

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2038-12-21T14:09:13.650
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 673882812581500672
 2Mass ID (if available) : 07575182+2113557

ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s

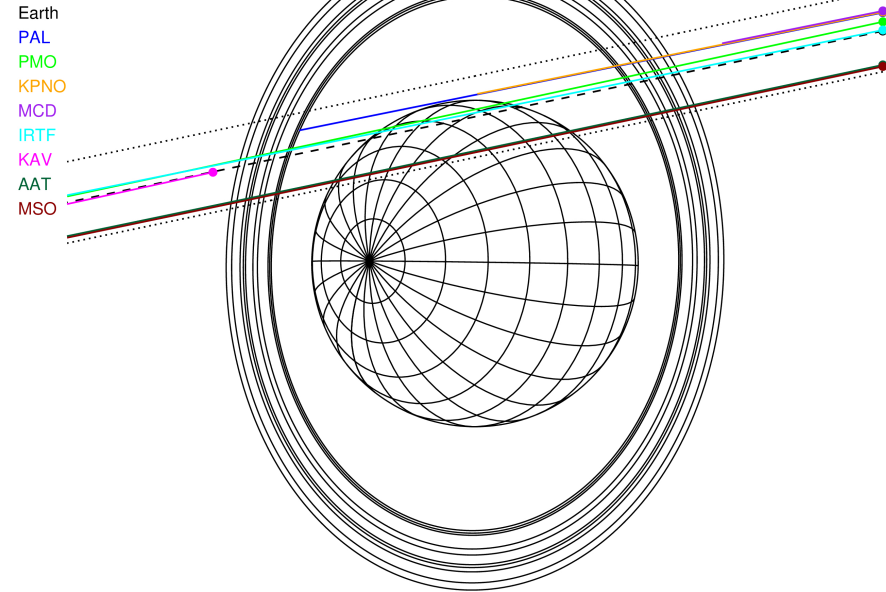
RUWE (>1.4 is poor) : 1.07
 K magnitude : 14.697
 G magnitude : 16.608
 RP magnitude : 15.982
 BP magnitude : 17.076
 DUPflag : 0
 Distance (au) : 17.775
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.76
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 90.69
 B (ring opening deg) : 49.62
 PA of pole (deg) : 88.66

#	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



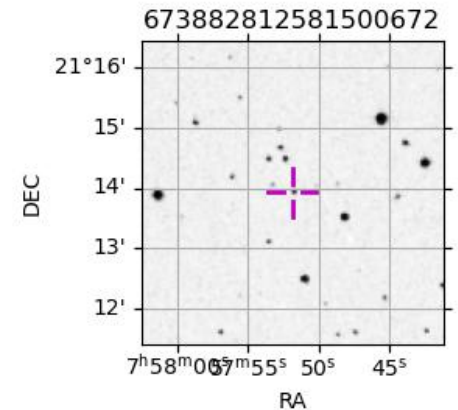
2038-12-21T14:09:13.6500 ra: 07 57 51.8291 s: +21 13 55.550 C/A 1.755° PA 191.87 deg v_sky -19.76 km/s D 17.77 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2038-12-21T14:09:13 K14.70 G16.61 PgtRgt

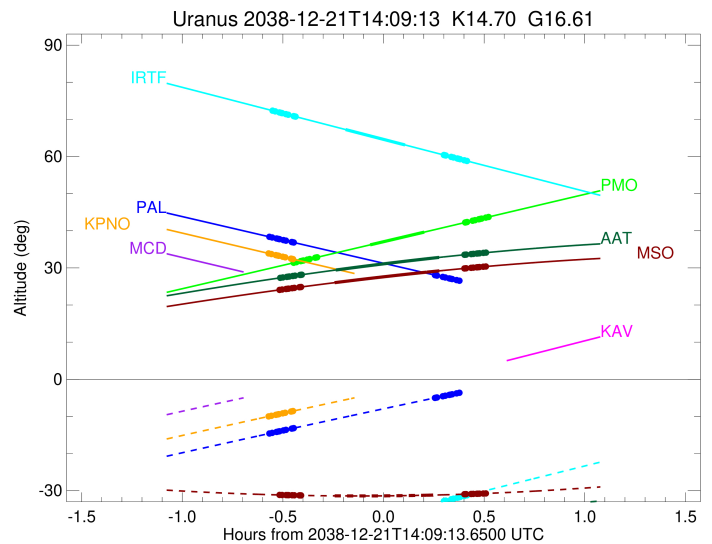
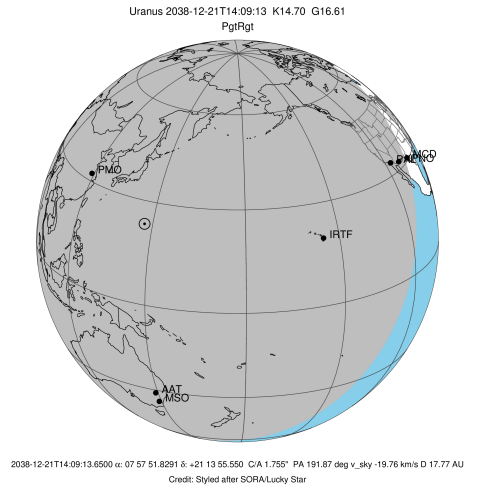


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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 21 13:35 - DEC 21 14:24	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++	+ +	+++++	DEC 21 13:42 - DEC 21 14:40	PieRie
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++			DEC 21 13:35 - DEC 21 13:42	PnnRin
MCD	McDonald Obs. 2.7m	30.7	256.0					PnnRnn
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	DEC 21 13:36 - DEC 21 14:34	PieRie
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	+++++	+ +	+++++	DEC 21 13:38 - DEC 21 14:39	PieRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	+++++	+ +	+++++	DEC 21 13:38 - DEC 21 14:39	PieRie



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2038-12-21T14:05:30.260
 Event type : PgtRgt
 : Uranus occs: geocentric, 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 : 673882812581500672
 2Mass ID (if available) : 07575182+2113557
 ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s
 RUWE (>1.4 is poor) : 1.07
 K magnitude : 14.697
 G magnitude : 16.608
 RP magnitude : 15.982
 BP magnitude : 17.076
 DUPflag : 0
 Distance (au) : 17.775
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.76
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 91.22
 B (ring opening deg) : 49.62
 PA of pole (deg) : 88.66
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.008
 C/A sky separation (km) : 25880.7
 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



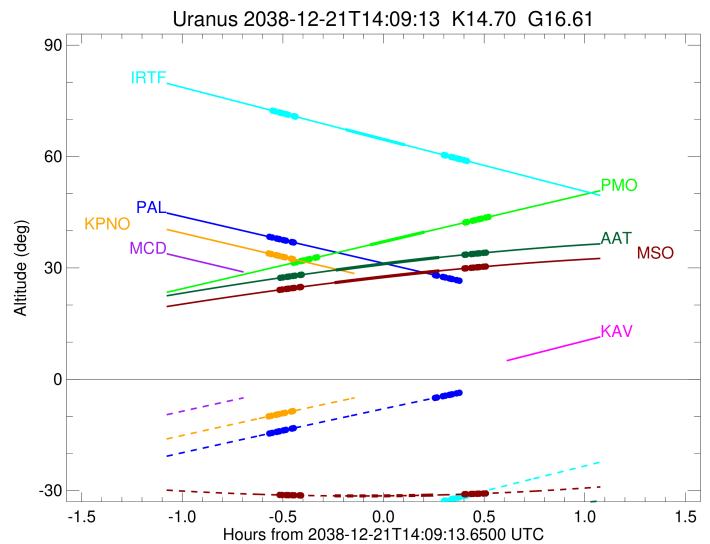
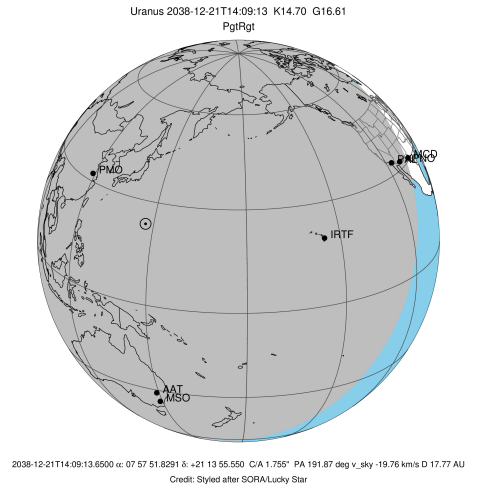
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2038-12-21T13:35:31.039		38.31	-14.54	50745.09	-22.21		
lambda	I	2038-12-21T13:36:03.489		38.19	-14.44	50026.71	-22.08		
delta	I	2038-12-21T13:37:22.215		37.92	-14.18	48300.35	-21.77		
gamma	I	2038-12-21T13:37:53.473		37.81	-14.07	47621.82	-21.64		
eta	I	2038-12-21T13:38:14.111		37.74	-14.01	47176.12	-21.55		
beta	I	2038-12-21T13:39:25.536		37.49	-13.77	45650.63	-21.23		
alpha	I	2038-12-21T13:40:09.990		37.33	-13.63	44704.19	-21.01		
4	I	2038-12-21T13:41:55.296		36.96	-13.28	42537.35	-20.41		
5	I	2038-12-21T13:42:12.321		36.91	-13.22	42191.58	-20.35		
6	I	2038-12-21T13:42:27.765		36.85	-13.17	41848.33	-20.20		

No planet occultations

6	E	2038-12-21T14:24:36.005		28.05	-5.01	41874.85	20.14		
5	E	2038-12-21T14:24:54.857		27.99	-4.95x	42310.72	20.29		
4	E	2038-12-21T14:25:07.354		27.94	-4.91x	42550.22	20.35		
alpha	E	2038-12-21T14:26:54.593		27.57	-4.57x	44752.20	20.94		
beta	E	2038-12-21T14:27:38.769		27.42	-4.44x	45680.83	21.16		
eta	E	2038-12-21T14:28:49.005		27.18	-4.21x	47176.12	21.47		
gamma	E	2038-12-21T14:29:09.883		27.10	-4.15x	47625.36	21.56		
delta	E	2038-12-21T14:29:41.093		27.00	-4.05x	48300.35	21.69		
lambda	E	2038-12-21T14:31:00.124		26.72	-3.80x	50026.71	21.99		
epsilon	E	2038-12-21T14:32:00.933		26.51	-3.61x	51370.54	22.12		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2038-12-21T14:13:26.180
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : 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 : 673882812581500672
 2Mass ID (if available) : 07575182+2113557
 ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s
 RUWE (>1.4 is poor) : 1.07
 K magnitude : 14.697
 G magnitude : 16.608
 RP magnitude : 15.982
 BP magnitude : 17.076
 DUPflag : 0
 Distance (au) : 17.775
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.76
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 91.27
 B (ring opening deg) : 49.62
 PA of pole (deg) : 88.66
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.830
 C/A sky separation (km) : 23585.8
 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

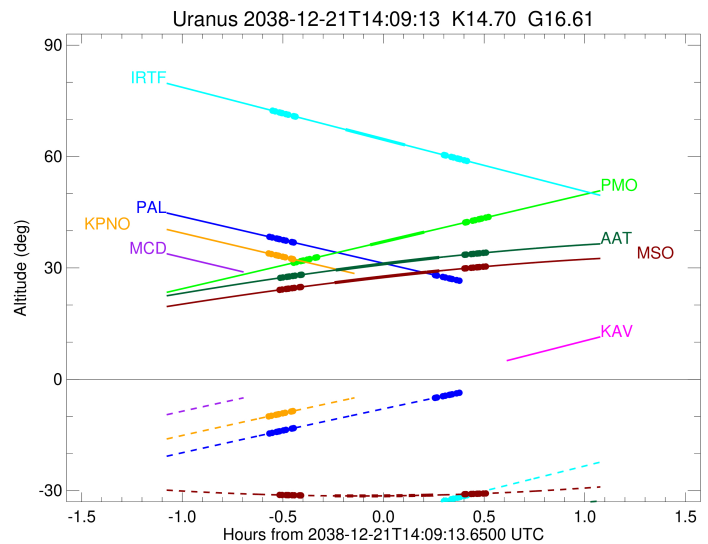
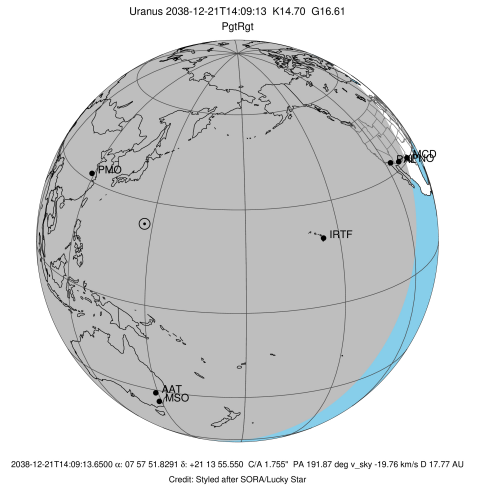


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2038-12-21T13:42:45.155		31.44	-58.02	50743.94	-22.85		
lambda	I	2038-12-21T13:43:16.613		31.55	-58.13	50026.71	-22.75		
delta	I	2038-12-21T13:44:32.890		31.82	-58.40	48300.35	-22.51		
gamma	I	2038-12-21T13:45:03.098		31.93	-58.50	47621.96	-22.40		
eta	I	2038-12-21T13:45:23.028		32.00	-58.57	47176.12	-22.33		
beta	I	2038-12-21T13:46:31.874		32.24	-58.82	45649.78	-22.08		
alpha	I	2038-12-21T13:47:14.585		32.39	-58.96	44702.59	-21.90		
4	I	2038-12-21T13:48:55.130		32.75	-59.32	42539.13	-21.44		
5	I	2038-12-21T13:49:11.632		32.80	-59.38	42187.73	-21.39		
6	I	2038-12-21T13:49:26.053		32.86	-59.43	41845.89	-21.27		
Uranus	I	2038-12-21T14:05:14.872		36.21	-62.74	25550.20		-5.94	-6.22
Uranus	E	2038-12-21T14:21:23.168		39.64	-66.08	25443.75		22.07	23.00
6	E	2038-12-21T14:33:36.656		42.24	-68.58	41873.22	21.34		
5	E	2038-12-21T14:33:54.426		42.30	-68.64	42312.52	21.47		
4	E	2038-12-21T14:34:06.320		42.35	-68.68	42553.30	21.51		
alpha	E	2038-12-21T14:35:48.061		42.71	-69.02	44752.39	21.99		
beta	E	2038-12-21T14:36:30.144		42.86	-69.16	45681.06	22.17		
eta	E	2038-12-21T14:37:37.292		43.09	-69.38	47176.12	22.43		
gamma	E	2038-12-21T14:37:57.308		43.17	-69.45	47625.70	22.50		
delta	E	2038-12-21T14:38:27.224		43.27	-69.55	48300.35	22.60		
lambda	E	2038-12-21T14:39:43.173		43.54	-69.80	50026.71	22.85		
epsilon	E	2038-12-21T14:40:42.620		43.75	-70.00	51390.60	22.95		

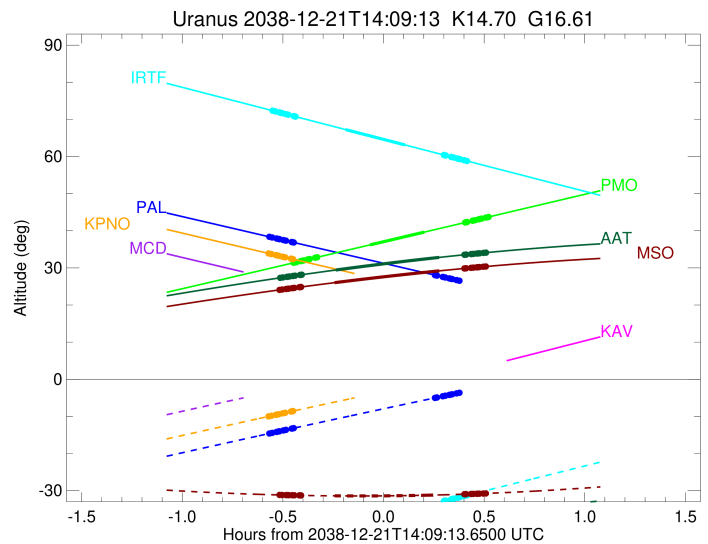
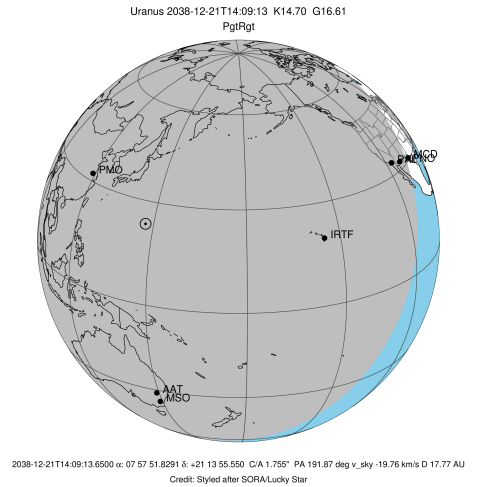

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2038-12-21T14:06:53.120
Event type           : PgtRgt
: Uranus occs: geocentric, 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       : 673882812581500672
2Mass ID (if available) : 07575182+2113557
ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s
RUWE (>1.4 is poor) : 1.07
K magnitude          : 14.697
G magnitude           : 16.608
RP magnitude         : 15.982
BP magnitude         : 17.076
DUPflag              : 0
Distance (au)        : 17.775
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -19.76
Sun-Target sep (deg) : 151.96
Sun-Moon sep (deg)   : 91.60
B (ring opening deg) : 49.62
PA of pole (deg)     : 88.66
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (" ) : 1.793
C/A sky separation (km) : 23119.6
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_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
    
```



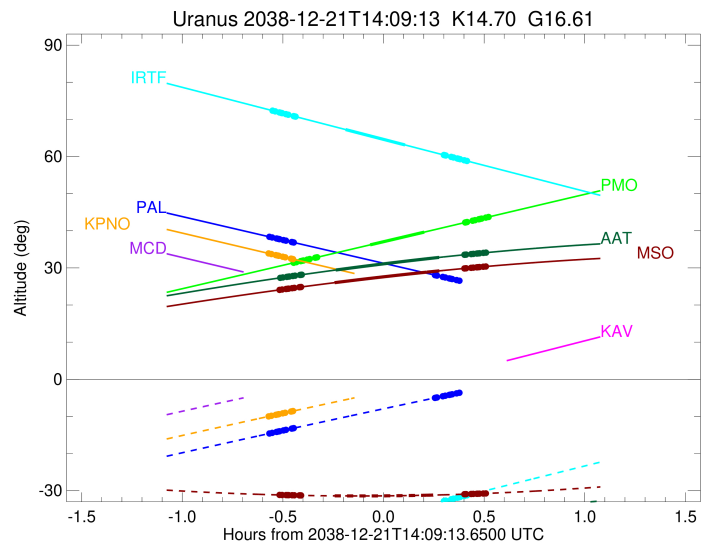
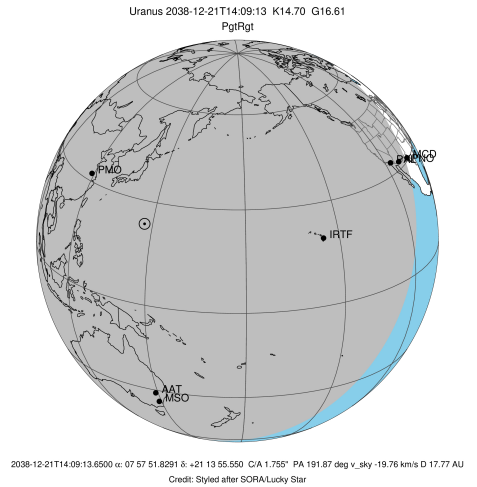
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2038-12-21T13:36:26.899		72.29	-44.37	50743.65	-23.24		
lambda	I	2038-12-21T13:36:57.810		72.17	-44.26	50026.71	-23.15		
delta	I	2038-12-21T13:38:12.767		71.88	-43.97	48300.35	-22.91		
gamma	I	2038-12-21T13:38:42.439		71.76	-43.86	47622.03	-22.81		
eta	I	2038-12-21T13:39:02.018		71.68	-43.78	47176.12	-22.74		
beta	I	2038-12-21T13:40:09.635		71.42	-43.53	45649.43	-22.49		
alpha	I	2038-12-21T13:40:51.564		71.26	-43.37	44701.95	-22.32		
4	I	2038-12-21T13:42:30.135		70.87	-42.99	42539.86	-21.87		
5	I	2038-12-21T13:42:46.424		70.81	-42.93	42186.27	-21.83		
6	I	2038-12-21T13:43:00.458		70.75	-42.88	41844.93	-21.71		
Uranus	I	2038-12-21T13:57:53.915		67.27	-39.48	25543.15		-7.98	-8.36
Uranus	E	2038-12-21T14:15:39.469		63.12	-35.45	25432.64		23.17	24.14
6	E	2038-12-21T14:27:15.897		60.41	-32.82	41873.08	21.67		
5	E	2038-12-21T14:27:33.401		60.34	-32.75	42312.64	21.79		
4	E	2038-12-21T14:27:45.126		60.29	-32.71	42553.53	21.83		
alpha	E	2038-12-21T14:29:25.455		59.90	-32.33	44752.40	22.28		
beta	E	2038-12-21T14:30:06.995		59.74	-32.17	45681.07	22.45		
eta	E	2038-12-21T14:31:13.323		59.48	-31.92	47176.12	22.69		
gamma	E	2038-12-21T14:31:33.104		59.41	-31.85	47625.72	22.76		
delta	E	2038-12-21T14:32:02.676		59.29	-31.73	48300.35	22.86		
lambda	E	2038-12-21T14:33:17.793		59.00	-31.45	50026.71	23.10		
epsilon	E	2038-12-21T14:34:16.659		58.77	-31.23	51391.39	23.19		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2038-12-21T14:10:29.570
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : AAT
 Location : Siding Spring (AAT)
 Latitude (deg) : -31.27703
 E. Longitude (deg) : 149.06608
 Altitude (km) : 1.164
 Gaia source ID : 673882812581500672
 2Mass ID (if available) : 07575182+2113557
 ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s
 RUWE (>1.4 is poor) : 1.07
 K magnitude : 14.697
 G magnitude : 16.608
 RP magnitude : 15.982
 BP magnitude : 17.076
 DUPflag : 0
 Distance (au) : 17.775
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.76
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 91.20
 B (ring opening deg) : 49.62
 PA of pole (deg) : 88.66
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.338
 C/A sky separation (km) : 17254.1
 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	2038-12-21T13:38:43.565		27.36	-35.18	50745.33	-24.48		
lambda	I	2038-12-21T13:39:12.937		27.43	-35.19	50026.71	-24.44		
delta	I	2038-12-21T13:40:23.742		27.58	-35.22	48300.35	-24.32		
gamma	I	2038-12-21T13:40:51.645		27.64	-35.23	47622.49	-24.27		
eta	I	2038-12-21T13:41:10.052		27.68	-35.24	47176.12	-24.23		
beta	I	2038-12-21T13:42:13.429		27.82	-35.26	45647.27	-24.11		
alpha	I	2038-12-21T13:42:52.545		27.91	-35.27	44697.89	-24.02		
4	I	2038-12-21T13:44:23.387		28.10	-35.30	42545.22	-23.79		
5	I	2038-12-21T13:44:39.059		28.14	-35.31	42177.04	-23.78		
6	I	2038-12-21T13:44:51.364		28.16	-35.31	41838.32	-23.70		
Uranus	I	2038-12-21T13:54:59.656		29.43	-35.44	25451.09		-21.31	-22.22
Uranus	E	2038-12-21T14:25:48.842		32.83	-35.16	25303.10		34.20	35.44
6	E	2038-12-21T14:33:23.970		33.54	-34.94	41868.77	23.75		
5	E	2038-12-21T14:33:39.941		33.57	-34.93	42314.92	23.83		
4	E	2038-12-21T14:33:50.875		33.58	-34.92	42560.58	23.84		
alpha	E	2038-12-21T14:35:23.088		33.72	-34.87	44752.21	24.07		
beta	E	2038-12-21T14:36:01.546		33.78	-34.85	45681.23	24.16		
eta	E	2038-12-21T14:37:03.353		33.87	-34.81	47176.12	24.29		
gamma	E	2038-12-21T14:37:21.879		33.90	-34.80	47626.48	24.33		
delta	E	2038-12-21T14:37:49.547		33.94	-34.78	48300.35	24.38		
lambda	E	2038-12-21T14:39:00.167		34.04	-34.74	50026.71	24.51		
epsilon	E	2038-12-21T14:39:57.404		34.12	-34.70	51432.12	24.55		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2038-12-21T14:10:21.370
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : MSO
 Location : Mt. Stromlo Observatory
 Latitude (deg) : -35.32000
 E. Longitude (deg) : 149.00833
 Altitude (km) : 0.770
 Gaia source ID : 673882812581500672
 2Mass ID (if available) : 07575182+2113557
 ICRS Star Coord at Epoch: 07h 57m 51.82914s +21:13:55.54975s
 RUWE (>1.4 is poor) : 1.07
 K magnitude : 14.697
 G magnitude : 16.608
 RP magnitude : 15.982
 BP magnitude : 17.076
 DUPflag : 0
 Distance (au) : 17.775
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -19.76
 Sun-Target sep (deg) : 151.96
 Sun-Moon sep (deg) : 91.14
 B (ring opening deg) : 49.62
 PA of pole (deg) : 88.66
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.320
 C/A sky separation (km) : 17013.2
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2038-12-21T13:38:31.572		24.11	-31.17	50745.53	-24.51		
lambda	I	2038-12-21T13:39:00.920		24.17	-31.18	50026.71	-24.47		
delta	I	2038-12-21T13:40:11.639		24.32	-31.20	48300.35	-24.35		
gamma	I	2038-12-21T13:40:39.504		24.37	-31.21	47622.51	-24.30		
eta	I	2038-12-21T13:40:57.886		24.41	-31.22	47176.12	-24.27		
beta	I	2038-12-21T13:42:01.172		24.54	-31.24	45647.19	-24.14		
alpha	I	2038-12-21T13:42:40.227		24.62	-31.25	44697.73	-24.06		
4	I	2038-12-21T13:44:10.889		24.80	-31.28	42545.45	-23.84		
5	I	2038-12-21T13:44:26.558		24.83	-31.28	42176.70	-23.83		
6	I	2038-12-21T13:44:38.817		24.86	-31.29	41838.05	-23.75		
Uranus	I	2038-12-21T13:54:40.052		26.02	-31.40	25447.06		-21.73	-22.65
Uranus	E	2038-12-21T14:25:52.186		29.20	-31.16	25299.41		34.49	35.73
6	E	2038-12-21T14:33:22.293		29.86	-30.96	41868.59	23.80		
5	E	2038-12-21T14:33:38.233		29.88	-30.95	42314.97	23.88		
4	E	2038-12-21T14:33:49.154		29.89	-30.95	42560.86	23.89		
alpha	E	2038-12-21T14:35:21.196		30.02	-30.90	44752.19	24.11		
beta	E	2038-12-21T14:35:59.592		30.07	-30.88	45681.22	24.20		
eta	E	2038-12-21T14:37:01.313		30.16	-30.85	47176.12	24.32		
gamma	E	2038-12-21T14:37:19.815		30.18	-30.84	47626.51	24.36		
delta	E	2038-12-21T14:37:47.447		30.22	-30.82	48300.35	24.41		
lambda	E	2038-12-21T14:38:57.988		30.31	-30.78	50026.71	24.53		
epsilon	E	2038-12-21T14:39:55.228		30.39	-30.75	51433.61	24.57		