

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-10-24T10:11:50.590
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3418380280664291712
 2Mass ID (if available) : 05063965+2253420

ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s

RUWE (>1.4 is poor) : 1.13
 K magnitude : 11.227
 G magnitude : 12.920
 RP magnitude : 12.345
 BP magnitude : 13.322
 DUPflag : 0
 Distance (au) : 18.539
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -14.03
 Sun-Target sep (deg) : 133.14
 Sun-Moon sep (deg) : 24.99
 B (ring opening deg) : 82.26
 PA of pole (deg) : -4.63

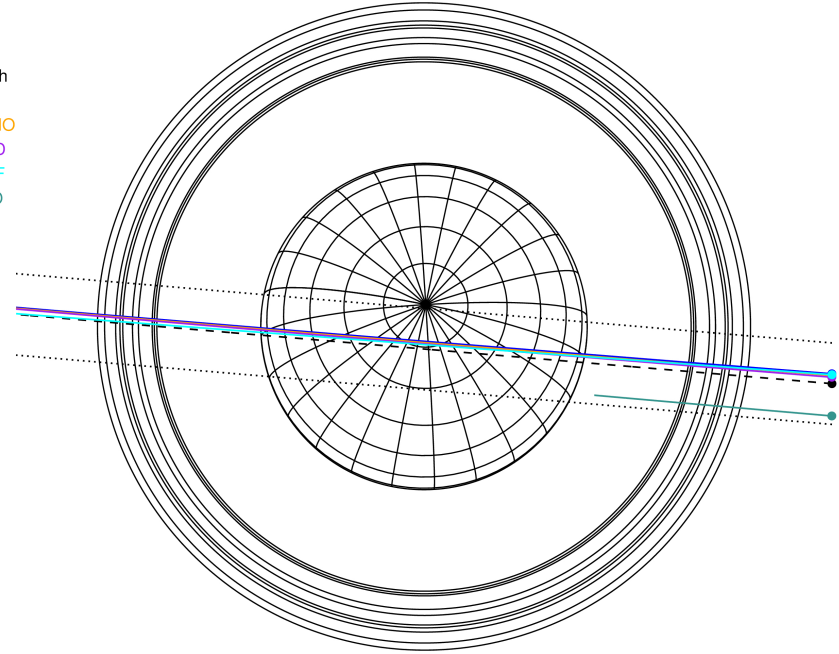
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2029-10-24T10:11:50.5900 ex: 05 06 39.6507 ex: +22 53 42.060 C/A 0.255" PA 355.15 deg v_sky -14.03 km/s D 18.54 AU
 Credit: Styled after SORA/Lucky Star

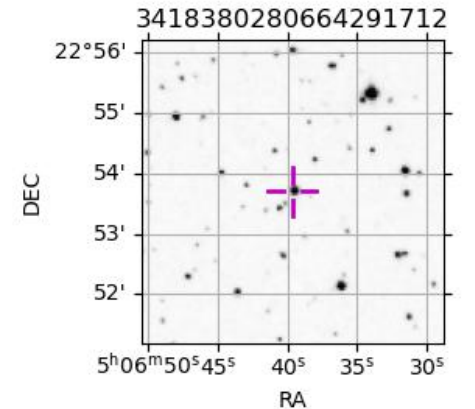
Uranus 2029-10-24T10:11:50 K11.23 G12.92 PgtRgt

Earth
 PAL
 KPNO
 MCD
 IRTF
 ESO

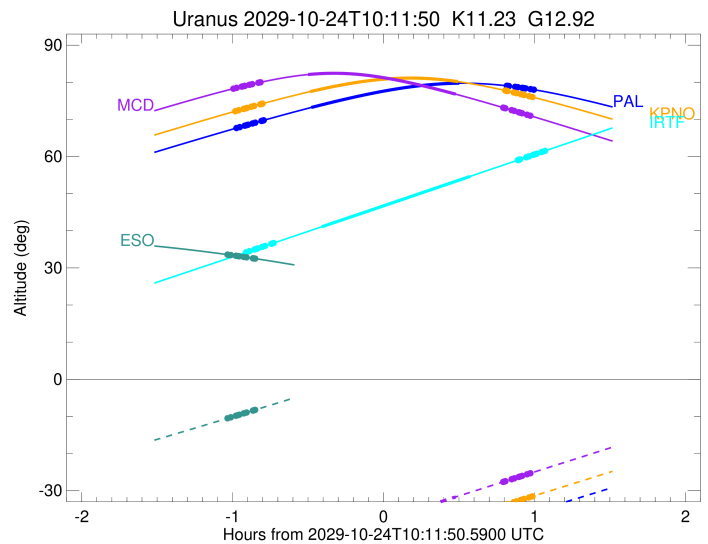
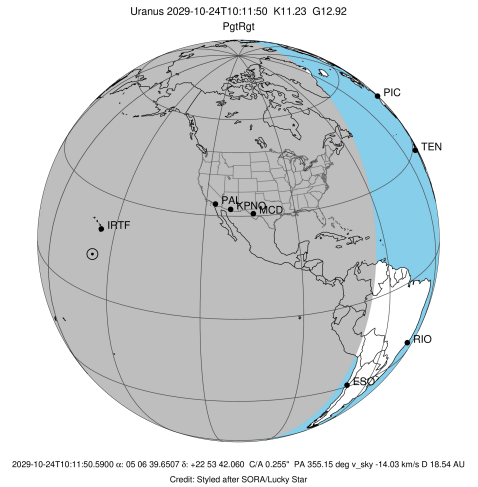


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	+++++	+ +	+++++	OCT 24 09:13 - OCT 24 11:11	PieRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	OCT 24 09:12 - OCT 24 11:10	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	OCT 24 09:11 - OCT 24 11:09	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	OCT 24 09:16 - OCT 24 11:15	PieRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European Southern Obs	-29.3	289.3	+++++			OCT 24 09:09 - OCT 24 09:20	PnnRin
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



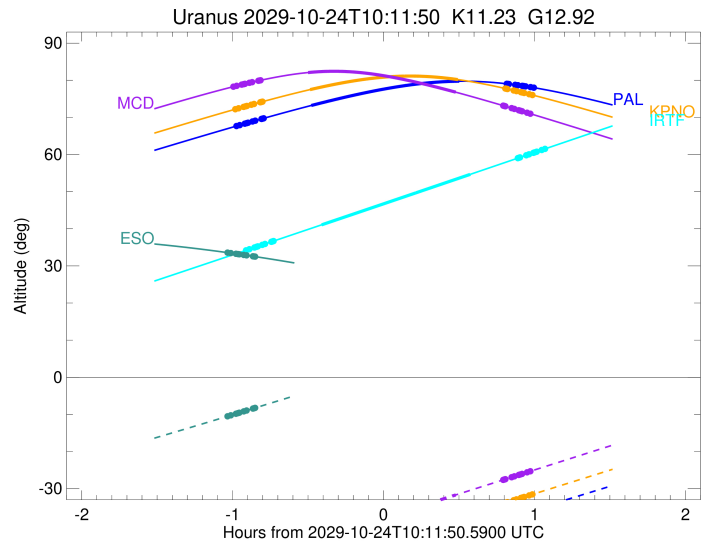
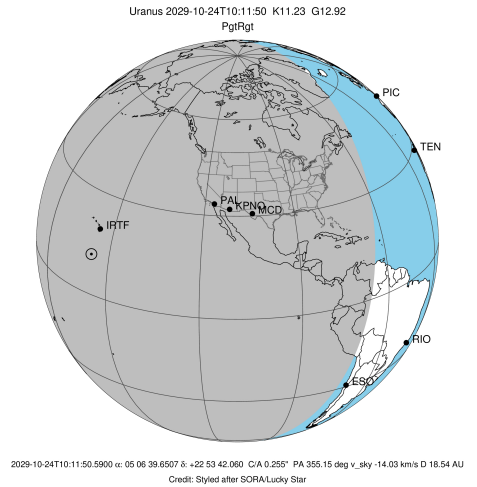
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-10-24T10:12:34.300
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 3418380280664291712
 2Mass ID (if available) : 05063965+2253420
 ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s
 RUWE (>1.4 is poor) : 1.13
 K magnitude : 11.227
 G magnitude : 12.920
 RP magnitude : 12.345
 BP magnitude : 13.322
 DUPflag : 0
 Distance (au) : 18.539
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -14.03
 Sun-Target sep (deg) : 133.14
 Sun-Moon sep (deg) : 25.27
 B (ring opening deg) : 82.26
 PA of pole (deg) : -4.63
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.172
 C/A sky separation (km) : 2306.7
 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	2029-10-24T09:13:01.377		67.60	-58.54	51487.56	-14.35		
lambda	I	2029-10-24T09:14:43.196		67.93	-58.26	50026.71	-14.35		
delta	I	2029-10-24T09:16:43.516		68.32	-57.92	48300.35	-14.35		
gamma	I	2029-10-24T09:17:30.815		68.47	-57.78	47621.69	-14.35		
eta	I	2029-10-24T09:18:01.868		68.57	-57.69	47176.12	-14.35		
beta	I	2029-10-24T09:19:48.722		68.92	-57.39	45642.95	-14.35		
alpha	I	2029-10-24T09:20:51.415		69.12	-57.21	44743.46	-14.35		
4	I	2029-10-24T09:23:25.527		69.61	-56.76	42532.26	-14.35		
5	I	2029-10-24T09:23:50.091		69.68	-56.69	42179.57	-14.35		
6	I	2029-10-24T09:24:15.613		69.76	-56.61	41813.70	-14.35		
Uranus	I	2029-10-24T09:43:07.152		73.21	-53.21	25554.19		-0.69	-0.73
Uranus	E	2029-10-24T10:41:59.499		79.75	-41.71	25554.26		-0.69	-0.72
6	E	2029-10-24T11:00:52.080		79.05	-37.87	41864.35	14.40		
5	E	2029-10-24T11:01:22.041		79.01	-37.76	42296.13	14.40		
4	E	2029-10-24T11:01:44.021		78.98	-37.69	42612.41	14.40		
alpha	E	2029-10-24T11:04:08.365		78.78	-37.19	44691.42	14.40		
beta	E	2029-10-24T11:05:16.995		78.67	-36.96	45680.08	14.41		
eta	E	2029-10-24T11:07:00.841		78.51	-36.60	47176.12	14.41		
gamma	E	2029-10-24T11:07:32.386		78.45	-36.49	47630.58	14.41		
delta	E	2029-10-24T11:08:18.872		78.37	-36.33	48300.35	14.41		
lambda	E	2029-10-24T11:10:18.683		78.16	-35.92	50026.71	14.41		
epsilon	E	2029-10-24T11:11:14.394		78.05	-35.73	50829.53	14.41		

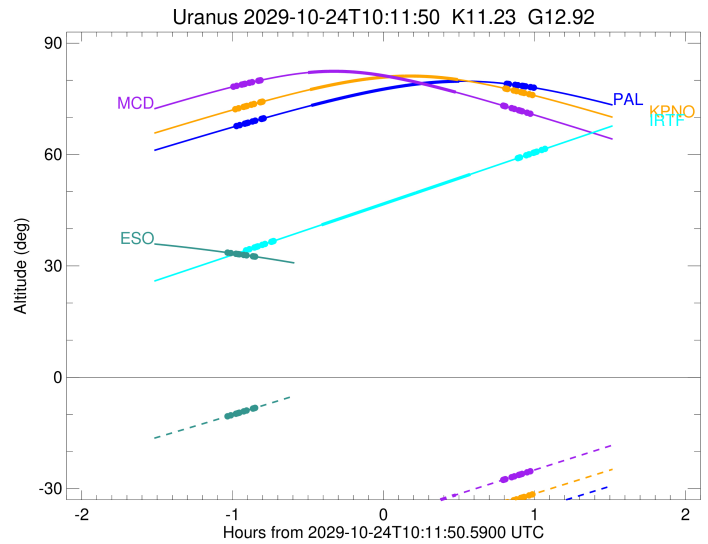
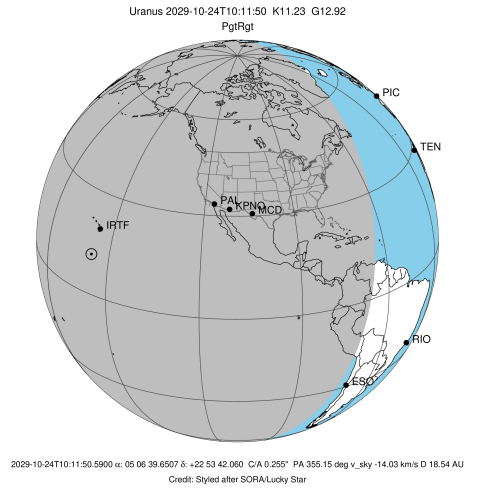
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-10-24T10:12:01.880
Event type          : PgtRgt
: Uranus occs: geocentric, topocentric
: 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      : 3418380280664291712
2Mass ID (if available) : 05063965+2253420
ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s
RUWE (>1.4 is poor) : 1.13
K magnitude         : 11.227
G magnitude         : 12.920
RP magnitude        : 12.345
BP magnitude        : 13.322
DUPflag            : 0
Distance (au)       : 18.539
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -14.03
Sun-Target sep (deg) : 133.14
Sun-Moon sep (deg)  : 25.34
B (ring opening deg) : 82.26
PA of pole (deg)    : -4.63
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.187
C/A sky separation (km) : 2513.6
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.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	2029-10-24T09:12:33.117		72.13	-55.62	51488.66	-14.37		
lambda	I	2029-10-24T09:14:14.902		72.46	-55.31	50026.71	-14.36		
delta	I	2029-10-24T09:16:15.096		72.84	-54.93	48300.35	-14.36		
gamma	I	2029-10-24T09:17:02.348		72.99	-54.78	47621.67	-14.36		
eta	I	2029-10-24T09:17:33.369		73.09	-54.68	47176.12	-14.36		
beta	I	2029-10-24T09:19:20.114		73.42	-54.35	45642.99	-14.36		
alpha	I	2029-10-24T09:20:22.759		73.62	-54.15	44743.33	-14.36		
4	I	2029-10-24T09:22:56.710		74.10	-53.66	42532.39	-14.36		
5	I	2029-10-24T09:23:21.237		74.17	-53.58	42179.90	-14.36		
6	I	2029-10-24T09:23:46.747		74.25	-53.50	41813.90	-14.36		
Uranus	I	2029-10-24T09:42:37.656		77.49	-49.82	25553.18		-0.76	-0.80
Uranus	E	2029-10-24T10:41:24.715		80.19	-37.79	25553.46		-0.74	-0.78
6	E	2029-10-24T11:00:17.559		77.78	-33.82	41864.48	14.40		
5	E	2029-10-24T11:00:47.526		77.70	-33.72	42296.34	14.40		
4	E	2029-10-24T11:01:09.501		77.65	-33.64	42612.48	14.40		
alpha	E	2029-10-24T11:03:33.849		77.27	-33.13	44691.34	14.40		
beta	E	2029-10-24T11:04:42.493		77.09	-32.89	45680.10	14.40		
eta	E	2029-10-24T11:06:26.348		76.80	-32.52	47176.12	14.41		
gamma	E	2029-10-24T11:06:57.895		76.72	-32.41	47630.57	14.41		
delta	E	2029-10-24T11:07:44.387		76.59	-32.25	48300.35	14.41		
lambda	E	2029-10-24T11:09:44.212		76.25	-31.83	50026.71	14.41		
epsilon	E	2029-10-24T11:10:39.985		76.09	-31.63	50830.33	14.41		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-10-24T10:11:12.960
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : 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 : 3418380280664291712
 2Mass ID (if available) : 05063965+2253420
 ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s
 RUWE (>1.4 is poor) : 1.13
 K magnitude : 11.227
 G magnitude : 12.920
 RP magnitude : 12.345
 BP magnitude : 13.322
 DUPflag : 0
 Distance (au) : 18.539
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -14.03
 Sun-Target sep (deg) : 133.14
 Sun-Moon sep (deg) : 25.43
 B (ring opening deg) : 82.26
 PA of pole (deg) : -4.63
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.201
 C/A sky separation (km) : 2706.9
 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_itrff93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

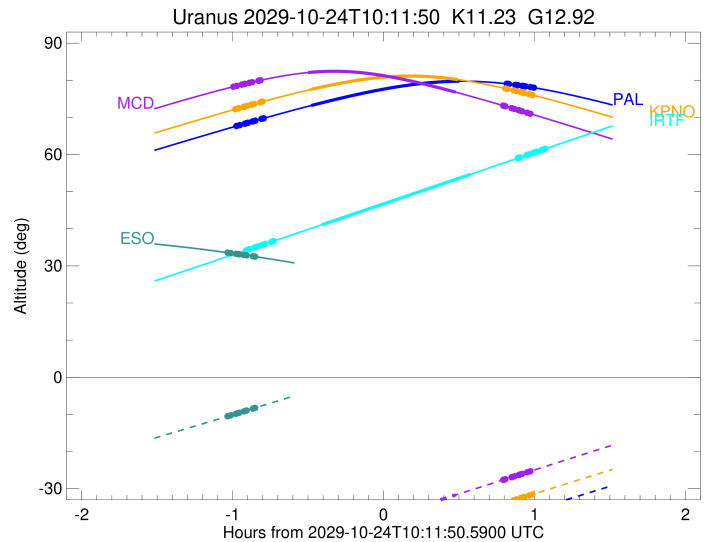
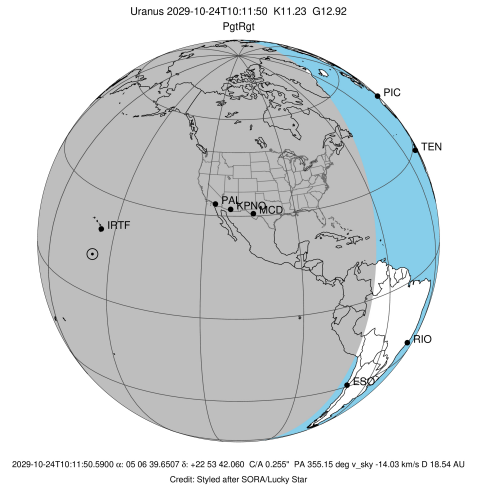


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-10-24T09:11:47.835		78.22	-50.37	51489.79	-14.38		
lambda	I	2029-10-24T09:13:29.590		78.50	-50.02	50026.71	-14.38		
delta	I	2029-10-24T09:15:29.660		78.84	-49.61	48300.35	-14.38		
gamma	I	2029-10-24T09:16:16.865		78.97	-49.45	47621.66	-14.38		
eta	I	2029-10-24T09:16:47.854		79.05	-49.35	47176.12	-14.38		
beta	I	2029-10-24T09:18:34.493		79.33	-48.99	45643.04	-14.38		
alpha	I	2029-10-24T09:19:37.093		79.50	-48.77	44743.20	-14.38		
4	I	2029-10-24T09:22:10.889		79.88	-48.25	42532.53	-14.37		
5	I	2029-10-24T09:22:35.379		79.94	-48.16	42180.25	-14.37		
6	I	2029-10-24T09:23:00.879		80.01	-48.07	41814.11	-14.37		
Uranus	I	2029-10-24T09:41:51.284		82.09	-44.17	25552.09		-0.83	-0.87
Uranus	E	2029-10-24T10:40:34.072		76.80	-31.70	25552.73		-0.79	-0.83
6	E	2029-10-24T10:59:27.737		73.17	-27.64	41864.59	14.39		
5	E	2029-10-24T10:59:57.725		73.07	-27.53	42296.51	14.39		
4	E	2029-10-24T11:00:19.708		72.99	-27.45	42612.54	14.39		
alpha	E	2029-10-24T11:02:44.142		72.51	-26.93	44691.28	14.39		
beta	E	2029-10-24T11:03:52.837		72.28	-26.69	45680.12	14.39		
eta	E	2029-10-24T11:05:36.760		71.93	-26.31	47176.12	14.40		
gamma	E	2029-10-24T11:06:08.328		71.82	-26.20	47630.56	14.40		
delta	E	2029-10-24T11:06:54.852		71.67	-26.03	48300.35	14.40		
lambda	E	2029-10-24T11:08:54.760		71.26	-25.60	50026.71	14.40		
epsilon	E	2029-10-24T11:09:50.615		71.07	-25.40	50830.94	14.40		

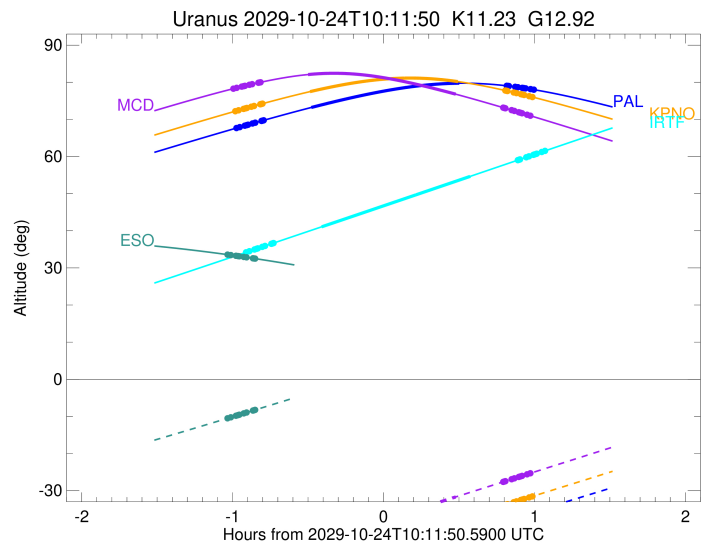
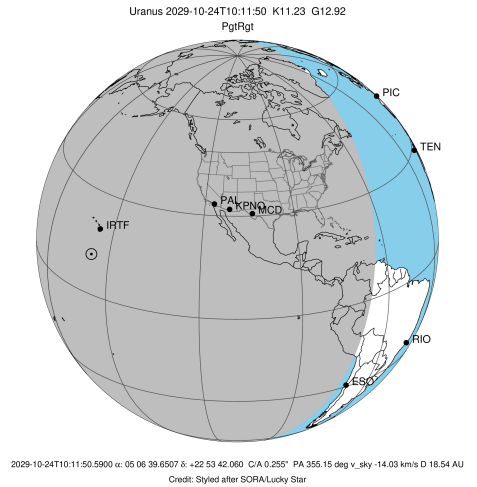
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-10-24T10:16:49.750
Event type          : PgtRgt
: Uranus occs: geocentric, topocentric
: 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      : 3418380280664291712
2Mass ID (if available) : 05063965+2253420
ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s
RUWE (>1.4 is poor) : 1.13
K magnitude          : 11.227
G magnitude          : 12.920
RP magnitude         : 12.345
BP magnitude         : 13.322
DUPflag             : 0
Distance (au)       : 18.539
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -14.03
Sun-Target sep (deg) : 133.14
Sun-Moon sep (deg)  : 24.71
B (ring opening deg) : 82.26
PA of pole (deg)    : -4.63
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.211
C/A sky separation (km) : 2833.3
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.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	2029-10-24T09:16:49.651		34.11	-75.83	51488.52	-14.20		
lambda	I	2029-10-24T09:18:32.638		34.50	-76.18	50026.71	-14.19		
delta	I	2029-10-24T09:20:34.247		34.96	-76.58	48300.35	-14.20		
gamma	I	2029-10-24T09:21:22.051		35.14	-76.73	47621.67	-14.20		
eta	I	2029-10-24T09:21:53.433		35.26	-76.83	47176.12	-14.20		
beta	I	2029-10-24T09:23:41.411		35.67	-77.18	45643.00	-14.20		
alpha	I	2029-10-24T09:24:44.774		35.92	-77.38	44743.32	-14.20		
4	I	2029-10-24T09:27:20.470		36.51	-77.87	42532.41	-14.20		
5	I	2029-10-24T09:27:45.270		36.60	-77.94	42179.94	-14.20		
6	I	2029-10-24T09:28:11.068		36.70	-78.02	41813.93	-14.20		
Uranus	I	2029-10-24T09:47:14.144		41.06	-81.00	25552.54		-0.80	-0.84
Uranus	E	2029-10-24T10:46:19.207		54.66	-77.59	25550.90		-0.90	-0.94
6	E	2029-10-24T11:05:16.518		59.04	-73.79	41864.98	14.36		
5	E	2029-10-24T11:05:46.574		59.15	-73.68	42297.13	14.36		
4	E	2029-10-24T11:06:08.576		59.24	-73.61	42612.77	14.36		
alpha	E	2029-10-24T11:08:33.226		59.79	-73.09	44691.04	14.37		
beta	E	2029-10-24T11:09:42.047		60.06	-72.85	45680.20	14.37		
eta	E	2029-10-24T11:11:26.107		60.46	-72.48	47176.12	14.38		
gamma	E	2029-10-24T11:11:57.711		60.58	-72.36	47630.52	14.38		
delta	E	2029-10-24T11:12:44.293		60.76	-72.20	48300.35	14.38		
lambda	E	2029-10-24T11:14:44.321		61.22	-71.76	50026.71	14.39		
epsilon	E	2029-10-24T11:15:40.430		61.44	-71.56	50833.90	14.39		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-10-24T10:08:20.050
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : 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 : 3418380280664291712
 2Mass ID (if available) : 05063965+2253420
 ICRS Star Coord at Epoch: 05h 06m 39.65071s +22:53:42.05967s
 RUWE (>1.4 is poor) : 1.13
 K magnitude : 11.227
 G magnitude : 12.920
 RP magnitude : 12.345
 BP magnitude : 13.322
 DUPflag : 0
 Distance (au) : 18.539
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -14.03
 Sun-Target sep (deg) : 133.14
 Sun-Moon sep (deg) : 25.63
 B (ring opening deg) : 82.26
 PA of pole (deg) : -4.63
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.621
 C/A sky separation (km) : 8355.5
 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	2029-10-24T09:09:25.816		33.61	-10.60	51513.54	-14.20		
lambda	I	2029-10-24T09:11:10.641		33.45	-10.24	50026.71	-14.18		
delta	I	2029-10-24T09:13:12.478		33.26	-9.82	48300.35	-14.16		
gamma	I	2029-10-24T09:14:00.436		33.18	-9.66	47621.36	-14.15		
eta	I	2029-10-24T09:14:31.897		33.13	-9.55	47176.12	-14.15		
beta	I	2029-10-24T09:16:20.221		32.95	-9.18	45644.35	-14.13		
alpha	I	2029-10-24T09:17:24.262		32.85	-8.96	44739.85	-14.12		
4	I	2029-10-24T09:20:00.477		32.58	-8.42	42536.24	-14.09		
5	I	2029-10-24T09:20:25.064		32.54	-8.33	42189.13	-14.09		
6	I	2029-10-24T09:20:51.369		32.50	-8.24	41819.47	-14.08		
Uranus	I	2029-10-24T09:40:23.401		30.34	-4.17x	25492.29		-2.59	-2.71
Uranus	E	2029-10-24T10:36:19.650		22.70	7.75x	25498.71		-2.46	-2.58
6	E	2029-10-24T10:56:00.481		19.60	12.01x	41868.62	14.01		
5	E	2029-10-24T10:56:31.345		19.51	12.12x	42302.69	14.02		
4	E	2029-10-24T10:56:53.672		19.45	12.20x	42614.60	14.02		
alpha	E	2029-10-24T10:59:21.459		19.05	12.74x	44689.02	14.05		
beta	E	2029-10-24T11:00:32.024		18.86	12.99x	45680.77	14.06		
eta	E	2029-10-24T11:02:18.350		18.56	13.38x	47176.12	14.07		
gamma	E	2029-10-24T11:02:50.617		18.48	13.50x	47630.18	14.07		
delta	E	2029-10-24T11:03:38.225		18.34	13.67x	48300.35	14.08		
lambda	E	2029-10-24T11:05:40.781		18.01	14.11x	50026.71	14.09		
epsilon	E	2029-10-24T11:06:39.855		17.84	14.33x	50859.40	14.11		