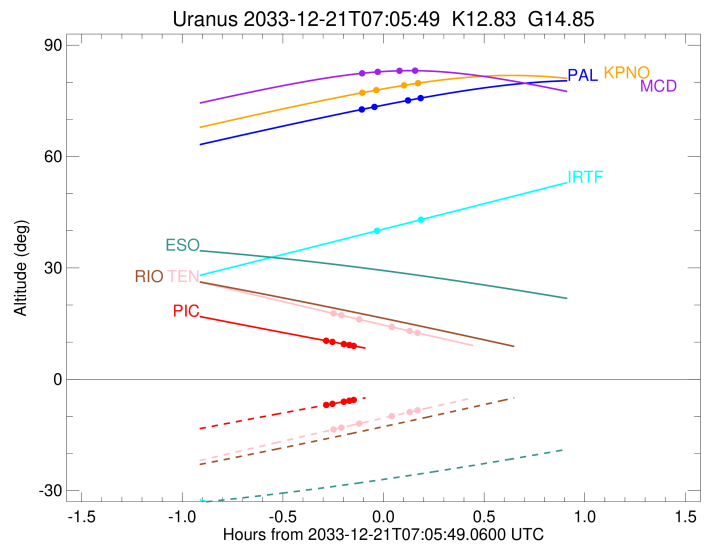
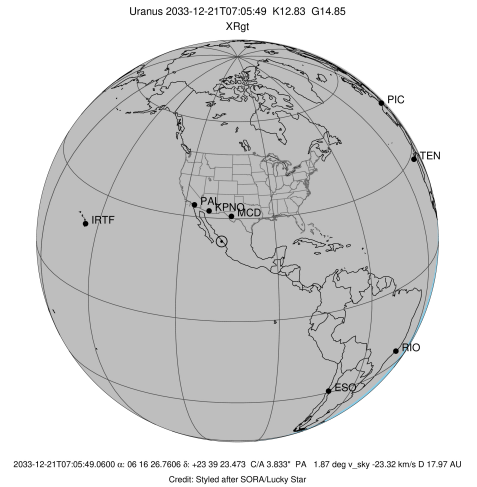
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-21T06:58:44.309		82.35	-82.86	51414.97	-6.26		
lambda	I	2033-12-21T07:04:12.536		82.81	-82.58	50026.71	-2.29		

No planet occultations

lambda	E	2033-12-21T07:10:28.972		83.10	-82.05	50026.71	2.29		
epsilon	E	2033-12-21T07:16:15.920		83.12	-81.39	51531.60	6.26		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-21T07:02:07.470
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      : 3425571602105888256
2Mass ID (if available) : 06162676+2339237
ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s
RUWE (>1.4 is poor) : 1.02
K magnitude         : 12.833
G magnitude         : 14.847
RP magnitude        : 14.167
BP magnitude        : 15.379
DUPflag            : 0
Distance (au)       : 17.973
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.32
Sun-Target sep (deg) : 175.47
Sun-Moon sep (deg)  : 169.51
B (ring opening deg) : 72.05
PA of pole (deg)    : 64.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.630
C/A sky separation (km) : 47321.0
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.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

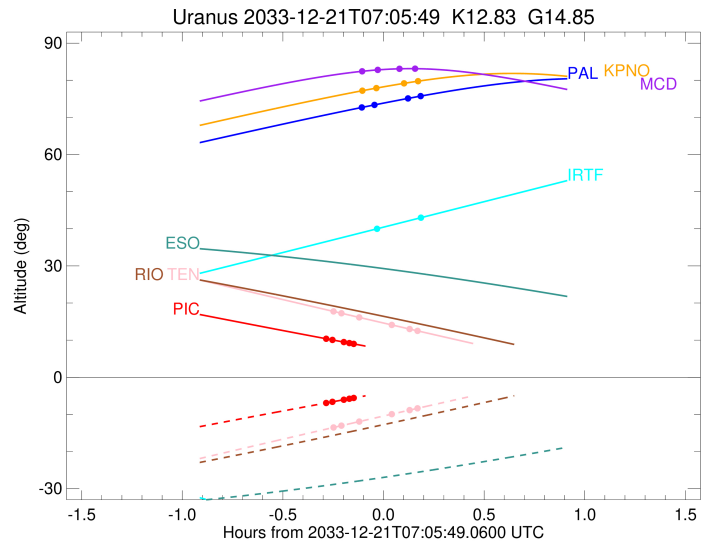
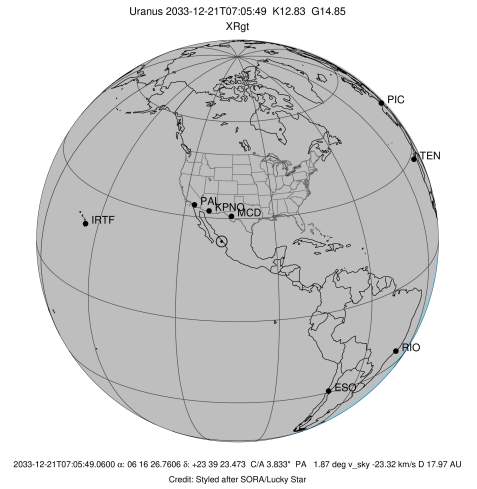
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-21T06:50:31.054		17.82	-13.61	51376.50	-9.08		
lambda	I	2033-12-21T06:53:18.325		17.24	-13.03	50026.71	-7.19		
delta	I	2033-12-21T06:58:39.014		16.11	-11.92	48300.35	-3.51		

No planet occultations

delta	E	2033-12-21T07:08:13.371		14.11	-9.95	48300.35	3.51		
lambda	E	2033-12-21T07:13:34.408		13.00	-8.86	50026.71	7.18		
epsilon	E	2033-12-21T07:16:40.809		12.36	-8.22	51546.23	9.06		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-21T07:09:02.760
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      : 3425571602105888256
2Mass ID (if available) : 06162676+2339237
ICRS Star Coord at Epoch: 06h 16m 26.76063s +23:39:23.47282s
RUWE (>1.4 is poor) : 1.02
K magnitude         : 12.833
G magnitude         : 14.847
RP magnitude        : 14.167
BP magnitude        : 15.379
DUPflag            : 0
Distance (au)       : 17.973
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -23.32
Sun-Target sep (deg) : 175.47
Sun-Moon sep (deg)  : 168.11
B (ring opening deg) : 72.05
PA of pole (deg)    : 64.85
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.815
C/A sky separation (km) : 49727.3
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.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	2033-12-21T07:03:00.295		39.79	-44.28	51424.30	-5.36		

No planet occultations

epsilon	E	2033-12-21T07:18:10.902		43.26	-47.74	51525.68	5.36		
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