

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-28T07:00:12.480  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110

ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s

RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 7.65  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55

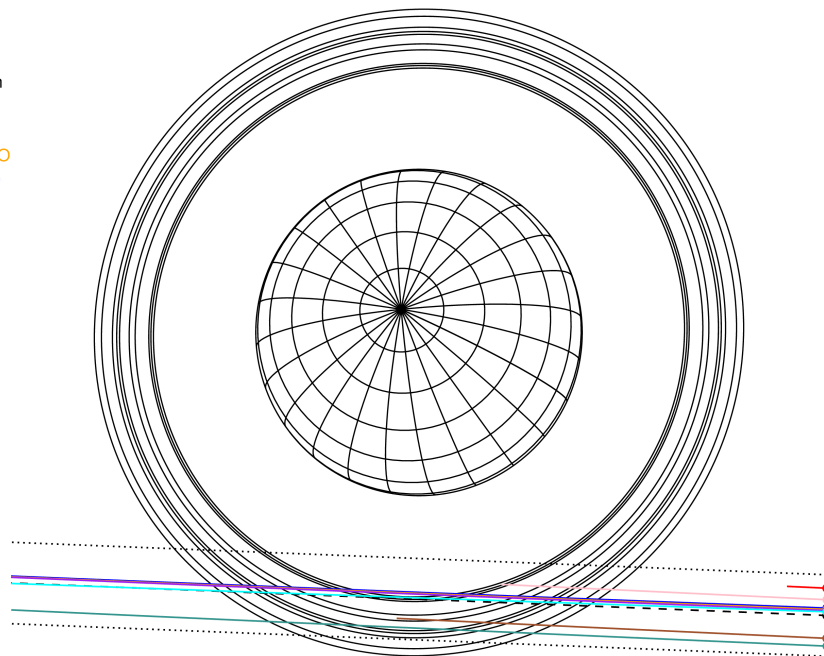
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-12-28T07:00:12.4800 α: 05 35 10.7644 δ: +23 28 10.749 C/A 3.169° PA 357.72 deg v\_sky -22.83 km/s D 18.12 AU  
 Credit: Styled after SORA/Lucky Star

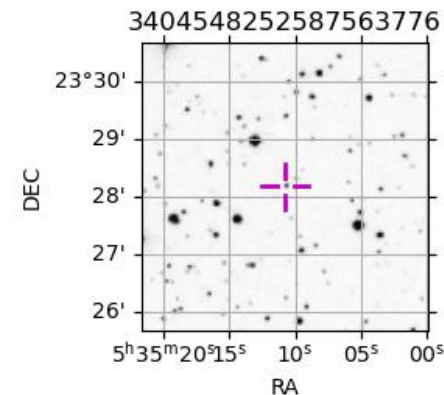
Uranus 2031-12-28T07:00:12 K14.14 G16.86 XRgt

Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO

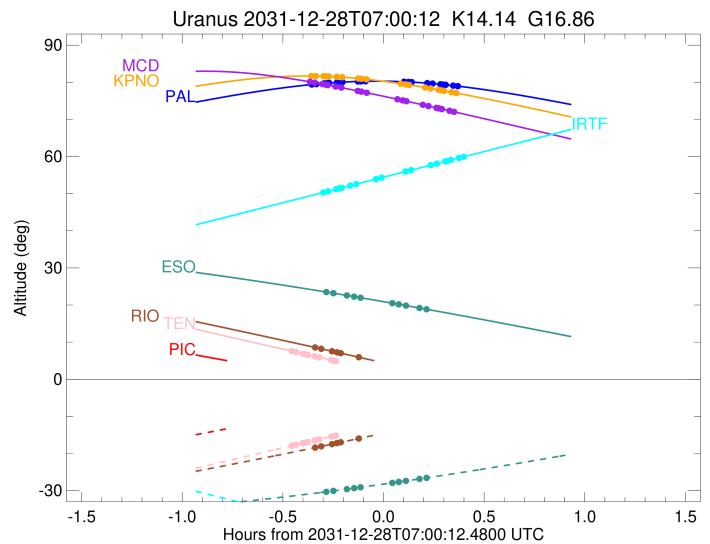
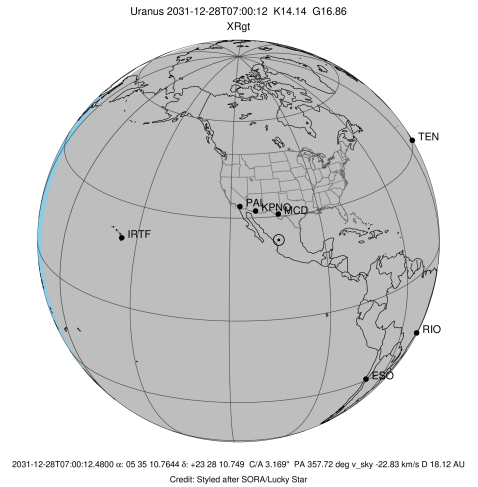


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++		+++++	DEC 28 06:38 - DEC 28 07:22	PnnRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++		+++++	DEC 28 06:38 - DEC 28 07:21	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++		+++++	DEC 28 06:37 - DEC 28 07:21	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++			DEC 28 06:32 - DEC 28 06:45	PnnRin
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++		+++++	DEC 28 06:41 - DEC 28 07:24	PnnRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++			DEC 28 06:39 - DEC 28 06:52	PnnRin
ESO	European Southern Obs	-29.3	289.3	+++++		+++++	DEC 28 06:42 - DEC 28 07:13	PnnRie
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 : 2031-12-28T07:00:07.940  
 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 : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110  
 ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 7.84  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.095  
 C/A sky separation (km) : 40669.3  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ural11.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ural11.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



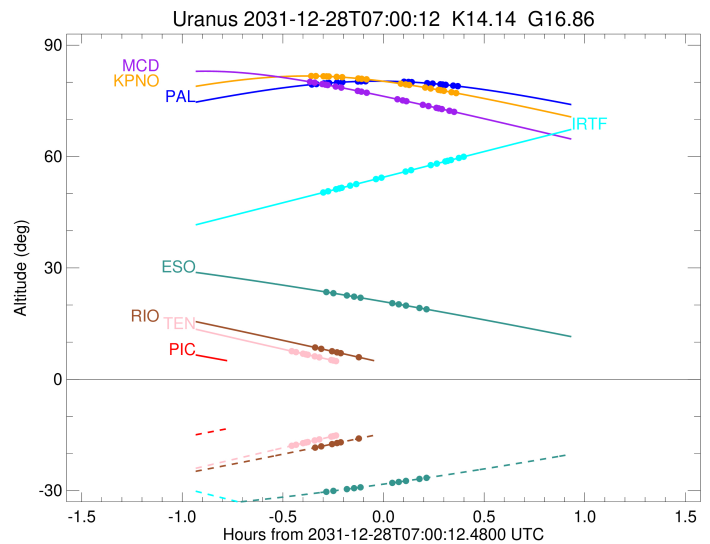
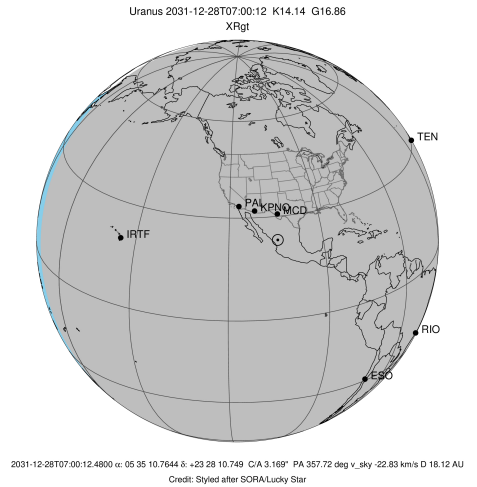
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T06:38:24.340		79.36	-71.66	51527.42	-14.05		
lambda	I	2031-12-28T06:40:13.685		79.52	-71.99	50026.71	-13.33		
delta	I	2031-12-28T06:42:28.338		79.70	-72.40	48300.35	-12.29		
gamma	I	2031-12-28T06:43:24.661		79.77	-72.57	47621.31	-11.82		
eta	I	2031-12-28T06:44:02.859		79.81	-72.68	47176.12	-11.49		
beta	I	2031-12-28T06:46:22.041		79.96	-73.10	45664.28	-10.20		
alpha	I	2031-12-28T06:47:56.581		80.04	-73.38	44742.97	-9.25		
4	I	2031-12-28T06:52:44.111		80.23	-74.21	42526.39	-6.06		
5	I	2031-12-28T06:53:38.268		80.25	-74.36	42226.37	-5.45		
6	I	2031-12-28T06:54:46.710		80.28	-74.56	41878.81	-4.56		

No planet occultations

6	E	2031-12-28T07:06:25.910		80.14	-76.42	41879.03	4.56		
5	E	2031-12-28T07:07:41.277		80.09	-76.61	42263.54	5.45		
4	E	2031-12-28T07:08:29.258		80.05	-76.72	42535.69	6.06		
alpha	E	2031-12-28T07:13:12.895		79.77	-77.39	44718.16	9.25		
beta	E	2031-12-28T07:14:48.440		79.65	-77.60	45647.48	10.20		
eta	E	2031-12-28T07:17:09.334		79.46	-77.91	47176.12	11.49		
gamma	E	2031-12-28T07:17:47.609		79.40	-77.99	47622.20	11.82		
delta	E	2031-12-28T07:18:43.862		79.32	-78.10	48300.35	12.29		
lambda	E	2031-12-28T07:20:58.525		79.10	-78.37	50026.71	13.33		
epsilon	E	2031-12-28T07:22:18.150		78.96	-78.52	51111.16	14.05		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-28T06:59:47.810
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      : 3404548252587563776
2Mass ID (if available) : 05351075+2328110
ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s
RUWE (>1.4 is poor) : 0.97
K magnitude         : 14.143
G magnitude         : 16.861
RP magnitude        : 16.040
BP magnitude        : 17.570
DUPflag            : 0
Distance (au)       : 18.120
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -22.83
Sun-Target sep (deg) : 168.43
Sun-Moon sep (deg)  : 7.76
B (ring opening deg) : 79.70
PA of pole (deg)    : 37.55
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.107
C/A sky separation (km) : 40829.1
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
    
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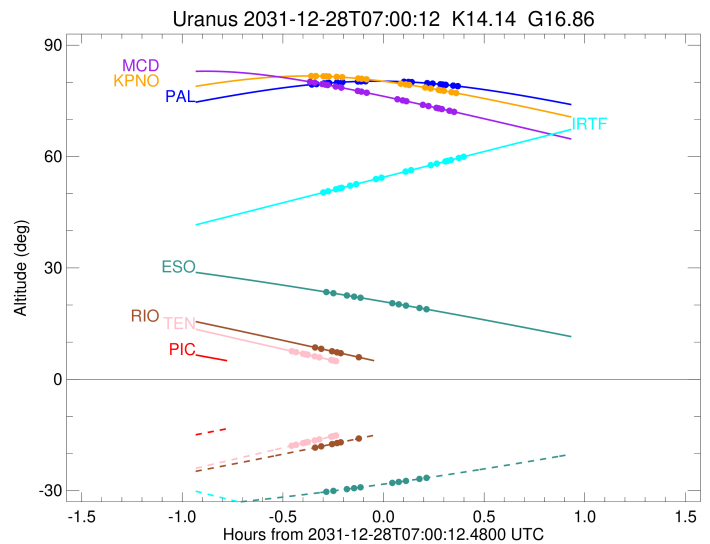
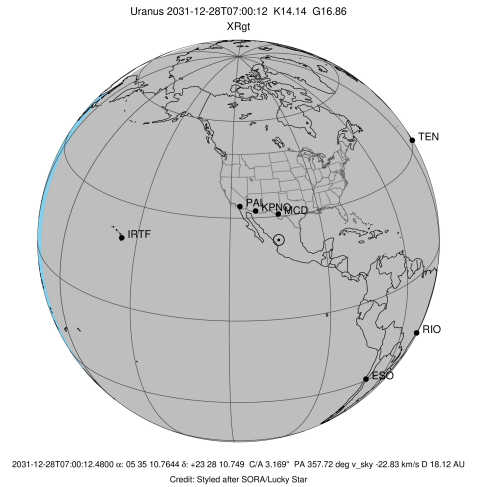


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T06:38:13.889		81.69	-76.14	51526.55	-13.96		
lambda	I	2031-12-28T06:40:03.959		81.67	-76.46	50026.71	-13.23		
delta	I	2031-12-28T06:42:19.812		81.62	-76.84	48300.35	-12.17		
gamma	I	2031-12-28T06:43:16.739		81.59	-77.00	47621.29	-11.69		
eta	I	2031-12-28T06:43:55.384		81.57	-77.11	47176.12	-11.35		
beta	I	2031-12-28T06:46:16.577		81.46	-77.49	45664.11	-10.03		
alpha	I	2031-12-28T06:47:52.915		81.37	-77.75	44742.73	-9.06		
4	I	2031-12-28T06:52:50.634		81.01	-78.52	42526.50	-5.72		
5	I	2031-12-28T06:53:48.171		80.93	-78.66	42227.77	-5.06		
6	I	2031-12-28T06:55:03.336		80.81	-78.84	41878.99	-4.08		

No planet occultations

6	E	2031-12-28T07:05:29.254		79.61	-80.17	41879.18	4.09		
5	E	2031-12-28T07:06:51.353		79.43	-80.32	42262.31	5.06		
4	E	2031-12-28T07:07:42.718		79.31	-80.41	42535.29	5.72		
alpha	E	2031-12-28T07:12:36.582		78.59	-80.86	44718.45	9.06		
beta	E	2031-12-28T07:14:13.943		78.34	-80.98	45647.59	10.03		
eta	E	2031-12-28T07:16:36.875		77.97	-81.14	47176.12	11.35		
gamma	E	2031-12-28T07:17:15.607		77.86	-81.18	47622.18	11.68		
delta	E	2031-12-28T07:18:12.474		77.71	-81.23	48300.35	12.16		
lambda	E	2031-12-28T07:20:28.373		77.33	-81.34	50026.71	13.23		
epsilon	E	2031-12-28T07:21:48.744		77.11	-81.39	51113.04	13.95		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-28T06:59:18.400  
 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 : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110  
 ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 7.66  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.116  
 C/A sky separation (km) : 40950.5  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ural11.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ural11.bsp  
 ural61.bsp  
 vgr2.ural61.bsp  
 peph.ural60.bsp  
 earthstns\_itrff93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

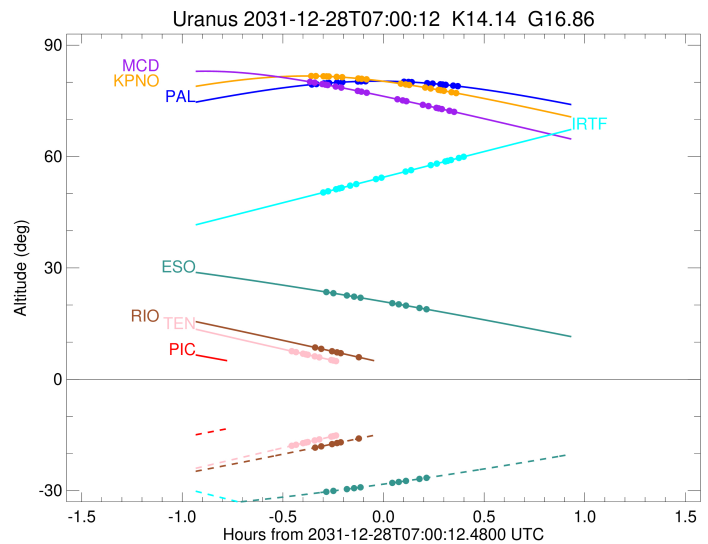
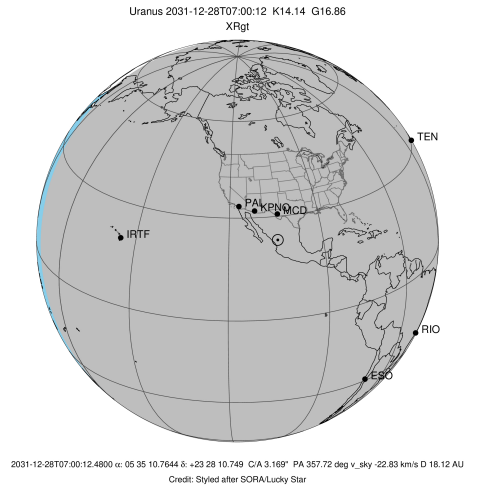


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T06:37:51.634		80.19	-81.57	51525.81	-13.88		
lambda	I	2031-12-28T06:39:42.277		79.89	-81.78	50026.71	-13.15		
delta	I	2031-12-28T06:41:59.089		79.52	-82.01	48300.35	-12.07		
gamma	I	2031-12-28T06:42:56.497		79.36	-82.10	47621.28	-11.58		
eta	I	2031-12-28T06:43:35.500		79.25	-82.15	47176.12	-11.24		
beta	I	2031-12-28T06:45:58.308		78.85	-82.34	45663.96	-9.90		
alpha	I	2031-12-28T06:47:36.106		78.56	-82.46	44742.54	-8.90		
4	I	2031-12-28T06:52:42.486		77.64	-82.70	42526.60	-5.45		
5	I	2031-12-28T06:53:43.115		77.46	-82.73	42228.94	-4.75		
6	I	2031-12-28T06:55:04.951		77.20	-82.76	41879.13	-3.68		

No planet occultations

6	E	2031-12-28T07:04:29.010		75.41	-82.61	41879.29	3.68		
5	E	2031-12-28T07:05:57.794		75.12	-82.53	42261.33	4.75		
4	E	2031-12-28T07:06:52.257		74.94	-82.48	42534.98	5.45		
alpha	E	2031-12-28T07:11:54.836		73.93	-82.09	44718.66	8.90		
beta	E	2031-12-28T07:13:33.682		73.60	-81.93	45647.67	9.89		
eta	E	2031-12-28T07:15:58.271		73.12	-81.68	47176.12	11.24		
gamma	E	2031-12-28T07:16:37.374		72.99	-81.61	47622.16	11.58		
delta	E	2031-12-28T07:17:34.741		72.79	-81.49	48300.35	12.06		
lambda	E	2031-12-28T07:19:51.648		72.33	-81.22	50026.71	13.14		
epsilon	E	2031-12-28T07:21:12.611		72.05	-81.04	51114.31	13.87		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-28T06:56:17.150  
 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 : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110  
 ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 7.20  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.953  
 C/A sky separation (km) : 38804.4  
 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	2031-12-28T06:32:25.720		7.66	-18.01	51534.47	-14.87		
lambda	I	2031-12-28T06:34:09.019		7.31	-17.65	50026.71	-14.27		
delta	I	2031-12-28T06:36:13.648		6.88	-17.21	48300.35	-13.42		
gamma	I	2031-12-28T06:37:04.959		6.71	-17.03	47621.44	-13.04		
eta	I	2031-12-28T06:37:39.453		6.59	-16.91	47176.12	-12.78		
beta	I	2031-12-28T06:39:42.306		6.18	-16.48	45665.84	-11.77		
alpha	I	2031-12-28T06:41:02.827		5.90	-16.20	44744.94	-11.07		
4	I	2031-12-28T06:44:43.967		5.16	-15.43	42525.94	-8.91		
5	I	2031-12-28T06:45:20.866		5.03	-15.30	42215.35	-8.56		
6	I	2031-12-28T06:46:00.888		4.90x	-15.16	41876.91	-8.10		

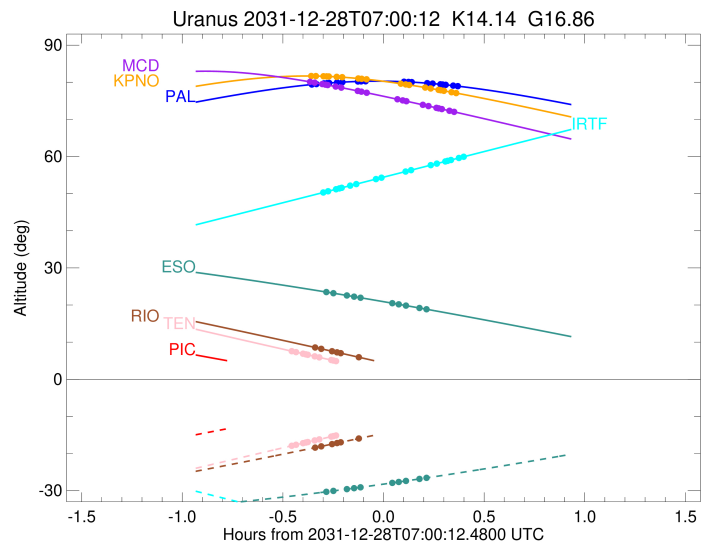
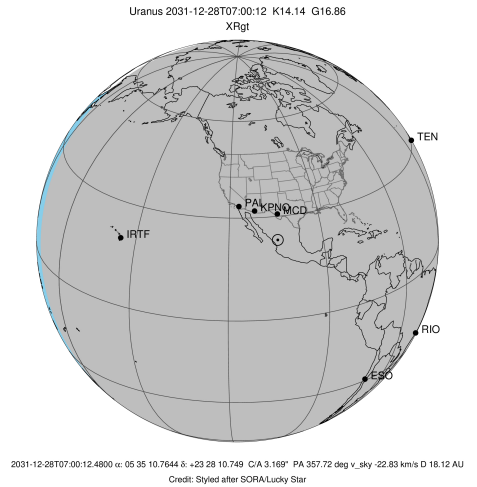
No planet occultations

6	E	2031-12-28T07:07:29.228		0.61x	-10.70	41877.09	8.08		
5	E	2031-12-28T07:08:16.408		0.45x	-10.54	42274.76	8.55		
4	E	2031-12-28T07:08:47.145		0.35x	-10.44	42540.10	8.89		
alpha	E	2031-12-28T07:12:24.738		-0.36x	-9.69	44714.66	11.04		
beta	E	2031-12-28T07:13:46.504		-0.63x	-9.41	45646.15	11.74		
eta	E	2031-12-28T07:15:51.441		-1.04x	-8.98	47176.12	12.74		
gamma	E	2031-12-28T07:16:26.121		-1.16x	-8.87	47622.49	13.00		
delta	E	2031-12-28T07:17:17.515		-1.32x	-8.69	48300.35	13.38		
lambda	E	2031-12-28T07:19:22.570		-1.73x	-8.26	50026.71	14.22		
epsilon	E	2031-12-28T07:20:35.775		-1.97x	-8.02	51084.45	14.81		



```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-28T07:02:43.150
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      : 3404548252587563776
2Mass ID (if available) : 05351075+2328110
ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s
RUWE (>1.4 is poor) : 0.97
K magnitude          : 14.143
G magnitude          : 16.861
RP magnitude         : 16.040
BP magnitude         : 17.570
DUPflag             : 0
Distance (au)       : 18.120
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -22.83
Sun-Target sep (deg) : 168.43
Sun-Moon sep (deg)  : 8.23
B (ring opening deg) : 79.70
PA of pole (deg)    : 37.55
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 3.160
C/A sky separation (km) : 41533.7
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
    
```

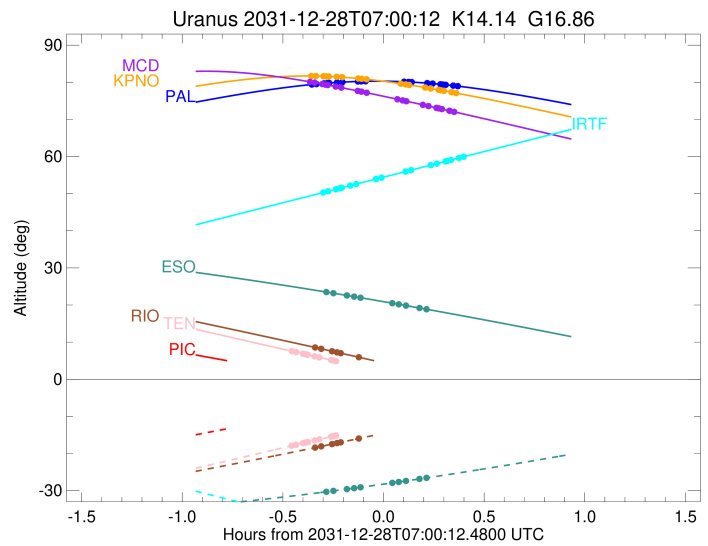
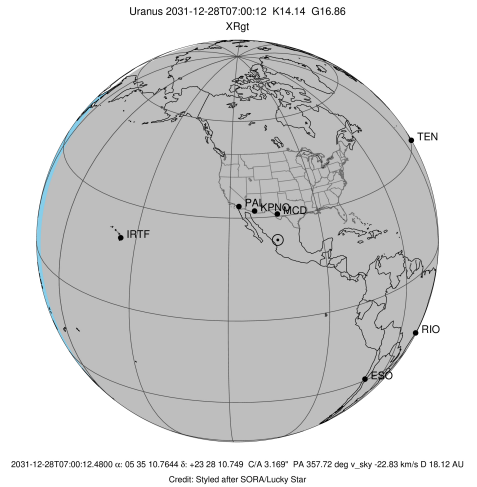


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T06:41:48.242		50.21	-38.68	51523.68	-13.46		
lambda	I	2031-12-28T06:43:42.416		50.65	-39.12	50026.71	-12.69		
delta	I	2031-12-28T06:46:04.773		51.19	-39.66	48300.35	-11.54		
gamma	I	2031-12-28T06:47:04.942		51.42	-39.89	47621.25	-11.02		
eta	I	2031-12-28T06:47:46.001		51.58	-40.04	47176.12	-10.66		
beta	I	2031-12-28T06:50:18.101		52.16	-40.62	45663.45	-9.19		
alpha	I	2031-12-28T06:52:04.478		52.57	-41.02	44741.80	-8.09		
4	I	2031-12-28T06:58:11.865		53.98	-42.42	42527.18	-3.84		
5	I	2031-12-28T06:59:44.394		54.33	-42.77	42235.51	-2.72		

No planet occultations

5	E	2031-12-28T07:06:46.762		55.95	-44.38	42254.11	2.72		
4	E	2031-12-28T07:08:13.030		56.28	-44.71	42533.02	3.84		
alpha	E	2031-12-28T07:14:16.252		57.67	-46.09	44720.10	8.10		
beta	E	2031-12-28T07:16:03.500		58.08	-46.50	45648.24	9.20		
eta	E	2031-12-28T07:18:37.102		58.67	-47.09	47176.12	10.67		
gamma	E	2031-12-28T07:19:18.173		58.83	-47.25	47622.06	11.04		
delta	E	2031-12-28T07:20:18.173		59.06	-47.48	48300.35	11.56		
lambda	E	2031-12-28T07:22:40.282		59.61	-48.02	50026.71	12.71		
epsilon	E	2031-12-28T07:24:04.561		59.93	-48.34	51124.76	13.49		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-28T06:56:24.440  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110  
 ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 6.76  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.415  
 C/A sky separation (km) : 44884.7  
 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

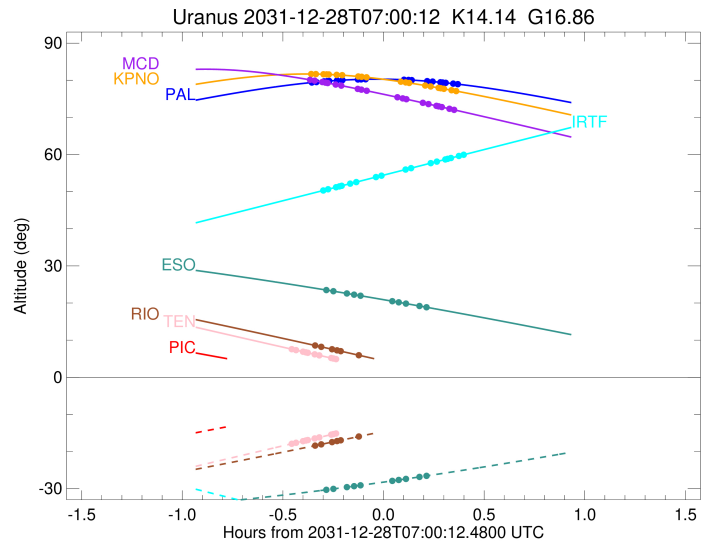
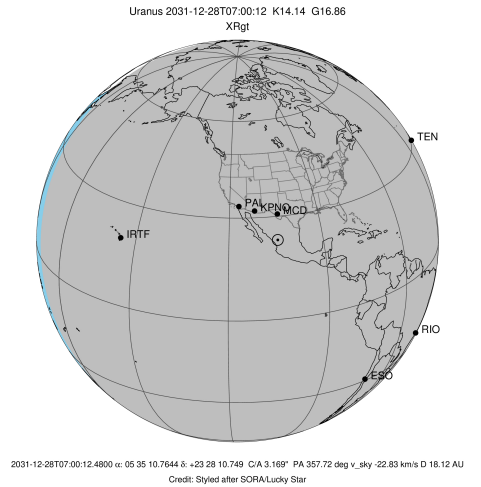


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-28T06:39:18.594		8.67	-18.50	51498.53	-10.90		
lambda	I	2031-12-28T06:41:40.150		8.19	-18.07	50026.71	-9.79		
delta	I	2031-12-28T06:44:53.949		7.54	-17.46	48300.35	-7.99		
gamma	I	2031-12-28T06:46:23.965		7.24	-17.18	47621.01	-7.09		
eta	I	2031-12-28T06:47:29.814		7.02	-16.97	47176.12	-6.41		
beta	I	2031-12-28T06:52:57.732		5.91	-15.94	45657.50	-2.78		

No planet occultations

beta	E	2031-12-28T07:00:52.432		4.30x	-14.43	45652.89	2.78		
eta	E	2031-12-28T07:06:22.420		3.17x	-13.36	47176.12	6.41		
gamma	E	2031-12-28T07:07:28.453		2.95x	-13.15	47621.57	7.08		
delta	E	2031-12-28T07:08:58.550		2.64x	-12.86	48300.35	7.98		
lambda	E	2031-12-28T07:12:12.765		1.97x	-12.23	50026.71	9.77		
epsilon	E	2031-12-28T07:14:04.457		1.58x	-11.86	51171.00	10.87		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-28T06:57:33.510  
 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 : 3404548252587563776  
 2Mass ID (if available) : 05351075+2328110  
 ICRS Star Coord at Epoch: 05h 35m 10.76444s +23:28:10.74947s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.143  
 G magnitude : 16.861  
 RP magnitude : 16.040  
 BP magnitude : 17.570  
 DUPflag : 0  
 Distance (au) : 18.120  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.83  
 Sun-Target sep (deg) : 168.43  
 Sun-Moon sep (deg) : 6.91  
 B (ring opening deg) : 79.70  
 PA of pole (deg) : 37.55  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.521  
 C/A sky separation (km) : 46271.0  
 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



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	2031-12-28T06:42:36.547		23.58	-30.38	51485.64	-9.68		
lambda	I	2031-12-28T06:45:17.643		23.18	-30.07	50026.71	-8.31		
delta	I	2031-12-28T06:49:19.916		22.57	-29.59	48300.35	-5.89		
gamma	I	2031-12-28T06:51:30.634		22.24	-29.33	47620.96	-4.49		
eta	I	2031-12-28T06:53:26.104		21.95	-29.10	47176.12	-3.21		

No planet occultations

eta	E	2031-12-28T07:02:45.397		20.50	-27.92	47176.12	3.21		
gamma	E	2031-12-28T07:04:41.017		20.20	-27.67	47621.31	4.49		
delta	E	2031-12-28T07:06:51.769		19.85	-27.39	48300.35	5.89		
lambda	E	2031-12-28T07:10:54.334		19.20	-26.85	50026.71	8.30		
epsilon	E	2031-12-28T07:13:05.697		18.85	-26.55	51196.88	9.67		