

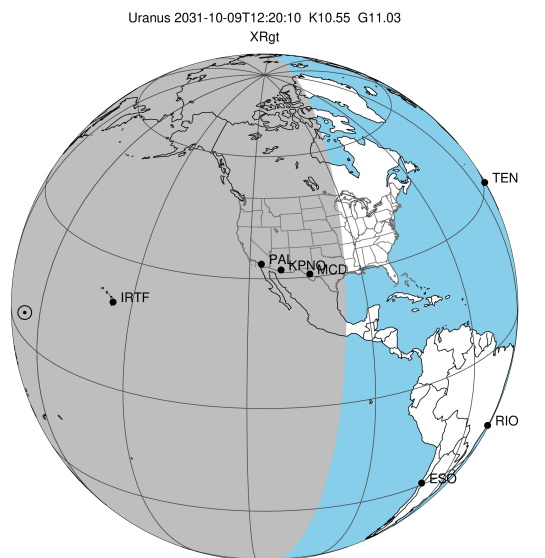
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:20:10.310  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083

ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s

RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 30.69  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68

# a(km) ring

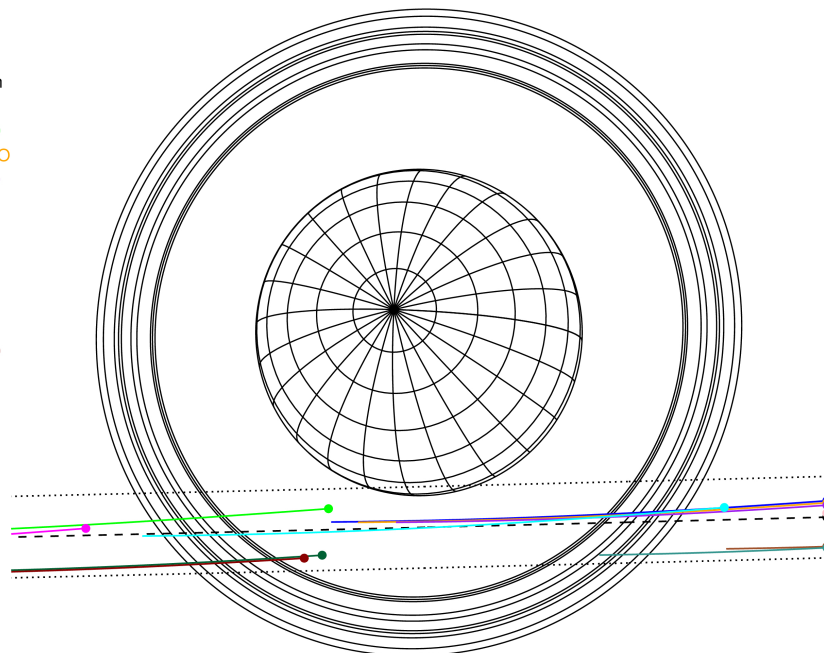
- 1 41837.2 6
- 2 42235.0 5
- 3 42571.2 4
- 4 44718.5 alpha
- 5 45661.1 beta
- 6 47176.1 eta
- 7 47626.3 gamma
- 8 48300.3 delta
- 9 50026.7 lambda
- 10 51149.4 epsilon



2031-10-09T12:20:10.310000: 05 46 01.61228: +23 32 08.2800 C/A 2.231° PA 0.90 deg v\_sky - 3.23 km/s D 18.75 AU  
 Credit: Styled after SORA/Lucky Star

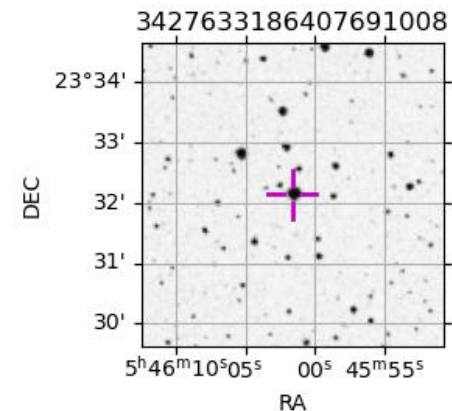
Uranus 2031-10-09T12:20:10 K10.55 G11.03 XRgt

Earth  
 PAL  
 PMO  
 KPNO  
 MCD  
 TEN  
 IRTF  
 KAV  
 RIO  
 ESO  
 AAT  
 MSO

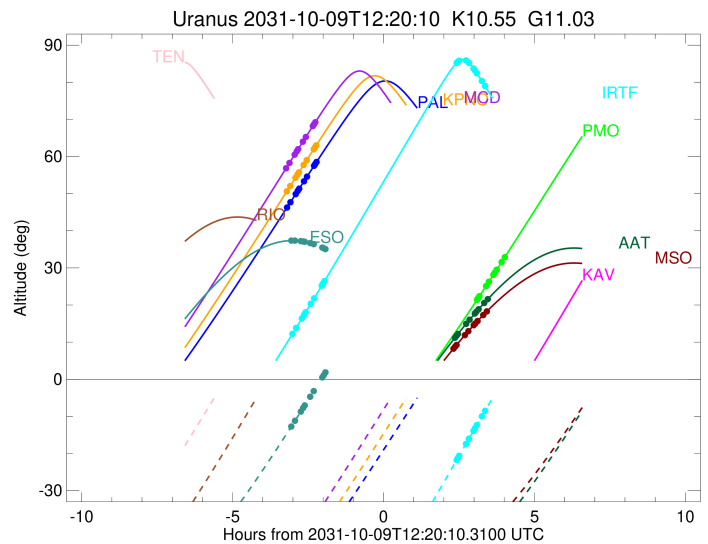
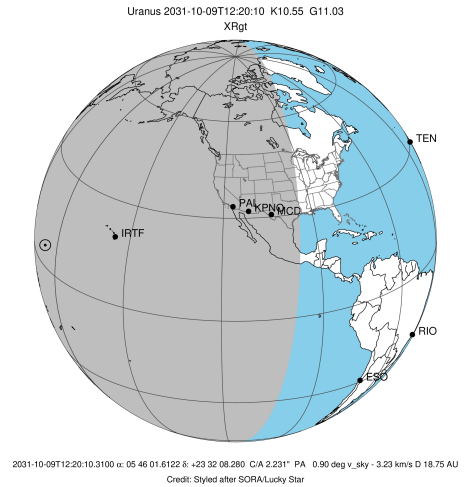


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++			OCT 09 09:09 - OCT 09 10:07	PnnRin
PMO	Purple Mtn Obs. Nanki	32.1	118.8			+++++	OCT 09 15:25 - OCT 09 16:23	PnnRne
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++			OCT 09 09:08 - OCT 09 10:06	PnnRin
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++			OCT 09 09:07 - OCT 09 10:04	PnnRin
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++			OCT 09 09:20 - OCT 09 15:44	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	+++++			OCT 09 09:17 - OCT 09 09:43	PnnRin
AAT	Siding Spring (AAT)	-31.3	149.1			+++++	OCT 09 14:41 - OCT 09 15:49	PnnRne
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0			+++++	OCT 09 14:38 - OCT 09 15:48	PnnRne



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:21:01.460  
 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.18  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.166  
 C/A sky separation (km) : 29463.1  
 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

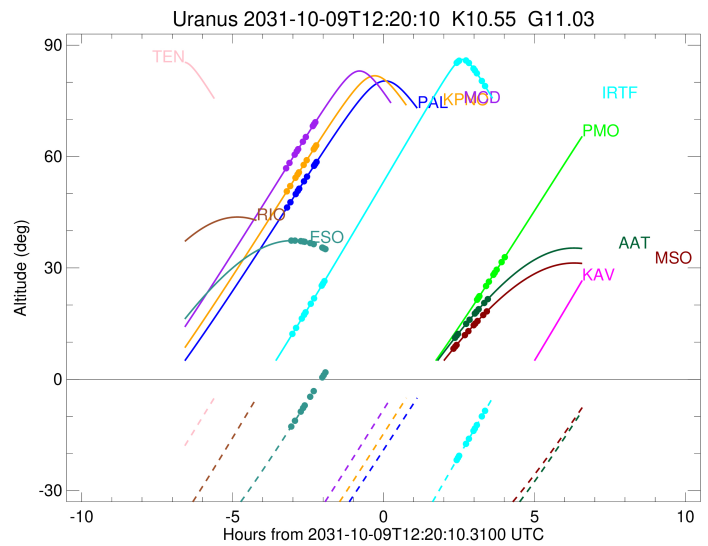
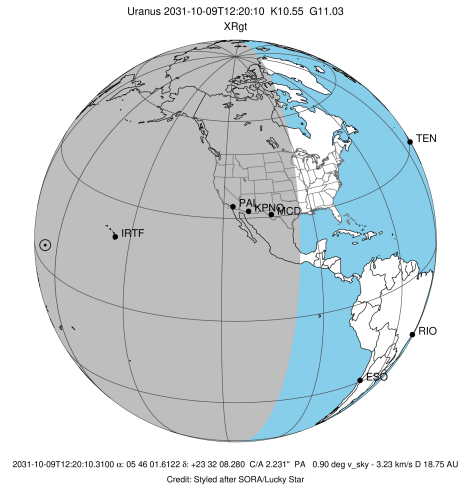


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:09:19.508		46.45	-55.26	51019.00	-2.80		
lambda	I	2031-10-09T09:15:17.678		47.70	-54.37	50026.71	-2.76		
delta	I	2031-10-09T09:25:48.092		49.91	-52.74	48300.35	-2.72		
gamma	I	2031-10-09T09:29:55.164		50.77	-52.07	47631.56	-2.70		
eta	I	2031-10-09T09:32:44.440		51.36	-51.61	47176.12	-2.68		
beta	I	2031-10-09T09:42:16.856		53.36	-50.01	45654.97	-2.63		
alpha	I	2031-10-09T09:48:26.760		54.65	-48.95	44686.91	-2.60		
4	I	2031-10-09T10:02:07.473		57.50	-46.52	42598.44	-2.50		
5	I	2031-10-09T10:03:56.670		57.88	-46.19	42312.34	-2.49		
6	I	2031-10-09T10:07:12.733		58.55	-45.59	41836.58	-2.46		

No planet occultations

6	E	2031-10-09T14:38:58.596		58.80	9.77x	41794.77	2.53		
5	E	2031-10-09T14:41:42.016		58.23	10.32x	42210.27	2.56		
4	E	2031-10-09T14:44:16.239		57.70	10.84x	42605.82	2.58		
alpha	E	2031-10-09T14:57:46.246		54.89	13.56x	44735.36	2.68		
beta	E	2031-10-09T15:03:36.238		53.67	14.72x	45681.08	2.72		
eta	E	2031-10-09T15:12:39.803		51.77	16.52x	47176.12	2.78		
gamma	E	2031-10-09T15:15:21.035		51.21	17.04x	47625.36	2.79		
delta	E	2031-10-09T15:19:21.637		50.37	17.83x	48300.35	2.82		
lambda	E	2031-10-09T15:29:28.896		48.25	19.80x	50026.71	2.87		
epsilon	E	2031-10-09T15:38:17.922		46.40	21.50x	51554.68	2.91		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:38:25.420  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.19  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.948  
 C/A sky separation (km) : 26499.9  
 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

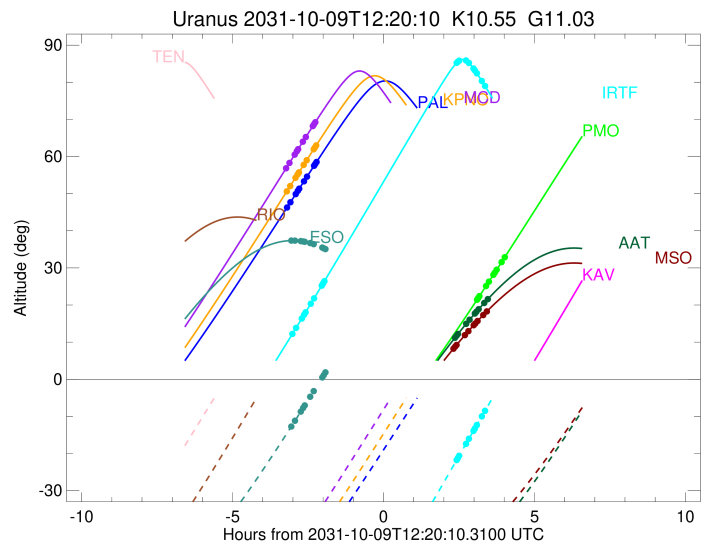
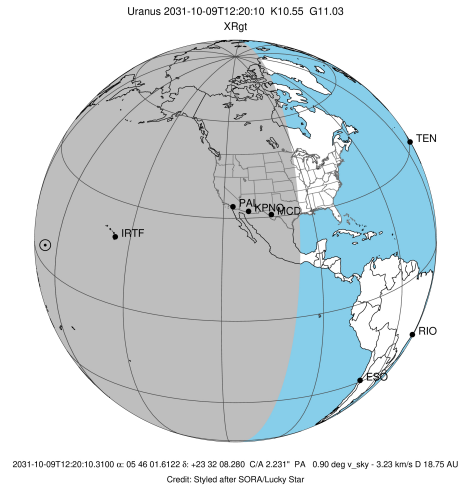


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T08:35:50.450	-34.54x	12.59x	50987.23	-2.43			
lambda	I	2031-10-09T08:42:29.477	-34.56x	11.23x	50026.71	-2.40			
delta	I	2031-10-09T08:54:33.914	-34.47x	8.74x	48300.35	-2.37			
gamma	I	2031-10-09T08:59:17.325	-34.40x	7.76x	47631.49	-2.35			
eta	I	2031-10-09T09:02:31.218	-34.33x	7.09x	47176.12	-2.34			
beta	I	2031-10-09T09:13:26.097	-34.04x	4.81x	45653.02	-2.31			
alpha	I	2031-10-09T09:20:26.560	-33.78x	3.35x	44685.77	-2.29			
4	I	2031-10-09T09:35:55.564	-33.05x	0.09x	42593.96	-2.23			
5	I	2031-10-09T09:37:55.183	-32.94x	-0.33x	42314.35	-2.22			
6	I	2031-10-09T09:41:32.710	-32.73x	-1.09x	41841.79	-2.20			

No planet occultations

6	E	2031-10-09T15:25:49.916	21.36	-63.74	41794.85	2.61			
5	E	2031-10-09T15:28:26.956	21.90	-63.87	42207.75	2.64			
4	E	2031-10-09T15:30:56.919	22.41	-63.99	42604.88	2.66			
alpha	E	2031-10-09T15:44:04.200	25.12	-64.40	44736.03	2.76			
beta	E	2031-10-09T15:49:44.436	26.30	-64.46	45681.12	2.80			
eta	E	2031-10-09T15:58:33.340	28.13	-64.42	47176.12	2.86			
gamma	E	2031-10-09T16:01:10.164	28.68	-64.38	47625.29	2.87			
delta	E	2031-10-09T16:05:04.167	29.49	-64.28	48300.35	2.90			
lambda	E	2031-10-09T16:14:54.047	31.55	-63.91	50026.71	2.96			
epsilon	E	2031-10-09T16:23:26.815	33.35	-63.43	51554.60	3.00			

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:19:13.670  
 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.12  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.176  
 C/A sky separation (km) : 29597.8  
 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

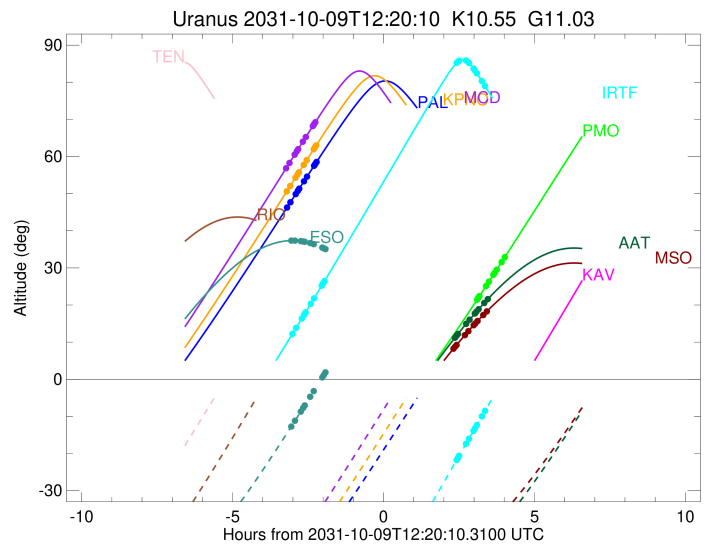
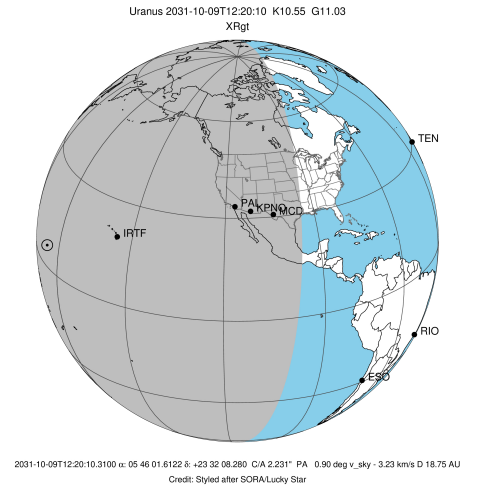


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:08:51.887		50.80	-52.93	51021.52	-2.81		
lambda	I	2031-10-09T09:14:49.007		52.07	-51.91	50026.71	-2.77		
delta	I	2031-10-09T09:25:16.275		54.30	-50.08	48300.35	-2.73		
gamma	I	2031-10-09T09:29:22.219		55.17	-49.34	47631.56	-2.71		
eta	I	2031-10-09T09:32:10.761		55.76	-48.83	47176.12	-2.70		
beta	I	2031-10-09T09:41:40.875		57.78	-47.08	45655.11	-2.64		
alpha	I	2031-10-09T09:47:49.556		59.08	-45.93	44687.00	-2.60		
4	I	2031-10-09T10:01:28.062		61.96	-43.31	42598.73	-2.51		
5	I	2031-10-09T10:03:17.243		62.34	-42.96	42312.16	-2.49		
6	I	2031-10-09T10:06:33.078		63.03	-42.32	41836.23	-2.46		

No planet occultations

6	E	2031-10-09T14:36:45.714		55.00	13.97x	41794.77	2.51		
5	E	2031-10-09T14:39:30.567		54.42	14.53x	42210.35	2.54		
4	E	2031-10-09T14:42:06.080		53.87	15.06x	42605.85	2.56		
alpha	E	2031-10-09T14:55:42.798		50.97	17.80x	44735.35	2.66		
beta	E	2031-10-09T15:01:35.657		49.72	18.97x	45681.08	2.70		
eta	E	2031-10-09T15:10:43.638		47.77	20.78x	47176.12	2.76		
gamma	E	2031-10-09T15:13:26.179		47.19	21.31x	47625.36	2.77		
delta	E	2031-10-09T15:17:28.733		46.33	22.10x	48300.35	2.79		
lambda	E	2031-10-09T15:27:40.936		44.16	24.08x	50026.71	2.84		
epsilon	E	2031-10-09T15:36:34.302		42.27	25.79x	51554.68	2.88		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:16:36.770  
 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.755  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.02  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.183  
 C/A sky separation (km) : 29687.5  
 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



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

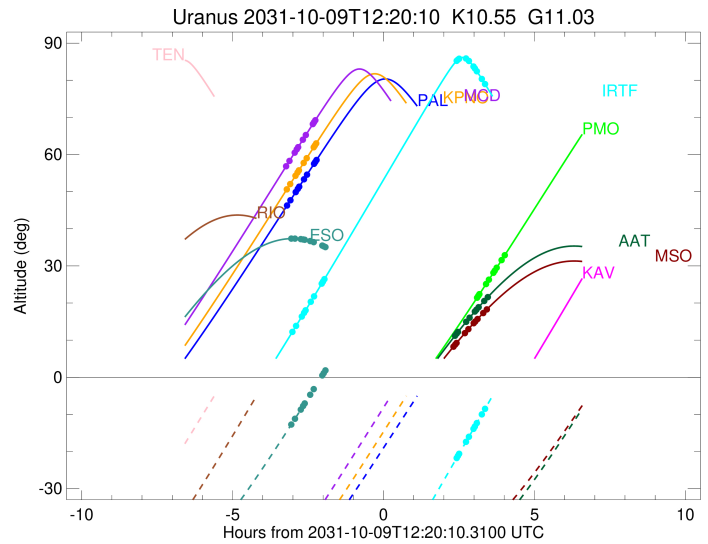
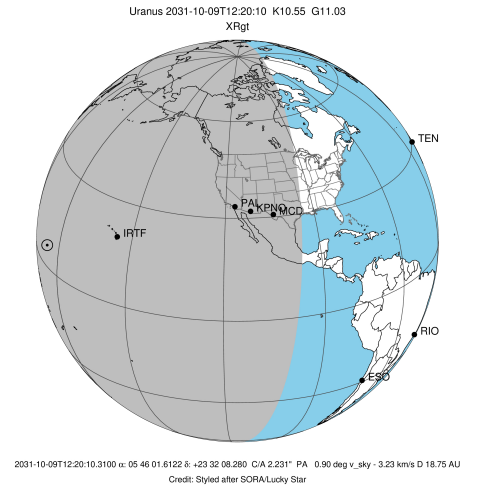
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:07:25.859		57.02	-48.43	51024.28	-2.84		
lambda	I	2031-10-09T09:13:21.120		58.30	-47.30	50026.71	-2.80		
delta	I	2031-10-09T09:23:43.737		60.53	-45.29	48300.35	-2.75		
gamma	I	2031-10-09T09:27:47.978		61.41	-44.49	47631.56	-2.73		
eta	I	2031-10-09T09:30:35.396		62.01	-43.94	47176.12	-2.71		
beta	I	2031-10-09T09:40:01.903		64.03	-42.05	45655.26	-2.66		
alpha	I	2031-10-09T09:46:08.531		65.33	-40.82	44687.10	-2.62		
4	I	2031-10-09T09:59:43.000		68.20	-38.05	42599.02	-2.52		
5	I	2031-10-09T10:01:31.924		68.58	-37.68	42311.98	-2.50		
6	I	2031-10-09T10:04:47.089		69.27	-37.01	41835.88	-2.47		

No planet occultations

6	E	2031-10-09T14:34:18.136		49.07	20.03x	41794.77	2.48		
5	E	2031-10-09T14:37:04.688		48.47	20.59x	42210.20	2.51		
4	E	2031-10-09T14:39:41.901		47.91	21.12x	42605.79	2.53		
alpha	E	2031-10-09T14:53:27.501		44.94	23.85x	44735.41	2.63		
beta	E	2031-10-09T14:59:24.203		43.66	25.02x	45681.08	2.67		
eta	E	2031-10-09T15:08:38.273		41.67	26.82x	47176.12	2.73		
gamma	E	2031-10-09T15:11:22.638		41.08	27.34x	47625.35	2.74		
delta	E	2031-10-09T15:15:27.944		40.20	28.13x	48300.35	2.76		
lambda	E	2031-10-09T15:25:47.193		37.99	30.08x	50026.71	2.81		
epsilon	E	2031-10-09T15:34:46.813		36.07	31.76x	51554.62	2.85		



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:34:16.260  
 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.53  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.250  
 C/A sky separation (km) : 30606.3  
 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

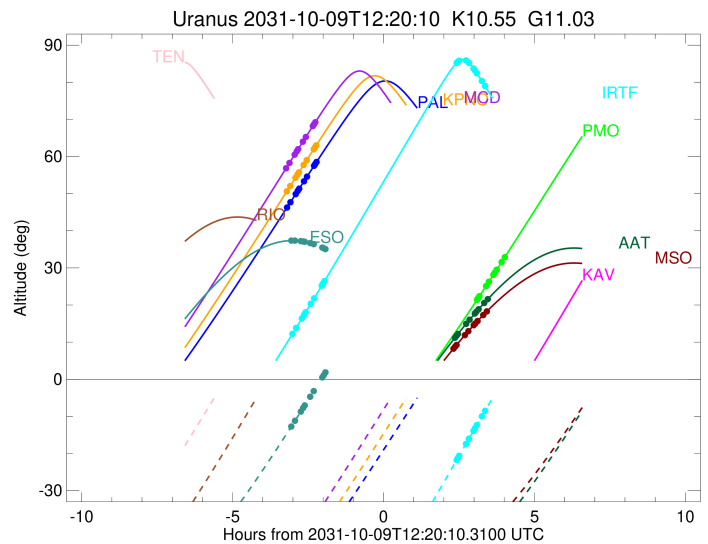
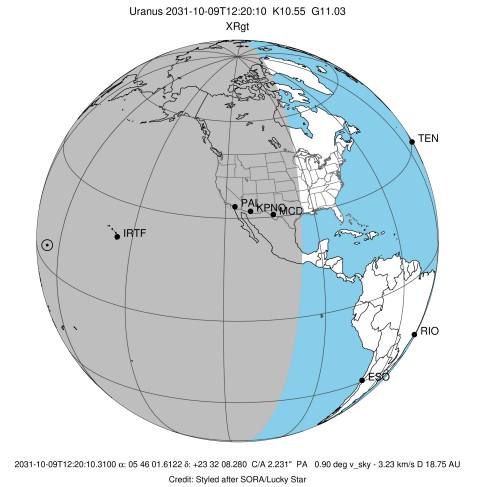


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:20:02.720		12.43	-72.01	51019.99	-2.58		
lambda	I	2031-10-09T09:26:31.582		13.86	-73.02	50026.71	-2.54		
delta	I	2031-10-09T09:37:55.210		16.39	-74.55	48300.35	-2.50		
gamma	I	2031-10-09T09:42:23.142		17.38	-75.06	47631.56	-2.49		
eta	I	2031-10-09T09:45:26.729		18.06	-75.37	47176.12	-2.47		
beta	I	2031-10-09T09:55:47.684		20.37	-76.17	45655.13	-2.43		
alpha	I	2031-10-09T10:02:29.311		21.87	-76.46	44687.02	-2.39		
4	I	2031-10-09T10:17:21.673		25.21	-76.42	42598.90	-2.30		
5	I	2031-10-09T10:19:20.986		25.66	-76.34	42312.04	-2.28		
6	I	2031-10-09T10:22:54.956		26.46	-76.16	41835.97	-2.25		

No planet occultations

6	E	2031-10-09T14:45:17.863		85.19	-21.84	41794.77	2.49		
5	E	2031-10-09T14:48:05.745		85.56	-21.18	42215.44	2.53		
4	E	2031-10-09T14:50:40.398		85.83	-20.57	42607.69	2.55		
alpha	E	2031-10-09T15:04:12.430		85.87	-17.39	44733.49	2.68		
beta	E	2031-10-09T15:10:02.169		85.20	-16.02	45680.89	2.73		
eta	E	2031-10-09T15:19:01.756		83.72	-13.90	47176.12	2.81		
gamma	E	2031-10-09T15:21:41.336		83.22	-13.28	47625.67	2.83		
delta	E	2031-10-09T15:25:38.755		82.44	-12.35	48300.35	2.86		
lambda	E	2031-10-09T15:35:36.020		80.37	-10.01	50026.71	2.92		
epsilon	E	2031-10-09T15:44:14.139		78.50	-7.98	51555.30	2.98		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:06:19.650  
 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.755  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 30.31  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.569  
 C/A sky separation (km) : 34943.0  
 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

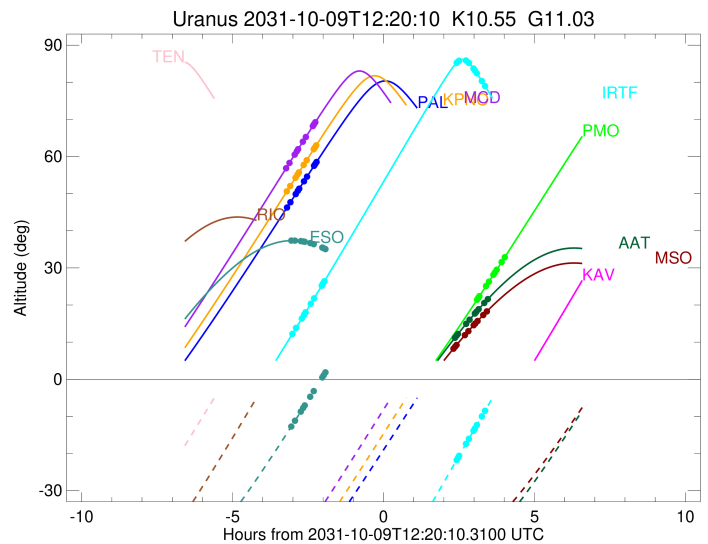
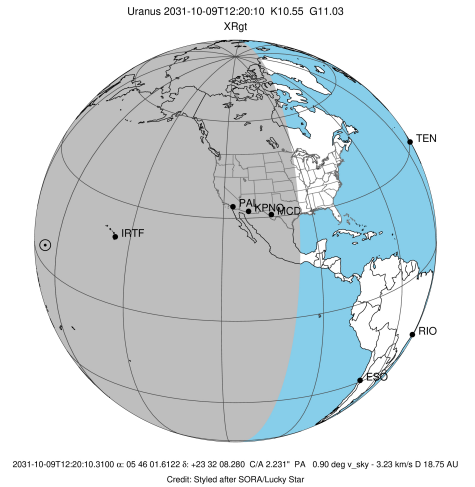


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:17:22.593		37.36	-12.63	51087.03	-2.60		
lambda	I	2031-10-09T09:24:18.040		37.35	-11.16	50026.71	-2.53		
delta	I	2031-10-09T09:35:53.311		37.21	-8.69	48300.35	-2.44		
gamma	I	2031-10-09T09:40:29.966		37.12	-7.71	47631.55	-2.40		
eta	I	2031-10-09T09:43:41.019		37.04	-7.02	47176.12	-2.37		
beta	I	2031-10-09T09:54:35.557		36.69	-4.68x	45659.04	-2.27		
alpha	I	2031-10-09T10:01:49.901		36.38	-3.12x	44690.26	-2.19		
4	I	2031-10-09T10:18:24.701		35.48	0.47x	42606.20	-2.00		
5	I	2031-10-09T10:20:50.163		35.33	1.00x	42304.96	-1.97		
6	I	2031-10-09T10:25:02.139		35.05	1.91x	41826.18	-1.91		

No planet occultations

6	E	2031-10-09T13:57:15.242		4.88x	47.37x	41795.25	1.83		
5	E	2031-10-09T14:01:07.708		4.15x	48.14x	42224.57	1.88		
4	E	2031-10-09T14:04:31.575		3.50x	48.80x	42610.48	1.91		
alpha	E	2031-10-09T14:22:11.918		0.09x	52.20x	44730.54	2.08		
beta	E	2031-10-09T14:29:41.199		-1.37x	53.59x	45680.49	2.15		
eta	E	2031-10-09T14:41:03.904		-3.62x	55.64x	47176.12	2.23		
gamma	E	2031-10-09T14:44:24.281		-4.28x	56.23x	47626.08	2.26		
delta	E	2031-10-09T14:49:20.758		-5.27x	57.08x	48300.35	2.29		
lambda	E	2031-10-09T15:01:41.728		-7.75x	59.12x	50026.71	2.37		
epsilon	E	2031-10-09T15:12:19.255		-9.90x	60.76x	51554.53	2.42		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:39:20.400  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.17  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.480  
 C/A sky separation (km) : 33731.8  
 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



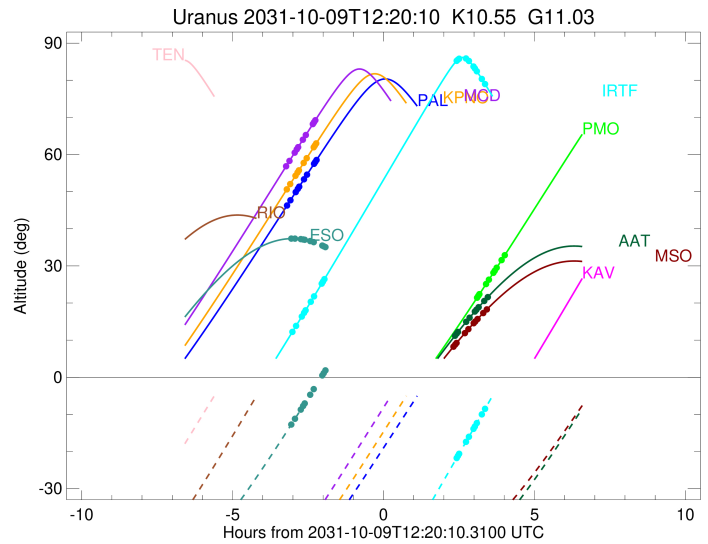
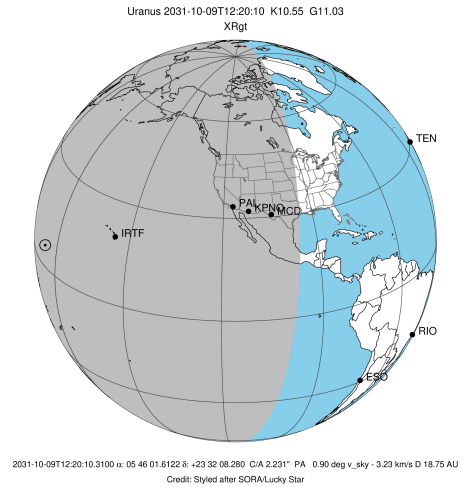
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:18:32.974	-54.28x	-15.12	51048.89	-2.19			
lambda	I	2031-10-09T09:26:26.192	-52.59x	-16.73	50026.71	-2.15			
delta	I	2031-10-09T09:40:01.241	-49.67x	-19.47	48300.35	-2.09			
gamma	I	2031-10-09T09:45:23.156	-48.52x	-20.54	47631.58	-2.07			
eta	I	2031-10-09T09:49:04.633	-47.73x	-21.28	47176.12	-2.05			
beta	I	2031-10-09T10:01:38.738	-45.03x	-23.76	45656.87	-1.98			
alpha	I	2031-10-09T10:09:52.842	-43.27x	-25.36	44688.34	-1.94			
4	I	2031-10-09T10:28:27.743	-39.30x	-28.90	42602.49	-1.81			
5	I	2031-10-09T10:31:03.221	-38.75x	-29.39	42309.22	-1.79			
6	I	2031-10-09T10:35:38.456	-37.77x	-30.24	41831.33	-1.75			

No planet occultations

6	E	2031-10-09T14:41:47.678	11.11	-50.64	41795.49	2.02			
5	E	2031-10-09T14:45:20.353	11.72	-50.37	42227.28	2.07			
4	E	2031-10-09T14:48:24.910	12.24	-50.12	42611.26	2.10			
alpha	E	2031-10-09T15:04:30.658	14.94	-48.63	44729.21	2.28			
beta	E	2031-10-09T15:11:20.730	16.05	-47.91	45680.23	2.36			
eta	E	2031-10-09T15:21:42.117	17.70	-46.72	47176.12	2.46			
gamma	E	2031-10-09T15:24:44.220	18.17	-46.36	47626.33	2.49			
delta	E	2031-10-09T15:29:13.060	18.86	-45.80	48300.35	2.53			
lambda	E	2031-10-09T15:40:23.135	20.55	-44.32	50026.71	2.62			
epsilon	E	2031-10-09T15:49:56.289	21.94	-42.98	51552.68	2.70			



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-10-09T12:38:19.090  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3427633186407691008  
 2Mass ID (if available) : 05460160+2332083  
 ICRS Star Coord at Epoch: 05h 46m 01.61219s +23:32:08.28007s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 10.546  
 G magnitude : 11.025  
 RP magnitude : 10.829  
 BP magnitude : 11.115  
 DUPflag : 0  
 Distance (au) : 18.754  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -3.24  
 Sun-Target sep (deg) : 108.77  
 Sun-Moon sep (deg) : 31.12  
 B (ring opening deg) : 77.96  
 PA of pole (deg) : 47.68  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.504  
 C/A sky separation (km) : 34054.0  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-09T09:19:34.599		-53.76x	-14.05	51053.10	-2.18		
lambda	I	2031-10-09T09:27:31.283		-52.14x	-15.59	50026.71	-2.14		
delta	I	2031-10-09T09:41:09.824		-49.36x	-18.20	48300.35	-2.08		
gamma	I	2031-10-09T09:46:33.461		-48.26x	-19.22	47631.58	-2.05		
eta	I	2031-10-09T09:50:16.248		-47.50x	-19.91	47176.12	-2.04		
beta	I	2031-10-09T10:02:55.540		-44.90x	-22.27	45657.13	-1.97		
alpha	I	2031-10-09T10:11:13.987		-43.20x	-23.79	44688.55	-1.92		
4	I	2031-10-09T10:30:01.418		-39.35x	-27.15	42602.99	-1.79		
5	I	2031-10-09T10:32:39.666		-38.81x	-27.61	42308.74	-1.76		
6	I	2031-10-09T10:37:19.206		-37.86x	-28.42	41830.66	-1.73		

No planet occultations

6	E	2031-10-09T14:38:47.581	8.16	-47.04	41795.58	1.97
5	E	2031-10-09T14:42:25.623	8.76	-46.81	42228.20	2.02
4	E	2031-10-09T14:45:33.871	9.27	-46.59	42611.50	2.06
alpha	E	2031-10-09T15:01:58.074	11.89	-45.30	44728.90	2.24
beta	E	2031-10-09T15:08:55.199	12.96	-44.66	45680.17	2.32
eta	E	2031-10-09T15:19:26.215	14.55	-43.60	47176.12	2.42
gamma	E	2031-10-09T15:22:30.972	15.01	-43.27	47626.37	2.45
delta	E	2031-10-09T15:27:03.557	15.68	-42.77	48300.35	2.49
lambda	E	2031-10-09T15:38:22.413	17.29	-41.44	50026.71	2.59
epsilon	E	2031-10-09T15:48:02.377	18.62	-40.22	51552.35	2.67