

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-29T17:39:23.210
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 144910689034698368
 2Mass ID (if available) : 04364126+2201520

ICRS Star Coord at Epoch: 04h 36m 41.26579s +22:01:51.89082s

RUWE (>1.4 is poor) : 1.10
 K magnitude : 10.981
 G magnitude : 13.751
 RP magnitude : 12.920
 BP magnitude : 14.483
 DUPflag : 0
 Distance (au) : 18.411
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.11
 Sun-Target sep (deg) : 152.61
 Sun-Moon sep (deg) : 4.11
 B (ring opening deg) : 79.68
 PA of pole (deg) : -49.74

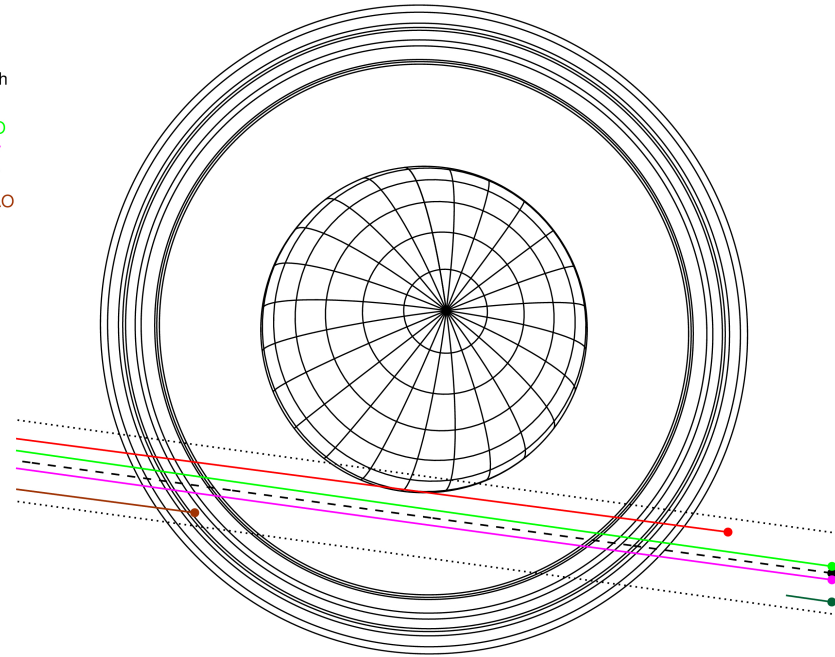
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2028-12-29T17:39:23.2100 α: 04 36 41.2658 δ: +22 01 51.891 C/A 2.172° PA 352.14 deg v_sky -20.11 km/s D 18.41 AU
 Credit: Styled after SORA/Lucky Star

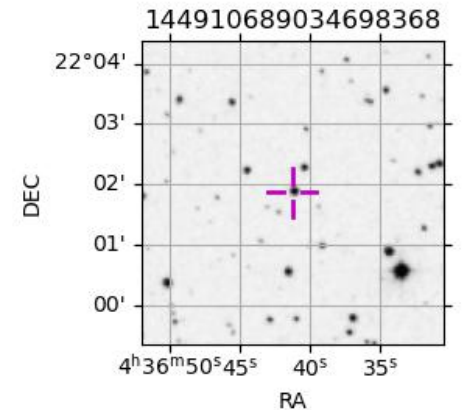
Uranus 2028-12-29T17:39:23 K10.98 G13.75 PRgt

Earth
 PIC
 PMO
 KAV
 AAT
 SAAO



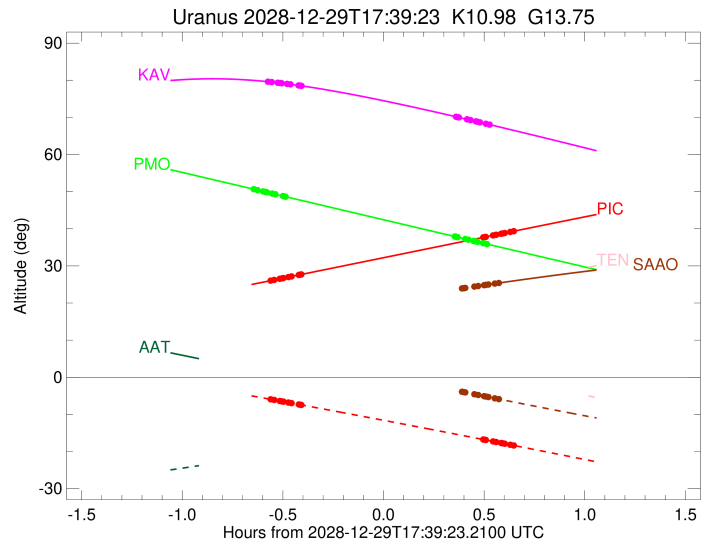
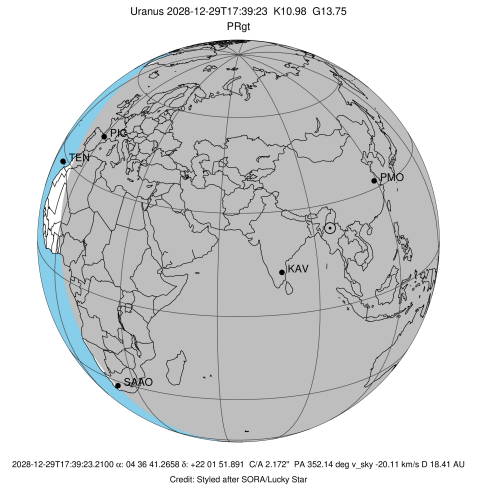
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 29 17:05 - DEC 29 18:18	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++		+++++	DEC 29 17:00 - DEC 29 18:10	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					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 29 17:04 - DEC 29 18:11	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 29 18:09 - DEC 29 18:14	PnnRne
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2028-12-29T17:42:22.350
Event type           : PRgt
: Uranus occs: not geocentric or topocentric
: 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       : 144910689034698368
2Mass ID (if available) : 04364126+2201520
ICRS Star Coord at Epoch: 04h 36m 41.26579s +22:01:51.89082s
RUWE (>1.4 is poor) : 1.10
K magnitude           : 10.981
G magnitude           : 13.751
RP magnitude          : 12.920
BP magnitude          : 14.483
DUPflag              : 0
Distance (au)         : 18.411
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -20.11
Sun-Target sep (deg) : 152.61
Sun-Moon sep (deg)   : 4.28
B (ring opening deg) : 79.68
PA of pole (deg)     : -49.74
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.892
C/A sky separation (km) : 25264.4
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_itrfr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```

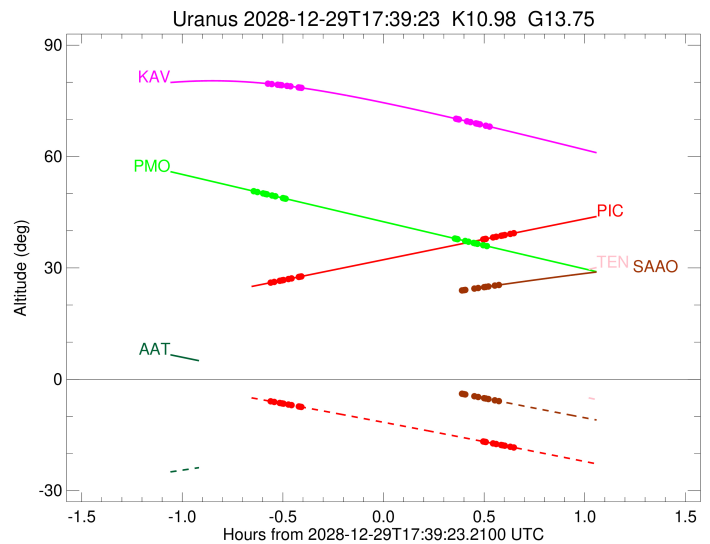
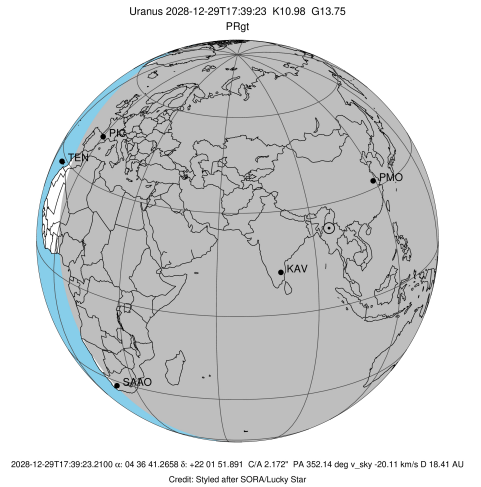


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-29T17:05:31.824		25.99	-5.90	51389.62	-17.72		
lambda	I	2028-12-29T17:06:49.350		26.23	-6.11	50026.71	-17.50		
delta	I	2028-12-29T17:08:28.626		26.53	-6.39	48300.35	-17.28		
gamma	I	2028-12-29T17:09:07.454		26.65	-6.49	47631.37	-17.18		
eta	I	2028-12-29T17:09:34.001		26.73	-6.57	47176.12	-17.11		
beta	I	2028-12-29T17:11:01.963		27.00	-6.81	45680.90	-16.88		
alpha	I	2028-12-29T17:12:00.836		27.18	-6.97	44691.87	-16.70		
4	I	2028-12-29T17:14:12.091		27.58	-7.34	42526.42	-16.29		
5	I	2028-12-29T17:14:34.911		27.65	-7.40	42154.90	-16.20		
6	I	2028-12-29T17:14:57.205		27.71	-7.46	41796.03	-16.12		

No planet occultations

6	E	2028-12-29T18:09:06.790		37.67	-16.76	41837.84	16.17		
5	E	2028-12-29T18:09:33.131		37.76	-16.84	42260.04	16.25		
4	E	2028-12-29T18:09:53.415		37.82	-16.90	42590.30	16.34		
alpha	E	2028-12-29T18:12:01.024		38.21	-17.27	44708.20	16.76		
beta	E	2028-12-29T18:12:57.331		38.38	-17.44	45657.03	16.94		
eta	E	2028-12-29T18:14:26.416		38.65	-17.70	47176.12	17.18		
gamma	E	2028-12-29T18:14:52.363		38.73	-17.78	47622.75	17.25		
delta	E	2028-12-29T18:15:31.542		38.85	-17.89	48300.35	17.34		
lambda	E	2028-12-29T18:17:10.421		39.15	-18.19	50026.71	17.57		
epsilon	E	2028-12-29T18:18:22.799		39.38	-18.40	51304.06	17.80		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-29T17:35:46.780
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : 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 : 144910689034698368
 2Mass ID (if available) : 04364126+2201520
 ICRS Star Coord at Epoch: 04h 36m 41.26579s +22:01:51.89082s
 RUWE (>1.4 is poor) : 1.10
 K magnitude : 10.981
 G magnitude : 13.751
 RP magnitude : 12.920
 BP magnitude : 14.483
 DUPflag : 0
 Distance (au) : 18.411
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.11
 Sun-Target sep (deg) : 152.61
 Sun-Moon sep (deg) : 3.52
 B (ring opening deg) : 79.68
 PA of pole (deg) : -49.74
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.082
 C/A sky separation (km) : 27794.1
 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



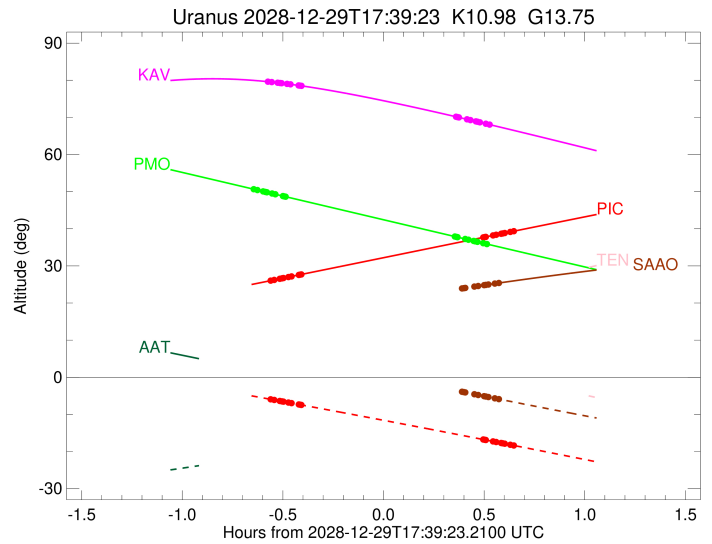
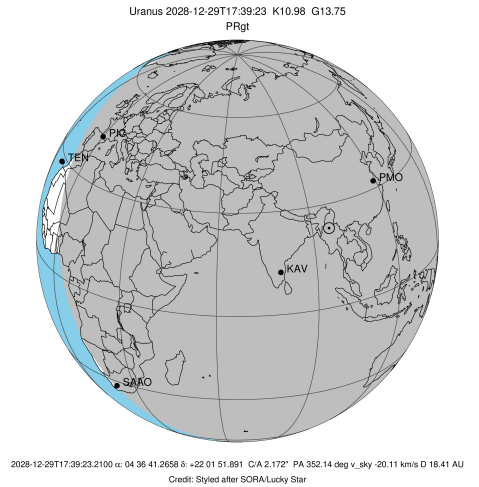
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-29T17:00:27.381		50.72	-75.32	51411.47	-17.29		
lambda	I	2028-12-29T17:01:48.256		50.43	-75.08	50026.71	-17.02		
delta	I	2028-12-29T17:03:30.558		50.07	-74.77	48300.35	-16.73		
gamma	I	2028-12-29T17:04:10.702		49.92	-74.65	47631.24	-16.61		
eta	I	2028-12-29T17:04:38.180		49.83	-74.57	47176.12	-16.52		
beta	I	2028-12-29T17:06:09.509		49.50	-74.29	45681.13	-16.21		
alpha	I	2028-12-29T17:07:11.031		49.29	-74.10	44690.25	-15.99		
4	I	2028-12-29T17:09:28.636		48.80	-73.68	42527.17	-15.44		
5	I	2028-12-29T17:09:52.792		48.71	-73.60	42155.52	-15.33		
6	I	2028-12-29T17:10:16.378		48.63	-73.53	41795.26	-15.22		

No planet occultations

6	E	2028-12-29T18:00:38.058		37.92	-63.46	41834.91	15.17		
5	E	2028-12-29T18:01:05.895		37.82	-63.36	42254.83	15.27		
4	E	2028-12-29T18:01:27.654		37.74	-63.29	42587.52	15.38		
alpha	E	2028-12-29T18:03:42.587		37.26	-62.82	44706.26	15.92		
beta	E	2028-12-29T18:04:41.962		37.05	-62.61	45658.18	16.15		
eta	E	2028-12-29T18:06:15.148		36.72	-62.29	47176.12	16.45		
gamma	E	2028-12-29T18:06:42.247		36.63	-62.20	47622.97	16.53		
delta	E	2028-12-29T18:07:23.074		36.48	-62.05	48300.35	16.65		
lambda	E	2028-12-29T18:09:05.857		36.12	-61.70	50026.71	16.94		
epsilon	E	2028-12-29T18:10:21.888		35.85	-61.43	51321.66	17.21		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-29T17:38:21.770
 Event type : PRgt
 : Uranus occs: not geocentric or topocentric
 : 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 : 144910689034698368
 2Mass ID (if available) : 04364126+2201520
 ICRS Star Coord at Epoch: 04h 36m 41.26579s +22:01:51.89082s
 RUWE (>1.4 is poor) : 1.10
 K magnitude : 10.981
 G magnitude : 13.751
 RP magnitude : 12.920
 BP magnitude : 14.483
 DUPflag : 0
 Distance (au) : 18.411
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -20.11
 Sun-Target sep (deg) : 152.61
 Sun-Moon sep (deg) : 4.15
 B (ring opening deg) : 79.68
 PA of pole (deg) : -49.74
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 2.265
 C/A sky separation (km) : 30249.8
 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_itrf93_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

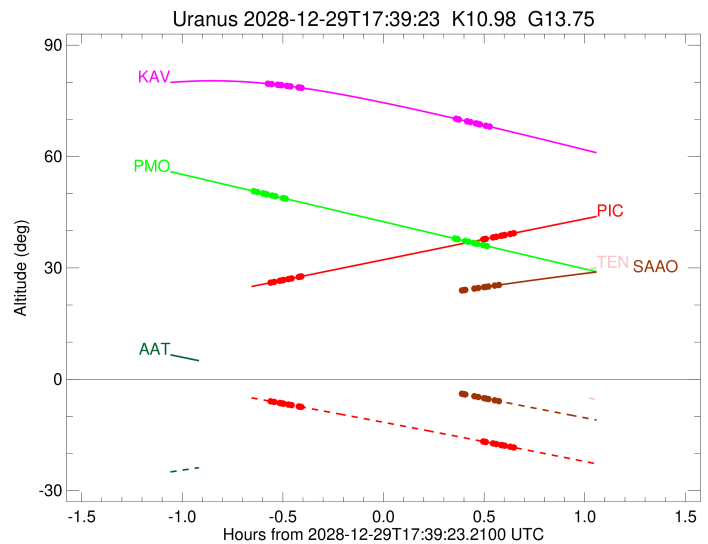
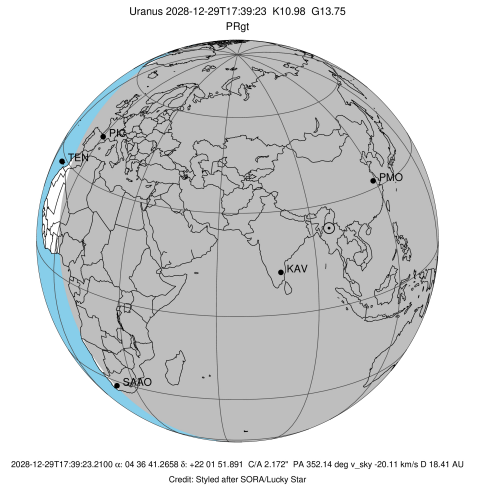
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-29T17:04:39.665		79.65	-63.46	51427.65	-16.73		
lambda	I	2028-12-29T17:06:04.396		79.52	-63.76	50026.71	-16.40		
delta	I	2028-12-29T17:07:50.792		79.34	-64.15	48300.35	-16.04		
gamma	I	2028-12-29T17:08:32.704		79.27	-64.30	47631.12	-15.89		
eta	I	2028-12-29T17:09:01.434		79.22	-64.40	47176.12	-15.78		
beta	I	2028-12-29T17:10:37.297		79.04	-64.74	45681.22	-15.40		
alpha	I	2028-12-29T17:11:42.319		78.91	-64.98	44689.04	-15.11		
4	I	2028-12-29T17:14:08.599		78.61	-65.50	42528.09	-14.41		
5	I	2028-12-29T17:14:34.551		78.55	-65.59	42156.56	-14.28		
6	I	2028-12-29T17:14:59.937		78.49	-65.68	41794.88	-14.14		

No planet occultations

6	E	2028-12-29T18:00:58.965		70.19	-74.72	41831.18	14.12		
5	E	2028-12-29T18:01:28.512		70.08	-74.80	42248.02	14.26		
4	E	2028-12-29T18:01:52.061		70.00	-74.87	42583.86	14.40		
alpha	E	2028-12-29T18:04:15.316		69.50	-75.26	44703.82	15.09		
beta	E	2028-12-29T18:05:18.076		69.28	-75.43	45659.70	15.38		
eta	E	2028-12-29T18:06:55.520		68.93	-75.69	47176.12	15.76		
gamma	E	2028-12-29T18:07:23.798		68.83	-75.77	47623.27	15.87		
delta	E	2028-12-29T18:08:06.267		68.68	-75.88	48300.35	16.02		
lambda	E	2028-12-29T18:09:52.830		68.30	-76.15	50026.71	16.38		
epsilon	E	2028-12-29T18:11:12.711		68.02	-76.35	51344.71	16.71		

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2028-12-29T17:42:48.380
Event type           : PRgt
: Uranus occs: not geocentric or topocentric
: 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       : 144910689034698368
2Mass ID (if available) : 04364126+2201520
ICRS Star Coord at Epoch: 04h 36m 41.26579s +22:01:51.89082s
RUWE (>1.4 is poor) : 1.10
K magnitude           : 10.981
G magnitude           : 13.751
RP magnitude          : 12.920
BP magnitude          : 14.483
DUPflag              : 0
Distance (au)        : 18.411
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -20.11
Sun-Target sep (deg) : 152.61
Sun-Moon sep (deg)   : 5.02
B (ring opening deg) : 79.68
PA of pole (deg)     : -49.74
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.481
C/A sky separation (km) : 33122.1
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	2028-12-29T17:10:35.335		16.09	5.92x	51446.73	-15.64		
lambda	I	2028-12-29T17:12:07.499		16.34	5.63x	50026.71	-15.24		
delta	I	2028-12-29T17:14:02.454		16.65	5.26x	48300.35	-14.79		
gamma	I	2028-12-29T17:14:48.018		16.77	5.11x	47630.94	-14.59		
eta	I	2028-12-29T17:15:19.330		16.86	5.01x	47176.12	-14.46		
beta	I	2028-12-29T17:17:04.497		17.14	4.67x	45681.21	-13.96		
alpha	I	2028-12-29T17:18:16.596		17.33	4.44x	44687.68	-13.59		
4	I	2028-12-29T17:21:00.728		17.76	3.92x	42529.65	-12.68		
5	I	2028-12-29T17:21:30.357		17.84	3.82x	42158.62	-12.49		
6	I	2028-12-29T17:21:59.512		17.92	3.73x	41794.76	-12.30		

No planet occultations

6	E	2028-12-29T18:02:45.497		23.92	-3.89x	41826.44	12.33		
5	E	2028-12-29T18:03:18.756		24.00	-4.00x	42239.13	12.52		
4	E	2028-12-29T18:03:45.902		24.06	-4.08x	42579.03	12.70		
alpha	E	2028-12-29T18:06:26.381		24.42	-4.56x	44700.88	13.63		
beta	E	2028-12-29T18:07:35.962		24.58	-4.77x	45661.60	14.00		
eta	E	2028-12-29T18:09:22.298		24.81	-5.09	47176.12	14.50		
gamma	E	2028-12-29T18:09:53.025		24.88	-5.19	47623.67	14.63		
delta	E	2028-12-29T18:10:38.956		24.98	-5.32	48300.35	14.83		
lambda	E	2028-12-29T18:12:33.565		25.23	-5.67	50026.71	15.29		
epsilon	E	2028-12-29T18:14:00.641		25.42	-5.93	51371.88	15.69		