

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:28:42.440  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517

ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s

RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 5.16  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33

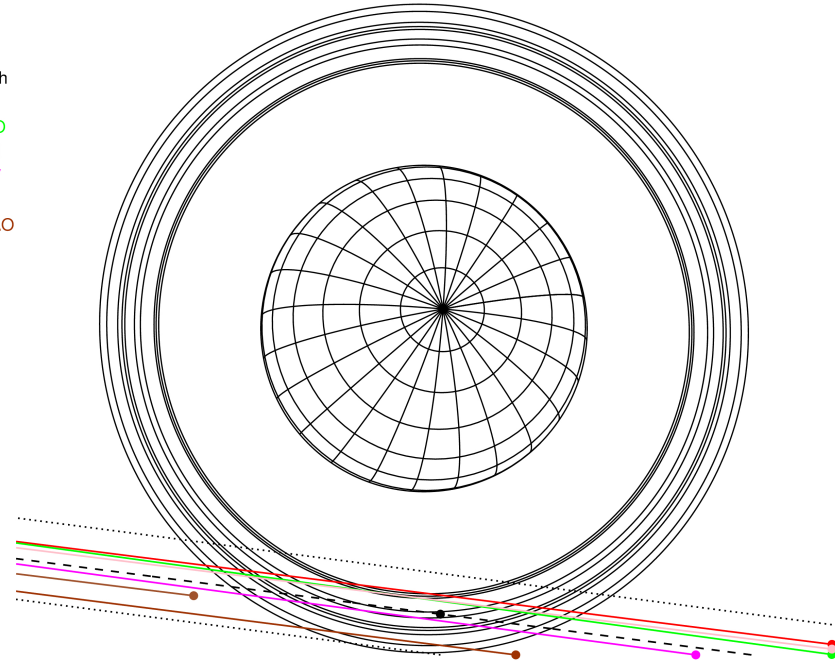
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2028-12-01T21:28:42.4400 cc: 04 41 30.38989 s +22 10 51.374 C/A 3.3111 PA 352.54 deg v\_sky -23.43 km/s D 18.31 AU  
 Credit: Styled after SORA/Lucky Star

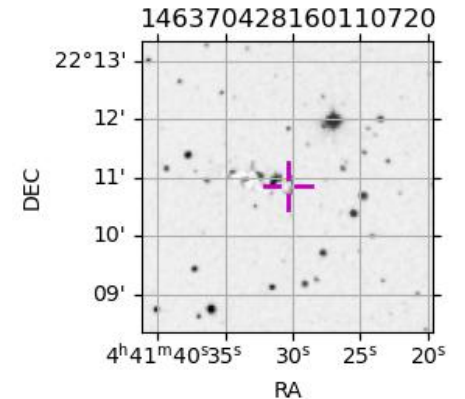
Uranus 2028-12-01T21:28:42 K14.65 G17.62 XRgt

Earth  
 PIC  
 PMO  
 TEN  
 KAV  
 RIO  
 SAAO

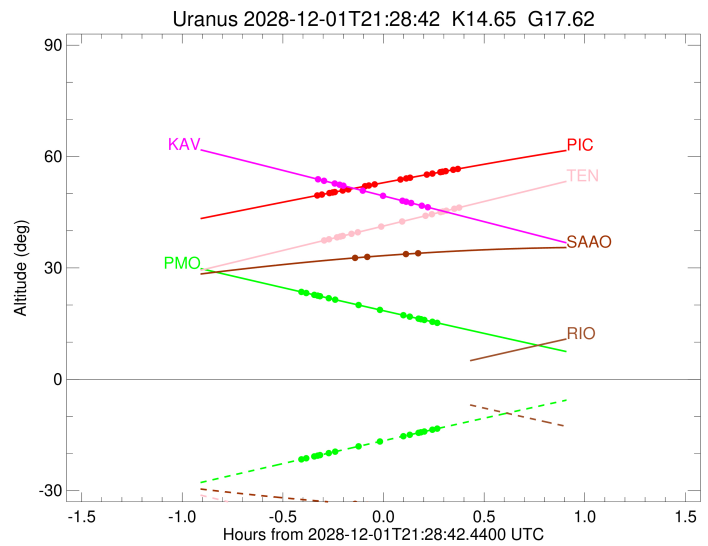
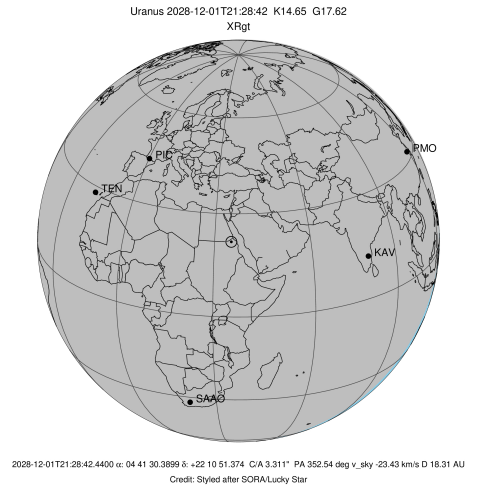


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 01 21:08 - DEC 01 21:51	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++		+++++	DEC 01 21:04 - DEC 01 21:45	PnnRie
KPNO	Kitt Peak Natl Obs	32.0	248.4					PnnRnn
MCD	McDonald Obs. 2.7m	30.7	256.0					PnnRnn
TEN	Teide Obs./Tenerife	28.3	343.5	+++++		+++++	DEC 01 21:10 - DEC 01 21:51	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 01 21:08 - DEC 01 21:42	PnnRie
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	++		++	DEC 01 21:19 - DEC 01 21:40	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:30:18.940  
 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 : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517  
 ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 4.68  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.096  
 C/A sky separation (km) : 41107.3  
 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\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

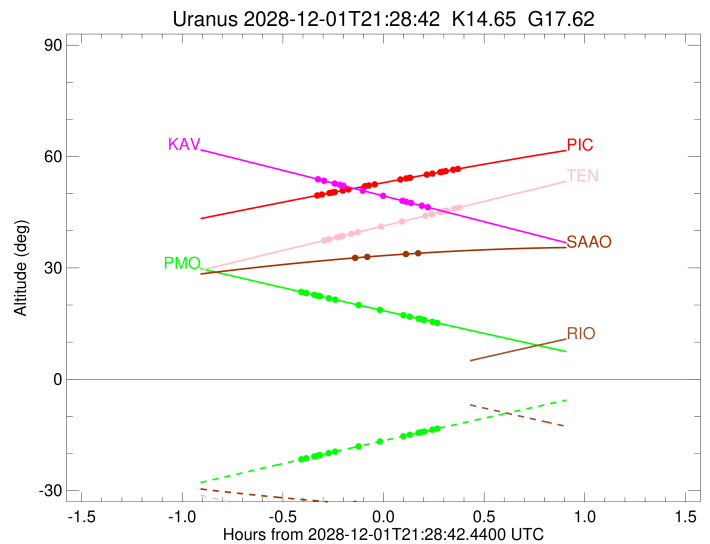
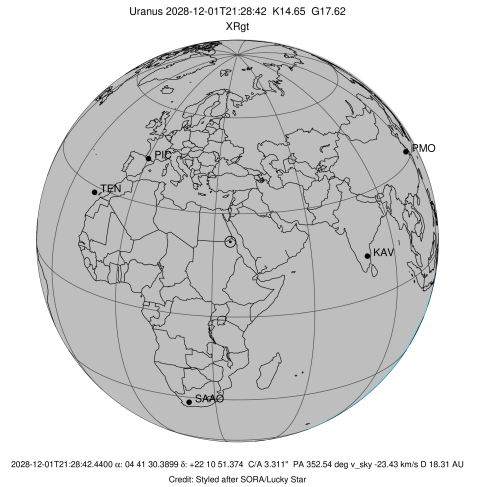


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-01T21:08:47.149		49.48	-50.87	51305.79	-14.13		
lambda	I	2028-12-01T21:10:20.896		49.76	-51.14	50026.71	-13.29		
delta	I	2028-12-01T21:12:36.373		50.16	-51.53	48300.35	-12.18		
gamma	I	2028-12-01T21:13:32.422		50.32	-51.69	47631.56	-11.68		
eta	I	2028-12-01T21:14:12.016		50.44	-51.80	47176.12	-11.32		
beta	I	2028-12-01T21:16:32.807		50.85	-52.20	45677.51	-9.95		
alpha	I	2028-12-01T21:18:16.278		51.15	-52.50	44704.44	-8.84		
4	I	2028-12-01T21:23:22.817		52.03	-53.37	42529.60	-5.22		
5	I	2028-12-01T21:24:39.657		52.25	-53.58	42164.97	-4.22		
6	I	2028-12-01T21:26:21.341		52.55	-53.87	41807.38	-2.88		

No planet occultations

6	E	2028-12-01T21:33:26.309		53.75	-55.05	41800.99	2.88		
5	E	2028-12-01T21:35:09.191		54.04	-55.33	42155.74	4.22		
4	E	2028-12-01T21:36:26.795		54.26	-55.55	42525.96	5.22		
alpha	E	2028-12-01T21:41:32.058		55.12	-56.38	44687.04	8.85		
beta	E	2028-12-01T21:43:17.578		55.41	-56.66	45680.63	9.96		
eta	E	2028-12-01T21:45:37.935		55.80	-57.04	47176.12	11.34		
gamma	E	2028-12-01T21:46:17.289		55.90	-57.14	47629.34	11.70		
delta	E	2028-12-01T21:47:13.455		56.06	-57.29	48300.35	12.19		
lambda	E	2028-12-01T21:49:28.737		56.43	-57.65	50026.71	13.31		
epsilon	E	2028-12-01T21:51:19.921		56.73	-57.94	51553.33	14.16		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:24:51.970  
 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 : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517  
 ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 5.72  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.159  
 C/A sky separation (km) : 41949.6  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ura111.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ura111.bsp  
 ura161.bsp  
 vgr2.ura161.bsp  
 peph.ura160.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

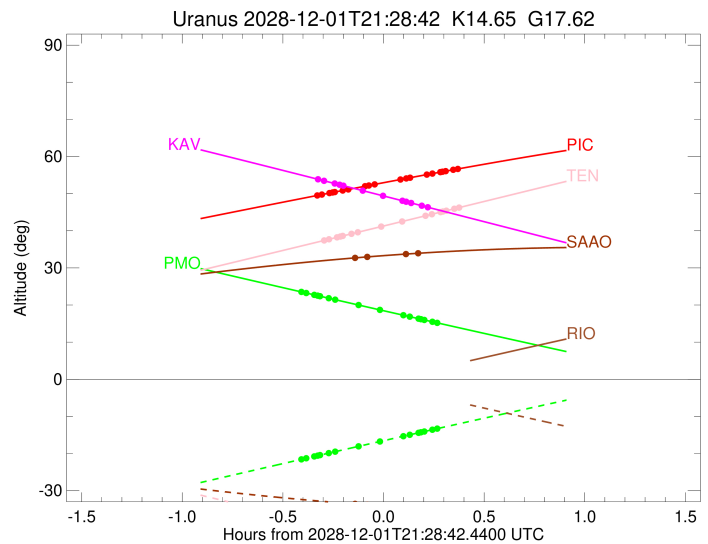
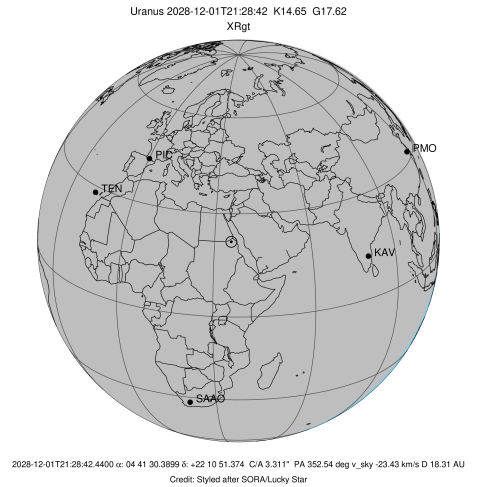


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-01T21:04:01.613		23.57	-21.62	51320.34	-13.50		
lambda	I	2028-12-01T21:05:41.245		23.23	-21.27	50026.71	-12.59		
delta	I	2028-12-01T21:08:05.170		22.73	-20.78	48300.35	-11.37		
gamma	I	2028-12-01T21:09:05.406		22.52	-20.57	47631.58	-10.83		
eta	I	2028-12-01T21:09:48.273		22.37	-20.43	47176.12	-10.42		
beta	I	2028-12-01T21:12:23.460		21.84	-19.89	45678.15	-8.87		
alpha	I	2028-12-01T21:14:22.160		21.43	-19.49	44702.44	-7.55		
4	I	2028-12-01T21:21:41.949		19.91	-17.98	42527.54	-2.17		

No planet occultations

4	E	2028-12-01T21:27:12.838		18.78	-16.85	42526.10	2.17		
alpha	E	2028-12-01T21:34:31.951		17.27	-15.36	44687.63	7.55		
beta	E	2028-12-01T21:36:32.961		16.86	-14.95	45680.80	8.85		
eta	E	2028-12-01T21:39:08.179		16.33	-14.43	47176.12	10.40		
gamma	E	2028-12-01T21:39:50.939		16.19	-14.28	47629.45	10.80		
delta	E	2028-12-01T21:40:51.507		15.98	-14.08	48300.35	11.35		
lambda	E	2028-12-01T21:43:15.786		15.49	-13.59	50026.71	12.56		
epsilon	E	2028-12-01T21:45:13.141		15.09	-13.20	51553.99	13.47		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:31:33.110  
 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 : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517  
 ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 4.52  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.160  
 C/A sky separation (km) : 41962.6  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ura111.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ura111.bsp  
 ura161.bsp  
 vgr2.ura161.bsp  
 peph.ura160.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

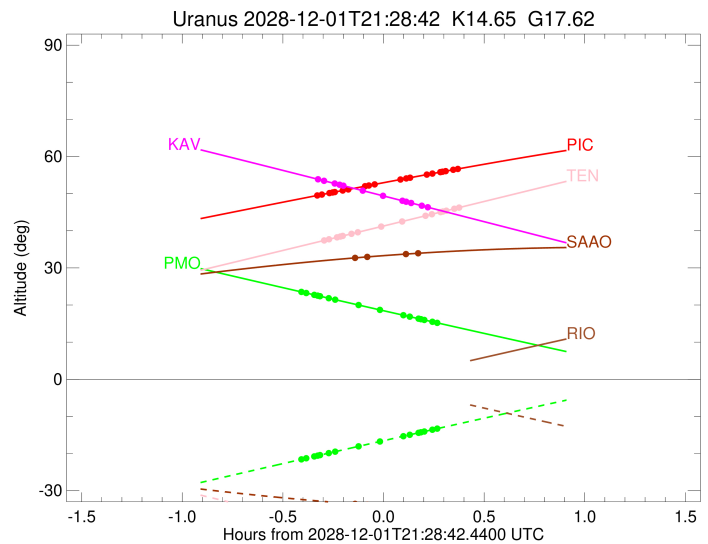
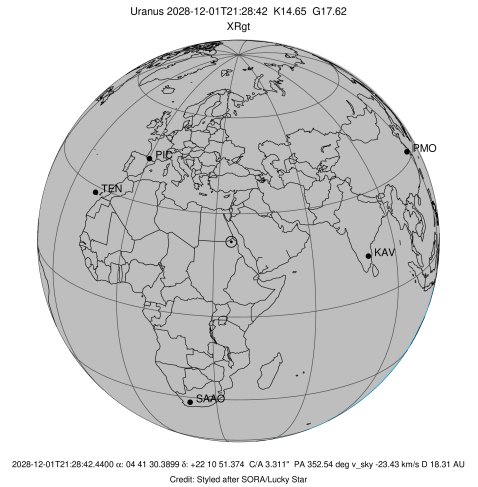


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-01T21:10:49.451		37.35	-39.21	51315.91	-13.55		
lambda	I	2028-12-01T21:12:28.405		37.71	-39.57	50026.71	-12.64		
delta	I	2028-12-01T21:14:51.799		38.24	-40.10	48300.35	-11.42		
gamma	I	2028-12-01T21:15:51.805		38.46	-40.32	47631.57	-10.87		
eta	I	2028-12-01T21:16:34.504		38.61	-40.47	47176.12	-10.46		
beta	I	2028-12-01T21:19:09.083		39.18	-41.04	45678.03	-8.90		
alpha	I	2028-12-01T21:21:07.241		39.61	-41.47	44702.80	-7.59		
4	I	2028-12-01T21:28:26.142		41.22	-43.07	42527.67	-2.15		

No planet occultations

4	E	2028-12-01T21:33:50.823		42.41	-44.26	42526.15	2.16		
alpha	E	2028-12-01T21:41:08.329		44.02	-45.87	44687.81	7.60		
beta	E	2028-12-01T21:43:08.484		44.46	-46.31	45680.85	8.92		
eta	E	2028-12-01T21:45:42.535		45.02	-46.87	47176.12	10.48		
gamma	E	2028-12-01T21:46:24.966		45.18	-47.03	47629.51	10.89		
delta	E	2028-12-01T21:47:25.046		45.40	-47.25	48300.35	11.44		
lambda	E	2028-12-01T21:49:48.134		45.93	-47.78	50026.71	12.67		
epsilon	E	2028-12-01T21:51:44.508		46.36	-48.20	51554.37	13.58		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:25:58.490  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517  
 ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 5.80  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.392  
 C/A sky separation (km) : 45046.8  
 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

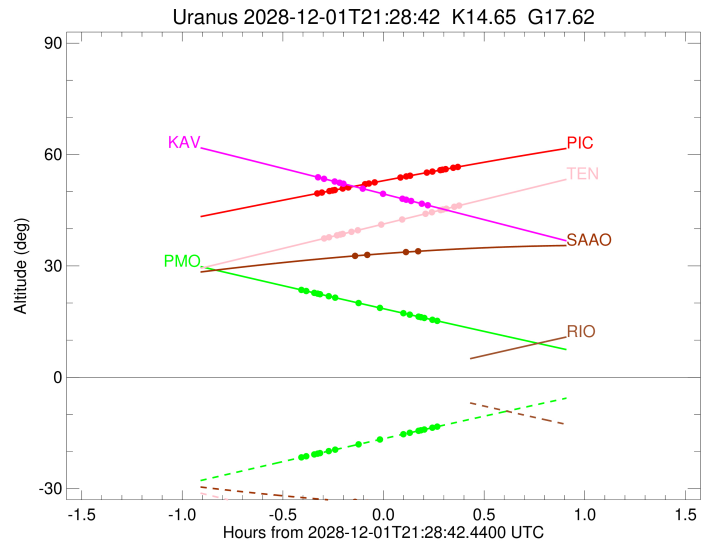
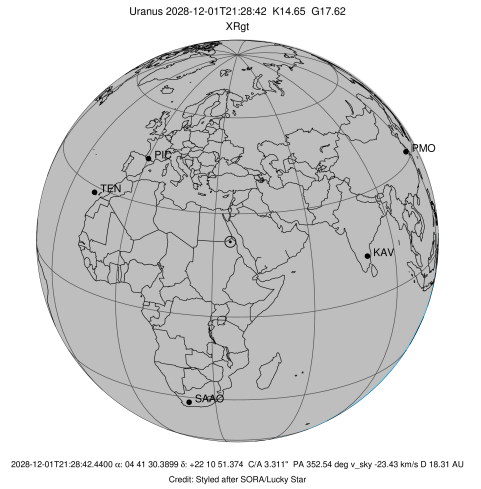


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-01T21:08:53.585		53.94	-51.95	51361.13	-11.26		
lambda	I	2028-12-01T21:11:00.050		53.46	-51.46	50026.71	-9.97		
delta	I	2028-12-01T21:14:11.178		52.73	-50.73	48300.35	-8.06		
gamma	I	2028-12-01T21:15:39.255		52.39	-50.39	47631.52	-7.12		
eta	I	2028-12-01T21:16:46.768		52.13	-50.14	47176.12	-6.37		
beta	I	2028-12-01T21:22:29.944		50.82	-48.82	45680.48	-2.29		

No planet occultations

beta	E	2028-12-01T21:28:35.844		49.41	-47.41	45681.16	2.29		
eta	E	2028-12-01T21:34:18.967		48.09	-46.09	47176.12	6.36		
gamma	E	2028-12-01T21:35:26.351		47.83	-45.83	47630.15	7.11		
delta	E	2028-12-01T21:36:54.716		47.49	-45.49	48300.35	8.05		
lambda	E	2028-12-01T21:40:06.095		46.76	-44.76	50026.71	9.96		
epsilon	E	2028-12-01T21:42:30.106		46.20	-44.20	51554.98	11.24		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2028-12-01T21:30:06.040  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 146370428160110720  
 2Mass ID (if available) : 04413039+2210517  
 ICRS Star Coord at Epoch: 04h 41m 30.38987s +22:10:51.37381s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 14.651  
 G magnitude : 17.618  
 RP magnitude : 16.710  
 BP magnitude : 18.499  
 DUPflag : 0  
 Distance (au) : 18.309  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.43  
 Sun-Target sep (deg) : 177.94  
 Sun-Moon sep (deg) : 5.44  
 B (ring opening deg) : 80.40  
 PA of pole (deg) : -44.33  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.682  
 C/A sky separation (km) : 48899.4  
 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	2028-12-01T21:19:33.705		32.65	-33.53	51423.79	-6.85		
lambda	I	2028-12-01T21:23:55.659		32.97	-33.81	50026.71	-3.91		

No planet occultations

lambda	E	2028-12-01T21:35:20.323		33.72	-34.47	50026.71	3.91		
epsilon	E	2028-12-01T21:39:59.699		34.00	-34.70	51543.07	6.85		