

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-01-08T07:49:21.800
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3415735783400056704
 2Mass ID (if available) : 05133706+2306200

ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s

RUWE (>1.4 is poor) : 2.21
 K magnitude : 14.439
 G magnitude : 16.187
 RP magnitude : 15.546
 BP magnitude : 16.584
 DUPflag : 0
 Distance (au) : 18.277
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.95
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 23.41
 B (ring opening deg) : 82.00
 PA of pole (deg) : 7.61

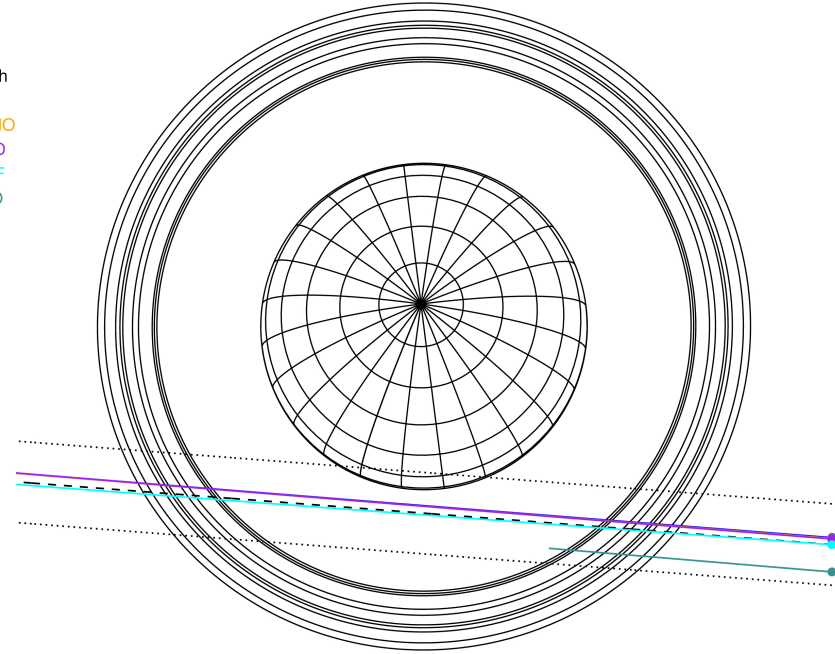
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-01-08T07:49:21.8000 ra: 05 13 37.0621 s: +23 06 20.157 C/A 2.193 PA 355.60 deg v_sky -19.95 km/s D 18.28 AU
 Credit: Styled after SORA/Lucky Star

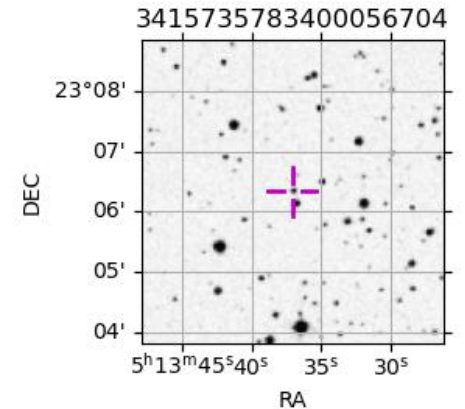
Uranus 2031-01-08T07:49:21 K14.44 G16.19 PRgt

Earth
 PAL
 KPNO
 MCD
 IRTF
 ESO



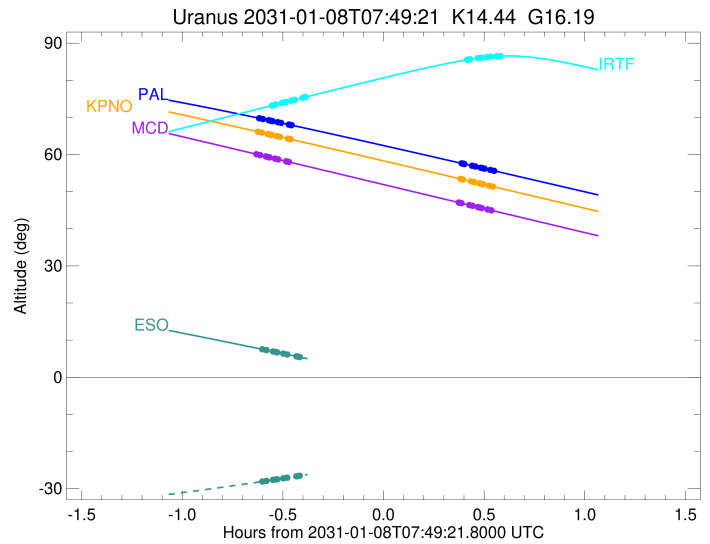
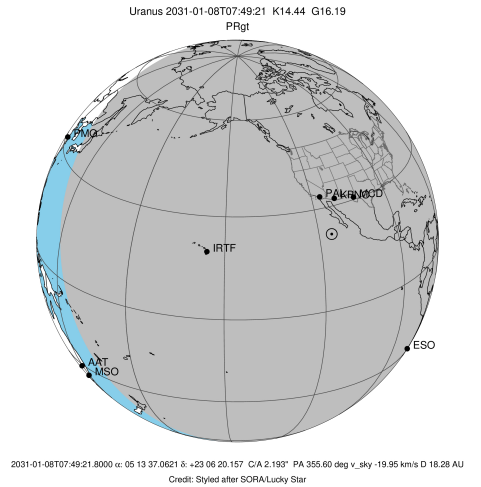
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++		+++++	JAN 08 07:12 - JAN 08 08:22	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++		+++++	JAN 08 07:12 - JAN 08 08:22	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++		+++++	JAN 08 07:11 - JAN 08 08:21	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++		+++++	JAN 08 07:16 - JAN 08 08:24	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	+++++			JAN 08 07:13 - JAN 08 07:24	PnnRin
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            : 2031-01-08T07:47:11.870
Event type          : PRgt
: Uranus occs: not geocentric or topocentric
: 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      : 3415735783400056704
2Mass ID (if available) : 05133706+2306200
ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s
RUWE (>1.4 is poor) : 2.21
K magnitude         : 14.439
G magnitude         : 16.187
RP magnitude        : 15.546
BP magnitude        : 16.584
DUPflag            : 0
Distance (au)       : 18.277
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 151.96
Sun-Moon sep (deg)  : 23.40
B (ring opening deg) : 82.00
PA of pole (deg)    : 7.61
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.110
C/A sky separation (km) : 27975.8
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
  
```



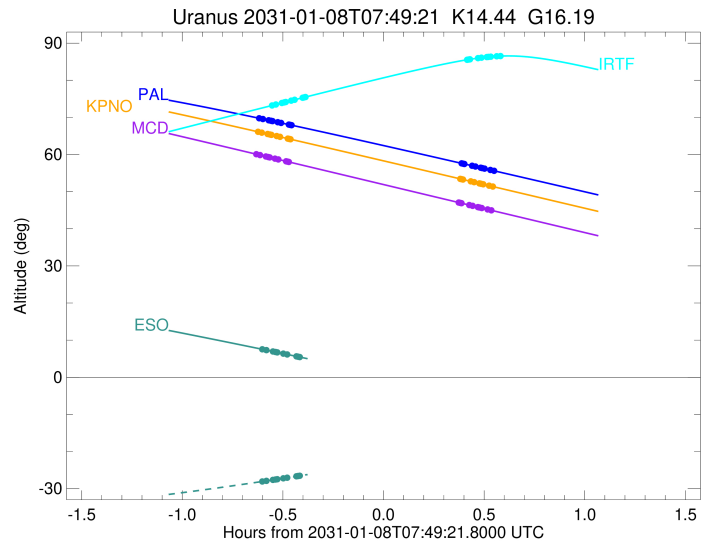
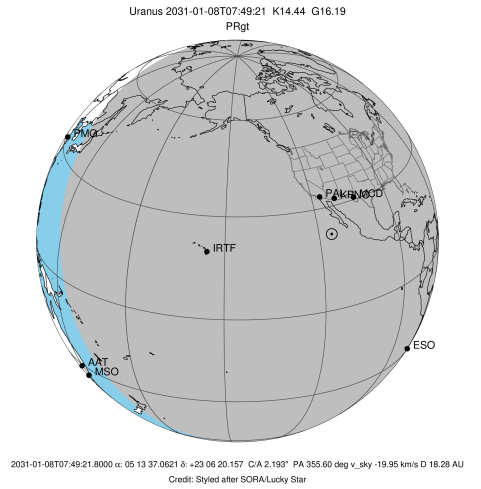
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-08T07:12:30.722		69.73	-75.75	50941.19	-16.99		
lambda	I	2031-01-08T07:13:25.029		69.56	-75.88	50026.71	-16.77		
delta	I	2031-01-08T07:15:08.863		69.23	-76.11	48300.35	-16.48		
gamma	I	2031-01-08T07:15:50.102		69.09	-76.21	47623.30	-16.36		
eta	I	2031-01-08T07:16:17.515		69.01	-76.27	47176.12	-16.27		
beta	I	2031-01-08T07:17:50.790		68.71	-76.47	45672.26	-15.96		
alpha	I	2031-01-08T07:18:49.182		68.52	-76.60	44745.57	-15.76		
4	I	2031-01-08T07:21:07.778		68.07	-76.89	42603.40	-15.21		
5	I	2031-01-08T07:21:26.326		68.01	-76.92	42315.09	-15.12		
6	I	2031-01-08T07:21:56.934		67.91	-76.98	41862.16	-14.97		

No planet occultations

6	E	2031-01-08T08:12:35.762		57.64	-78.32	41800.72	14.94		
5	E	2031-01-08T08:13:03.867		57.54	-78.28	42221.15	15.08		
4	E	2031-01-08T08:13:28.960		57.45	-78.25	42598.94	15.18		
alpha	E	2031-01-08T08:15:47.149		56.98	-78.05	44732.95	15.72		
beta	E	2031-01-08T08:16:44.639		56.78	-77.97	45642.26	15.91		
eta	E	2031-01-08T08:18:20.089		56.45	-77.82	47176.12	16.22		
gamma	E	2031-01-08T08:18:48.075		56.35	-77.77	47631.36	16.31		
delta	E	2031-01-08T08:19:28.941		56.21	-77.70	48300.35	16.43		
lambda	E	2031-01-08T08:21:13.090		55.85	-77.52	50026.71	16.72		
epsilon	E	2031-01-08T08:22:43.715		55.53	-77.36	51552.01	16.93		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-01-08T07:46:50.140
Event type           : PRgt
: Uranus occs: not geocentric or topocentric
: 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       : 3415735783400056704
2Mass ID (if available) : 05133706+2306200
ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s
RUWE (>1.4 is poor) : 2.21
K magnitude           : 14.439
G magnitude           : 16.187
RP magnitude          : 15.546
BP magnitude          : 16.584
DUPflag              : 0
Distance (au)         : 18.277
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -19.95
Sun-Target sep (deg) : 151.96
Sun-Moon sep (deg)   : 23.33
B (ring opening deg) : 82.00
PA of pole (deg)     : 7.61
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.117
C/A sky separation (km) : 28057.7
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
  
```

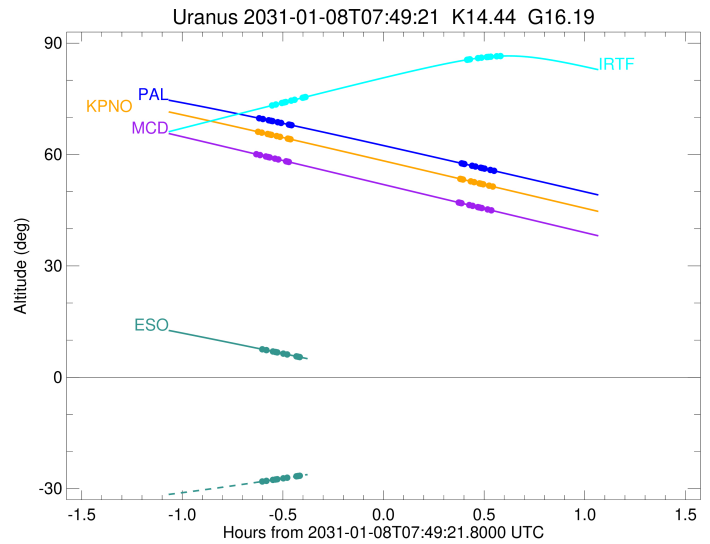
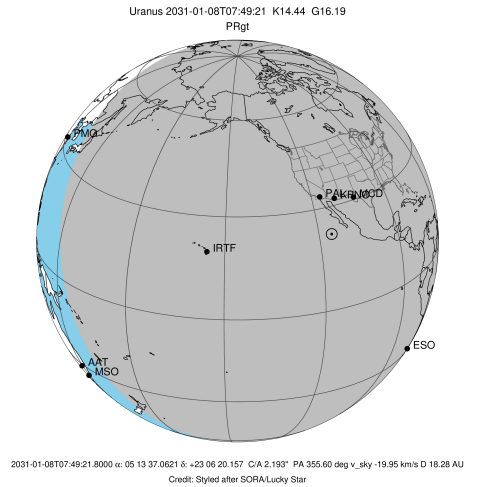


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-08T07:12:10.722		66.08	-79.41	50942.10	-16.96		
lambda	I	2031-01-08T07:13:05.174		65.89	-79.49	50026.71	-16.74		
delta	I	2031-01-08T07:14:49.194		65.53	-79.65	48300.35	-16.45		
gamma	I	2031-01-08T07:15:30.512		65.39	-79.71	47623.31	-16.32		
eta	I	2031-01-08T07:15:57.979		65.30	-79.74	47176.12	-16.24		
beta	I	2031-01-08T07:17:31.453		64.97	-79.86	45672.21	-15.92		
alpha	I	2031-01-08T07:18:29.970		64.77	-79.94	44745.63	-15.72		
4	I	2031-01-08T07:20:48.912		64.29	-80.09	42603.50	-15.17		
5	I	2031-01-08T07:21:07.518		64.23	-80.11	42315.08	-15.08		
6	I	2031-01-08T07:21:38.221		64.12	-80.14	41862.04	-14.93		

No planet occultations

6	E	2031-01-08T08:12:11.350		53.46	-77.07	41800.76	14.89		
5	E	2031-01-08T08:12:39.552		53.36	-77.00	42221.31	15.04		
4	E	2031-01-08T08:13:04.718		53.27	-76.94	42599.01	15.13		
alpha	E	2031-01-08T08:15:23.307		52.78	-76.58	44733.00	15.67		
beta	E	2031-01-08T08:16:20.948		52.57	-76.43	45642.27	15.87		
eta	E	2031-01-08T08:17:56.639		52.23	-76.18	47176.12	16.18		
gamma	E	2031-01-08T08:18:24.693		52.13	-76.10	47631.35	16.27		
delta	E	2031-01-08T08:19:05.656		51.99	-75.99	48300.35	16.39		
lambda	E	2031-01-08T08:20:50.041		51.62	-75.70	50026.71	16.68		
epsilon	E	2031-01-08T08:22:20.856		51.29	-75.45	51551.94	16.90		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-01-08T07:46:21.010
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : 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 : 3415735783400056704
 2Mass ID (if available) : 05133706+2306200
 ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s
 RUWE (>1.4 is poor) : 2.21
 K magnitude : 14.439
 G magnitude : 16.187
 RP magnitude : 15.546
 BP magnitude : 16.584
 DUPflag : 0
 Distance (au) : 18.277
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.95
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 23.22
 B (ring opening deg) : 82.00
 PA of pole (deg) : 7.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.117
 C/A sky separation (km) : 28067.9
 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

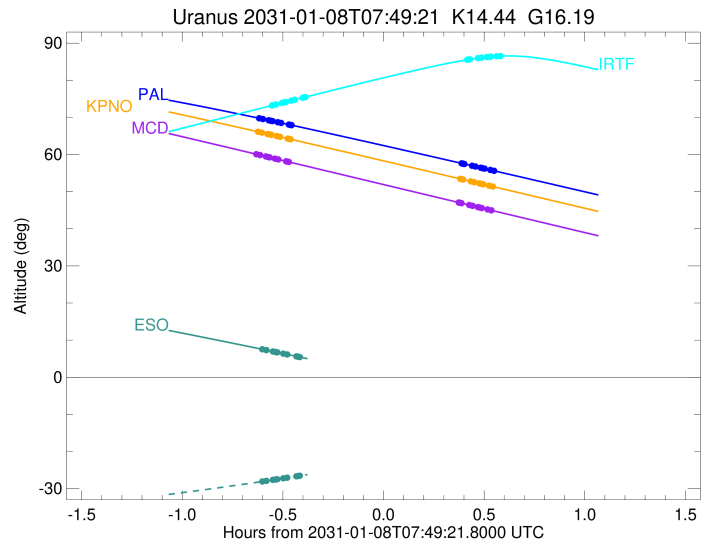
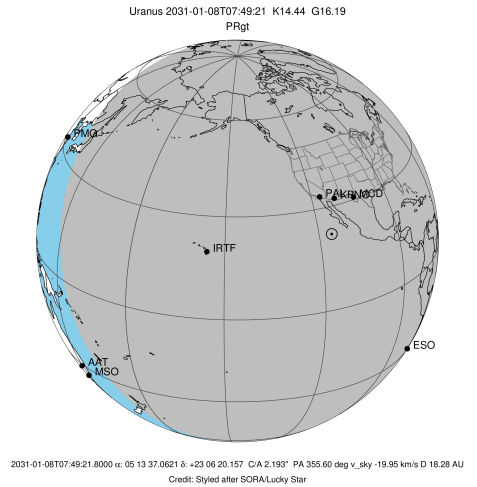


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-08T07:11:39.679		60.04	-81.50	50942.52	-16.94		
lambda	I	2031-01-08T07:12:34.215		59.85	-81.45	50026.71	-16.72		
delta	I	2031-01-08T07:14:18.350		59.47	-81.34	48300.35	-16.43		
gamma	I	2031-01-08T07:14:59.713		59.33	-81.29	47623.32	-16.31		
eta	I	2031-01-08T07:15:27.213		59.23	-81.26	47176.12	-16.22		
beta	I	2031-01-08T07:17:00.797		58.89	-81.14	45672.19	-15.90		
alpha	I	2031-01-08T07:17:59.381		58.68	-81.06	44745.66	-15.70		
4	I	2031-01-08T07:20:18.495		58.18	-80.85	42603.54	-15.15		
5	I	2031-01-08T07:20:37.128		58.12	-80.82	42315.07	-15.06		
6	I	2031-01-08T07:21:07.874		58.01	-80.77	41861.99	-14.91		

No planet occultations

6	E	2031-01-08T08:11:43.870		47.08	-72.49	41800.75	14.86		
5	E	2031-01-08T08:12:12.121		46.98	-72.39	42221.26	15.01		
4	E	2031-01-08T08:12:37.333		46.89	-72.31	42598.99	15.10		
alpha	E	2031-01-08T08:14:56.168		46.39	-71.85	44732.99	15.65		
beta	E	2031-01-08T08:15:53.911		46.19	-71.66	45642.26	15.84		
eta	E	2031-01-08T08:17:29.770		45.84	-71.34	47176.12	16.16		
gamma	E	2031-01-08T08:17:57.873		45.74	-71.25	47631.36	16.24		
delta	E	2031-01-08T08:18:38.907		45.59	-71.11	48300.35	16.36		
lambda	E	2031-01-08T08:20:23.474		45.22	-70.76	50026.71	16.65		
epsilon	E	2031-01-08T08:21:54.450		44.89	-70.46	51551.98	16.87		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-01-08T07:50:06.530
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : 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 : 3415735783400056704
 2Mass ID (if available) : 05133706+2306200
 ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s
 RUWE (>1.4 is poor) : 2.21
 K magnitude : 14.439
 G magnitude : 16.187
 RP magnitude : 15.546
 BP magnitude : 16.584
 DUPflag : 0
 Distance (au) : 18.277
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.95
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 23.89
 B (ring opening deg) : 82.00
 PA of pole (deg) : 7.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.221
 C/A sky separation (km) : 29434.6
 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

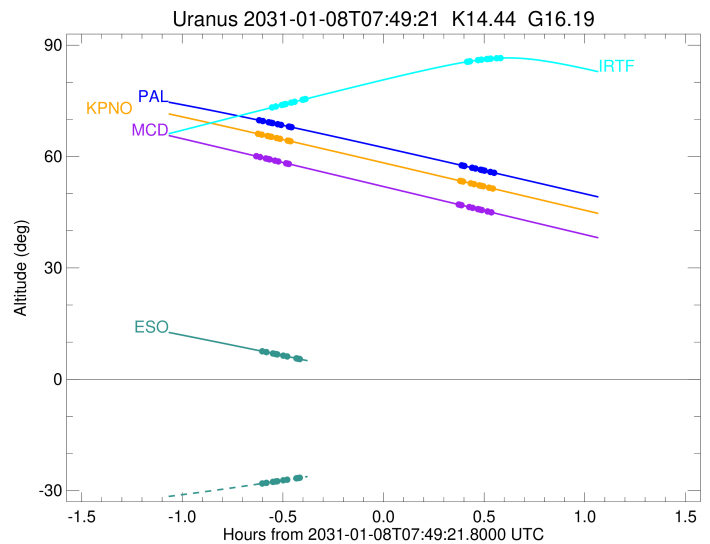
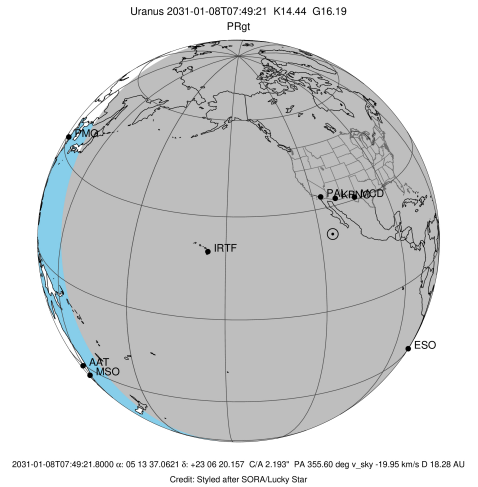


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-08T07:16:21.293		73.27	-45.28	50951.60	-16.62		
lambda	I	2031-01-08T07:17:17.487		73.48	-45.50	50026.71	-16.38		
delta	I	2031-01-08T07:19:03.942		73.89	-45.91	48300.35	-16.05		
gamma	I	2031-01-08T07:19:46.301		74.05	-46.07	47623.45	-15.91		
eta	I	2031-01-08T07:20:14.504		74.15	-46.18	47176.12	-15.81		
beta	I	2031-01-08T07:21:50.676		74.52	-46.55	45671.64	-15.45		
alpha	I	2031-01-08T07:22:50.941		74.75	-46.78	44746.33	-15.23		
4	I	2031-01-08T07:25:14.825		75.29	-47.33	42604.71	-14.60		
5	I	2031-01-08T07:25:34.266		75.36	-47.40	42314.81	-14.49		
6	I	2031-01-08T07:26:06.340		75.49	-47.53	41860.63	-14.32		

No planet occultations

6	E	2031-01-08T08:14:13.868		85.52	-58.64	41801.94	14.33		
5	E	2031-01-08T08:14:43.378		85.59	-58.75	42225.37	14.50		
4	E	2031-01-08T08:15:09.301		85.65	-58.85	42600.78	14.60		
alpha	E	2031-01-08T08:17:32.351		85.97	-59.40	44734.42	15.23		
beta	E	2031-01-08T08:18:31.515		86.09	-59.63	45642.60	15.46		
eta	E	2031-01-08T08:20:09.549		86.25	-60.01	47176.12	15.82		
gamma	E	2031-01-08T08:20:38.229		86.30	-60.12	47631.29	15.92		
delta	E	2031-01-08T08:21:20.073		86.35	-60.28	48300.35	16.06		
lambda	E	2031-01-08T08:23:06.469		86.47	-60.69	50026.71	16.39		
epsilon	E	2031-01-08T08:24:38.662		86.54	-61.04	51549.61	16.63		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-01-08T07:45:18.170
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : 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 : 3415735783400056704
 2Mass ID (if available) : 05133706+2306200
 ICRS Star Coord at Epoch: 05h 13m 37.06207s +23:06:20.15694s
 RUWE (>1.4 is poor) : 2.21
 K magnitude : 14.439
 G magnitude : 16.187
 RP magnitude : 15.546
 BP magnitude : 16.584
 DUPflag : 0
 Distance (au) : 18.277
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.95
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 22.69
 B (ring opening deg) : 82.00
 PA of pole (deg) : 7.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.488
 C/A sky separation (km) : 32978.4
 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	2031-01-08T07:13:24.629		7.50	-28.05	50987.58	-15.34		
lambda	I	2031-01-08T07:14:28.131		7.31	-27.91	50026.71	-15.02		
delta	I	2031-01-08T07:16:24.774		6.94	-27.64	48300.35	-14.57		
gamma	I	2031-01-08T07:17:11.486		6.80	-27.54	47623.97	-14.38		
eta	I	2031-01-08T07:17:42.767		6.70	-27.47	47176.12	-14.25		
beta	I	2031-01-08T07:19:30.254		6.36	-27.22	45669.53	-13.76		
alpha	I	2031-01-08T07:20:37.901		6.15	-27.06	44748.50	-13.44		
4	I	2031-01-08T07:23:22.853		5.63	-26.68	42608.53	-12.55		
5	I	2031-01-08T07:23:45.956		5.56	-26.62	42312.89	-12.40		
6	I	2031-01-08T07:24:23.914		5.44	-26.53	41855.41	-12.16		

No planet occultations

6	E	2031-01-08T08:06:24.447	-2.71x	-20.12	41805.05	12.11	
5	E	2031-01-08T08:06:59.830	-2.82x	-20.02	42234.79	12.35	
4	E	2031-01-08T08:07:29.708	-2.92x	-19.94	42604.54	12.50	
alpha	E	2031-01-08T08:10:14.563	-3.47x	-19.49	44737.42	13.38	
beta	E	2031-01-08T08:11:21.477	-3.69x	-19.31	45643.45	13.69	
eta	E	2031-01-08T08:13:11.435	-4.06x	-19.01	47176.12	14.18	
gamma	E	2031-01-08T08:13:43.374	-4.16x	-18.92	47631.11	14.31	
delta	E	2031-01-08T08:14:29.833	-4.32x	-18.79	48300.35	14.50	
lambda	E	2031-01-08T08:16:27.116	-4.71x	-18.46	50026.71	14.93	
epsilon	E	2031-01-08T08:18:07.498	-5.05x	-18.18	51543.05	15.25	