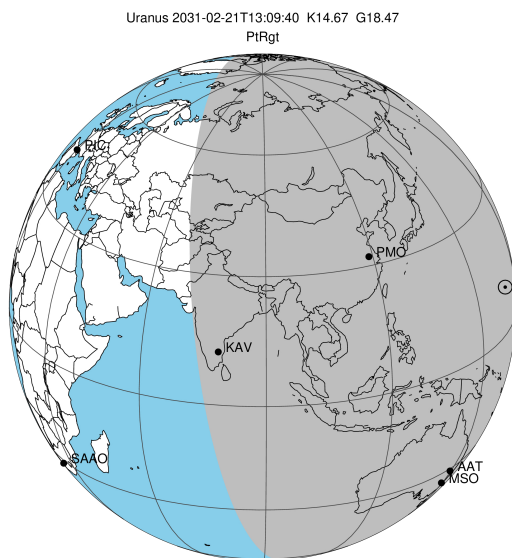


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T13:09:40.700
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564

ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s

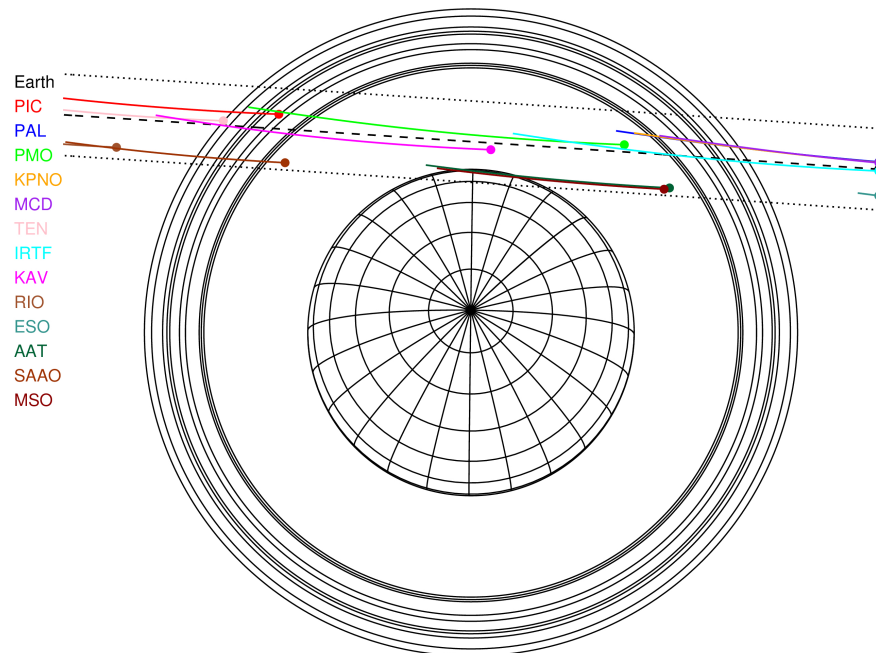
RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.844
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 107.53
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51

#	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



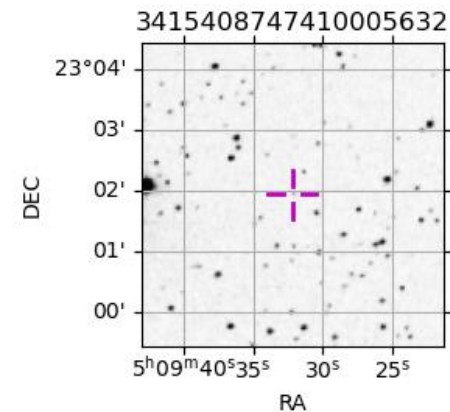
2031-02-21T13:09:40.7000 α: 05 09 32.1430 δ: +23 01 56.305 C/A 2.191" PA 177.52 deg v_sky - 1.96 km/s D 18.84 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2031-02-21T13:09:40 K14.67 G18.47 PtRgt

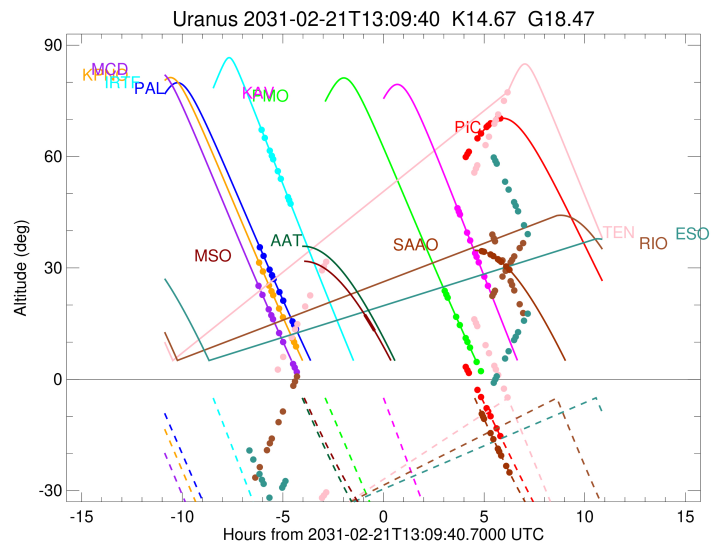
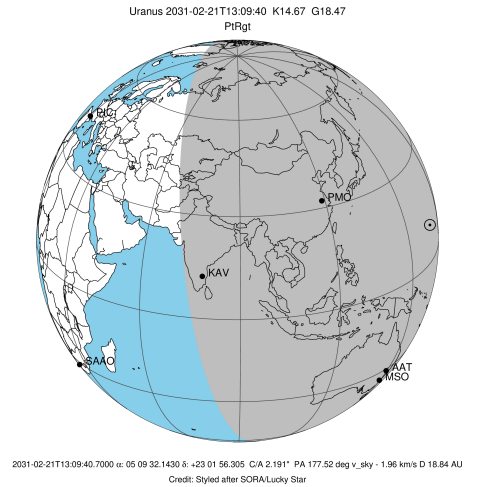


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1			+++++	FEB 21 18:16 - FEB 21 18:55	PnnRne
PAL	Palomar Mt (200")	33.4	243.1	+++++			FEB 21 07:03 - FEB 21 08:48	PnnRin
PMO	Purple Mtn Obs. Nanki	32.1	118.8			+++++	FEB 21 16:12 - FEB 21 17:27	PnnRne
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++			FEB 21 07:01 - FEB 21 08:49	PnnRin
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++			FEB 21 07:00 - FEB 21 08:10	PnnRin
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++			FEB 21 07:08 - FEB 21 08:32	PnnRin
KAV	Kavalur Observatory	12.6	78.8			+++++	FEB 21 16:50 - FEB 21 18:18	PnnRne
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			+++++	FEB 21 18:02 - FEB 21 19:23	PnnRne
MSO	Mt. Stromlo Observato	-35.3	149.0		+ +		FEB 21 12:13 - FEB 21 12:43	PieRnn



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T14:05:33.690
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.844
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 108.02
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.465
 C/A sky separation (km) : 33685.2
 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

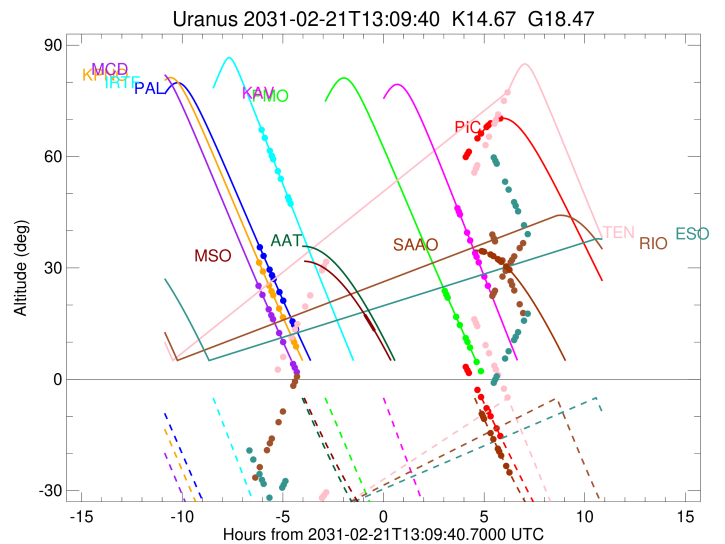
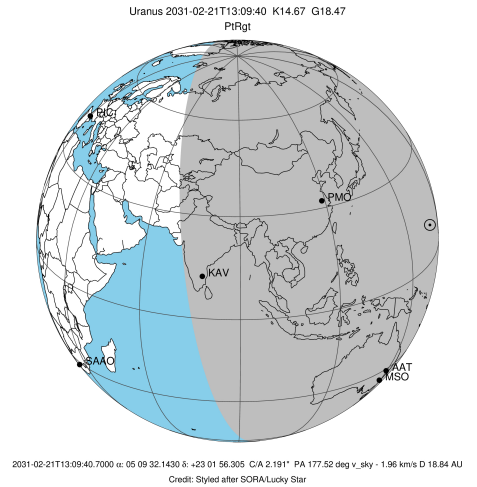
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T08:20:30.523	-22.02x	14.86x	50836.29	-1.23			
lambda	I	2031-02-21T08:31:27.130	-21.34x	16.58x	50026.71	-1.23			
delta	I	2031-02-21T08:55:13.301	-19.58x	20.17x	48300.35	-1.19			
gamma	I	2031-02-21T09:04:43.755	-18.77x	21.54x	47622.64	-1.18			
eta	I	2031-02-21T09:11:03.184	-18.20x	22.43x	47176.12	-1.17			
beta	I	2031-02-21T09:32:43.492	-16.06x	25.34x	45672.64	-1.14			
alpha	I	2031-02-21T09:46:24.140	-14.57x	27.05x	44746.66	-1.12			
4	I	2031-02-21T10:19:14.788	-10.60x	30.70x	42610.72	-1.05			
5	I	2031-02-21T10:23:56.008	-9.99x	31.16x	42309.73	-1.04			
6	I	2031-02-21T10:31:25.853	-9.00x	31.87x	41848.67	-1.03			

No planet occultations

6	E	2031-02-21T17:15:16.380	59.94	3.26x	41879.62	1.30			
5	E	2031-02-21T17:20:23.143	60.73	2.36x	42286.18	1.32			
4	E	2031-02-21T17:23:51.132	61.25	1.75x	42561.72	1.34			
alpha	E	2031-02-21T17:49:26.140	64.85	-2.80x	44704.91	1.45			
beta	E	2031-02-21T18:00:28.487	66.21	-4.79x	45678.97	1.49			
eta	E	2031-02-21T18:16:51.549	67.94	-7.76	47176.12	1.55			
gamma	E	2031-02-21T18:21:37.617	68.37	-8.63	47622.24	1.57			
delta	E	2031-02-21T18:28:47.119	68.94	-9.94	48300.35	1.59			
lambda	E	2031-02-21T18:46:35.194	69.96	-13.20	50026.71	1.64			
epsilon	E	2031-02-21T18:55:33.072	70.23	-14.84	50915.90	1.66			

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-02-21T12:18:52.890
Event type           : PtRgt
: Uranus occs: topocentric, not geocentric
: 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       : 3415408747410005632
2Mass ID (if available) : 05093215+2301564
ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
RUWE (>1.4 is poor) : 0.99
K magnitude           : 14.674
G magnitude           : 18.469
RP magnitude          : 17.314
BP magnitude          : 19.955
DUPflag              : 0
Distance (au)        : 18.843
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -1.96
Sun-Target sep (deg) : 106.14
Sun-Moon sep (deg)   : 106.98
B (ring opening deg) : 82.14
PA of pole (deg)     : 0.51
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.526
C/A sky separation (km) : 34523.3
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_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```

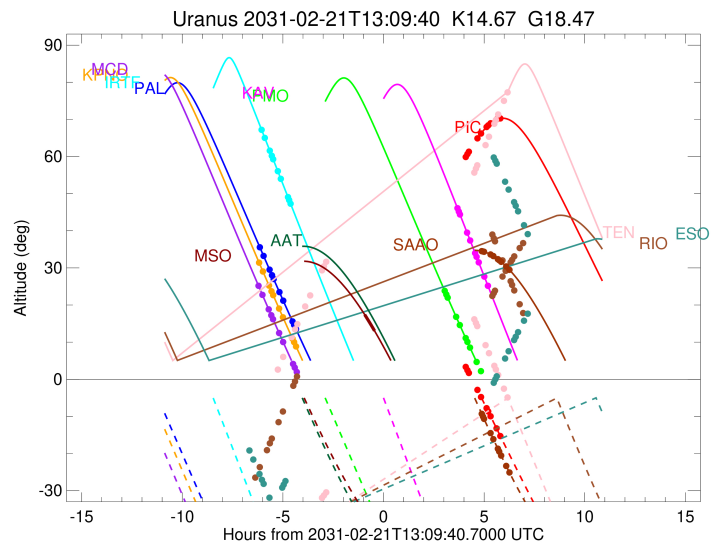
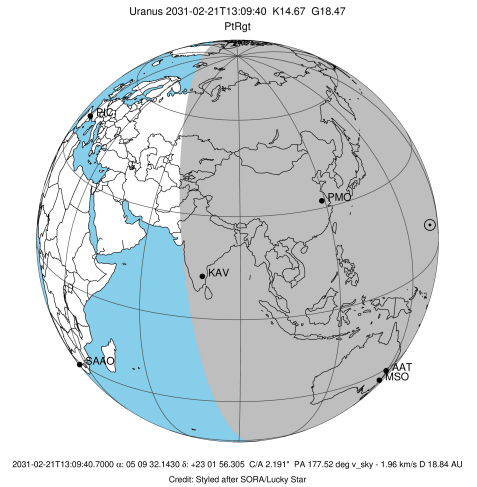


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T07:03:53.573		34.94	-63.88	50864.32	-1.68		
lambda	I	2031-02-21T07:12:15.470		33.20	-64.79	50026.71	-1.65		
delta	I	2031-02-21T07:30:08.758		29.49	-66.32	48300.35	-1.57		
gamma	I	2031-02-21T07:37:26.066		27.98	-66.77	47623.07	-1.53		
eta	I	2031-02-21T07:42:20.296		26.97	-67.00	47176.12	-1.51		
beta	I	2031-02-21T07:59:28.204		23.46	-67.40	45670.83	-1.42		
alpha	I	2031-02-21T08:10:30.403		21.21	-67.30	44748.51	-1.36		
4	I	2031-02-21T08:38:09.549		15.63	-65.84	42612.83	-1.21		
5	I	2031-02-21T08:42:19.501		14.80	-65.49	42306.28	-1.19		
6	I	2031-02-21T08:48:57.326		13.48	-64.86	41844.38	-1.16		

No planet occultations

6	E	2031-02-21T16:42:01.018	-28.06x	25.62x	41879.00	0.78
5	E	2031-02-21T16:50:39.566	-27.17x	27.12x	42292.59	0.80
4	E	2031-02-21T16:56:20.479	-26.56x	28.08x	42566.49	0.81
alpha	E	2031-02-21T17:38:02.232	-21.38x	34.67x	44707.81	0.90
beta	E	2031-02-21T17:55:38.790	-18.89x	37.15x	45679.70	0.94
eta	E	2031-02-21T18:21:22.747	-14.98x	40.35x	47176.12	1.00
gamma	E	2031-02-21T18:28:45.610	-13.81x	41.17x	47622.00	1.02
delta	E	2031-02-21T18:39:45.486	-12.02x	42.29x	48300.35	1.04
lambda	E	2031-02-21T19:06:35.640	-7.46x	44.52x	50026.71	1.10
epsilon	E	2031-02-21T19:19:33.294	-5.18x	45.30x	50897.13	1.13

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T12:46:09.530
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.843
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 108.24
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.257
 C/A sky separation (km) : 30847.3
 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

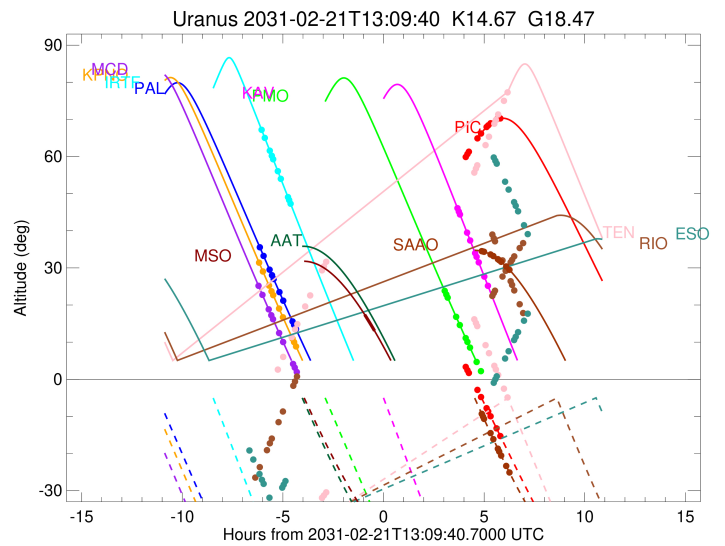
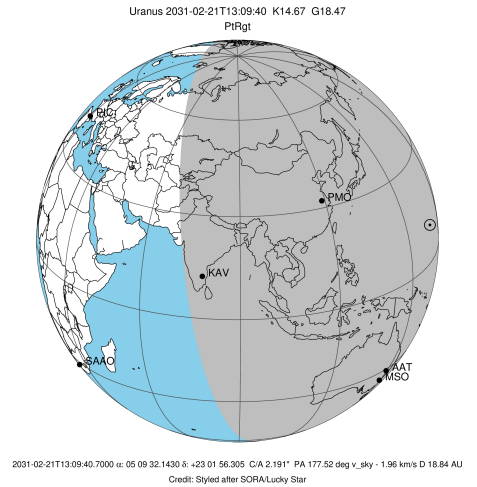


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T08:12:07.807		49.46	19.85x	50865.28	-1.89		
lambda	I	2031-02-21T08:19:31.897		51.03	18.45x	50026.71	-1.88		
delta	I	2031-02-21T08:34:57.463		54.31	15.47x	48300.35	-1.85		
gamma	I	2031-02-21T08:41:05.399		55.61	14.27x	47623.14	-1.83		
eta	I	2031-02-21T08:45:09.990		56.48	13.47x	47176.12	-1.82		
beta	I	2031-02-21T08:59:05.120		59.42	10.71x	45670.33	-1.78		
alpha	I	2031-02-21T09:07:45.897		61.24	8.97x	44749.03	-1.75		
4	I	2031-02-21T09:28:32.360		65.56	4.76x	42613.70	-1.67		
5	I	2031-02-21T09:31:34.391		66.18	4.14x	42304.18	-1.66		
6	I	2031-02-21T09:36:16.991		67.14	3.17x	41841.91	-1.64		

No planet occultations

6	E	2031-02-21T16:12:34.204		23.74	-68.53	41879.66	1.38		
5	E	2031-02-21T16:17:23.490		22.74	-68.57	42285.63	1.39		
4	E	2031-02-21T16:20:42.142		22.06	-68.56	42561.41	1.40		
alpha	E	2031-02-21T16:45:56.168		16.89	-67.63	44705.06	1.43		
beta	E	2031-02-21T16:57:14.989		14.59	-66.74	45679.05	1.44		
eta	E	2031-02-21T17:14:30.065		11.13	-64.93	47176.12	1.45		
gamma	E	2031-02-21T17:19:37.337		10.11	-64.29	47622.19	1.45		
delta	E	2031-02-21T17:27:23.875		8.57	-63.26	48300.35	1.45		
lambda	E	2031-02-21T17:47:10.298		4.70x	-60.31	50026.71	1.45		
epsilon	E	2031-02-21T17:57:16.029		2.75x	-58.65	50907.35	1.45		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T12:24:11.180
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.843
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 106.95
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.531
 C/A sky separation (km) : 34588.2
 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

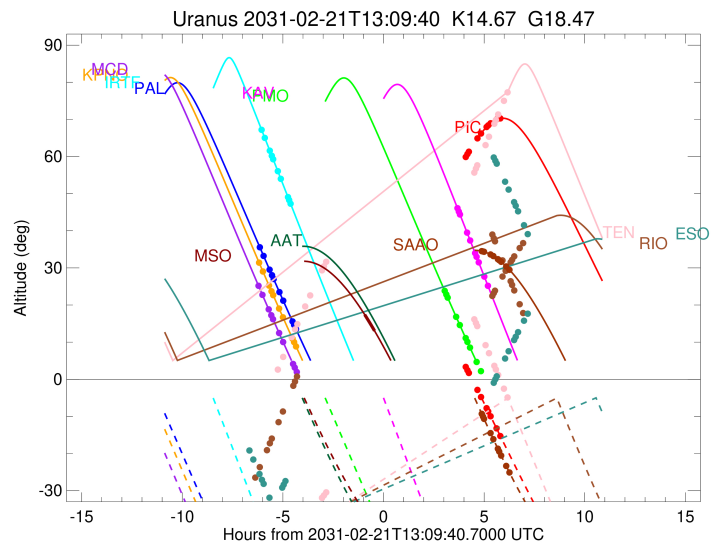
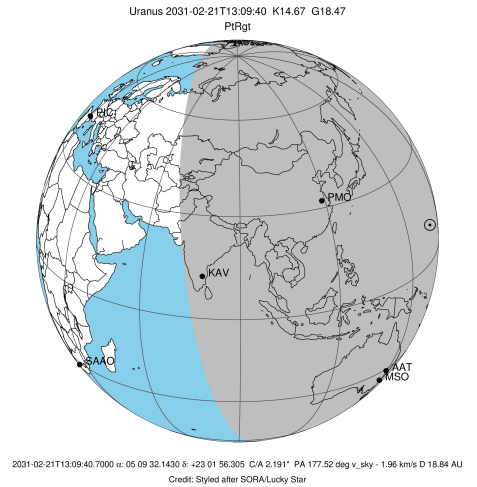


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T07:01:48.281		30.79	-67.04	50864.26	-1.65		
lambda	I	2031-02-21T07:10:18.158		29.01	-67.72	50026.71	-1.62		
delta	I	2031-02-21T07:28:29.917		25.21	-68.64	48300.35	-1.54		
gamma	I	2031-02-21T07:35:55.293		23.67	-68.78	47623.06	-1.50		
eta	I	2031-02-21T07:40:55.128		22.63	-68.80	47176.12	-1.48		
beta	I	2031-02-21T07:58:23.790		19.03	-68.37	45670.86	-1.39		
alpha	I	2031-02-21T08:09:40.422		16.73	-67.71	44748.48	-1.33		
4	I	2031-02-21T08:37:59.410		11.02	-64.91	42612.79	-1.18		
5	I	2031-02-21T08:42:15.730		10.17	-64.37	42306.37	-1.16		
6	I	2031-02-21T08:49:04.152		8.81	-63.45	41844.50	-1.12		

No planet occultations

6	E	2031-02-21T16:50:25.783	-25.95x	31.45x	41879.06	0.78
5	E	2031-02-21T16:59:00.704	-24.86x	32.85x	42292.12	0.81
4	E	2031-02-21T17:04:39.357	-24.12x	33.75x	42566.11	0.82
alpha	E	2031-02-21T17:45:51.043	-18.19x	39.71x	44707.52	0.92
beta	E	2031-02-21T18:03:09.481	-15.45x	41.84x	45679.63	0.96
eta	E	2031-02-21T18:28:21.858	-11.24x	44.44x	47176.12	1.02
gamma	E	2031-02-21T18:35:34.764	-9.99x	45.06x	47622.03	1.04
delta	E	2031-02-21T18:46:19.099	-8.11x	45.88x	48300.35	1.07
lambda	E	2031-02-21T19:12:28.738	-3.37x	47.28x	50026.71	1.13
epsilon	E	2031-02-21T19:25:08.102	-1.01x	47.65x	50899.84	1.16

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T12:34:25.230
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.843
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 106.94
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.539
 C/A sky separation (km) : 34703.2
 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_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

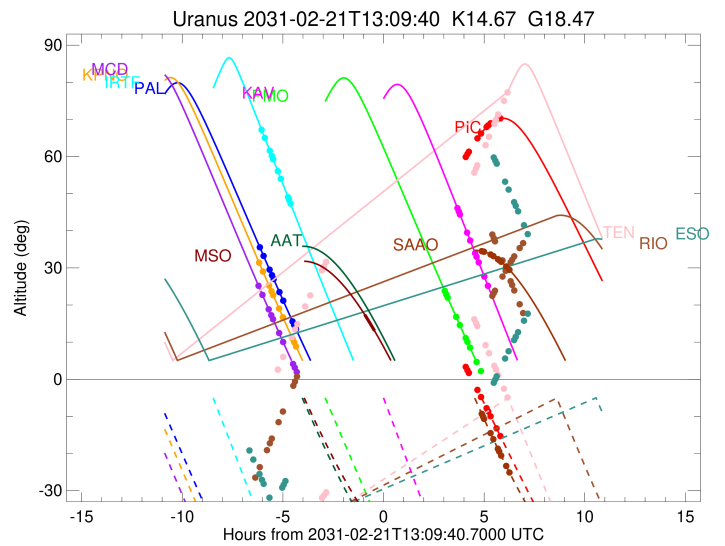
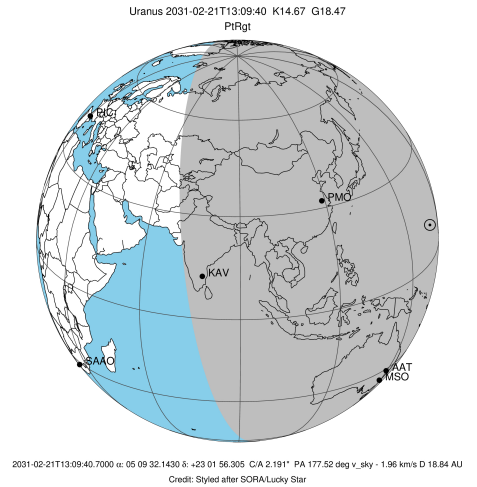


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T07:00:06.382		24.53	-69.97	50863.44	-1.61		
lambda	I	2031-02-21T07:08:50.384		22.70	-70.09	50026.71	-1.58		
delta	I	2031-02-21T07:27:35.632		18.79	-69.66	48300.35	-1.49		
gamma	I	2031-02-21T07:35:15.556		17.21	-69.22	47623.05	-1.45		
eta	I	2031-02-21T07:40:25.459		16.14	-68.85	47176.12	-1.43		
beta	I	2031-02-21T07:58:31.237		12.44	-67.08	45670.95	-1.34		
alpha	I	2031-02-21T08:10:13.652		10.07	-65.62	44748.39	-1.28		
4	I	2031-02-21T08:39:43.280		4.19x	-61.12	42612.66	-1.13		
5	I	2031-02-21T08:44:10.699		3.31x	-60.36	42306.63	-1.11		
6	I	2031-02-21T08:51:17.801		1.92x	-59.12	41844.82	-1.07		

No planet occultations

6	E	2031-02-21T17:01:42.332		-21.22x	38.80x	41879.15	0.80		
5	E	2031-02-21T17:10:05.673		-19.93x	39.98x	42291.42	0.82		
4	E	2031-02-21T17:15:37.029		-19.07x	40.73x	42565.55	0.84		
alpha	E	2031-02-21T17:55:39.706		-12.43x	45.37x	44707.12	0.95		
beta	E	2031-02-21T18:12:23.541		-9.48x	46.81x	45679.53	0.99		
eta	E	2031-02-21T18:36:40.722		-5.05x	48.31x	47176.12	1.06		
gamma	E	2031-02-21T18:43:37.079		-3.75x	48.60x	47622.07	1.08		
delta	E	2031-02-21T18:53:56.214		-1.80x	48.90x	48300.35	1.11		
lambda	E	2031-02-21T19:19:02.818		3.05x	49.02x	50026.71	1.18		
epsilon	E	2031-02-21T19:31:14.103		5.44	48.76x	50903.42	1.21		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T11:54:12.350
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.843
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 107.06
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.328
 C/A sky separation (km) : 31810.8
 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



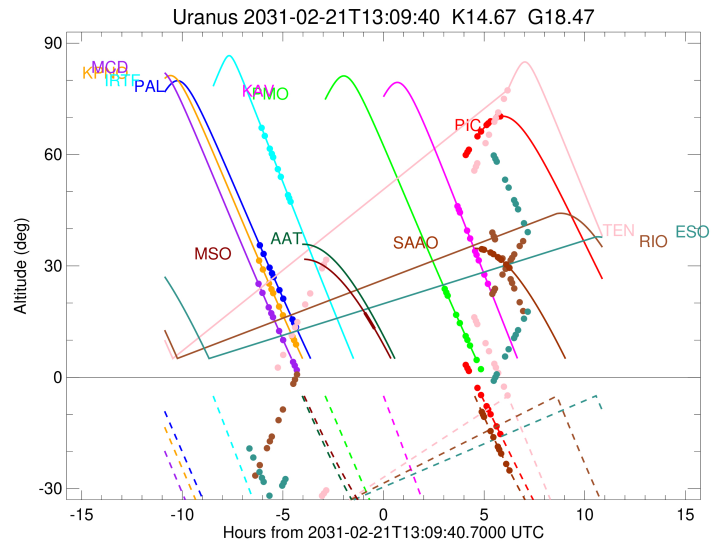
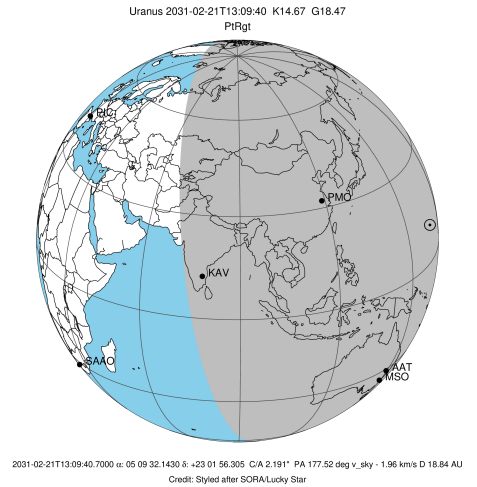
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T07:08:37.016		66.65	-39.44	50881.00	-1.98		
lambda	I	2031-02-21T07:15:50.123		64.99	-41.14	50026.71	-1.96		
delta	I	2031-02-21T07:30:46.527		61.54	-44.65	48300.35	-1.89		
gamma	I	2031-02-21T07:36:46.741		60.16	-46.05	47623.36	-1.87		
eta	I	2031-02-21T07:40:47.698		59.23	-46.99	47176.12	-1.85		
beta	I	2031-02-21T07:54:38.664		56.04	-50.23	45669.47	-1.78		
alpha	I	2031-02-21T08:03:22.336		54.03	-52.27	44749.69	-1.73		
4	I	2031-02-21T08:24:40.348		49.12	-57.21	42614.35	-1.61		
5	I	2031-02-21T08:27:51.533		48.39	-57.94	42302.37	-1.59		
6	I	2031-02-21T08:32:47.296		47.26	-59.07	41840.14	-1.56		

No planet occultations

6	E	2031-02-21T16:20:20.540		-44.18x	-7.02	41879.33	0.91		
5	E	2031-02-21T16:27:44.814		-44.80x	-5.30	42290.05	0.92		
4	E	2031-02-21T16:32:44.318		-45.18x	-4.14x	42564.60	0.92		
alpha	E	2031-02-21T17:10:56.779		-47.04x	4.68x	44706.98	0.95		
beta	E	2031-02-21T17:27:58.684		-47.23x	8.58x	45679.54	0.96		
eta	E	2031-02-21T17:53:47.202		-46.75x	14.43x	47176.12	0.97		
gamma	E	2031-02-21T18:01:23.344		-46.43x	16.14x	47622.03	0.98		
delta	E	2031-02-21T18:12:52.503		-45.81x	18.71x	48300.35	0.99		
lambda	E	2031-02-21T18:41:40.011		-43.54x	25.06x	50026.71	1.01		
epsilon	E	2031-02-21T18:55:56.413		-42.07x	28.15x	50897.61	1.02		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-02-21T13:22:08.610
Event type           : PtRgt
: Uranus occs: topocentric, not geocentric
: Ring occs: geocentric, topocentric
Observer code        : KAV
Location              : Kavalur Observatory
Latitude (deg)       : 12.57556
E. Longitude (deg)   : 78.83167
Altitude (km)        : 0.722
Gaia source ID       : 3415408747410005632
2Mass ID (if available) : 05093215+2301564
ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
RUWE (>1.4 is poor) : 0.99
K magnitude           : 14.674
G magnitude           : 18.469
RP magnitude          : 17.314
BP magnitude          : 19.955
DUPflag               : 0
Distance (au)         : 18.844
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -1.96
Sun-Target sep (deg) : 106.14
Sun-Moon sep (deg)   : 108.50
B (ring opening deg) : 82.14
PA of pole (deg)     : 0.51
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.102
C/A sky separation (km) : 28733.7
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ural11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ural11.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
  
```



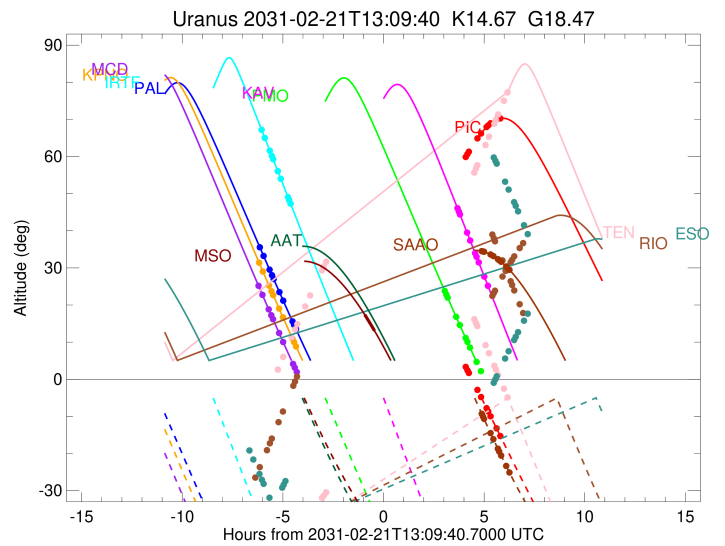
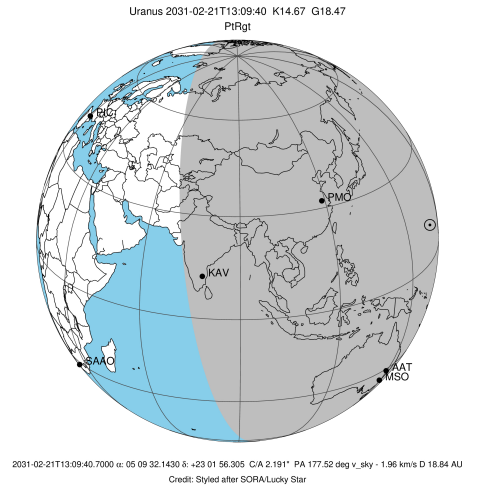
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T08:27:38.710		12.98	57.99x	50869.47	-1.77		
lambda	I	2031-02-21T08:35:33.626		14.79	56.60x	50026.71	-1.77		
delta	I	2031-02-21T08:51:49.943		18.52	53.57x	48300.35	-1.76		
gamma	I	2031-02-21T08:58:14.670		19.99	52.33x	47623.23	-1.76		
eta	I	2031-02-21T09:02:29.416		20.96	51.49x	47176.12	-1.75		
beta	I	2031-02-21T09:16:52.531		24.27	48.58x	45669.91	-1.74		
alpha	I	2031-02-21T09:25:44.618		26.31	46.73x	44749.40	-1.72		
4	I	2031-02-21T09:46:40.463		31.14	42.26x	42614.18	-1.68		
5	I	2031-02-21T09:49:42.709		31.84	41.60x	42302.82	-1.67		
6	I	2031-02-21T09:54:22.593		32.92	40.58x	41840.48	-1.66		

No planet occultations

6	E	2031-02-21T16:50:32.845		46.02	-58.67	41879.71	1.65		
5	E	2031-02-21T16:54:31.288		45.11	-59.64	42278.94	1.66		
4	E	2031-02-21T16:57:19.735		44.46	-60.32	42556.94	1.66		
alpha	E	2031-02-21T17:18:33.827		39.58	-65.50	44702.14	1.70		
beta	E	2031-02-21T17:28:06.556		37.38	-67.83	45678.13	1.71		
eta	E	2031-02-21T17:42:38.541		34.03	-71.37	47176.12	1.72		
gamma	E	2031-02-21T17:46:57.290		33.03	-72.42	47622.50	1.73		
delta	E	2031-02-21T17:53:29.517		31.52	-74.01	48300.35	1.73		
lambda	E	2031-02-21T18:10:06.189		27.69	-78.03	50026.71	1.73		
epsilon	E	2031-02-21T18:18:49.996		25.68	-80.13	50934.72	1.73		


```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-02-21T14:03:57.850
Event type          : PtRgt
: Uranus occs: topocentric, not geocentric
: Ring occs: geocentric, topocentric
Observer code       : SAAO
Location            : So. Afr. Astro. Obs. (Sutherland)
Latitude (deg)      : -32.37953
E. Longitude (deg)  : 20.81070
Altitude (km)       : 1.768
Gaia source ID      : 3415408747410005632
2Mass ID (if available) : 05093215+2301564
ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
RUWE (>1.4 is poor) : 0.99
K magnitude         : 14.674
G magnitude         : 18.469
RP magnitude        : 17.314
BP magnitude        : 19.955
DUPflag            : 0
Distance (au)       : 18.844
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -1.96
Sun-Target sep (deg) : 106.14
Sun-Moon sep (deg)  : 107.84
B (ring opening deg) : 82.14
PA of pole (deg)    : 0.51
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.889
C/A sky separation (km) : 25823.8
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.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
    
```



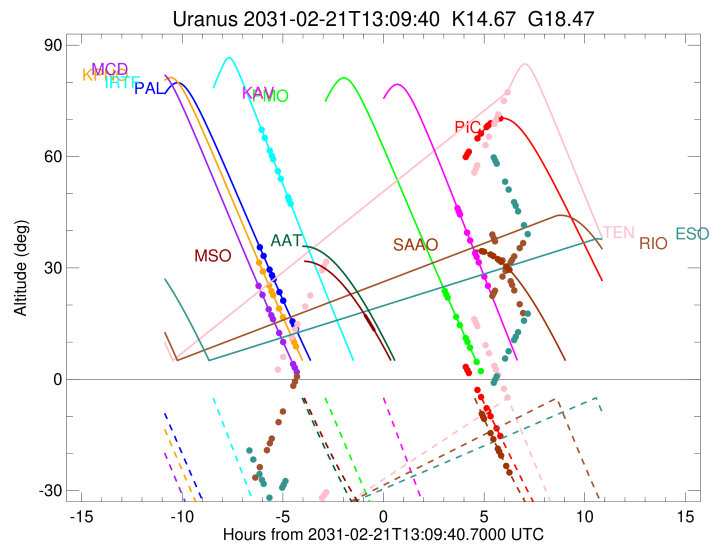
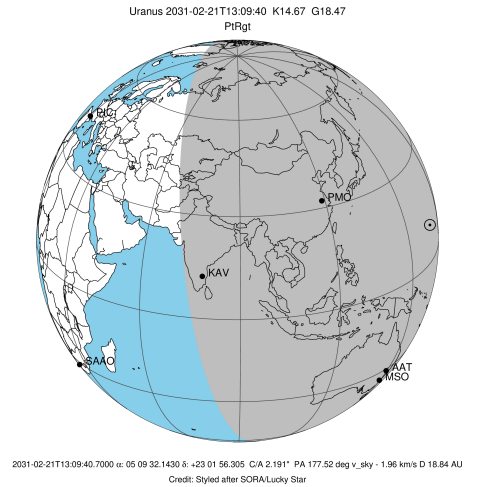
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b? alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-02-21T07:46:44.796	-61.44x	42.58x	50887.22	-1.45		
lambda	I	2031-02-21T07:56:37.493	-59.37x	44.58x	50026.71	-1.45		
delta	I	2031-02-21T08:16:29.931	-55.19x	48.51x	48300.35	-1.44		
gamma	I	2031-02-21T08:24:18.757	-53.54x	50.02x	47623.49	-1.44		
eta	I	2031-02-21T08:29:29.075	-52.45x	51.02x	47176.12	-1.44		
beta	I	2031-02-21T08:46:57.311	-48.74x	54.28x	45668.77	-1.43		
alpha	I	2031-02-21T08:57:38.356	-46.48x	56.19x	44750.22	-1.43		
4	I	2031-02-21T09:22:40.905	-41.17x	60.38x	42615.06	-1.41		
5	I	2031-02-21T09:26:20.133	-40.40x	60.95x	42299.76	-1.41		
6	I	2031-02-21T09:31:50.898	-39.23x	61.78x	41837.55	-1.41		

No planet occultations

6	E	2031-02-21T18:02:54.321	34.51	-9.36	41879.04	1.80		
5	E	2031-02-21T18:06:27.417	34.43	-10.08	42269.18	1.81		
4	E	2031-02-21T18:09:03.993	34.36	-10.60	42551.14	1.82		
alpha	E	2031-02-21T18:28:30.214	33.63	-14.44	44698.36	1.86		
beta	E	2031-02-21T18:37:14.396	33.18	-16.14	45676.59	1.88		
eta	E	2031-02-21T18:50:29.729	32.37	-18.68	47176.12	1.90		
gamma	E	2031-02-21T18:54:25.227	32.09	-19.43	47623.01	1.90		
delta	E	2031-02-21T19:00:21.022	31.65	-20.54	48300.35	1.91		
lambda	E	2031-02-21T19:15:22.575	30.40	-23.33	50026.71	1.92		
epsilon	E	2031-02-21T19:23:36.523	29.64	-24.82	50977.51	1.92		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-02-21T12:29:16.520
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3415408747410005632
 2Mass ID (if available) : 05093215+2301564
 ICRS Star Coord at Epoch: 05h 09m 32.14297s +23:01:56.30531s
 RUWE (>1.4 is poor) : 0.99
 K magnitude : 14.674
 G magnitude : 18.469
 RP magnitude : 17.314
 BP magnitude : 19.955
 DUPflag : 0
 Distance (au) : 18.843
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -1.96
 Sun-Target sep (deg) : 106.14
 Sun-Moon sep (deg) : 107.47
 B (ring opening deg) : 82.14
 PA of pole (deg) : 0.51
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.823
 C/A sky separation (km) : 24913.0
 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	2031-02-21T07:25:13.302		26.60	16.73x	50916.54	-2.14		
lambda	I	2031-02-21T07:32:09.032		27.23	15.31x	50026.71	-2.14		
delta	I	2031-02-21T07:45:41.562		28.36	12.54x	48300.35	-2.11		
gamma	I	2031-02-21T07:51:02.372		28.77	11.45x	47623.96	-2.10		
eta	I	2031-02-21T07:54:35.634		29.03	10.73x	47176.12	-2.10		
beta	I	2031-02-21T08:06:39.828		29.82	8.27x	45666.81	-2.07		
alpha	I	2031-02-21T08:14:03.618		30.24	6.77x	44751.32	-2.05		
4	I	2031-02-21T08:31:37.052		31.05	3.23x	42616.07	-2.00		
5	I	2031-02-21T08:34:15.754		31.14	2.70x	42294.07	-2.00		
6	I	2031-02-21T08:38:09.615		31.27	1.92x	41832.78	-1.99		
Uranus	I	2031-02-21T12:13:31.305		17.42	-35.74	25007.04		7.69	8.05
Uranus	E	2031-02-21T12:43:13.818		13.01	-39.19	24985.23		7.85	8.22
6	E	2031-02-21T17:06:20.087		-36.31x	-29.43	41879.52	1.38		
5	E	2031-02-21T17:11:03.543		-37.28x	-28.70	42274.75	1.38		
4	E	2031-02-21T17:14:28.219		-37.98x	-28.16	42554.38	1.38		
alpha	E	2031-02-21T17:40:31.443		-43.31x	-23.87	44700.58	1.37		
beta	E	2031-02-21T17:52:27.817		-45.76x	-21.81	45677.56	1.36		
eta	E	2031-02-21T18:10:51.895		-49.53x	-18.54	47176.12	1.35		
gamma	E	2031-02-21T18:16:22.531		-50.65x	-17.55	47622.69	1.35		
delta	E	2031-02-21T18:24:45.818		-52.36x	-16.01	48300.35	1.34		
lambda	E	2031-02-21T18:46:16.999		-56.71x	-11.99	50026.71	1.33		
epsilon	E	2031-02-21T18:57:52.935		-59.03x	-9.78	50949.67	1.32		