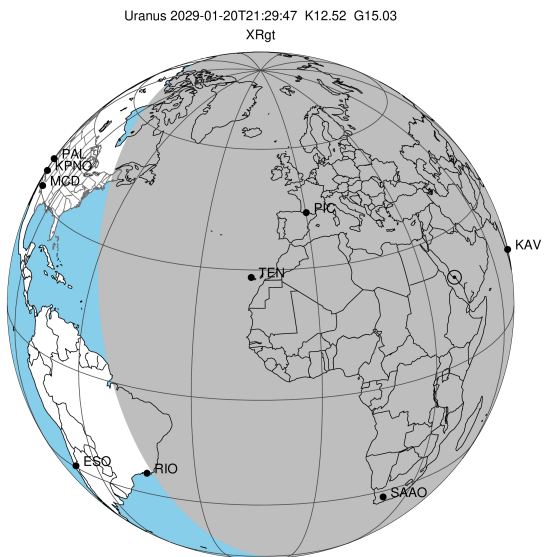


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:29:47.460
 Event type : XRgt
 : No Uranus occs
 : Ring occs: geocentric, topocentric
 Gaia source ID : 145001364385358720
 2Mass ID (if available) : 04335201+2156244

ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s

RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 60.33
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59

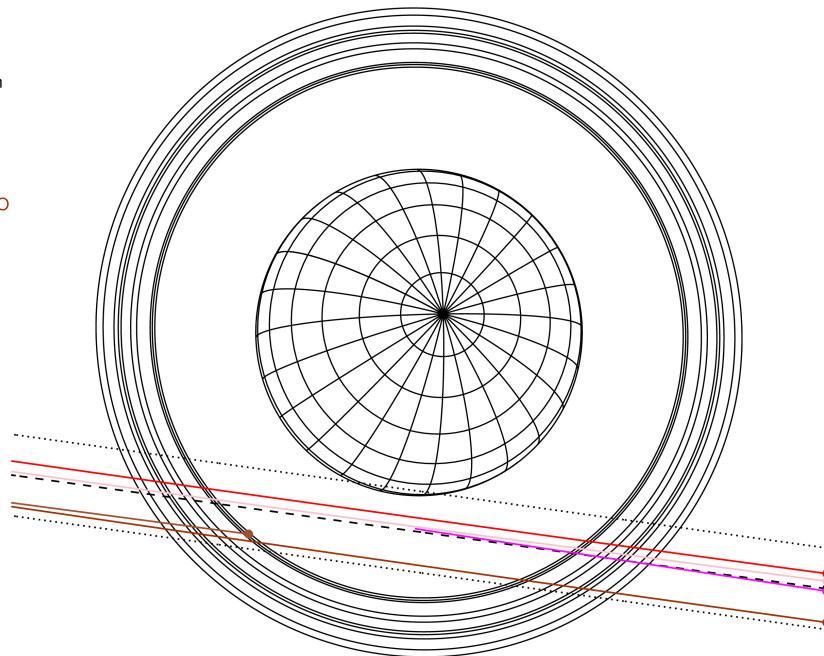
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2029-01-20T21:29:47.4600 ex: 04 33 52.0606 ex: +21 56 24.166 C/A 2.282" PA 352.06 deg v_sky -12.57 km/s D 18.65 AU
 Credit: Styled after SORA/Lucky Star

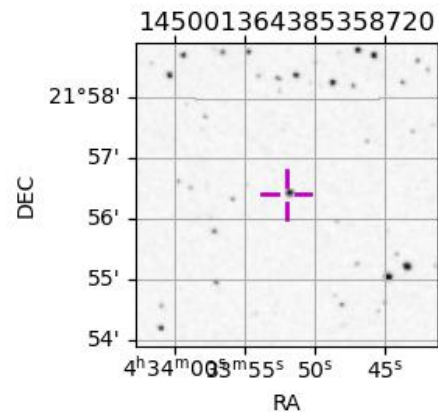
Uranus 2029-01-20T21:29:47 K12.52 G15.03 XRgt

Earth
 PIC
 TEN
 KAV
 RIO
 SAAO

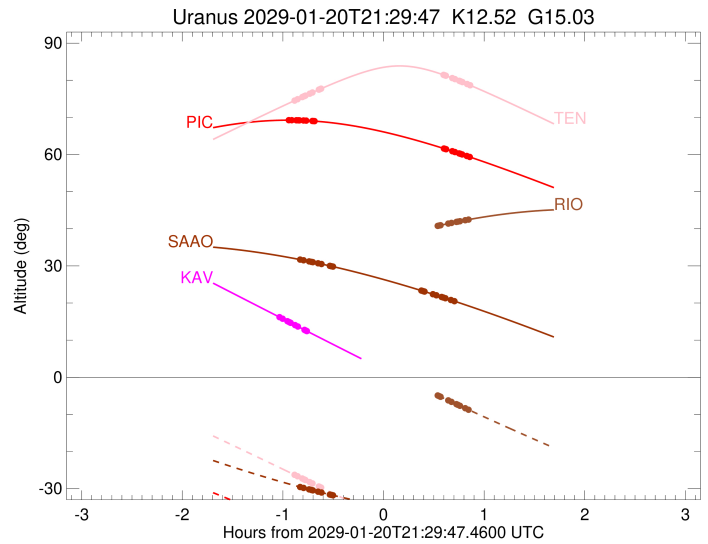
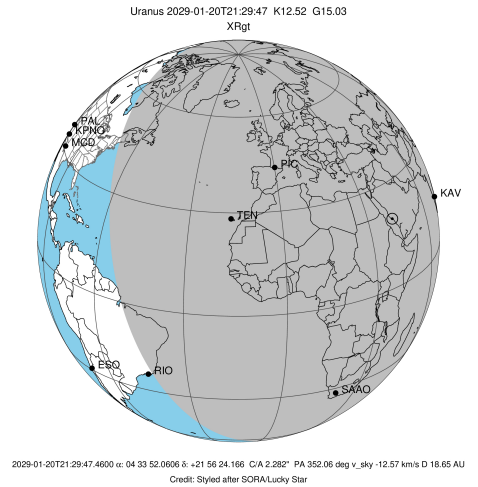


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	JAN 20 20:32 - JAN 20 22:21	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
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	+++++		+++++	JAN 20 20:36 - JAN 20 22:21	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++			JAN 20 20:27 - JAN 20 20:44	PnnRin
RIO	Rio de Janeiro	-22.9	316.8			+++++	JAN 20 22:03 - JAN 20 22:20	PnnRne
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	+++++		+++++	JAN 20 20:39 - JAN 20 22:12	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:27:52.370
 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 : 145001364385358720
 2Mass ID (if available) : 04335201+2156244
 ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s
 RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 61.14
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.129
 C/A sky separation (km) : 28789.5
 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

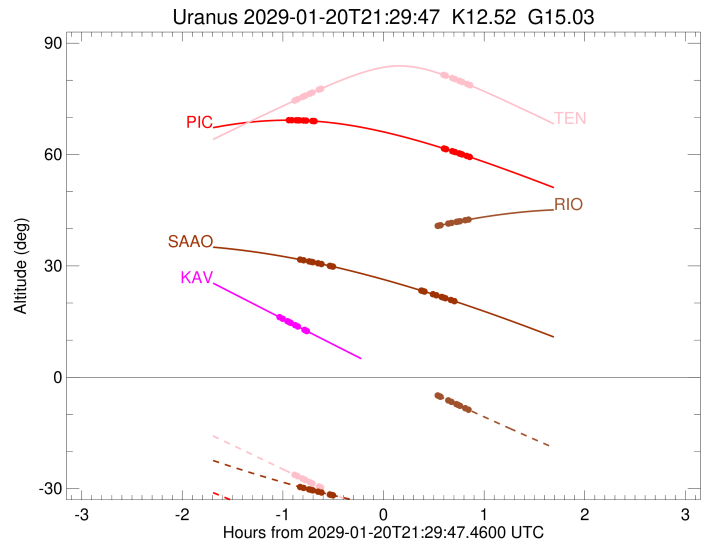
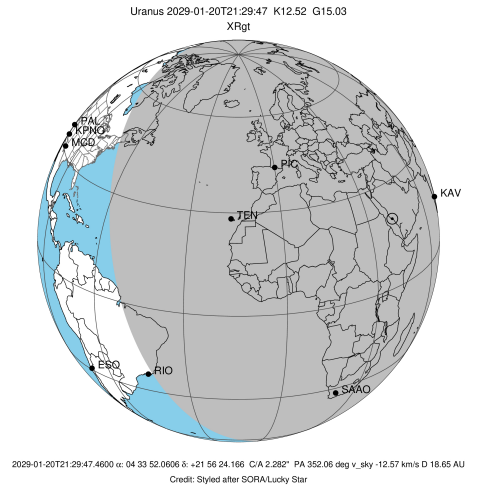


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-01-20T20:32:45.140		69.26	-39.23	51533.96	-10.78		
lambda	I	2029-01-20T20:35:06.217		69.25	-39.66	50026.71	-10.61		
delta	I	2029-01-20T20:37:50.518		69.23	-40.15	48300.35	-10.41		
gamma	I	2029-01-20T20:38:55.304		69.22	-40.35	47628.90	-10.32		
eta	I	2029-01-20T20:39:39.298		69.21	-40.48	47176.12	-10.26		
beta	I	2029-01-20T20:42:06.942		69.17	-40.92	45676.48	-10.05		
alpha	I	2029-01-20T20:43:46.256		69.13	-41.22	44685.93	-9.90		
4	I	2029-01-20T20:47:25.477		69.04	-41.88	42557.41	-9.52		
5	I	2029-01-20T20:48:02.655		69.02	-41.99	42204.91	-9.46		
6	I	2029-01-20T20:48:44.468		69.00	-42.11	41811.98	-9.37		

No planet occultations

6	E	2029-01-20T22:05:51.934		61.61	-55.26	41872.41	9.34		
5	E	2029-01-20T22:06:37.406		61.50	-55.37	42311.04	9.43		
4	E	2029-01-20T22:07:10.573		61.43	-55.46	42615.31	9.49		
alpha	E	2029-01-20T22:10:48.628		60.90	-56.02	44732.95	9.86		
beta	E	2029-01-20T22:12:20.665		60.68	-56.26	45645.44	10.01		
eta	E	2029-01-20T22:14:52.054		60.30	-56.64	47176.12	10.22		
gamma	E	2029-01-20T22:15:35.480		60.20	-56.75	47621.13	10.28		
delta	E	2029-01-20T22:16:41.306		60.03	-56.92	48300.35	10.36		
lambda	E	2029-01-20T22:19:26.354		59.62	-57.33	50026.71	10.56		
epsilon	E	2029-01-20T22:21:09.985		59.36	-57.59	51126.54	10.73		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:29:47.280
 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 : 145001364385358720
 2Mass ID (if available) : 04335201+2156244
 ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s
 RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 61.10
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.234
 C/A sky separation (km) : 30216.5
 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

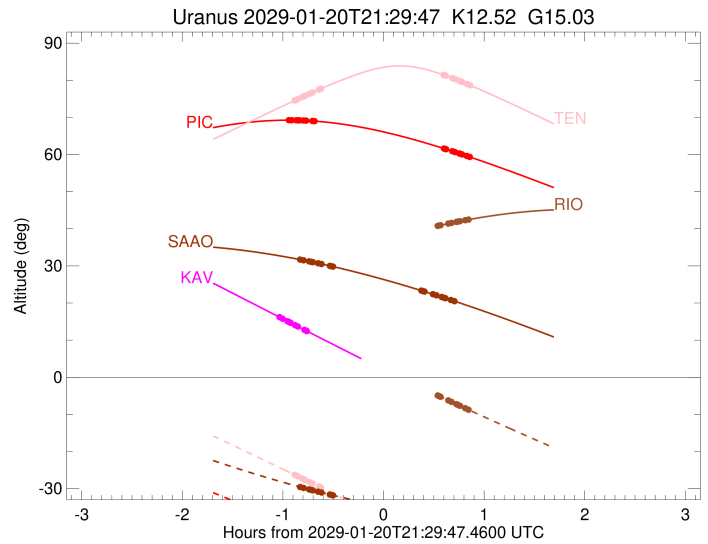
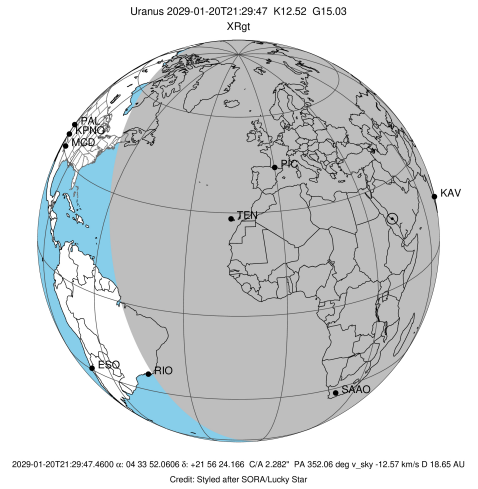


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-01-20T20:36:10.547		74.41	-26.15	51537.76	-10.56		
lambda	I	2029-01-20T20:38:35.082		74.91	-26.67	50026.71	-10.37		
delta	I	2029-01-20T20:41:23.426		75.49	-27.28	48300.35	-10.14		
gamma	I	2029-01-20T20:42:29.970		75.72	-27.53	47628.74	-10.04		
eta	I	2029-01-20T20:43:15.182		75.87	-27.69	47176.12	-9.98		
beta	I	2029-01-20T20:45:47.361		76.38	-28.24	45675.98	-9.73		
alpha	I	2029-01-20T20:47:29.935		76.73	-28.61	44686.33	-9.56		
4	I	2029-01-20T20:51:17.548		77.49	-29.44	42559.31	-9.13		
5	I	2029-01-20T20:51:56.216		77.61	-29.58	42208.24	-9.06		
6	I	2029-01-20T20:52:40.078		77.76	-29.74	41813.56	-8.96		

No planet occultations

6	E	2029-01-20T22:05:39.757		81.45	-45.77	41871.11	8.95		
5	E	2029-01-20T22:06:27.089		81.32	-45.94	42309.62	9.05		
4	E	2029-01-20T22:07:01.721		81.23	-46.07	42614.71	9.12		
alpha	E	2029-01-20T22:10:47.518		80.60	-46.90	44731.50	9.55		
beta	E	2029-01-20T22:12:22.591		80.32	-47.25	45646.02	9.72		
eta	E	2029-01-20T22:14:58.037		79.86	-47.82	47176.12	9.97		
gamma	E	2029-01-20T22:15:42.545		79.73	-47.98	47621.19	10.03		
delta	E	2029-01-20T22:16:49.912		79.52	-48.23	48300.35	10.13		
lambda	E	2029-01-20T22:19:38.445		79.00	-48.85	50026.71	10.35		
epsilon	E	2029-01-20T22:21:25.471		78.66	-49.24	51141.89	10.55		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:21:55.290
 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 : 145001364385358720
 2Mass ID (if available) : 04335201+2156244
 ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s
 RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 60.79
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.253
 C/A sky separation (km) : 30464.2
 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

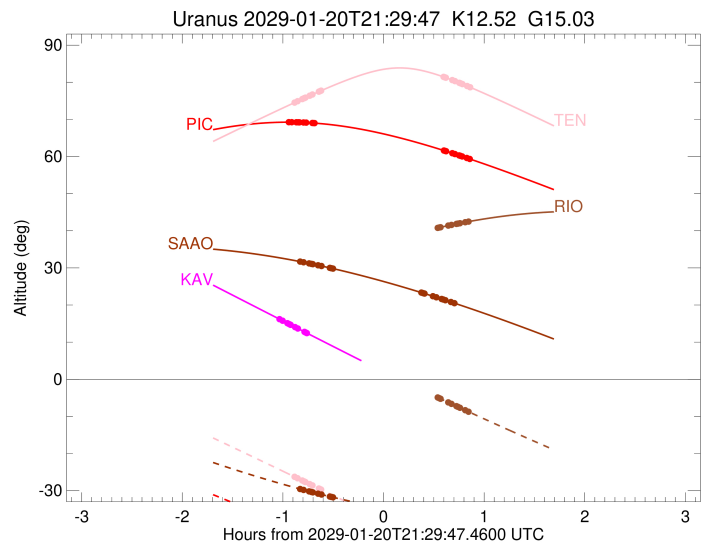
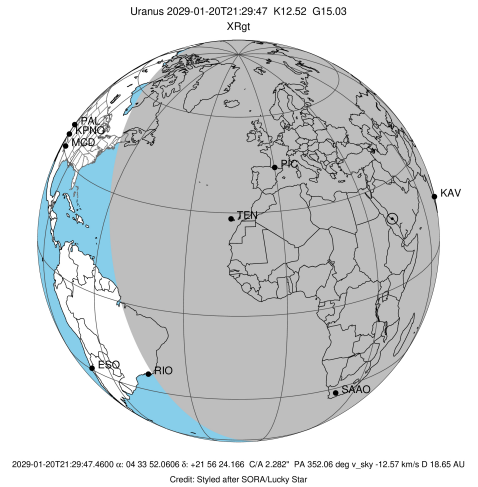


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-01-20T20:27:10.686		16.33	-66.89	51540.60	-10.30		
lambda	I	2029-01-20T20:29:39.218		15.76	-66.33	50026.71	-10.10		
delta	I	2029-01-20T20:32:32.076		15.10	-65.67	48300.35	-9.87		
gamma	I	2029-01-20T20:33:40.473		14.83	-65.41	47628.62	-9.77		
eta	I	2029-01-20T20:34:26.943		14.66	-65.24	47176.12	-9.70		
beta	I	2029-01-20T20:37:03.555		14.06	-64.64	45675.62	-9.45		
alpha	I	2029-01-20T20:38:49.141		13.65	-64.24	44686.62	-9.28		
4	I	2029-01-20T20:42:43.857		12.75	-63.34	42560.50	-8.84		
5	I	2029-01-20T20:43:23.716		12.60	-63.19	42210.32	-8.76		
6	I	2029-01-20T20:44:09.138		12.42	-63.01	41814.54	-8.66		

No planet occultations

6	E	2029-01-20T21:58:37.286		-4.50x	-45.65	41871.32	8.55		
5	E	2029-01-20T21:59:26.827		-4.69x	-45.45	42309.87	8.65		
4	E	2029-01-20T22:00:03.037		-4.82x	-45.31	42614.82	8.72		
alpha	E	2029-01-20T22:03:59.116		-5.70x	-44.39	44731.79	9.14		
beta	E	2029-01-20T22:05:38.399		-6.07x	-44.00	45645.89	9.31		
eta	E	2029-01-20T22:08:20.763		-6.68x	-43.36	47176.12	9.54		
gamma	E	2029-01-20T22:09:07.236		-6.85x	-43.18	47621.18	9.61		
delta	E	2029-01-20T22:10:17.573		-7.11x	-42.91	48300.35	9.70		
lambda	E	2029-01-20T22:13:13.500		-7.76x	-42.22	50026.71	9.92		
epsilon	E	2029-01-20T22:15:04.767		-8.17x	-41.78	51137.48	10.11		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:33:44.550
 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 : 145001364385358720
 2Mass ID (if available) : 04335201+2156244
 ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s
 RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 60.59
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.569
 C/A sky separation (km) : 34740.5
 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

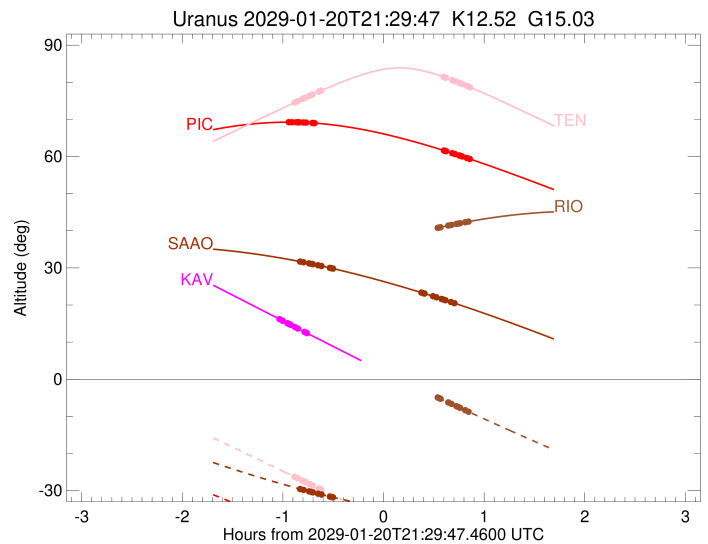
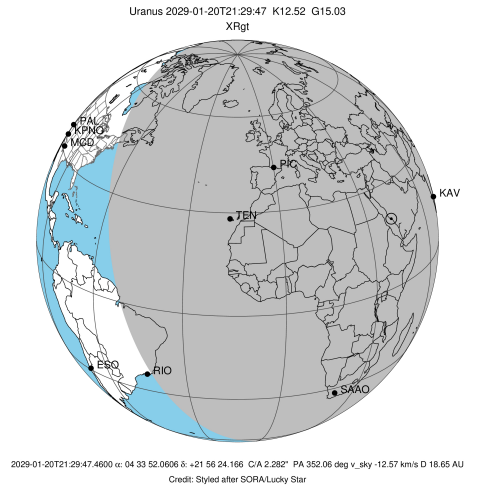


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-01-20T20:44:35.572		30.37	11.85x	51548.46	-9.54		
lambda	I	2029-01-20T20:47:17.369		30.80	11.26x	50026.71	-9.28		
delta	I	2029-01-20T20:50:26.794		31.30	10.56x	48300.35	-8.95		
gamma	I	2029-01-20T20:51:42.536		31.50	10.29x	47628.12	-8.80		
eta	I	2029-01-20T20:52:34.171		31.64	10.10x	47176.12	-8.70		
beta	I	2029-01-20T20:55:30.398		32.10	9.45x	45673.95	-8.33		
alpha	I	2029-01-20T20:57:30.557		32.40	9.01x	44688.22	-8.07		
4	I	2029-01-20T21:02:04.953		33.10	8.01x	42566.63	-7.39		
5	I	2029-01-20T21:02:52.292		33.22	7.84x	42221.27	-7.27		
6	I	2029-01-20T21:03:47.891		33.36	7.63x	41819.97	-7.11		

No planet occultations

6	E	2029-01-20T22:02:10.366		40.79	-4.91x	41865.90	7.13		
5	E	2029-01-20T22:03:09.046		40.88	-5.12	42303.22	7.29		
4	E	2029-01-20T22:03:52.327		40.96	-5.27	42611.83	7.41		
alpha	E	2029-01-20T22:08:23.693		41.40	-6.22	44726.47	8.10		
beta	E	2029-01-20T22:10:15.867		41.57	-6.61	45648.16	8.37		
eta	E	2029-01-20T22:13:14.551		41.85	-7.24	47176.12	8.74		
gamma	E	2029-01-20T22:14:05.229		41.92	-7.41	47621.45	8.84		
delta	E	2029-01-20T22:15:21.419		42.03	-7.68	48300.35	8.98		
lambda	E	2029-01-20T22:18:30.041		42.30	-8.33	50026.71	9.32		
epsilon	E	2029-01-20T22:20:33.653		42.48	-8.76	51190.91	9.59		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-01-20T21:26:49.180
 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 : 145001364385358720
 2Mass ID (if available) : 04335201+2156244
 ICRS Star Coord at Epoch: 04h 33m 52.06057s +21:56:24.16599s
 RUWE (>1.4 is poor) : 5.05
 K magnitude : 12.523
 G magnitude : 15.029
 RP magnitude : 14.223
 BP magnitude : 15.657
 DUPflag : 0
 Distance (au) : 18.646
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -12.57
 Sun-Target sep (deg) : 129.38
 Sun-Moon sep (deg) : 60.88
 B (ring opening deg) : 79.23
 PA of pole (deg) : -52.59
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.670
 C/A sky separation (km) : 36111.7
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-01-20T20:39:22.394		31.76	-29.48	51551.67	-9.24		
lambda	I	2029-01-20T20:42:10.235		31.51	-29.82	50026.71	-8.94		
delta	I	2029-01-20T20:45:27.493		31.21	-30.20	48300.35	-8.56		
gamma	I	2029-01-20T20:46:46.815		31.09	-30.36	47627.83	-8.39		
eta	I	2029-01-20T20:47:40.988		31.00	-30.46	47176.12	-8.28		
beta	I	2029-01-20T20:50:47.189		30.71	-30.82	45672.98	-7.85		
alpha	I	2029-01-20T20:52:54.944		30.50	-31.06	44689.26	-7.55		
4	I	2029-01-20T20:57:51.509		30.00	-31.60	42569.92	-6.74		
5	I	2029-01-20T20:58:43.239		29.91	-31.70	42227.17	-6.60		
6	I	2029-01-20T20:59:45.022		29.80	-31.81	41822.99	-6.40		

No planet occultations

6	E	2029-01-20T21:52:24.692		23.34	-36.22	41864.24	6.37		
5	E	2029-01-20T21:53:29.966		23.19	-36.29	42301.05	6.56		
4	E	2029-01-20T21:54:18.069		23.08	-36.33	42610.82	6.71		
alpha	E	2029-01-20T21:59:14.154		22.38	-36.61	44725.17	7.50		
beta	E	2029-01-20T22:01:15.058		22.09	-36.71	45648.72	7.80		
eta	E	2029-01-20T22:04:25.649		21.63	-36.86	47176.12	8.22		
gamma	E	2029-01-20T22:05:19.447		21.50	-36.91	47621.53	8.34		
delta	E	2029-01-20T22:06:40.101		21.30	-36.97	48300.35	8.50		
lambda	E	2029-01-20T22:09:58.871		20.81	-37.11	50026.71	8.87		
epsilon	E	2029-01-20T22:12:09.646		20.49	-37.20	51201.02	9.16		