

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:49:19.280  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231

ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s

RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 94.74  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12

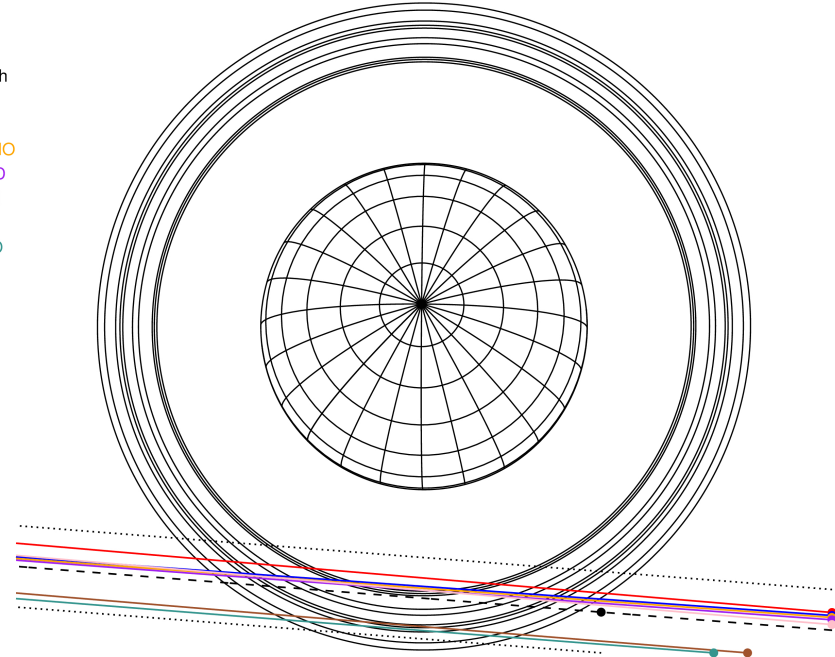
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-01-14T02:49:19.2800 ra: 05 12 44.8761 s: +23 05 23.300 C/A 3.186" PA 355.52 deg v\_sky -18.32 km/s D 18.33 AU  
 Credit: Styled after SORA/Lucky Star

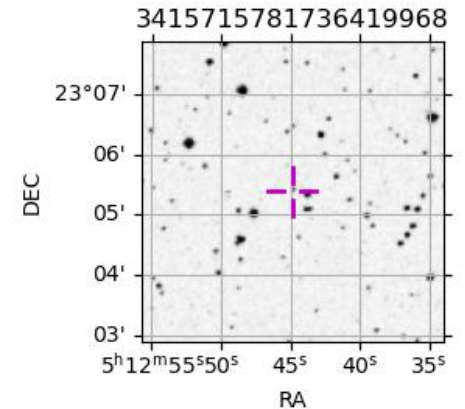
Uranus 2031-01-14T02:49:19 K14.87 G18.25 XRgt

Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 RIO  
 ESO



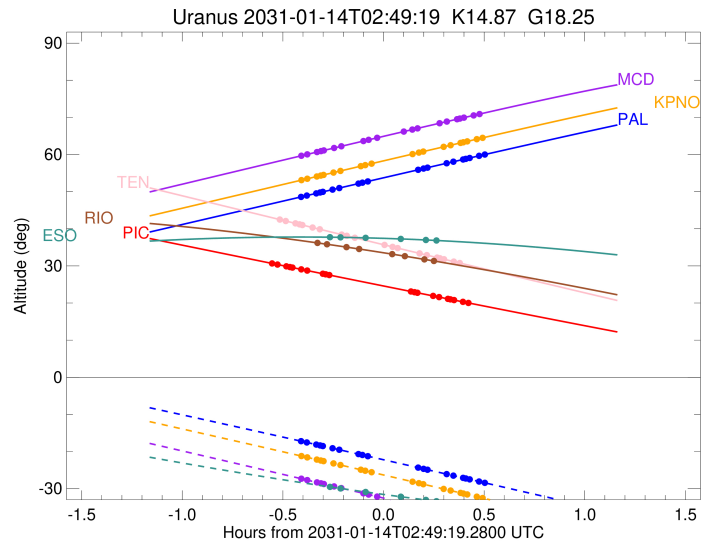
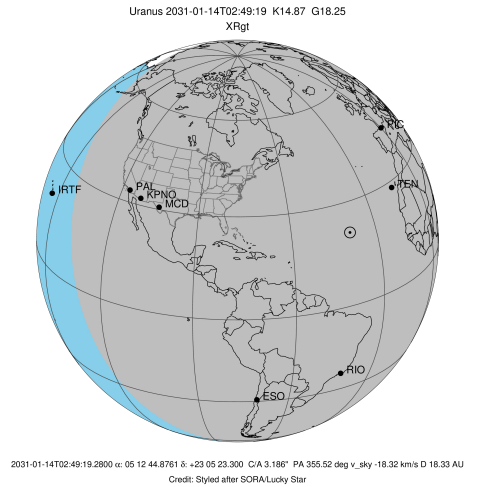
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	JAN 14 02:16 - JAN 14 03:15	PnnRie
PAL	Palomar Mt (200")	33.4	243.1	+++++		+++++	JAN 14 02:24 - JAN 14 03:20	PnnRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++		+++++	JAN 14 02:24 - JAN 14 03:19	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++		+++++	JAN 14 02:24 - JAN 14 03:18	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++		+++++	JAN 14 02:18 - JAN 14 03:12	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	++++		++++	JAN 14 02:29 - JAN 14 03:05	PnnRie
ESO	European Southern Obs	-29.3	289.3	+++		+++	JAN 14 02:33 - JAN 14 03:05	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            : 2031-01-14T02:45:11.990
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      : 3415715781736419968
2Mass ID (if available) : 05124486+2305231
ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s
RUWE (>1.4 is poor) : 1.04
K magnitude         : 14.868
G magnitude         : 18.253
RP magnitude        : 16.840
BP magnitude        : 18.528
DUPflag            : 0
Distance (au)       : 18.327
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -18.32
Sun-Target sep (deg) : 145.86
Sun-Moon sep (deg)  : 95.19
B (ring opening deg) : 82.04
PA of pole (deg)    : 6.12
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.953
C/A sky separation (km) : 39249.4
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.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
  
```

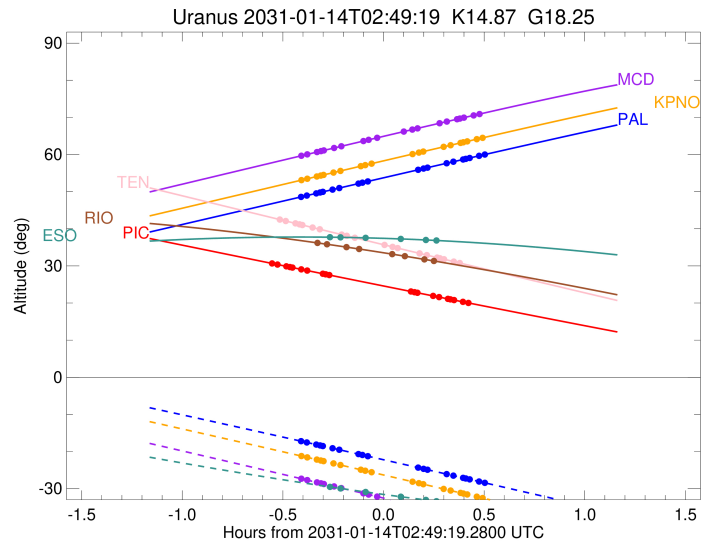
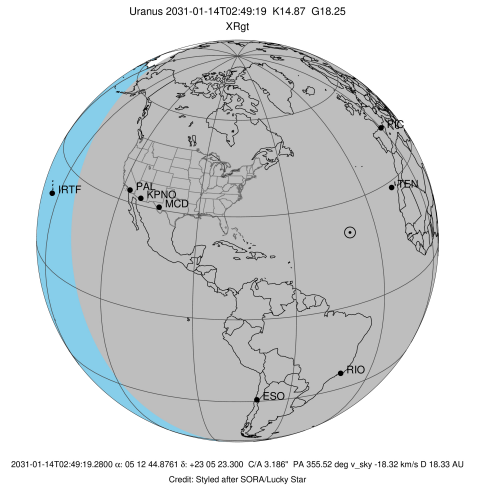


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:16:09.947		30.65	-55.82	51109.81	-11.77		
lambda	I	2031-01-14T02:17:44.433		30.36	-55.57	50026.71	-11.26		
delta	I	2031-01-14T02:20:22.631		29.88	-55.14	48300.35	-10.55		
gamma	I	2031-01-14T02:21:27.531		29.68	-54.96	47625.93	-10.23		
eta	I	2031-01-14T02:22:11.973		29.54	-54.84	47176.12	-10.01		
beta	I	2031-01-14T02:24:49.882		29.06	-54.41	45660.98	-9.15		
alpha	I	2031-01-14T02:26:32.233		28.75	-54.13	44752.43	-8.57		
4	I	2031-01-14T02:31:10.529		27.90	-53.36	42616.52	-6.77		
5	I	2031-01-14T02:31:58.814		27.75	-53.22	42289.63	-6.41		
6	I	2031-01-14T02:33:14.946		27.52	-53.01	41830.36	-5.87		

No planet occultations

6	E	2031-01-14T02:57:21.241		23.14	-48.87	41806.40	5.86		
5	E	2031-01-14T02:58:33.099		22.92	-48.66	42238.01	6.39		
4	E	2031-01-14T02:59:28.717		22.75	-48.50	42605.64	6.76		
alpha	E	2031-01-14T03:04:07.475		21.91	-47.68	44738.22	8.54		
beta	E	2031-01-14T03:05:49.959		21.61	-47.38	45643.74	9.12		
eta	E	2031-01-14T03:08:30.403		21.13	-46.91	47176.12	9.97		
gamma	E	2031-01-14T03:09:15.528		20.99	-46.77	47631.03	10.19		
delta	E	2031-01-14T03:10:20.204		20.80	-46.58	48300.35	10.50		
lambda	E	2031-01-14T03:12:59.130		20.32	-46.11	50026.71	11.21		
epsilon	E	2031-01-14T03:15:10.863		19.93	-45.72	51539.01	11.71		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:52:01.880  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.45  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.055  
 C/A sky separation (km) : 40607.4  
 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

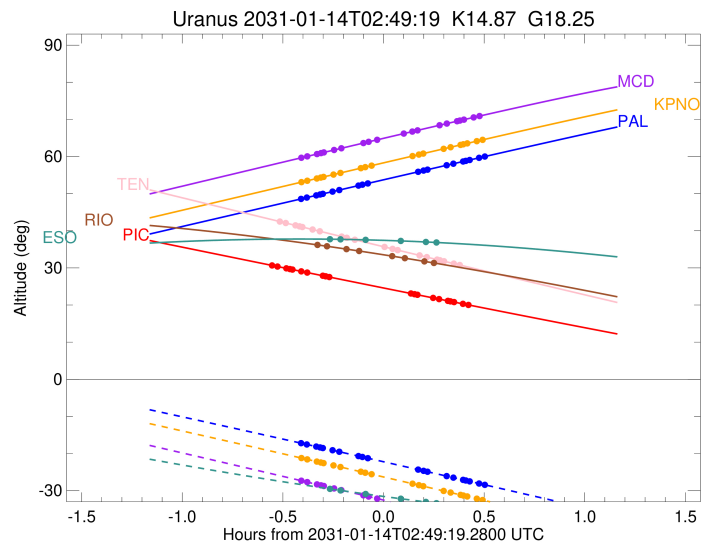
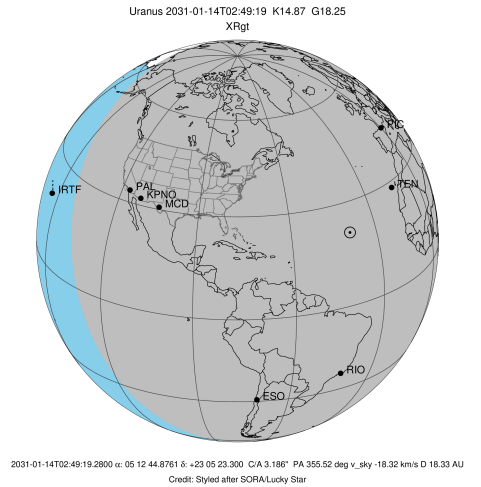


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:24:48.328		48.60	-17.23	51122.03	-11.22		
lambda	I	2031-01-14T02:26:29.031		48.95	-17.57	50026.71	-10.65		
delta	I	2031-01-14T02:29:17.558		49.54	-18.13	48300.35	-9.82		
gamma	I	2031-01-14T02:30:27.481		49.78	-18.37	47626.15	-9.46		
eta	I	2031-01-14T02:31:15.738		49.95	-18.53	47176.12	-9.19		
beta	I	2031-01-14T02:34:10.050		50.56	-19.12	45659.96	-8.17		
alpha	I	2031-01-14T02:36:05.990		50.97	-19.52	44752.40	-7.45		
4	I	2031-01-14T02:41:46.594		52.15	-20.67	42616.52	-5.06		
5	I	2031-01-14T02:42:54.280		52.39	-20.90	42283.67	-4.52		
6	I	2031-01-14T02:44:48.449		52.79	-21.29	41825.60	-3.63		

No planet occultations

6	E	2031-01-14T02:59:25.941		55.84	-24.29	41810.81	3.64		
5	E	2031-01-14T03:01:15.712		56.22	-24.67	42247.82	4.52		
4	E	2031-01-14T03:02:30.495		56.48	-24.92	42608.77	5.07		
alpha	E	2031-01-14T03:08:10.323		57.65	-26.09	44740.47	7.46		
beta	E	2031-01-14T03:10:05.803		58.05	-26.49	45644.56	8.19		
eta	E	2031-01-14T03:13:01.718		58.66	-27.09	47176.12	9.21		
gamma	E	2031-01-14T03:13:50.376		58.83	-27.26	47630.87	9.48		
delta	E	2031-01-14T03:14:59.656		59.07	-27.50	48300.35	9.85		
lambda	E	2031-01-14T03:17:47.798		59.64	-28.08	50026.71	10.67		
epsilon	E	2031-01-14T03:20:04.827		60.11	-28.55	51531.99	11.25		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:51:45.200  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.49  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.076  
 C/A sky separation (km) : 40891.8  
 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\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

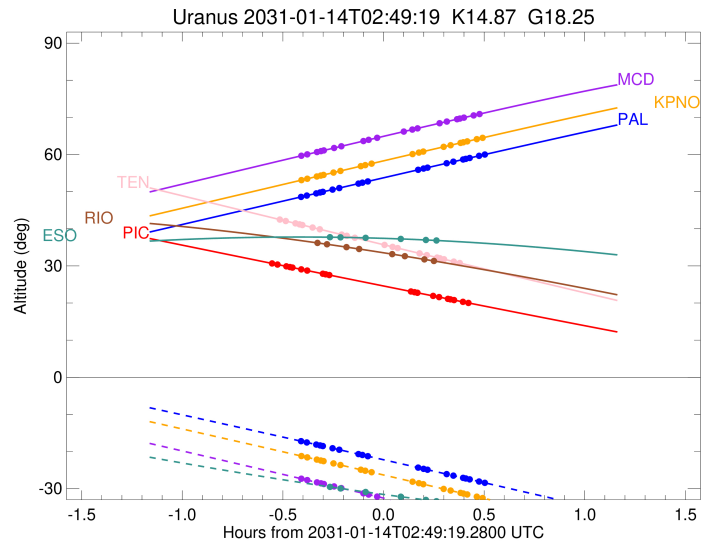
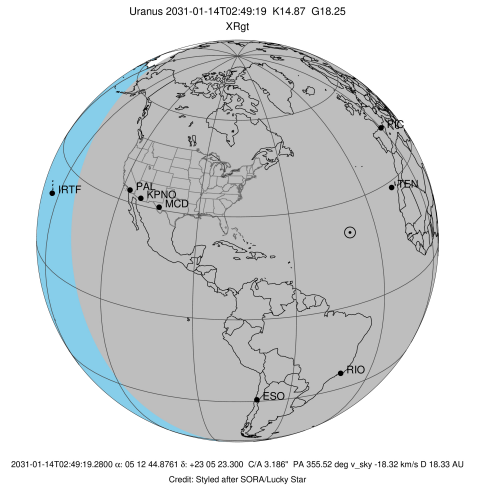


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:24:54.643		53.12	-21.24	51125.99	-11.10		
lambda	I	2031-01-14T02:26:36.936		53.48	-21.59	50026.71	-10.51		
delta	I	2031-01-14T02:29:27.990		54.09	-22.18	48300.35	-9.66		
gamma	I	2031-01-14T02:30:39.172		54.34	-22.43	47626.22	-9.28		
eta	I	2031-01-14T02:31:28.403		54.51	-22.60	47176.12	-9.01		
beta	I	2031-01-14T02:34:27.052		55.15	-23.22	45659.66	-7.94		
alpha	I	2031-01-14T02:36:26.778		55.57	-23.63	44752.37	-7.18		
4	I	2031-01-14T02:42:28.180		56.85	-24.89	42616.46	-4.60		
5	I	2031-01-14T02:43:44.121		57.12	-25.15	42281.72	-3.98		
6	I	2031-01-14T02:45:58.546		57.59	-25.62	41824.00	-2.92		

No planet occultations

6	E	2031-01-14T02:57:42.672		60.07	-28.08	41812.11	2.93		
5	E	2031-01-14T02:59:52.710		60.53	-28.53	42250.14	3.99		
4	E	2031-01-14T03:01:15.752		60.82	-28.82	42609.41	4.60		
alpha	E	2031-01-14T03:07:16.428		62.08	-30.09	44740.88	7.19		
beta	E	2031-01-14T03:09:15.719		62.49	-30.51	45644.73	7.95		
eta	E	2031-01-14T03:12:16.007		63.12	-31.14	47176.12	9.02		
gamma	E	2031-01-14T03:13:05.650		63.30	-31.31	47630.84	9.30		
delta	E	2031-01-14T03:14:16.207		63.54	-31.56	48300.35	9.68		
lambda	E	2031-01-14T03:17:06.924		64.13	-32.16	50026.71	10.53		
epsilon	E	2031-01-14T03:19:25.521		64.61	-32.65	51530.76	11.12		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:51:16.610  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.55  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.100  
 C/A sky separation (km) : 41211.9  
 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



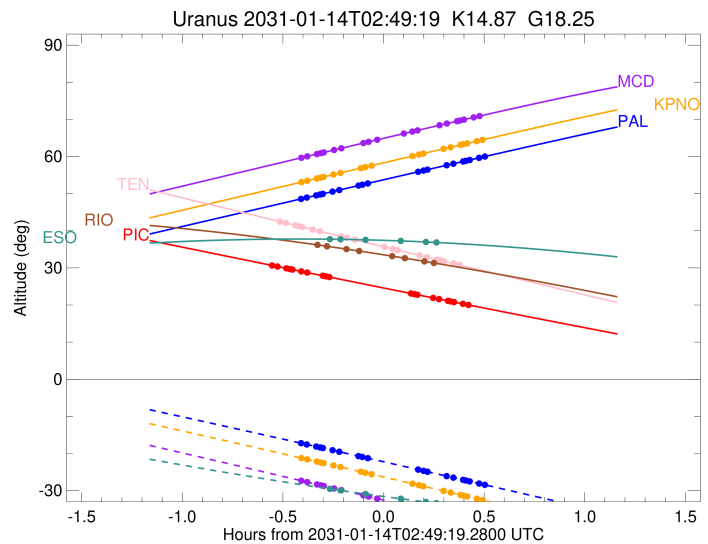
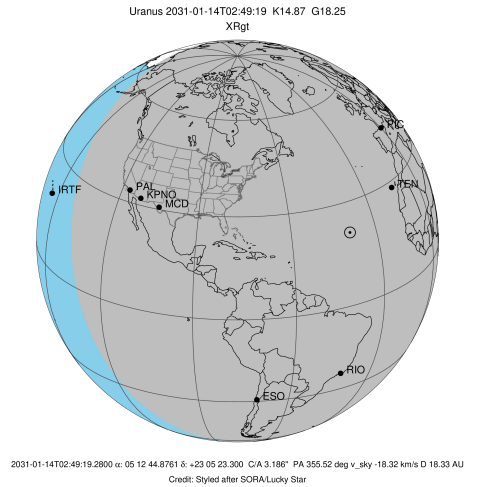
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:24:52.547		59.68	-27.34	51130.60	-10.96		
lambda	I	2031-01-14T02:26:36.717		60.05	-27.71	50026.71	-10.35		
delta	I	2031-01-14T02:29:30.775		60.67	-28.32	48300.35	-9.47		
gamma	I	2031-01-14T02:30:43.472		60.93	-28.58	47626.29	-9.07		
eta	I	2031-01-14T02:31:33.883		61.11	-28.76	47176.12	-8.79		
beta	I	2031-01-14T02:34:37.876		61.77	-29.41	45659.30	-7.67		
alpha	I	2031-01-14T02:36:42.408		62.21	-29.85	44752.33	-6.86		
4	I	2031-01-14T02:43:13.513		63.61	-31.24	42616.32	-4.01		
5	I	2031-01-14T02:44:43.672		63.93	-31.56	42279.07	-3.27		
6	I	2031-01-14T02:47:46.069		64.57	-32.21	41821.53	-1.80		

No planet occultations

6	E	2031-01-14T02:54:58.198		66.10	-33.75	41814.23	1.80		
5	E	2031-01-14T02:57:56.222		66.73	-34.38	42253.18	3.27		
4	E	2031-01-14T02:59:33.490		67.07	-34.73	42610.17	4.01		
alpha	E	2031-01-14T03:06:03.954		68.44	-36.13	44741.34	6.87		
beta	E	2031-01-14T03:08:08.091		68.87	-36.57	45644.92	7.68		
eta	E	2031-01-14T03:11:13.787		69.51	-37.23	47176.12	8.80		
gamma	E	2031-01-14T03:12:04.627		69.69	-37.42	47630.80	9.09		
delta	E	2031-01-14T03:13:16.731		69.94	-37.67	48300.35	9.48		
lambda	E	2031-01-14T03:16:10.529		70.53	-38.29	50026.71	10.37		
epsilon	E	2031-01-14T03:18:30.989		71.02	-38.80	51529.37	10.98		



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:45:03.820  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.35  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.097  
 C/A sky separation (km) : 41160.5  
 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

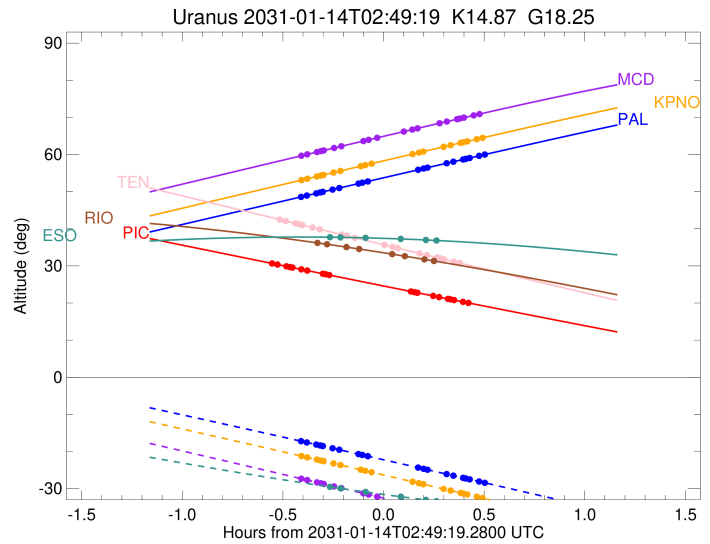
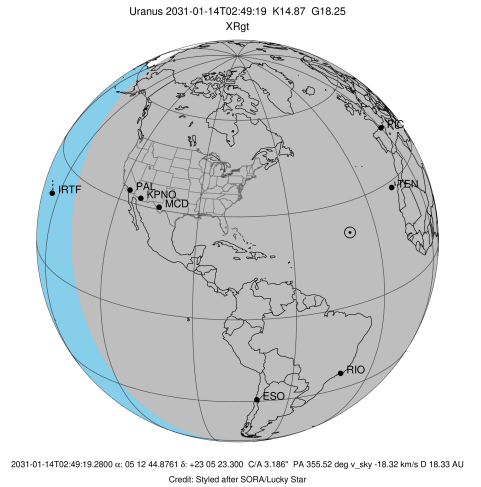


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:18:27.276		42.47	-74.06	51134.62	-10.95		
lambda	I	2031-01-14T02:20:11.932		42.09	-73.70	50026.71	-10.34		
delta	I	2031-01-14T02:23:06.134		41.45	-73.10	48300.35	-9.46		
gamma	I	2031-01-14T02:24:18.858		41.19	-72.85	47626.35	-9.07		
eta	I	2031-01-14T02:25:09.281		41.00	-72.67	47176.12	-8.79		
beta	I	2031-01-14T02:28:13.186		40.33	-72.03	45659.12	-7.68		
alpha	I	2031-01-14T02:30:17.429		39.88	-71.60	44752.30	-6.88		
4	I	2031-01-14T02:36:45.004		38.46	-70.23	42616.30	-4.09		
5	I	2031-01-14T02:38:12.966		38.14	-69.92	42278.76	-3.38		
6	I	2031-01-14T02:41:04.315		37.52	-69.31	41821.56	-2.02		

No planet occultations

6	E	2031-01-14T02:49:15.647		35.73	-67.55	41813.37	2.02		
5	E	2031-01-14T02:52:02.734		35.12	-66.95	42251.71	3.37		
4	E	2031-01-14T02:53:38.024		34.77	-66.61	42609.76	4.09		
alpha	E	2031-01-14T03:00:06.070		33.37	-65.21	44740.96	6.87		
beta	E	2031-01-14T03:02:10.456		32.92	-64.76	45644.74	7.66		
eta	E	2031-01-14T03:05:16.903		32.24	-64.08	47176.12	8.76		
gamma	E	2031-01-14T03:06:08.012		32.06	-63.90	47630.84	9.04		
delta	E	2031-01-14T03:07:20.523		31.79	-63.63	48300.35	9.43		
lambda	E	2031-01-14T03:10:15.472		31.16	-63.00	50026.71	10.29		
epsilon	E	2031-01-14T03:12:37.172		30.65	-62.48	51531.29	10.89		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:46:50.100  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.30  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.526  
 C/A sky separation (km) : 46865.2  
 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



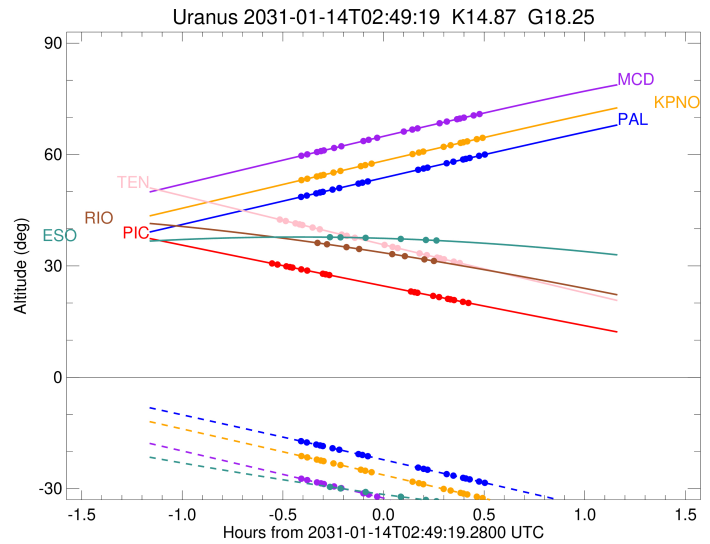
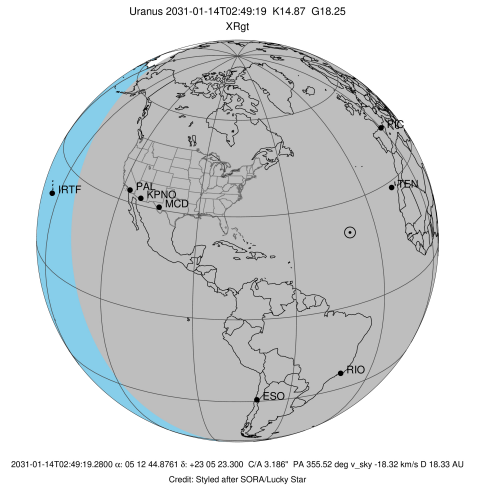
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b? alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-14T02:29:29.419	36.21	-45.20	51225.91	-7.30		
lambda	I	2031-01-14T02:32:30.548	35.82	-45.32	50026.71	-6.07		
delta	I	2031-01-14T02:38:20.949	35.05	-45.53	48300.35	-3.75		
gamma	I	2031-01-14T02:42:09.466	34.54	-45.64	47628.38	-2.12		

No planet occultations

gamma	E	2031-01-14T02:51:49.387	33.18	-45.83	47629.43	2.12		
delta	E	2031-01-14T02:55:37.602	32.63	-45.87	48300.35	3.74		
lambda	E	2031-01-14T03:01:28.507	31.76	-45.89	50026.71	6.06		
epsilon	E	2031-01-14T03:05:06.329	31.21	-45.89	51489.37	7.28		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-14T02:49:04.930  
 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 : 3415715781736419968  
 2Mass ID (if available) : 05124486+2305231  
 ICRS Star Coord at Epoch: 05h 12m 44.87615s +23:05:23.29995s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 14.868  
 G magnitude : 18.253  
 RP magnitude : 16.840  
 BP magnitude : 18.528  
 DUPflag : 0  
 Distance (au) : 18.327  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.32  
 Sun-Target sep (deg) : 145.86  
 Sun-Moon sep (deg) : 95.32  
 B (ring opening deg) : 82.04  
 PA of pole (deg) : 6.12  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.573  
 C/A sky separation (km) : 47493.8  
 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	2031-01-14T02:33:10.012		37.73	-29.51	51237.47	-6.73		
lambda	I	2031-01-14T02:36:32.800		37.69	-29.95	50026.71	-5.33		
delta	I	2031-01-14T02:44:05.834		37.56	-30.92	48300.35	-2.23		

No planet occultations

delta	E	2031-01-14T02:54:21.933		37.27	-32.17	48300.35	2.23		
lambda	E	2031-01-14T03:01:55.117		36.99	-33.04	50026.71	5.33		
epsilon	E	2031-01-14T03:05:54.346		36.81	-33.48	51480.84	6.73		