

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:45:40.710  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536

ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s

RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 41.84  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98

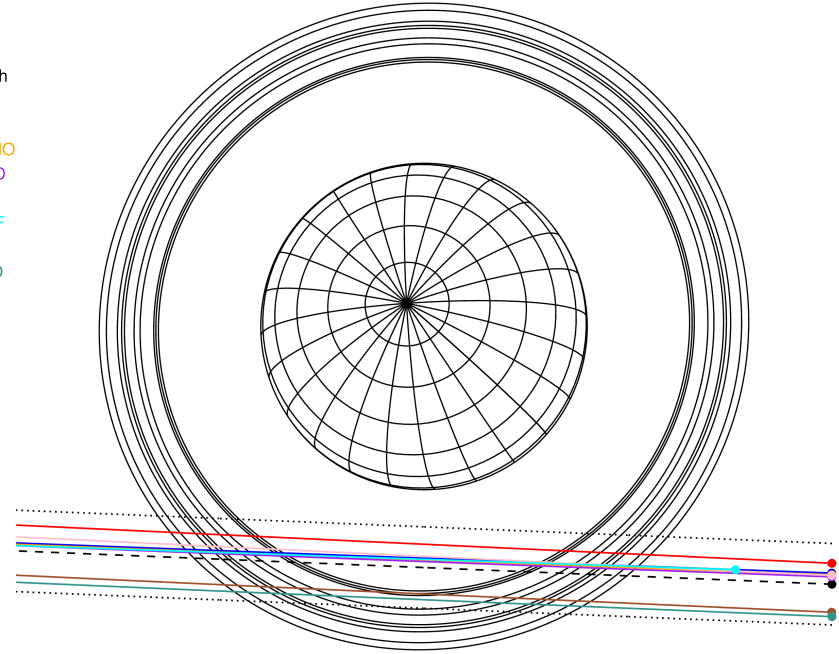
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-12-31T04:45:40.7100 ra: 05 34 39.3401 s: +23 27 53.605 C/A 2.862" PA 357.66 deg v\_sky -22.47 km/s D 18.13 AU  
 Credit: Styled after SORA/Lucky Star

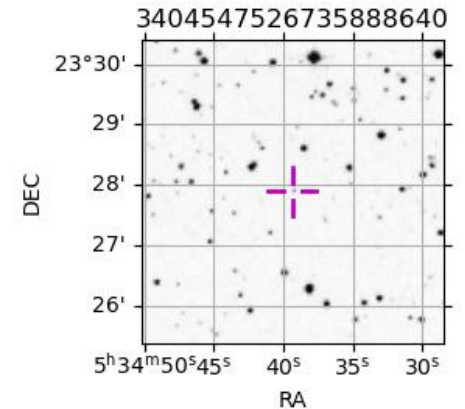
Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO

Uranus 2031-12-31T04:45:40 K14.80 G17.79 XRgt

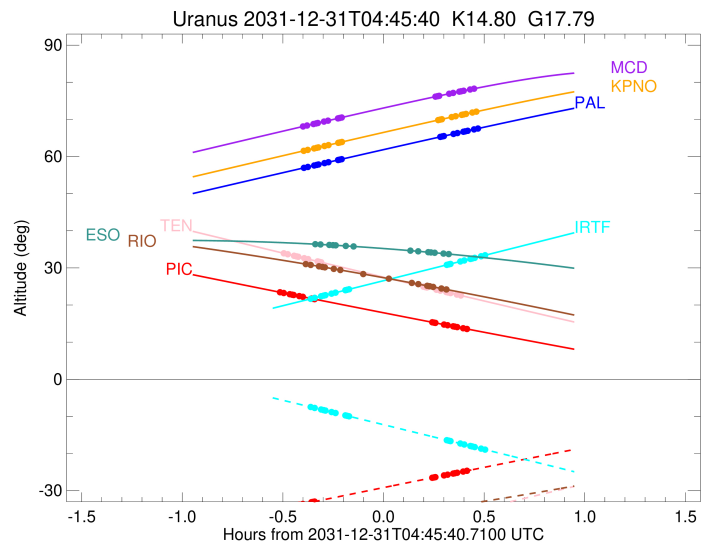
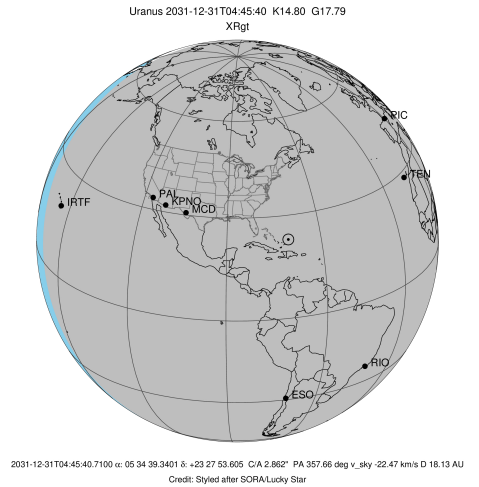


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 31 04:14 - DEC 31 05:10	PnnRie
PAL	Palomar Mt (200")	33.4	243.1	+++++		+++++	DEC 31 04:21 - DEC 31 05:13	PnnRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++		+++++	DEC 31 04:21 - DEC 31 05:13	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++		+++++	DEC 31 04:21 - DEC 31 05:12	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++		+++++	DEC 31 04:15 - DEC 31 05:08	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++		+++++	DEC 31 04:23 - DEC 31 05:15	PnnRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++		+++++	DEC 31 04:22 - DEC 31 05:04	PnnRie
ESO	European Southern Obs	-29.3	289.3	+++++		+++++	DEC 31 04:24 - DEC 31 05:05	PnnRie
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:42:15.780  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 41.58  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.590  
 C/A sky separation (km) : 34063.1  
 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

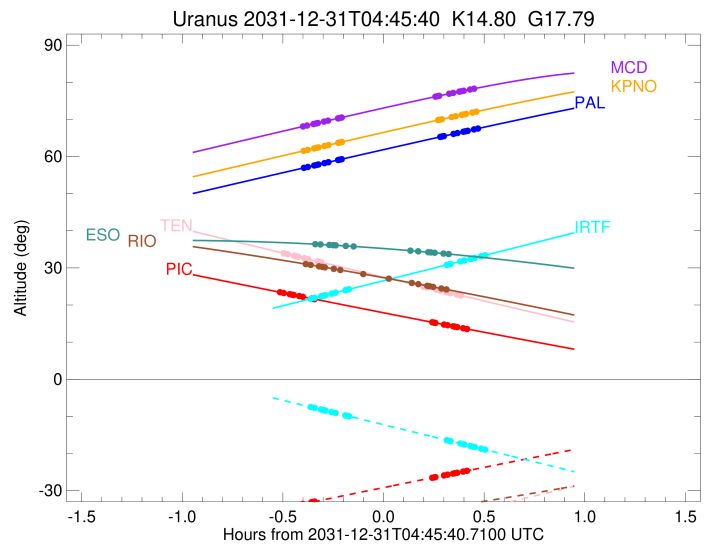
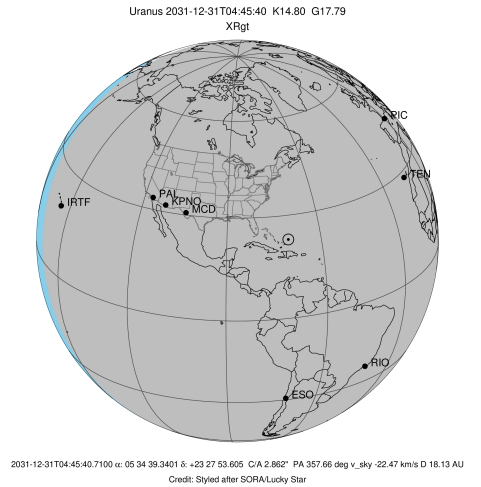


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:14:26.335		23.51	-34.91	51542.07	-16.86		
lambda	I	2031-12-31T04:15:57.176		23.23	-34.63	50026.71	-16.47		
delta	I	2031-12-31T04:17:43.764		22.91	-34.31	48300.35	-15.92		
gamma	I	2031-12-31T04:18:26.724		22.78	-34.17	47621.61	-15.68		
eta	I	2031-12-31T04:18:55.285		22.70	-34.09	47176.12	-15.52		
beta	I	2031-12-31T04:20:34.384		22.40	-33.78	45667.32	-14.90		
alpha	I	2031-12-31T04:21:37.017		22.21	-33.59	44746.57	-14.49		
4	I	2031-12-31T04:24:16.199		21.74	-33.11	42526.10	-13.32		
5	I	2031-12-31T04:24:41.123		21.66	-33.03	42207.48	-13.16		
6	I	2031-12-31T04:25:06.419		21.58	-32.95	41875.04	-12.93		

No planet occultations

6	E	2031-12-31T05:00:14.164		15.35	-26.53	41868.60	12.90		
5	E	2031-12-31T05:00:46.900		15.25	-26.43	42297.36	13.13		
4	E	2031-12-31T05:01:06.403		15.20	-26.37	42553.71	13.29		
alpha	E	2031-12-31T05:03:41.322		14.74	-25.90	44704.87	14.45		
beta	E	2031-12-31T05:04:45.347		14.56	-25.71	45643.03	14.86		
eta	E	2031-12-31T05:06:26.441		14.26	-25.40	47176.12	15.47		
gamma	E	2031-12-31T05:06:55.218		14.18	-25.32	47623.52	15.63		
delta	E	2031-12-31T05:07:38.201		14.06	-25.19	48300.35	15.86		
lambda	E	2031-12-31T05:09:25.168		13.75	-24.86	50026.71	16.41		
epsilon	E	2031-12-31T05:10:24.322		13.58	-24.68	51005.42	16.80		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:47:29.720  
 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 : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 42.67  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.758  
 C/A sky separation (km) : 36270.0  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl1.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

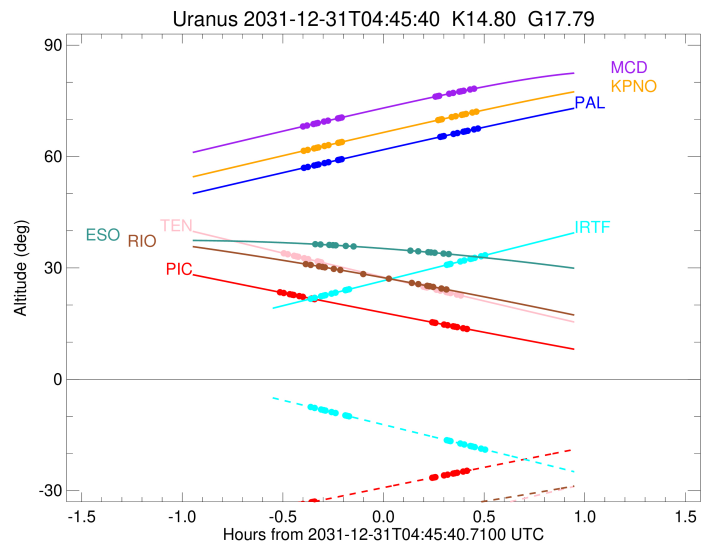
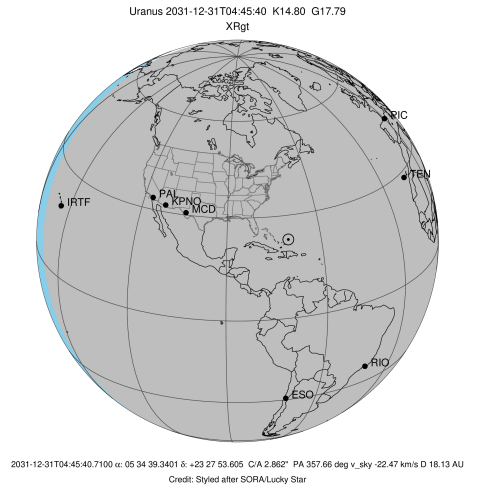


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:21:34.056		56.87	-43.41	51536.40	-16.08		
lambda	I	2031-12-31T04:23:09.217		57.20	-43.74	50026.71	-15.60		
delta	I	2031-12-31T04:25:02.229		57.59	-44.13	48300.35	-14.93		
gamma	I	2031-12-31T04:25:48.132		57.75	-44.29	47621.47	-14.64		
eta	I	2031-12-31T04:26:18.760		57.86	-44.40	47176.12	-14.44		
beta	I	2031-12-31T04:28:06.059		58.23	-44.77	45666.01	-13.67		
alpha	I	2031-12-31T04:29:14.670		58.47	-45.01	44745.11	-13.15		
4	I	2031-12-31T04:32:13.060		59.08	-45.63	42525.93	-11.64		
5	I	2031-12-31T04:32:41.107		59.18	-45.73	42214.22	-11.42		
6	I	2031-12-31T04:33:10.793		59.28	-45.83	41876.66	-11.11		

No planet occultations

6	E	2031-12-31T05:02:38.311		65.30	-51.99	41871.58	11.12		
5	E	2031-12-31T05:03:15.209		65.43	-52.12	42291.57	11.43		
4	E	2031-12-31T05:03:37.735		65.50	-52.20	42549.41	11.65		
alpha	E	2031-12-31T05:06:31.351		66.08	-52.80	44707.78	13.17		
beta	E	2031-12-31T05:07:41.040		66.32	-53.04	45643.86	13.69		
eta	E	2031-12-31T05:09:29.856		66.68	-53.42	47176.12	14.46		
gamma	E	2031-12-31T05:10:00.554		66.78	-53.53	47623.16	14.66		
delta	E	2031-12-31T05:10:46.272		66.93	-53.68	48300.35	14.96		
lambda	E	2031-12-31T05:12:39.103		67.30	-54.08	50026.71	15.63		
epsilon	E	2031-12-31T05:13:42.717		67.51	-54.30	51032.29	16.11		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:47:13.240  
 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 : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 42.65  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.777  
 C/A sky separation (km) : 36521.8  
 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

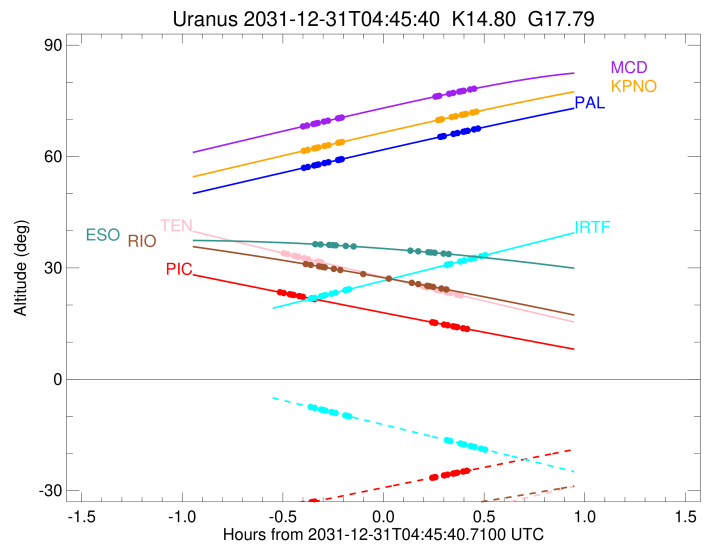
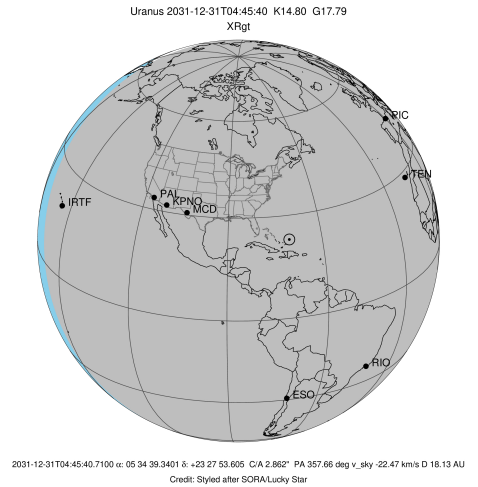


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:21:30.656		61.45	-47.81	51535.47	-15.98		
lambda	I	2031-12-31T04:23:06.382		61.79	-48.15	50026.71	-15.50		
delta	I	2031-12-31T04:25:00.269		62.19	-48.56	48300.35	-14.81		
gamma	I	2031-12-31T04:25:46.578		62.35	-48.72	47621.45	-14.51		
eta	I	2031-12-31T04:26:17.492		62.46	-48.83	47176.12	-14.30		
beta	I	2031-12-31T04:28:05.949		62.84	-49.21	45665.82	-13.52		
alpha	I	2031-12-31T04:29:15.421		63.08	-49.46	44744.89	-12.98		
4	I	2031-12-31T04:32:16.686		63.71	-50.10	42525.94	-11.42		
5	I	2031-12-31T04:32:45.213		63.81	-50.20	42215.20	-11.19		
6	I	2031-12-31T04:33:15.601		63.92	-50.31	41876.86	-10.87		

No planet occultations

6	E	2031-12-31T05:02:00.941		69.83	-56.40	41871.89	10.88		
5	E	2031-12-31T05:02:38.542		69.96	-56.54	42290.90	11.20		
4	E	2031-12-31T05:03:01.554		70.03	-56.62	42548.96	11.43		
alpha	E	2031-12-31T05:05:58.082		70.62	-57.24	44708.08	12.99		
beta	E	2031-12-31T05:07:08.646		70.86	-57.49	45643.95	13.53		
eta	E	2031-12-31T05:08:58.642		71.22	-57.87	47176.12	14.32		
gamma	E	2031-12-31T05:09:29.634		71.32	-57.98	47623.13	14.53		
delta	E	2031-12-31T05:10:15.769		71.48	-58.14	48300.35	14.83		
lambda	E	2031-12-31T05:12:09.504		71.85	-58.54	50026.71	15.52		
epsilon	E	2031-12-31T05:13:13.725		72.06	-58.77	51034.87	16.00		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:46:46.500  
 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 : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 42.60  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.797  
 C/A sky separation (km) : 36785.8  
 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

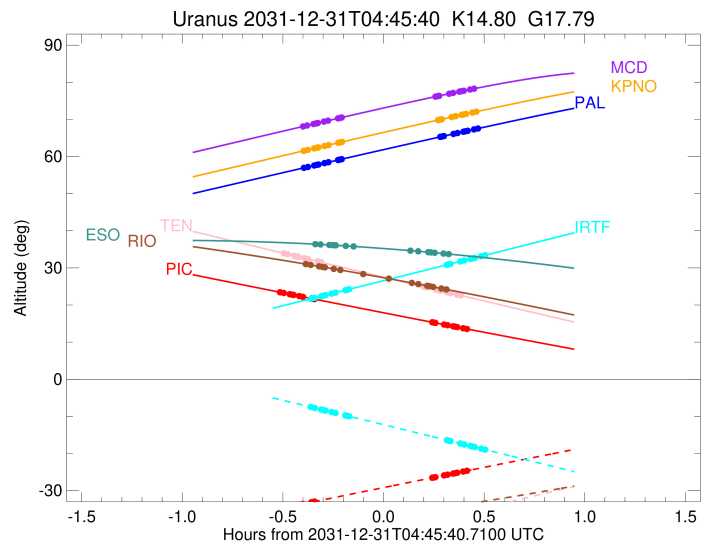
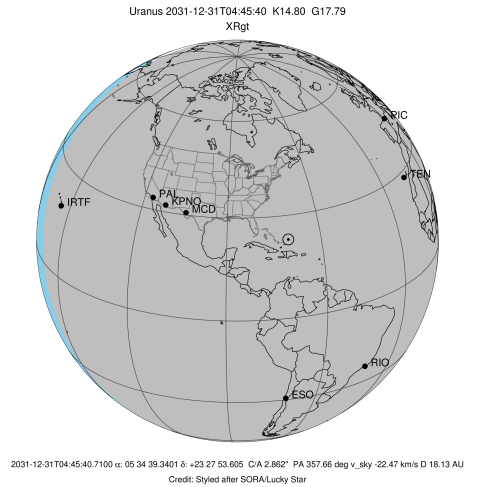


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:21:17.899		68.02	-54.27	51534.42	-15.87		
lambda	I	2031-12-31T04:22:54.223		68.36	-54.62	50026.71	-15.38		
delta	I	2031-12-31T04:24:49.047		68.76	-55.03	48300.35	-14.68		
gamma	I	2031-12-31T04:25:35.794		68.92	-55.20	47621.43	-14.37		
eta	I	2031-12-31T04:26:07.018		69.03	-55.31	47176.12	-14.15		
beta	I	2031-12-31T04:27:56.732		69.41	-55.70	45665.61	-13.35		
alpha	I	2031-12-31T04:29:07.146		69.66	-55.96	44744.65	-12.79		
4	I	2031-12-31T04:32:11.602		70.30	-56.62	42525.95	-11.18		
5	I	2031-12-31T04:32:40.667		70.40	-56.72	42216.28	-10.94		
6	I	2031-12-31T04:33:11.851		70.51	-56.83	41877.08	-10.60		

No planet occultations

6	E	2031-12-31T05:01:11.656		76.14	-62.82	41872.20	10.61		
5	E	2031-12-31T05:01:50.056		76.26	-62.96	42290.19	10.95		
4	E	2031-12-31T05:02:13.616		76.34	-63.04	42548.49	11.18		
alpha	E	2031-12-31T05:05:13.391		76.91	-63.68	44708.40	12.80		
beta	E	2031-12-31T05:06:24.921		77.13	-63.93	45644.05	13.36		
eta	E	2031-12-31T05:08:16.212		77.47	-64.33	47176.12	14.17		
gamma	E	2031-12-31T05:08:47.525		77.57	-64.44	47623.09	14.38		
delta	E	2031-12-31T05:09:34.116		77.71	-64.60	48300.35	14.69		
lambda	E	2031-12-31T05:11:28.834		78.06	-65.01	50026.71	15.40		
epsilon	E	2031-12-31T05:12:33.707		78.25	-65.24	51037.49	15.89		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:41:53.970  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 41.58  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.734  
 C/A sky separation (km) : 35956.1  
 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



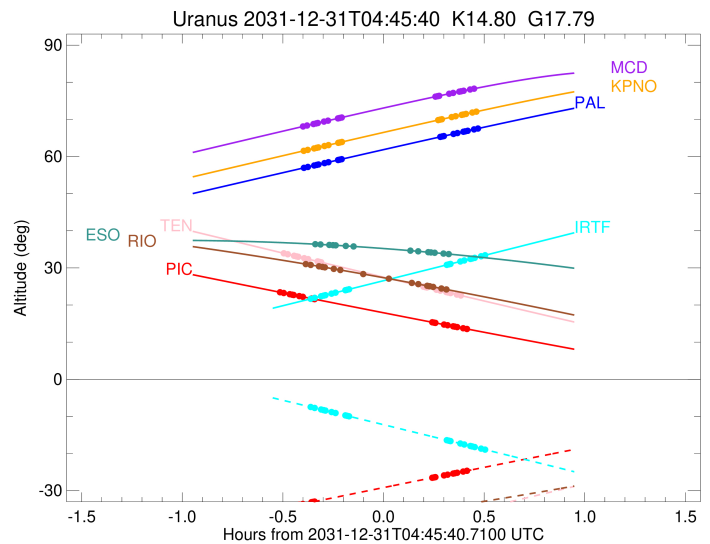
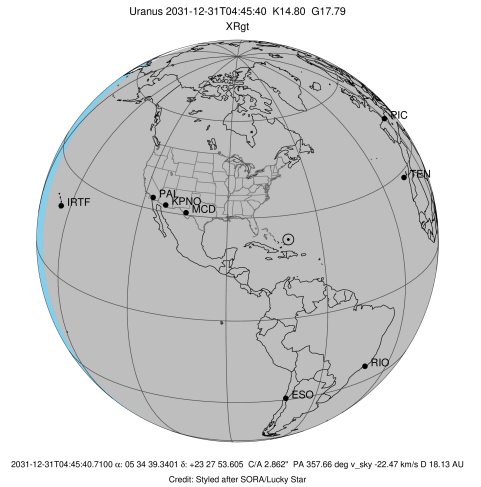
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:15:34.178		34.02	-47.83	51536.21	-16.14		
lambda	I	2031-12-31T04:17:08.896		33.67	-47.48	50026.71	-15.68		
delta	I	2031-12-31T04:19:01.261		33.27	-47.07	48300.35	-15.03		
gamma	I	2031-12-31T04:19:46.849		33.10	-46.90	47621.47	-14.75		
eta	I	2031-12-31T04:20:17.246		32.99	-46.79	47176.12	-14.55		
beta	I	2031-12-31T04:22:03.596		32.61	-46.40	45666.04	-13.81		
alpha	I	2031-12-31T04:23:11.460		32.36	-46.15	44745.16	-13.31		
4	I	2031-12-31T04:26:07.208		31.73	-45.51	42525.93	-11.86		
5	I	2031-12-31T04:26:34.750		31.63	-45.41	42213.84	-11.65		
6	I	2031-12-31T04:27:03.801		31.52	-45.30	41876.57	-11.36		

No planet occultations

6	E	2031-12-31T04:57:35.459		24.95	-38.62	41870.92	11.33		
5	E	2031-12-31T04:58:11.924		24.82	-38.49	42293.00	11.62		
4	E	2031-12-31T04:58:34.040		24.74	-38.41	42550.41	11.83		
alpha	E	2031-12-31T05:01:25.602		24.13	-37.79	44707.05	13.27		
beta	E	2031-12-31T05:02:34.869		23.88	-37.54	45643.64	13.77		
eta	E	2031-12-31T05:04:23.237		23.50	-37.14	47176.12	14.50		
gamma	E	2031-12-31T05:04:53.858		23.39	-37.03	47623.25	14.70		
delta	E	2031-12-31T05:05:39.484		23.22	-36.87	48300.35	14.98		
lambda	E	2031-12-31T05:07:32.263		22.82	-36.46	50026.71	15.62		
epsilon	E	2031-12-31T05:08:35.472		22.60	-36.23	51024.90	16.08		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-31T04:49:34.270
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       : 3404547526735888640
2Mass ID (if available) : 05343934+2327536
ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s
RUWE (>1.4 is poor) : 1.16
K magnitude           : 14.800
G magnitude           : 17.786
RP magnitude          : 16.965
BP magnitude          : 18.489
DUPflag              : 0
Distance (au)        : 18.131
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -22.46
Sun-Target sep (deg) : 165.35
Sun-Moon sep (deg)   : 42.70
B (ring opening deg) : 79.77
PA of pole (deg)     : 36.98
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.772
C/A sky separation (km) : 36445.8
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
    
```

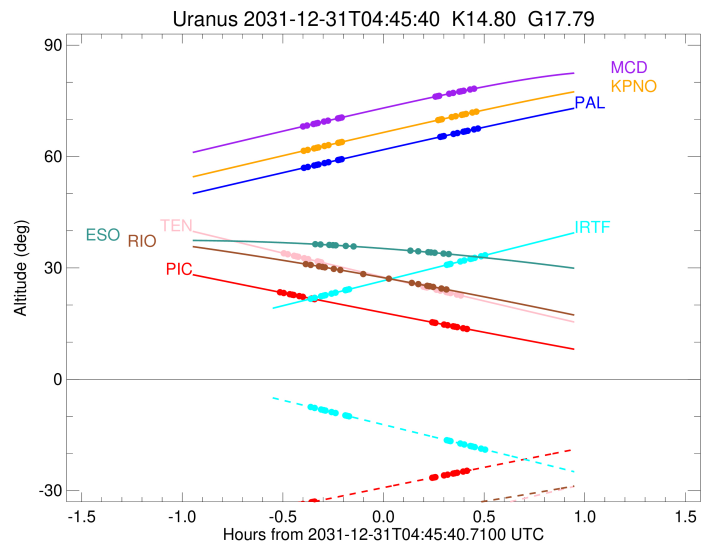
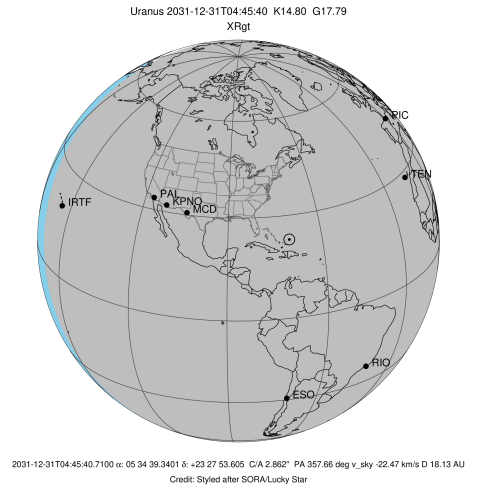


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:23:34.087		21.58	-7.38	51536.19	-15.86		
lambda	I	2031-12-31T04:25:10.568		21.94	-7.73	50026.71	-15.38		
delta	I	2031-12-31T04:27:05.250		22.37	-8.15	48300.35	-14.71		
gamma	I	2031-12-31T04:27:51.864		22.54	-8.32	47621.46	-14.41		
eta	I	2031-12-31T04:28:22.977		22.66	-8.43	47176.12	-14.21		
beta	I	2031-12-31T04:30:12.074		23.07	-8.83	45665.95	-13.44		
alpha	I	2031-12-31T04:31:21.918		23.33	-9.09	44745.04	-12.91		
4	I	2031-12-31T04:34:23.952		24.01	-9.75	42525.93	-11.38		
5	I	2031-12-31T04:34:52.613		24.12	-9.86	42214.63	-11.16		
6	I	2031-12-31T04:35:23.042		24.23	-9.97	41876.75	-10.84		

No planet occultations

6	E	2031-12-31T05:04:35.216		30.83	-16.42	41871.89	10.87		
5	E	2031-12-31T05:05:12.857		30.97	-16.56	42290.87	11.18		
4	E	2031-12-31T05:05:35.906		31.05	-16.64	42548.94	11.41		
alpha	E	2031-12-31T05:08:32.899		31.72	-17.30	44708.12	12.95		
beta	E	2031-12-31T05:09:43.714		31.99	-17.56	45643.97	13.48		
eta	E	2031-12-31T05:11:34.158		32.41	-17.97	47176.12	14.26		
gamma	E	2031-12-31T05:12:05.286		32.53	-18.09	47623.12	14.46		
delta	E	2031-12-31T05:12:51.631		32.70	-18.26	48300.35	14.76		
lambda	E	2031-12-31T05:14:45.910		33.14	-18.68	50026.71	15.44		
epsilon	E	2031-12-31T05:15:50.503		33.38	-18.92	51035.65	15.92		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:42:58.200  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 41.66  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.182  
 C/A sky separation (km) : 41848.5  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl1.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



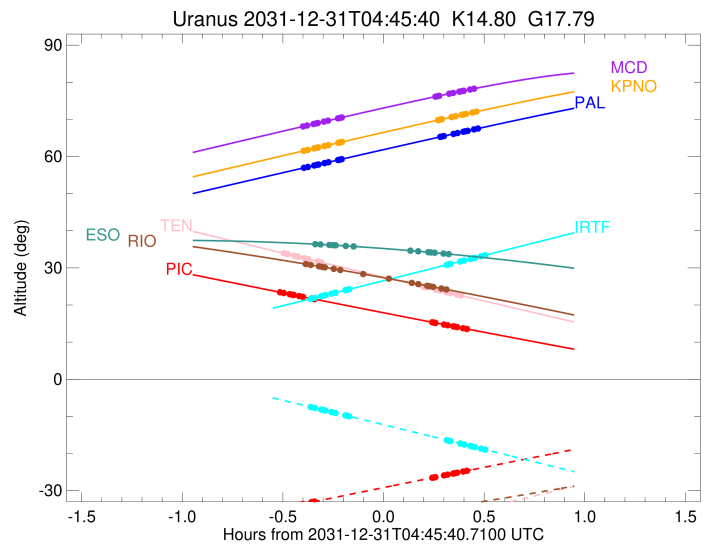
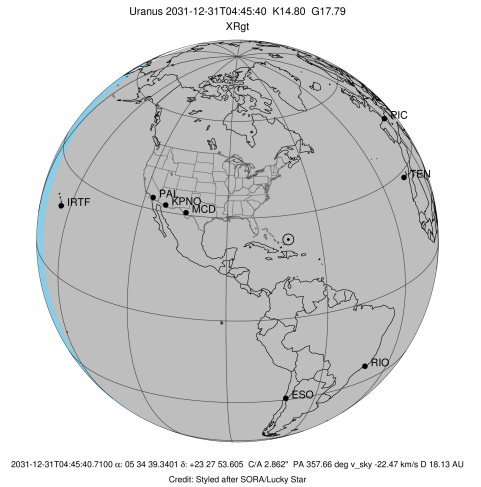
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T04:22:03.576		31.09	-39.55	51507.97	-13.05		
lambda	I	2031-12-31T04:24:00.160		30.79	-39.35	50026.71	-12.28		
delta	I	2031-12-31T04:26:27.659		30.42	-39.09	48300.35	-11.11		
gamma	I	2031-12-31T04:27:30.303		30.26	-38.98	47621.08	-10.57		
eta	I	2031-12-31T04:28:13.149		30.15	-38.91	47176.12	-10.19		
beta	I	2031-12-31T04:30:53.394		29.73	-38.62	45660.83	-8.67		
alpha	I	2031-12-31T04:32:47.097		29.44	-38.41	44738.10	-7.51		
4	I	2031-12-31T04:39:58.216		28.29	-37.59	42530.05	-2.59		

No planet occultations

4	E	2031-12-31T04:46:57.983		27.15	-36.74	42535.35	2.59		
alpha	E	2031-12-31T04:54:04.883		25.96	-35.84	44716.72	7.50		
beta	E	2031-12-31T04:55:59.916		25.64	-35.59	45646.84	8.66		
eta	E	2031-12-31T04:58:42.090		25.18	-35.24	47176.12	10.18		
gamma	E	2031-12-31T04:59:25.131		25.06	-35.14	47622.35	10.55		
delta	E	2031-12-31T05:00:27.774		24.88	-35.00	48300.35	11.09		
lambda	E	2031-12-31T05:02:55.582		24.46	-34.67	50026.71	12.25		
epsilon	E	2031-12-31T05:04:20.815		24.21	-34.48	51097.54	13.02		



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T04:44:44.250  
 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 : 3404547526735888640  
 2Mass ID (if available) : 05343934+2327536  
 ICRS Star Coord at Epoch: 05h 34m 39.34015s +23:27:53.60538s  
 RUWE (>1.4 is poor) : 1.16  
 K magnitude : 14.800  
 G magnitude : 17.786  
 RP magnitude : 16.965  
 BP magnitude : 18.489  
 DUPflag : 0  
 Distance (au) : 18.131  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.46  
 Sun-Target sep (deg) : 165.35  
 Sun-Moon sep (deg) : 41.98  
 B (ring opening deg) : 79.77  
 PA of pole (deg) : 36.98  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.251  
 C/A sky separation (km) : 42754.0  
 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	2031-12-31T04:24:53.226		36.41	-37.56	51502.31	-12.46		
lambda	I	2031-12-31T04:26:55.328		36.31	-37.60	50026.71	-11.62		
delta	I	2031-12-31T04:29:32.637		36.18	-37.65	48300.35	-10.31		
gamma	I	2031-12-31T04:30:40.520		36.12	-37.67	47621.04	-9.70		
eta	I	2031-12-31T04:31:27.429		36.08	-37.68	47176.12	-9.27		
beta	I	2031-12-31T04:34:28.150		35.92	-37.73	45659.75	-7.47		
alpha	I	2031-12-31T04:36:44.757		35.79	-37.75	44736.21	-6.00		

No planet occultations

alpha	E	2031-12-31T04:53:40.060		34.65	-37.76	44719.19	6.00		
beta	E	2031-12-31T04:55:57.894		34.47	-37.74	45647.72	7.47		
eta	E	2031-12-31T04:59:00.386		34.23	-37.70	47176.12	9.26		
gamma	E	2031-12-31T04:59:47.443		34.17	-37.69	47622.18	9.69		
delta	E	2031-12-31T05:00:55.256		34.08	-37.67	48300.35	10.30		
lambda	E	2031-12-31T05:03:32.687		33.86	-37.62	50026.71	11.61		
epsilon	E	2031-12-31T05:05:03.444		33.73	-37.59	51111.86	12.45		