

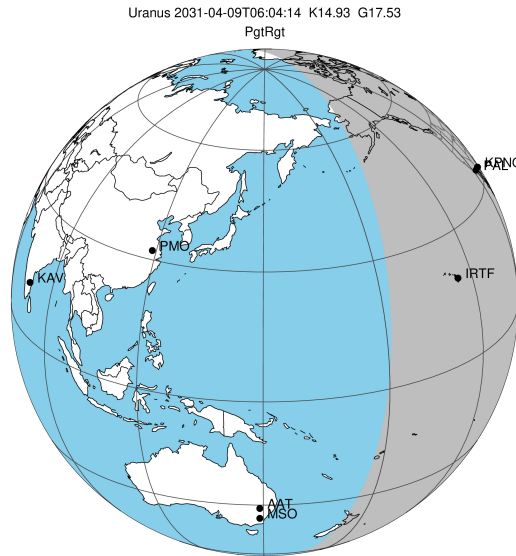
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-04-09T06:04:14.190
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3415715919175995008
 2Mass ID (if available) : 05125622+2306035

Uranus 2031-04-09T06:04:14 K14.93 G17.53 PgtRgt

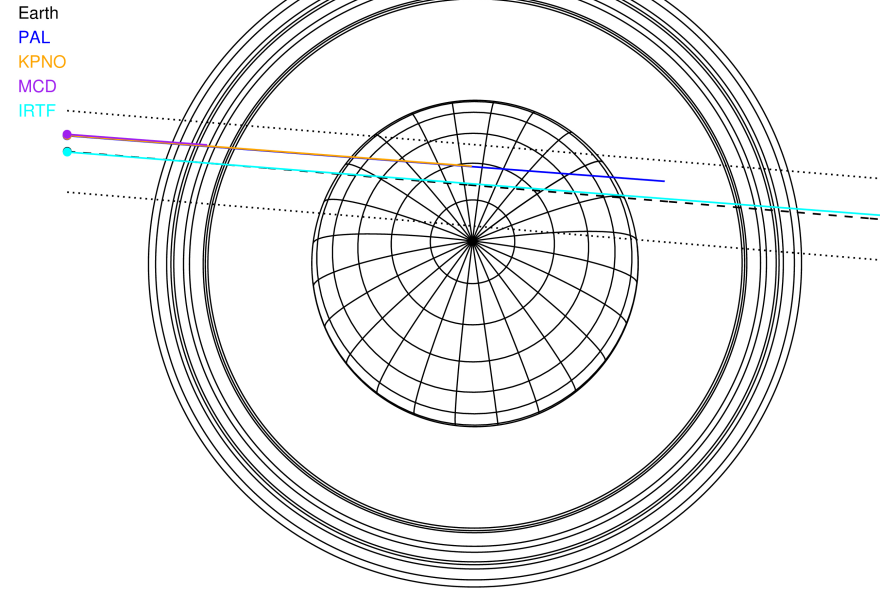
ICRS Star Coord at Epoch: 05h 12m 56.23116s +23:06:03.56367s

RUWE (>1.4 is poor) : 0.98
 K magnitude : 14.933
 G magnitude : 17.531
 RP magnitude : 16.728
 BP magnitude : 18.208
 DUPflag : 0
 Distance (au) : 19.608
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 21.02
 Sun-Target sep (deg) : 60.42
 Sun-Moon sep (deg) : 139.43
 B (ring opening deg) : 82.03
 PA of pole (deg) : 6.44

#	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

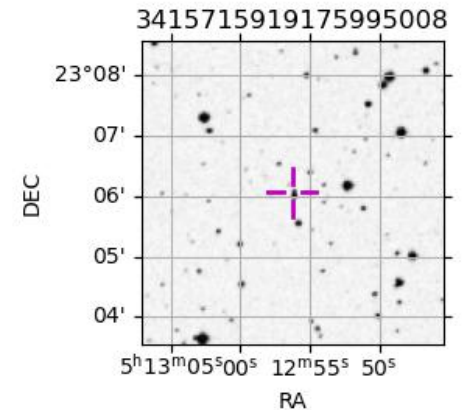


2031-04-09T06:04:14.1900 ex: 05 12 56.2312 d: +23 06 03.564 C/A 0.861" PA 175.23 deg v_sky +21.02 km/s D 19.61 AU
 Credit: Styled after SORA/Lucky Star

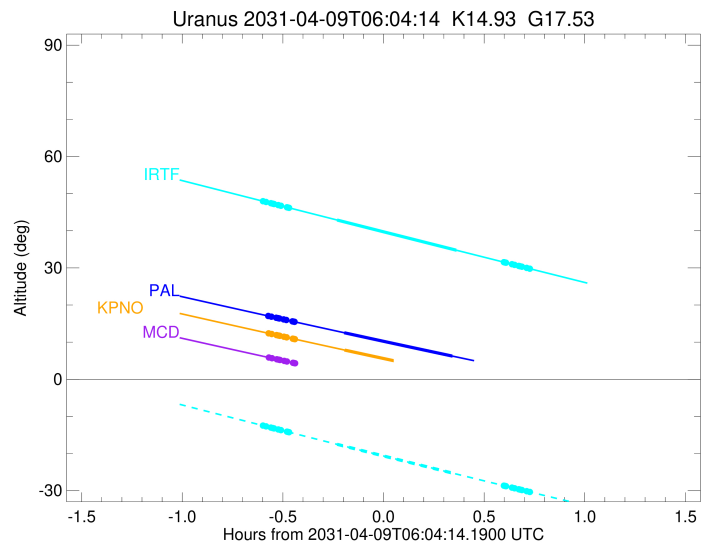
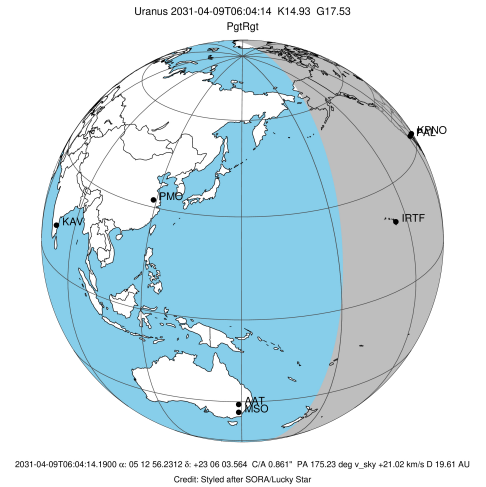


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++	+ +		APR 09 05:30 - APR 09 06:24	PieRin
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+		APR 09 05:30 - APR 09 05:52	PinRin
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++			APR 09 05:30 - APR 09 05:33	PnnRin
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	APR 09 05:28 - APR 09 06:48	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					PnnRnn
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



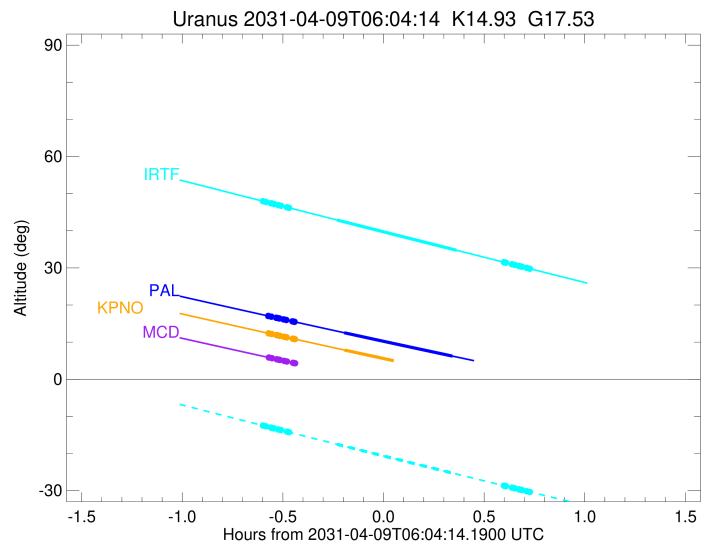
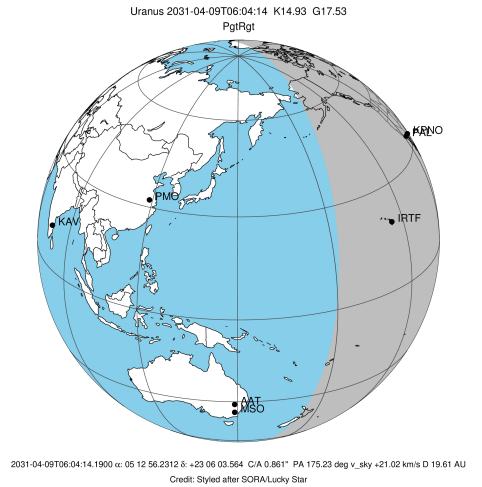
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-04-09T06:08:34.000
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 3415715919175995008
 2Mass ID (if available) : 05125622+2306035
 ICRS Star Coord at Epoch: 05h 12m 56.23116s +23:06:03.56367s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 14.933
 G magnitude : 17.531
 RP magnitude : 16.728
 BP magnitude : 18.208
 DUPflag : 0
 Distance (au) : 19.608
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 21.02
 Sun-Target sep (deg) : 60.42
 Sun-Moon sep (deg) : 140.18
 B (ring opening deg) : 82.03
 PA of pole (deg) : 6.44
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.061
 C/A sky separation (km) : 15091.8
 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_itrff93_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	2031-04-09T05:30:12.871		16.98	-37.62	50753.63	-19.99		
lambda	I	2031-04-09T05:30:49.248		16.86	-37.71	50026.71	-19.97		
delta	I	2031-04-09T05:32:15.854		16.57	-37.92	48300.35	-19.90		
gamma	I	2031-04-09T05:32:50.014		16.45	-38.01	47621.20	-19.87		
eta	I	2031-04-09T05:33:12.430		16.38	-38.06	47176.12	-19.84		
beta	I	2031-04-09T05:34:28.175		16.12	-38.25	45676.05	-19.77		
alpha	I	2031-04-09T05:35:15.317		15.97	-38.36	44745.30	-19.72		
4	I	2031-04-09T05:37:03.616		15.61	-38.62	42615.96	-19.59		
5	I	2031-04-09T05:37:20.295		15.55	-38.66	42291.16	-19.56		
6	I	2031-04-09T05:37:44.103		15.47	-38.72	41827.00	-19.53		
Uranus	I	2031-04-09T05:52:31.592		12.53	-40.77	25241.70		5.87	6.15
Uranus	E	2031-04-09T06:24:47.183		6.24	-44.63	25448.85		3.43	3.60
6	E	2031-04-09T06:39:23.351		3.46x	-46.05	41816.78	19.64		
5	E	2031-04-09T06:39:40.480		3.40x	-46.07	42154.96	19.67		
4	E	2031-04-09T06:40:00.212		3.34x	-46.10	42542.82	19.71		
alpha	E	2031-04-09T06:41:49.863		2.99x	-46.26	44711.20	19.85		
beta	E	2031-04-09T06:42:36.672		2.85x	-46.33	45641.09	19.90		
eta	E	2031-04-09T06:43:53.664		2.60x	-46.44	47176.12	19.98		
gamma	E	2031-04-09T06:44:16.433		2.53x	-46.47	47631.26	20.00		
delta	E	2031-04-09T06:44:49.859		2.43x	-46.52	48300.35	20.03		
lambda	E	2031-04-09T06:46:15.863		2.16x	-46.64	50026.71	20.11		
epsilon	E	2031-04-09T06:47:25.116		1.94x	-46.73	51421.52	20.13		

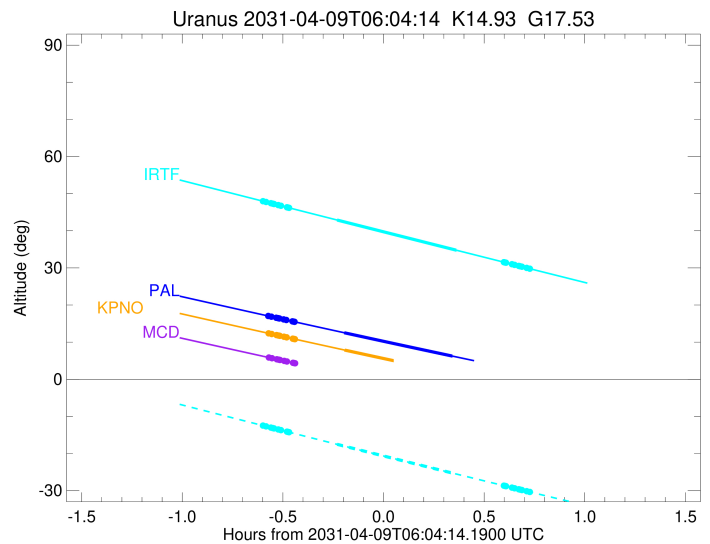
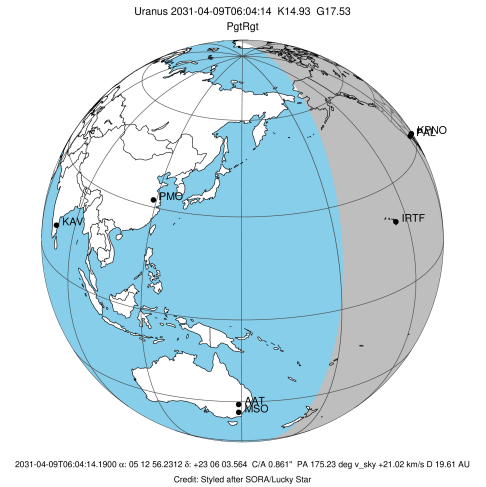
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-04-09T06:08:35.430
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      : 3415715919175995008
2Mass ID (if available) : 05125622+2306035
ICRS Star Coord at Epoch: 05h 12m 56.23116s +23:06:03.56367s
RUWE (>1.4 is poor) : 0.98
K magnitude         : 14.933
G magnitude         : 17.531
RP magnitude        : 16.728
BP magnitude        : 18.208
DUPflag            : 0
Distance (au)       : 19.608
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : 21.02
Sun-Target sep (deg) : 60.42
Sun-Moon sep (deg)  : 140.14
B (ring opening deg) : 82.03
PA of pole (deg)    : 6.44
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.066
C/A sky separation (km) : 15166.7
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itrff93_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	2031-04-09T05:30:19.354		12.30	-41.68	50753.51	-20.01		
lambda	I	2031-04-09T05:30:55.682		12.18	-41.77	50026.71	-19.99		
delta	I	2031-04-09T05:32:22.189		11.89	-41.96	48300.35	-19.92		
gamma	I	2031-04-09T05:32:56.311		11.78	-42.04	47621.20	-19.89		
eta	I	2031-04-09T05:33:18.702		11.71	-42.09	47176.12	-19.87		
beta	I	2031-04-09T05:34:34.366		11.45	-42.26	45676.02	-19.79		
alpha	I	2031-04-09T05:35:21.457		11.30	-42.37	44745.33	-19.74		
4	I	2031-04-09T05:37:09.649		10.94	-42.61	42615.97	-19.61		
5	I	2031-04-09T05:37:26.318		10.88	-42.65	42291.06	-19.57		
6	I	2031-04-09T05:37:50.103		10.80	-42.70	41826.93	-19.55		
Uranus	I	2031-04-09T05:52:37.452		7.87	-44.56	25239.66		5.89	6.17
Uranus	E	2031-04-09T06:24:44.228		1.64x	-47.88	25447.08		3.46	3.63
6	E	2031-04-09T06:39:20.235		-1.12x	-49.00	41816.71	19.66		
5	E	2031-04-09T06:39:37.350		-1.18x	-49.01	42154.95	19.69		
4	E	2031-04-09T06:39:57.068		-1.24x	-49.04	42542.89	19.73		
alpha	E	2031-04-09T06:41:46.608		-1.58x	-49.16	44711.26	19.87		
beta	E	2031-04-09T06:42:33.364		-1.72x	-49.21	45641.08	19.92		
eta	E	2031-04-09T06:43:50.271		-1.96x	-49.29	47176.12	20.00		
gamma	E	2031-04-09T06:44:13.015		-2.03x	-49.31	47631.26	20.02		
delta	E	2031-04-09T06:44:46.403		-2.14x	-49.34	48300.35	20.06		
lambda	E	2031-04-09T06:46:12.306		-2.40x	-49.43	50026.71	20.14		
epsilon	E	2031-04-09T06:47:21.452		-2.62x	-49.50	51421.02	20.16		

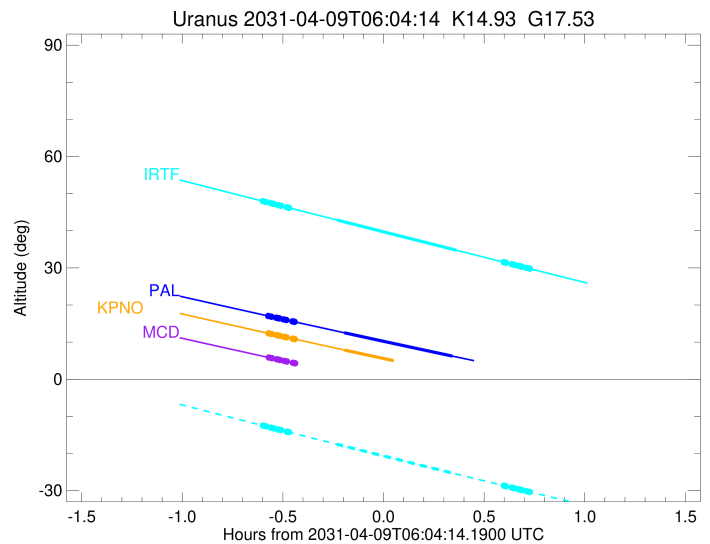
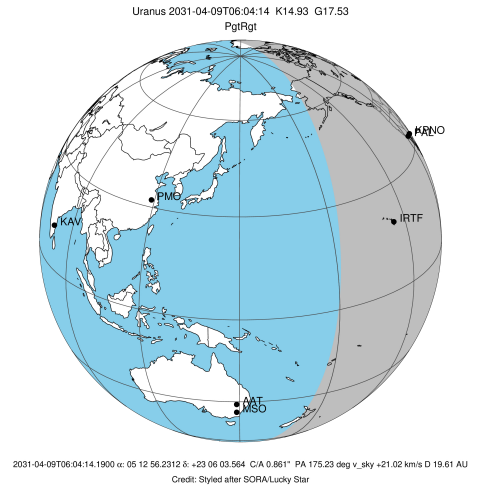
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-04-09T06:08:31.770
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : MCD
 Location : McDonald Obs. 2.7m
 Latitude (deg) : 30.67158
 E. Longitude (deg) : 255.97844
 Altitude (km) : 2.075
 Gaia source ID : 3415715919175995008
 2Mass ID (if available) : 05125622+2306035
 ICRS Star Coord at Epoch: 05h 12m 56.23116s +23:06:03.56367s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 14.933
 G magnitude : 17.531
 RP magnitude : 16.728
 BP magnitude : 18.208
 DUPflag : 0
 Distance (au) : 19.608
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 21.02
 Sun-Target sep (deg) : 60.42
 Sun-Moon sep (deg) : 140.06
 B (ring opening deg) : 82.03
 PA of pole (deg) : 6.44
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.079
 C/A sky separation (km) : 15342.8
 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_itrff93_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	2031-04-09T05:30:24.097		5.79	-46.60	50753.20	-20.04		
lambda	I	2031-04-09T05:31:00.362		5.67	-46.67	50026.71	-20.02		
delta	I	2031-04-09T05:32:26.763		5.38	-46.83	48300.35	-19.94		
gamma	I	2031-04-09T05:33:00.845		5.27	-46.89	47621.21	-19.91		
eta	I	2031-04-09T05:33:23.212		5.20	-46.94	47176.12	-19.89		
beta	I	2031-04-09T05:34:38.799		4.95x	-47.08	45675.97	-19.81		
alpha	I	2031-04-09T05:35:25.837		4.79x	-47.16	44745.42	-19.76		
4	I	2031-04-09T05:37:13.940		4.44x	-47.36	42616.00	-19.62		
5	I	2031-04-09T05:37:30.613		4.38x	-47.39	42290.81	-19.59		
6	I	2031-04-09T05:37:54.377		4.30x	-47.43	41826.74	-19.56		
Uranus	I	2031-04-09T05:52:42.783		1.41x	-48.91	25234.64		5.94	6.22
Uranus	E	2031-04-09T06:24:31.732		-4.64x	-51.15	25443.02		3.52	3.69
6	E	2031-04-09T06:39:08.805		-7.33x	-51.71	41816.54	19.67		
5	E	2031-04-09T06:39:25.916		-7.39x	-51.72	42154.93	19.70		
4	E	2031-04-09T06:39:45.631		-7.45x	-51.73	42543.05	19.74		
alpha	E	2031-04-09T06:41:35.089		-7.78x	-51.77	44711.40	19.88		
beta	E	2031-04-09T06:42:21.799		-7.92x	-51.79	45641.08	19.93		
eta	E	2031-04-09T06:43:38.634		-8.15x	-51.82	47176.12	20.02		
gamma	E	2031-04-09T06:44:01.354		-8.22x	-51.83	47631.25	20.04		
delta	E	2031-04-09T06:44:34.707		-8.32x	-51.84	48300.35	20.08		
lambda	E	2031-04-09T06:46:00.516		-8.58x	-51.86	50026.71	20.16		
epsilon	E	2031-04-09T06:47:09.525		-8.79x	-51.88	51419.92	20.18		

```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2031-04-09T06:08:06.850
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       : 3415715919175995008
2Mass ID (if available) : 05125622+2306035
ICRS Star Coord at Epoch: 05h 12m 56.23116s +23:06:03.56367s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 14.933
G magnitude           : 17.531
RP magnitude          : 16.728
BP magnitude          : 18.208
DUPflag              : 0
Distance (au)        : 19.608
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : 21.02
Sun-Target sep (deg) : 60.42
Sun-Moon sep (deg)   : 140.41
B (ring opening deg) : 82.03
PA of pole (deg)     : 6.44
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.873
C/A sky separation (km) : 12412.3
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	2031-04-09T05:28:37.999		47.89	-12.55	50758.97	-20.05		
lambda	I	2031-04-09T05:29:14.521		47.75	-12.69	50026.71	-20.04		
delta	I	2031-04-09T05:30:40.766		47.42	-13.02	48300.35	-19.99		
gamma	I	2031-04-09T05:31:14.756		47.29	-13.15	47621.12	-19.97		
eta	I	2031-04-09T05:31:37.043		47.21	-13.24	47176.12	-19.96		
beta	I	2031-04-09T05:32:52.263		46.92	-13.52	45676.83	-19.91		
alpha	I	2031-04-09T05:33:39.155		46.74	-13.70	44743.96	-19.88		
4	I	2031-04-09T05:35:26.440		46.33	-14.11	42615.38	-19.79		
5	I	2031-04-09T05:35:42.707		46.27	-14.17	42294.82	-19.77		
6	I	2031-04-09T05:36:06.306		46.18	-14.26	41829.77	-19.75		
Uranus	I	2031-04-09T05:50:23.634		42.90	-17.52	25314.32		5.14	5.39
Uranus	E	2031-04-09T06:25:58.682		34.76	-25.53	25500.81		2.49	2.61
6	E	2031-04-09T06:40:05.965		31.55	-28.65	41819.43	19.86		
5	E	2031-04-09T06:40:22.830		31.48	-28.72	42155.47	19.88		
4	E	2031-04-09T06:40:42.198		31.41	-28.79	42540.48	19.91		
alpha	E	2031-04-09T06:42:30.886		31.00	-29.19	44709.07	20.00		
beta	E	2031-04-09T06:43:17.461		30.82	-29.36	45641.20	20.03		
eta	E	2031-04-09T06:44:33.973		30.53	-29.64	47176.12	20.09		
gamma	E	2031-04-09T06:44:56.627		30.45	-29.72	47631.36	20.10		
delta	E	2031-04-09T06:45:29.886		30.32	-29.84	48300.35	20.13		
lambda	E	2031-04-09T06:46:55.554		30.00	-30.15	50026.71	20.18		
epsilon	E	2031-04-09T06:48:05.428		29.73	-30.41	51437.98	20.19		