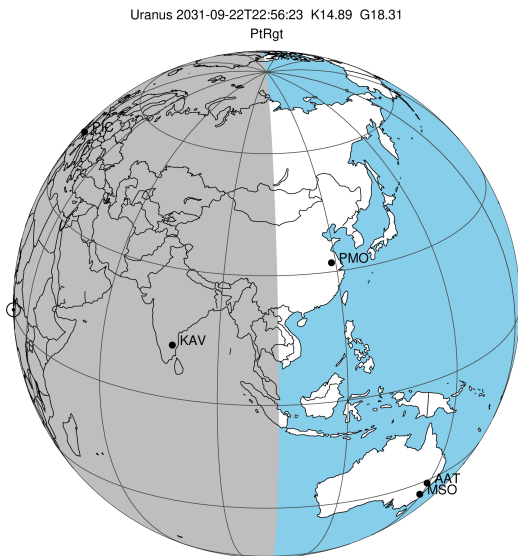


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T22:56:23.170
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499

ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s

RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 168.03
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61

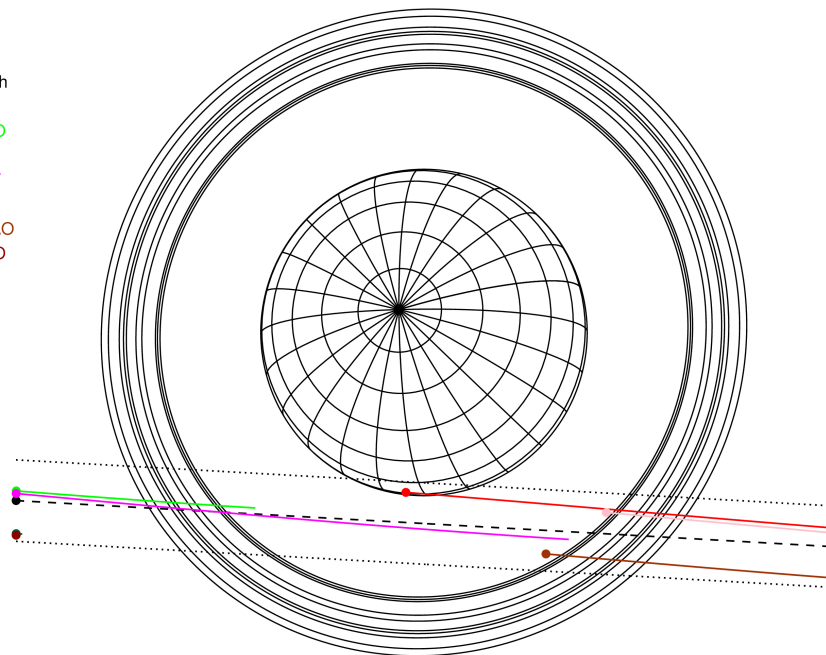
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-09-22T22:56:23.1700 ra: 05 45 55.0783 ec: +23 31 49.574 C/A 2.163° PA 356.77 deg v_sky + 5.02 km/s D 19.03 AU
 Credit: Styled after SORA/Lucky Star

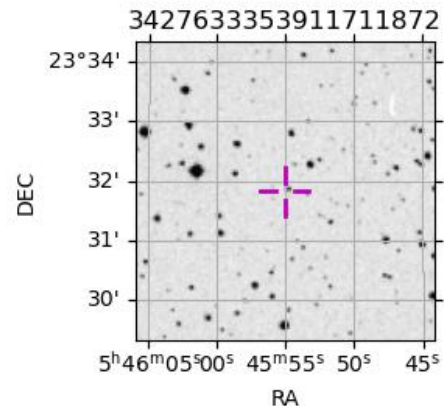
Uranus 2031-09-22T22:56:23 K14.89 G18.31 PtRgt

Earth
 PIC
 PMO
 TEN
 KAV
 AAT
 SAAO
 MSO

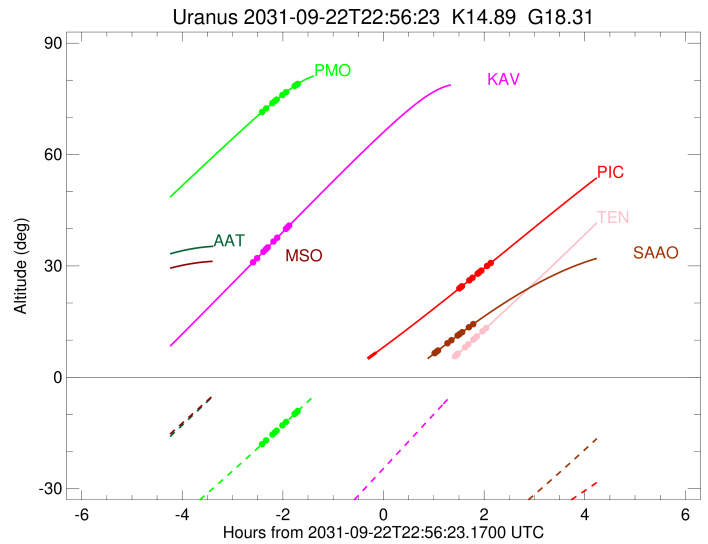
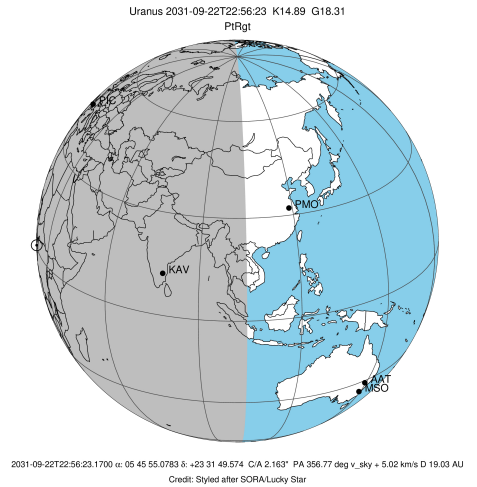


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEncode
PIC	Pic du Midi	42.9	0.1		+	+++++	SEP 22 22:47 - SEP 23 01:03	PneRne
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++			SEP 22 20:29 - SEP 22 21:14	PnnRin
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			+++++	SEP 23 00:21 - SEP 23 00:57	PnnRne
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++			SEP 22 20:19 - SEP 22 21:04	PnnRin
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			+++++	SEP 22 23:57 - SEP 23 00:42	PnnRne
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn

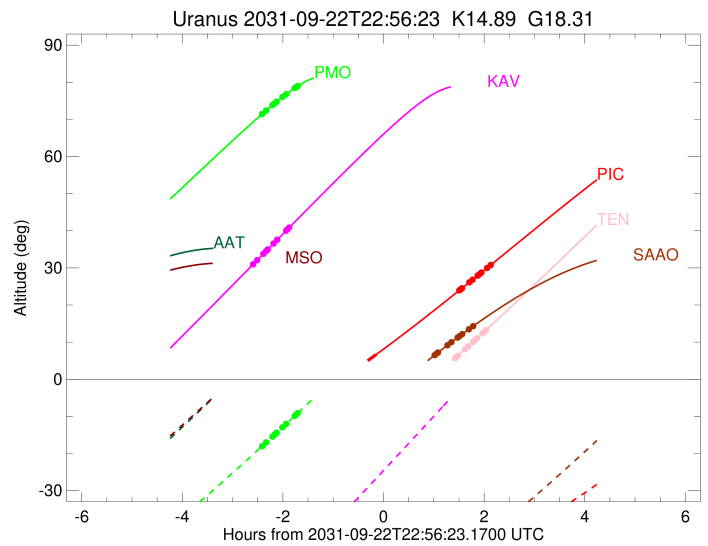
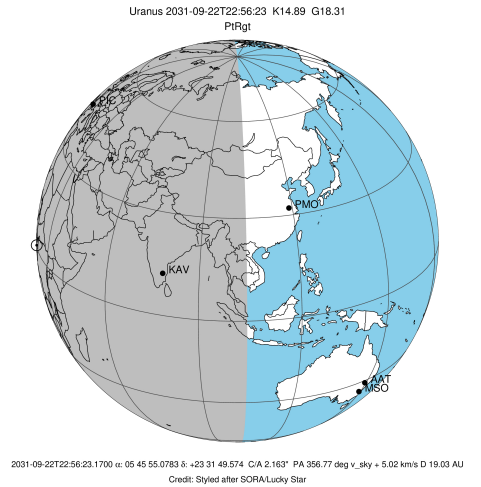


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T22:40:09.060
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499
 ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 167.50
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.825
 C/A sky separation (km) : 25189.2
 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	2031-09-22T20:18:15.314	-14.50x	-25.82	51549.64	-4.73			
lambda	I	2031-09-22T20:23:38.964	-13.89x	-26.70	50026.71	-4.68			
delta	I	2031-09-22T20:29:50.580	-13.18x	-27.70	48300.35	-4.61			
gamma	I	2031-09-22T20:32:17.023	-12.90x	-28.10	47627.05	-4.58			
eta	I	2031-09-22T20:33:55.611	-12.70x	-28.36	47176.12	-4.56			
beta	I	2031-09-22T20:39:26.222	-12.04x	-29.23	45678.63	-4.49			
alpha	I	2031-09-22T20:43:00.144	-11.61x	-29.78	44721.51	-4.44			
4	I	2031-09-22T20:51:00.261	-10.61x	-31.02	42615.96	-4.33			
5	I	2031-09-22T20:52:23.213	-10.44x	-31.23	42254.38	-4.31			
6	I	2031-09-22T20:54:09.109	-10.21x	-31.50	41800.93	-4.28			
Uranus	I	2031-09-22T22:29:13.511	3.66x	-43.29	25414.19			-6.00	-6.28
Uranus	E	2031-09-22T22:47:37.745	6.67	-44.78	25294.12			-8.16	-8.54
6	E	2031-09-23T00:26:52.829	23.96	-46.47	41867.68	3.97			
5	E	2031-09-23T00:28:45.724	24.30	-46.39	42304.85	4.00			
4	E	2031-09-23T00:29:48.743	24.49	-46.35	42565.94	4.01			
alpha	E	2031-09-23T00:38:31.943	26.08	-45.93	44685.76	4.10			
beta	E	2031-09-23T00:42:25.334	26.78	-45.71	45645.49	4.13			
eta	E	2031-09-23T00:48:33.717	27.90	-45.34	47176.12	4.18			
gamma	E	2031-09-23T00:50:22.264	28.24	-45.23	47630.71	4.19			
delta	E	2031-09-23T00:53:01.550	28.72	-45.05	48300.35	4.21			
lambda	E	2031-09-23T00:59:49.143	29.96	-44.56	50026.71	4.26			
epsilon	E	2031-09-23T01:03:11.543	30.58	-44.31	50890.27	4.29			

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T23:03:08.880
 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 : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499
 ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 168.48
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.095
 C/A sky separation (km) : 28917.9
 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_itrfr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

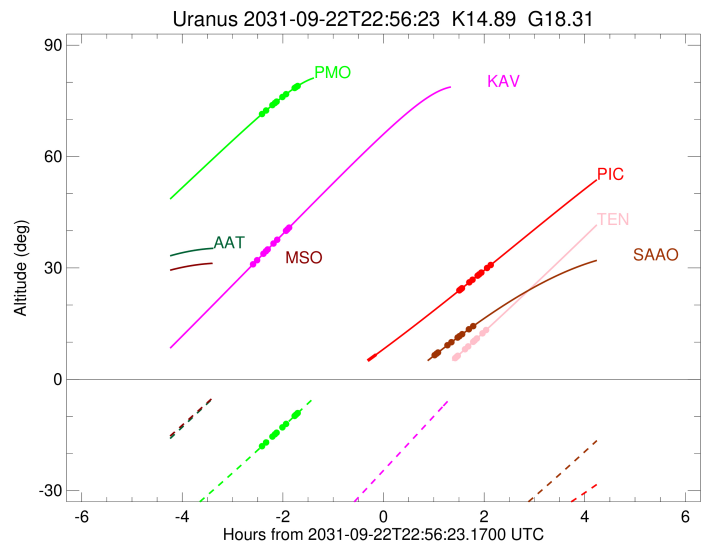
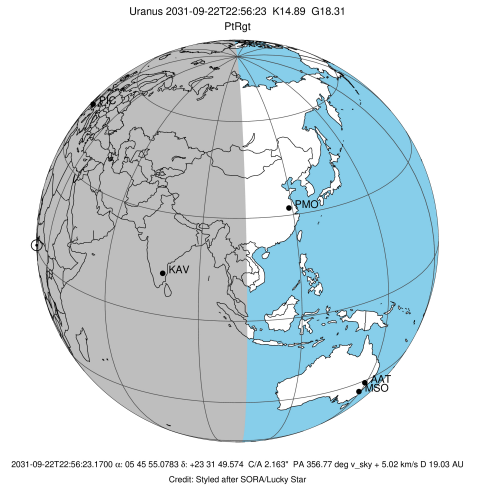


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-09-22T20:29:53.744		71.14	-18.36	51540.67	-3.90		
lambda	I	2031-09-22T20:36:24.782		72.42	-17.01	50026.71	-3.84		
delta	I	2031-09-22T20:43:58.924		73.87	-15.43	48300.35	-3.76		
gamma	I	2031-09-22T20:46:58.551		74.43	-14.80	47627.63	-3.73		
eta	I	2031-09-22T20:49:00.027		74.81	-14.38	47176.12	-3.71		
beta	I	2031-09-22T20:55:49.014		76.04	-12.95	45677.31	-3.62		
alpha	I	2031-09-22T21:00:15.950		76.82	-12.01	44717.29	-3.56		
4	I	2031-09-22T21:10:17.048		78.45	-9.90	42616.55	-3.42		
5	I	2031-09-22T21:11:59.710		78.71	-9.54	42264.75	-3.40		
6	I	2031-09-22T21:14:16.038		79.04	-9.06	41804.32	-3.36		

No planet occultations

6	E	2031-09-23T00:47:18.756		49.27	35.05x	41865.22	3.39		
5	E	2031-09-23T00:49:32.346		48.80	35.47x	42307.70	3.43		
4	E	2031-09-23T00:50:46.194		48.54	35.70x	42569.37	3.45		
alpha	E	2031-09-23T01:00:47.634		46.40	37.59x	44685.25	3.59		
beta	E	2031-09-23T01:05:13.255		45.46	38.41x	45646.31	3.65		
eta	E	2031-09-23T01:12:07.627		43.99	39.68x	47176.12	3.74		
gamma	E	2031-09-23T01:14:08.964		43.56	40.05x	47630.86	3.76		
delta	E	2031-09-23T01:17:06.243		42.94	40.58x	48300.35	3.79		
lambda	E	2031-09-23T01:24:36.546		41.34	41.91x	50026.71	3.87		
epsilon	E	2031-09-23T01:28:22.090		40.54	42.57x	50904.56	3.93		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T22:39:14.300
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499
 ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 167.36
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.861
 C/A sky separation (km) : 25681.3
 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

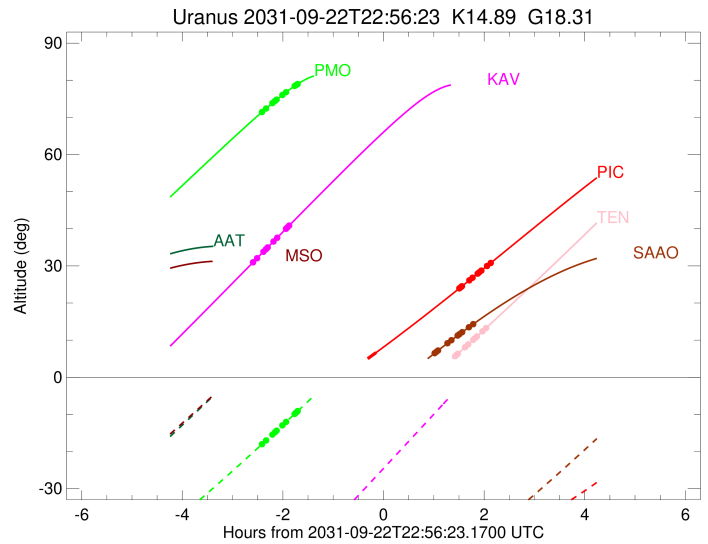
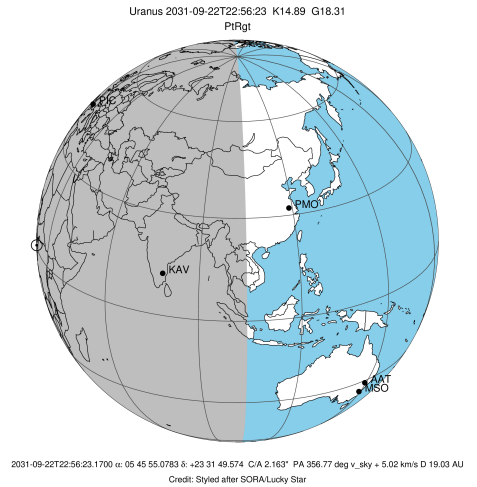


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-09-22T20:21:37.218	-33.60x	-18.13	51548.64	-4.80			
lambda	I	2031-09-22T20:26:55.860	-33.07x	-19.29	50026.71	-4.75			
delta	I	2031-09-22T20:33:02.077	-32.44x	-20.61	48300.35	-4.68			
gamma	I	2031-09-22T20:35:26.417	-32.18x	-21.13	47627.12	-4.65			
eta	I	2031-09-22T20:37:03.632	-32.00x	-21.48	47176.12	-4.63			
beta	I	2031-09-22T20:42:29.719	-31.40x	-22.65	45678.47	-4.56			
alpha	I	2031-09-22T20:46:00.885	-30.99x	-23.40	44720.96	-4.50			
4	I	2031-09-22T20:53:54.794	-30.05x	-25.09	42616.08	-4.38			
5	I	2031-09-22T20:55:16.537	-29.88x	-25.38	42255.71	-4.36			
6	I	2031-09-22T20:57:01.394	-29.66x	-25.75	41801.32	-4.33			

No planet occultations

6	E	2031-09-23T00:21:56.301	5.71	-60.46	41867.19	4.03			
5	E	2031-09-23T00:23:47.904	6.09	-60.59	42305.49	4.06			
4	E	2031-09-23T00:24:50.099	6.30	-60.66	42566.67	4.07			
alpha	E	2031-09-23T00:33:25.334	8.05	-61.16	44685.63	4.16			
beta	E	2031-09-23T00:37:15.195	8.83	-61.34	45645.68	4.20			
eta	E	2031-09-23T00:43:17.663	10.07	-61.56	47176.12	4.25			
gamma	E	2031-09-23T00:45:04.460	10.44	-61.61	47630.75	4.26			
delta	E	2031-09-23T00:47:41.131	10.98	-61.68	48300.35	4.28			
lambda	E	2031-09-23T00:54:21.960	12.36	-61.78	50026.71	4.33			
epsilon	E	2031-09-23T00:57:41.932	13.05	-61.80	50894.49	4.37			

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T22:45:14.760
 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 : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499
 ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 167.83
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.225
 C/A sky separation (km) : 30718.2
 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

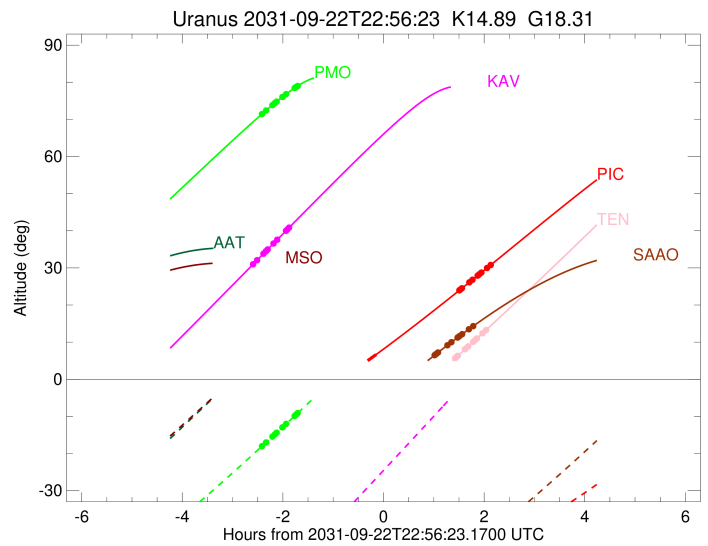
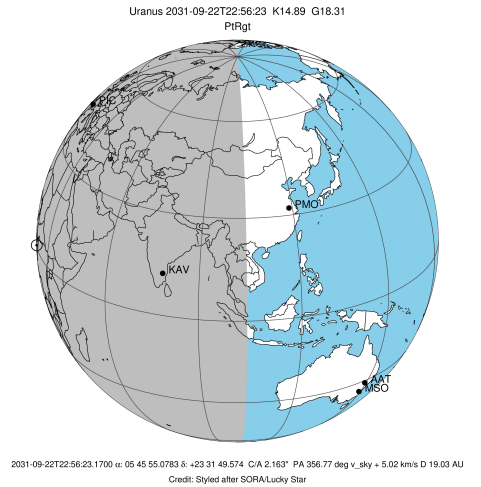


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-09-22T20:19:13.633		30.60	-61.75	51538.62	-3.93		
lambda	I	2031-09-22T20:25:41.817		32.09	-60.30	50026.71	-3.85		
delta	I	2031-09-22T20:33:15.636		33.83	-58.60	48300.35	-3.75		
gamma	I	2031-09-22T20:36:15.884		34.52	-57.91	47627.75	-3.71		
eta	I	2031-09-22T20:38:18.105		34.99	-57.45	47176.12	-3.68		
beta	I	2031-09-22T20:45:11.312		36.57	-55.87	45676.98	-3.57		
alpha	I	2031-09-22T20:49:42.727		37.61	-54.83	44716.31	-3.50		
4	I	2031-09-22T20:59:58.452		39.96	-52.44	42616.57	-3.32		
5	I	2031-09-22T21:01:43.861		40.37	-52.03	42267.33	-3.29		
6	I	2031-09-22T21:04:05.570		40.91	-51.48	41805.32	-3.24		

No planet occultations

6	E	2031-09-23T00:24:47.197		78.95	-3.03x	41862.27	3.06		
5	E	2031-09-23T00:27:16.655		78.95	-2.42x	42310.39	3.10		
4	E	2031-09-23T00:28:38.926		78.93	-2.09x	42573.29	3.13		
alpha	E	2031-09-23T00:39:38.521		78.48	0.59x	44684.83	3.28		
beta	E	2031-09-23T00:44:29.695		78.10	1.78x	45647.42	3.34		
eta	E	2031-09-23T00:52:01.539		77.32	3.62x	47176.12	3.43		
gamma	E	2031-09-23T00:54:13.762		77.05	4.15x	47631.05	3.45		
delta	E	2031-09-23T00:57:26.644		76.64	4.94x	48300.35	3.49		
lambda	E	2031-09-23T01:05:35.949		75.46	6.93x	50026.71	3.57		
epsilon	E	2031-09-23T01:09:47.061		74.79	7.95x	50927.56	3.63		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-22T22:34:34.190
 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 : 3427633353911711872
 2Mass ID (if available) : 05455507+2331499
 ICRS Star Coord at Epoch: 05h 45m 55.07827s +23:31:49.57406s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.894
 G magnitude : 18.315
 RP magnitude : 17.505
 BP magnitude : 19.007
 DUPflag : 0
 Distance (au) : 19.032
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 5.02
 Sun-Target sep (deg) : 92.53
 Sun-Moon sep (deg) : 167.11
 B (ring opening deg) : 77.98
 PA of pole (deg) : 47.61
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.381
 C/A sky separation (km) : 32863.0
 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_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	2031-09-22T20:26:33.292	-35.25x	-46.78	51531.71	-4.10			
lambda	I	2031-09-22T20:32:44.345	-33.95x	-47.75	50026.71	-4.01			
delta	I	2031-09-22T20:40:02.071	-32.42x	-48.84	48300.35	-3.88			
gamma	I	2031-09-22T20:42:56.545	-31.81x	-49.27	47628.06	-3.83			
eta	I	2031-09-22T20:44:55.243	-31.39x	-49.55	47176.12	-3.79			
beta	I	2031-09-22T20:51:38.237	-29.99x	-50.50	45676.14	-3.65			
alpha	I	2031-09-22T20:56:04.952	-29.07x	-51.10	44714.01	-3.56			
4	I	2031-09-22T21:06:14.628	-26.95x	-52.40	42616.42	-3.32			
5	I	2031-09-22T21:07:58.752	-26.59x	-52.61	42272.82	-3.28			
6	I	2031-09-22T21:10:22.195	-26.10x	-52.90	41807.60	-3.22			

No planet occultations

6	E	2031-09-22T23:57:21.084	6.49	-51.75	41858.82	2.99			
5	E	2031-09-22T23:59:55.133	6.94	-51.42	42312.67	3.05			
4	E	2031-09-23T00:01:19.779	7.19	-51.23	42577.53	3.08			
alpha	E	2031-09-23T00:12:22.954	9.12	-49.71	44684.62	3.27			
beta	E	2031-09-23T00:17:14.490	9.96	-49.01	45648.72	3.35			
eta	E	2031-09-23T00:24:43.567	11.23	-47.89	47176.12	3.45			
gamma	E	2031-09-23T00:26:54.741	11.60	-47.56	47631.22	3.48			
delta	E	2031-09-23T00:30:05.703	12.13	-47.06	48300.35	3.52			
lambda	E	2031-09-23T00:38:09.080	13.46	-45.78	50026.71	3.62			
epsilon	E	2031-09-23T00:42:23.695	14.15	-45.09	50953.39	3.68			