

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:39:51.920  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055

ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s

RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 136.70  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06

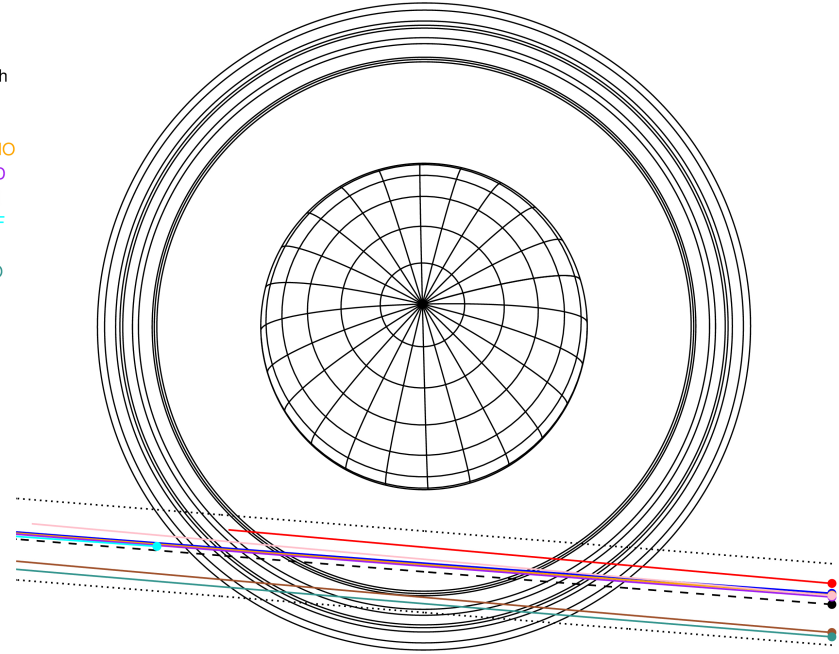
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2031-01-23T03:39:51.9200 ra: 05 11 33.6025 s: +23 04 05.764 C/A 2.860° PA 355.42 deg v\_sky -15.25 km/s D 18.42 AU  
 Credit: Styled after SORA/Lucky Star

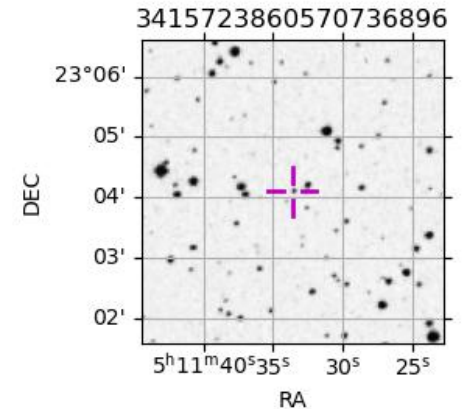
Uranus 2031-01-23T03:39:51 K14.44 G17.18 XRgt

Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO

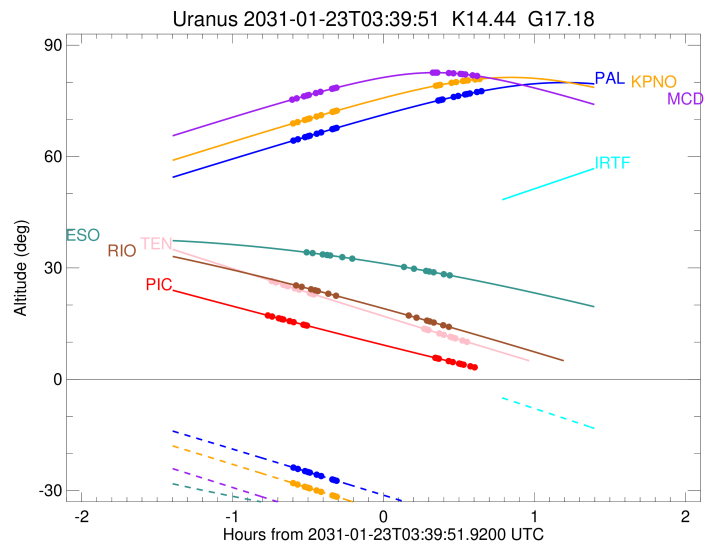
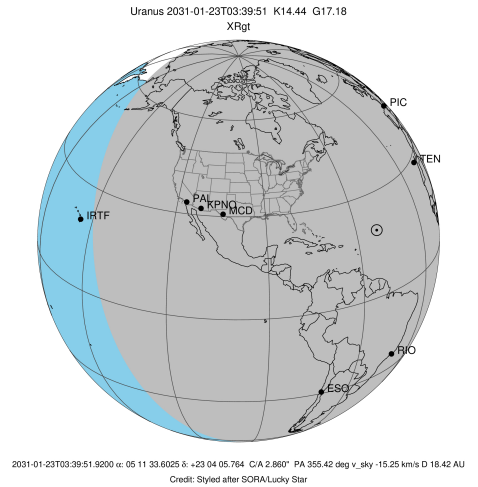


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++++		+++	JAN 23 02:53 - JAN 23 04:01	PnnRie
PAL	Palomar Mt (200")	33.4	243.1	+++++++		+++++++	JAN 23 03:04 - JAN 23 04:19	PnnRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++++		+++++++	JAN 23 03:03 - JAN 23 04:18	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++++		+++++++	JAN 23 03:03 - JAN 23 04:17	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++++		+++++++	JAN 23 02:55 - JAN 23 04:13	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++		+++++	JAN 23 03:04 - JAN 23 04:06	PnnRie
ESO	European Southern Obs	-29.3	289.3	+++++		+++++	JAN 23 03:09 - JAN 23 04:06	PnnRie
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 : 2031-01-23T03:34:47.710  
 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 136.29  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.577  
 C/A sky separation (km) : 34434.9  
 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\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

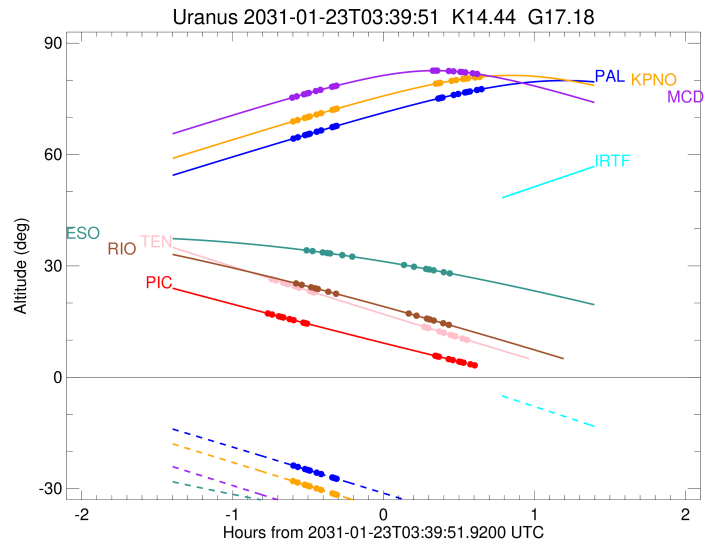
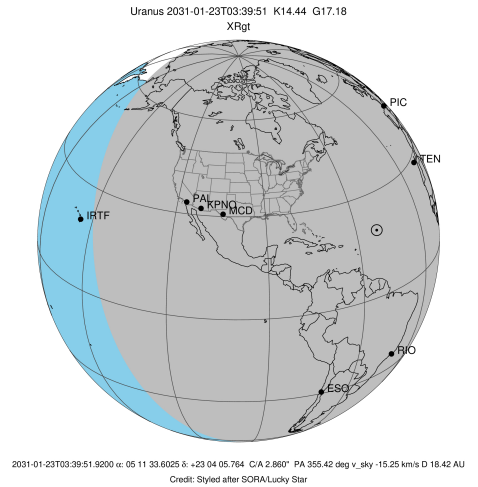


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T02:53:55.881		17.19	-48.71	51141.02	-11.29		
lambda	I	2031-01-23T02:55:36.296		16.89	-48.42	50026.71	-10.99		
delta	I	2031-01-23T02:58:16.193		16.42	-47.97	48300.35	-10.60		
gamma	I	2031-01-23T02:59:20.246		16.23	-47.78	47626.54	-10.44		
eta	I	2031-01-23T03:00:03.644		16.10	-47.66	47176.12	-10.32		
beta	I	2031-01-23T03:02:33.722		15.66	-47.22	45658.25	-9.89		
alpha	I	2031-01-23T03:04:06.584		15.39	-46.96	44752.14	-9.61		
4	I	2031-01-23T03:07:58.551		14.71	-46.28	42616.20	-8.82		
5	I	2031-01-23T03:08:36.250		14.60	-46.17	42278.60	-8.66		
6	I	2031-01-23T03:09:30.102		14.45	-46.01	41823.24	-8.46		

No planet occultations

6	E	2031-01-23T04:00:19.665		5.79	-36.91	41794.82	8.41		
5	E	2031-01-23T04:01:06.615		5.67	-36.76	42187.45	8.61		
4	E	2031-01-23T04:01:51.558		5.54	-36.63	42580.68	8.76		
alpha	E	2031-01-23T04:05:45.714		4.90x	-35.91	44721.08	9.54		
beta	E	2031-01-23T04:07:20.696		4.64x	-35.62	45641.06	9.82		
eta	E	2031-01-23T04:09:53.687		4.23x	-35.16	47176.12	10.24		
gamma	E	2031-01-23T04:10:37.914		4.11x	-35.02	47631.58	10.36		
delta	E	2031-01-23T04:11:41.999		3.93x	-34.83	48300.35	10.52		
lambda	E	2031-01-23T04:14:23.257		3.50x	-34.34	50026.71	10.89		
epsilon	E	2031-01-23T04:16:41.660		3.13x	-33.91	51554.23	11.19		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:41:19.760  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 137.54  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.766  
 C/A sky separation (km) : 36959.4  
 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

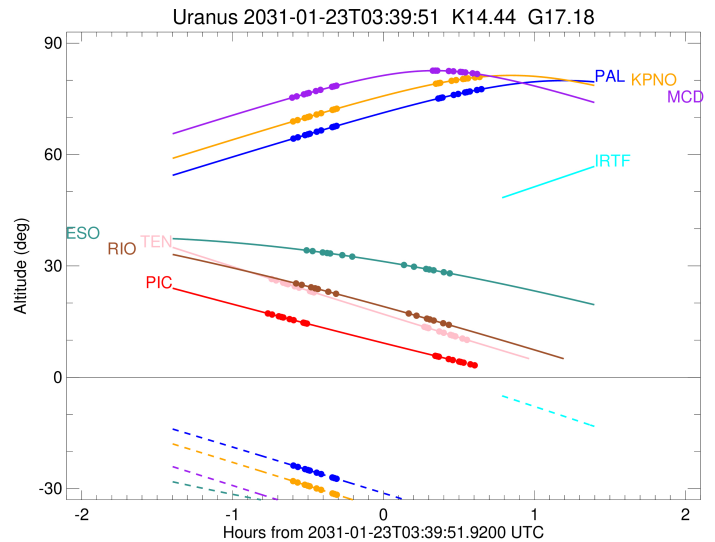
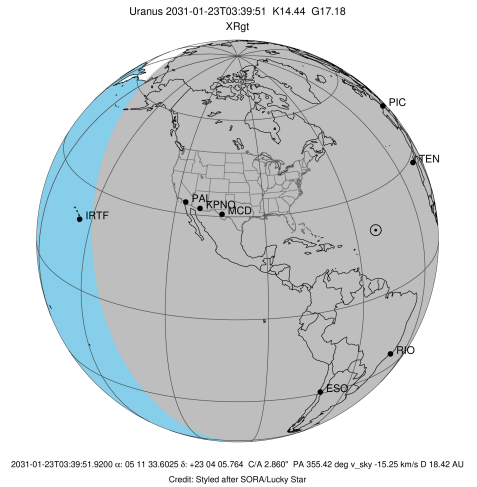


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T03:04:02.783		64.29	-23.78	51163.61	-10.75		
lambda	I	2031-01-23T03:05:50.835		64.65	-24.16	50026.71	-10.38		
delta	I	2031-01-23T03:08:41.068		65.22	-24.74	48300.35	-9.89		
gamma	I	2031-01-23T03:09:49.859		65.45	-24.98	47626.90	-9.68		
eta	I	2031-01-23T03:10:36.768		65.61	-25.14	47176.12	-9.53		
beta	I	2031-01-23T03:13:20.765		66.15	-25.71	45656.72	-8.97		
alpha	I	2031-01-23T03:15:03.634		66.49	-26.07	44751.66	-8.60		
4	I	2031-01-23T03:19:28.632		67.36	-26.98	42615.42	-7.52		
5	I	2031-01-23T03:20:13.851		67.51	-27.14	42271.47	-7.30		
6	I	2031-01-23T03:21:17.928		67.72	-27.36	41819.02	-7.02		

No planet occultations

6	E	2031-01-23T04:01:30.615		75.06	-35.75	41795.52	7.02		
5	E	2031-01-23T04:02:27.713		75.22	-35.95	42196.21	7.31		
4	E	2031-01-23T04:03:19.798		75.36	-36.13	42586.19	7.53		
alpha	E	2031-01-23T04:07:45.219		76.05	-37.05	44724.76	8.61		
beta	E	2031-01-23T04:09:29.334		76.31	-37.42	45641.20	8.98		
eta	E	2031-01-23T04:12:14.914		76.71	-37.99	47176.12	9.55		
gamma	E	2031-01-23T04:13:02.249		76.83	-38.16	47631.55	9.70		
delta	E	2031-01-23T04:14:10.479		76.99	-38.40	48300.35	9.91		
lambda	E	2031-01-23T04:17:00.499		77.37	-38.99	50026.71	10.39		
epsilon	E	2031-01-23T04:19:24.937		77.69	-39.49	51555.27	10.77		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:40:53.390  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 137.50  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.784  
 C/A sky separation (km) : 37193.1  
 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



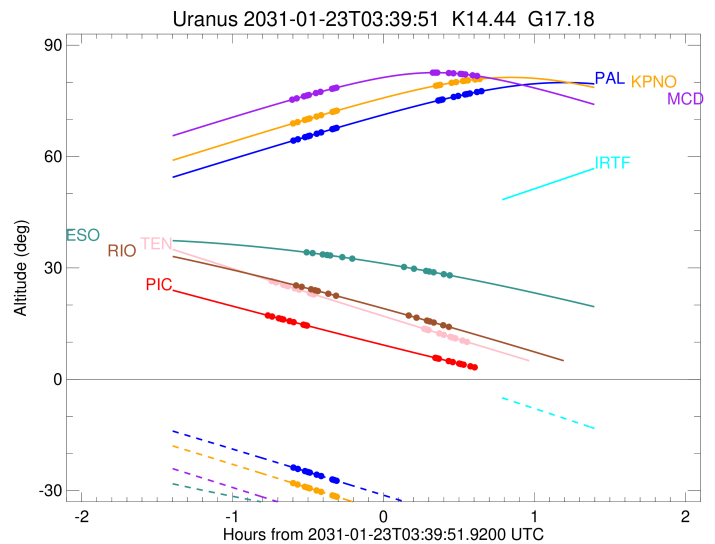
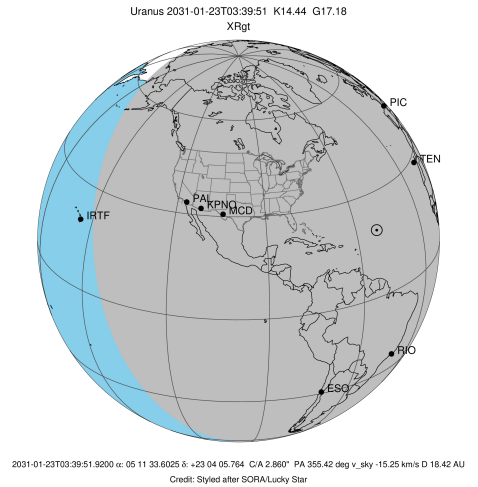
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T03:03:54.964		68.92	-27.98	51166.61	-10.69		
lambda	I	2031-01-23T03:05:43.987		69.28	-28.36	50026.71	-10.31		
delta	I	2031-01-23T03:08:35.492		69.85	-28.96	48300.35	-9.81		
gamma	I	2031-01-23T03:09:44.870		70.08	-29.21	47626.94	-9.60		
eta	I	2031-01-23T03:10:32.217		70.24	-29.37	47176.12	-9.44		
beta	I	2031-01-23T03:13:17.973		70.79	-29.96	45656.53	-8.87		
alpha	I	2031-01-23T03:15:02.129		71.13	-30.32	44751.58	-8.49		
4	I	2031-01-23T03:19:31.552		72.01	-31.27	42615.29	-7.37		
5	I	2031-01-23T03:20:17.832		72.16	-31.44	42270.56	-7.14		
6	I	2031-01-23T03:21:23.361		72.37	-31.67	41818.50	-6.85		

No planet occultations

6	E	2031-01-23T04:00:32.810		79.05	-39.98	41795.62	6.85		
5	E	2031-01-23T04:01:31.384		79.19	-40.18	42197.01	7.14		
4	E	2031-01-23T04:02:24.542		79.30	-40.37	42586.65	7.37		
alpha	E	2031-01-23T04:06:54.500		79.85	-41.33	44725.06	8.49		
beta	E	2031-01-23T04:08:39.954		80.05	-41.70	45641.22	8.87		
eta	E	2031-01-23T04:11:27.374		80.34	-42.29	47176.12	9.45		
gamma	E	2031-01-23T04:12:15.172		80.41	-42.46	47631.54	9.60		
delta	E	2031-01-23T04:13:24.029		80.52	-42.71	48300.35	9.82		
lambda	E	2031-01-23T04:16:15.423		80.75	-43.31	50026.71	10.32		
epsilon	E	2031-01-23T04:18:40.852		80.92	-43.83	51555.24	10.70		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-01-23T03:40:12.360
Event type          : XRgt
: No Uranus occs
: 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      : 3415723860570736896
2Mass ID (if available) : 05113359+2304055
ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s
RUWE (>1.4 is poor) : 1.01
K magnitude         : 14.443
G magnitude         : 17.176
RP magnitude        : 16.323
BP magnitude        : 17.945
DUPflag            : 0
Distance (au)       : 18.423
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -15.25
Sun-Target sep (deg) : 136.38
Sun-Moon sep (deg)  : 137.44
B (ring opening deg) : 82.09
PA of pole (deg)    : 4.06
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.801
C/A sky separation (km) : 37428.3
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
  
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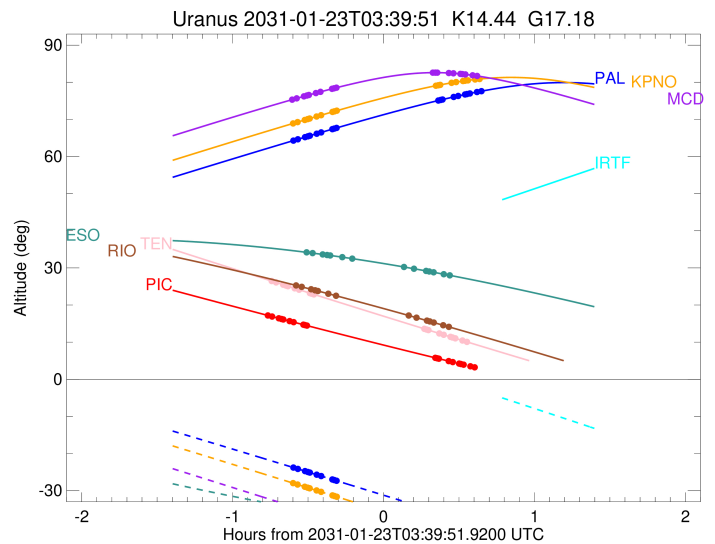
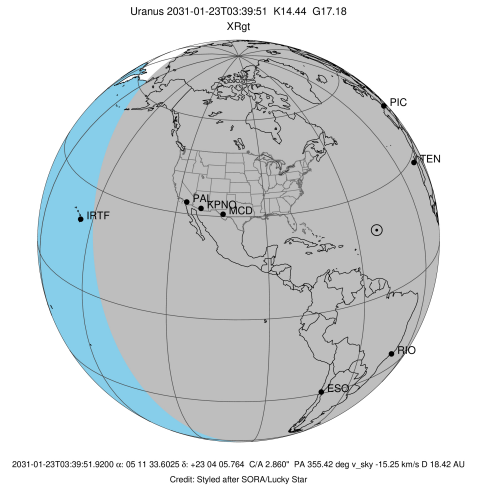


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T03:03:32.758		75.32	-34.24	51169.83	-10.63		
lambda	I	2031-01-23T03:05:22.794		75.67	-34.63	50026.71	-10.24		
delta	I	2031-01-23T03:08:15.616		76.22	-35.25	48300.35	-9.73		
gamma	I	2031-01-23T03:09:25.604		76.44	-35.50	47626.99	-9.51		
eta	I	2031-01-23T03:10:13.409		76.59	-35.67	47176.12	-9.35		
beta	I	2031-01-23T03:13:01.010		77.10	-36.27	45656.33	-8.76		
alpha	I	2031-01-23T03:14:46.524		77.42	-36.65	44751.49	-8.37		
4	I	2031-01-23T03:19:20.690		78.23	-37.63	42615.14	-7.21		
5	I	2031-01-23T03:20:08.125		78.37	-37.80	42269.57	-6.98		
6	I	2031-01-23T03:21:15.241		78.56	-38.04	41817.96	-6.67		

No planet occultations

6	E	2031-01-23T03:59:19.348		82.60	-46.24	41795.73	6.67		
5	E	2031-01-23T04:00:19.541		82.60	-46.45	42197.81	6.98		
4	E	2031-01-23T04:01:13.877		82.60	-46.65	42587.11	7.21		
alpha	E	2031-01-23T04:05:48.748		82.50	-47.63	44725.35	8.37		
beta	E	2031-01-23T04:07:35.642		82.42	-48.01	45641.24	8.76		
eta	E	2031-01-23T04:10:25.034		82.26	-48.62	47176.12	9.35		
gamma	E	2031-01-23T04:11:13.328		82.21	-48.79	47631.54	9.51		
delta	E	2031-01-23T04:12:22.856		82.12	-49.04	48300.35	9.73		
lambda	E	2031-01-23T04:15:15.723		81.88	-49.66	50026.71	10.24		
epsilon	E	2031-01-23T04:17:42.217		81.64	-50.18	51555.20	10.62		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:34:00.550  
 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 136.27  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.717  
 C/A sky separation (km) : 36308.5  
 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

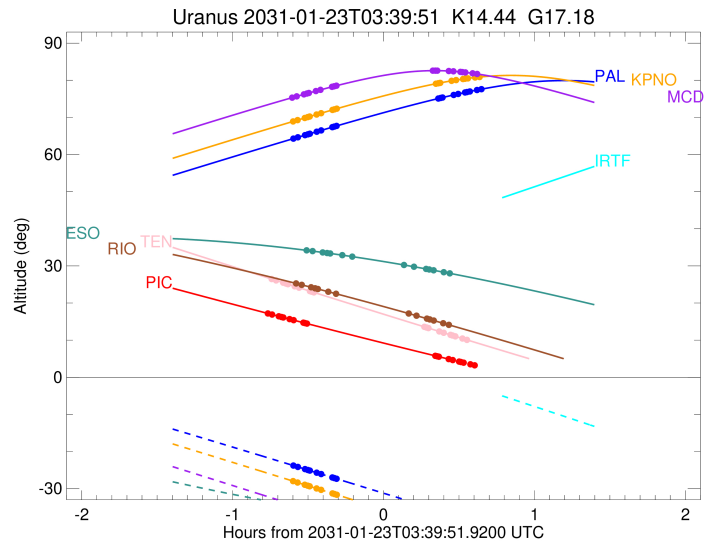
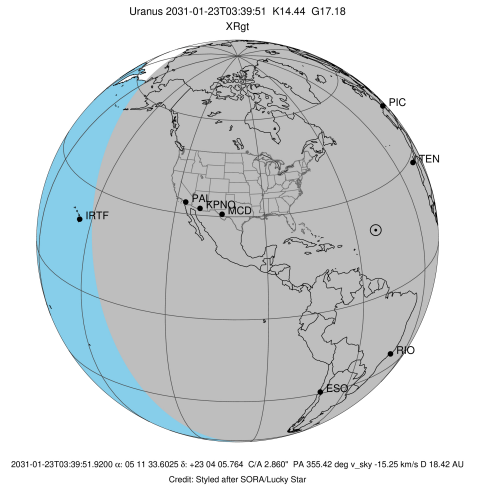


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T02:55:25.115		26.46	-66.09	51162.17	-10.83		
lambda	I	2031-01-23T02:57:12.162		26.08	-65.71	50026.71	-10.47		
delta	I	2031-01-23T03:00:00.606		25.48	-65.12	48300.35	-10.02		
gamma	I	2031-01-23T03:01:08.503		25.23	-64.87	47626.86	-9.82		
eta	I	2031-01-23T03:01:54.730		25.07	-64.71	47176.12	-9.68		
beta	I	2031-01-23T03:04:35.837		24.49	-64.13	45656.92	-9.16		
alpha	I	2031-01-23T03:06:16.442		24.13	-63.78	44751.73	-8.81		
4	I	2031-01-23T03:10:33.195		23.22	-62.85	42615.58	-7.83		
5	I	2031-01-23T03:11:16.432		23.06	-62.70	42272.72	-7.63		
6	I	2031-01-23T03:12:17.646		22.85	-62.48	41819.75	-7.37		

No planet occultations

6	E	2031-01-23T03:55:57.978		13.62	-52.95	41795.18	7.33		
5	E	2031-01-23T03:56:52.372		13.43	-52.75	42192.97	7.58		
4	E	2031-01-23T03:57:42.864		13.25	-52.57	42584.22	7.78		
alpha	E	2031-01-23T04:02:01.995		12.35	-51.62	44723.41	8.75		
beta	E	2031-01-23T04:03:44.803		11.99	-51.24	45641.12	9.09		
eta	E	2031-01-23T04:06:28.964		11.43	-50.64	47176.12	9.60		
gamma	E	2031-01-23T04:07:16.063		11.26	-50.47	47631.56	9.74		
delta	E	2031-01-23T04:08:24.065		11.03	-50.22	48300.35	9.93		
lambda	E	2031-01-23T04:11:14.053		10.44	-49.59	50026.71	10.37		
epsilon	E	2031-01-23T04:13:38.962		9.94	-49.06	51555.19	10.72		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:35:17.950  
 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 136.36  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.162  
 C/A sky separation (km) : 42255.9  
 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\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

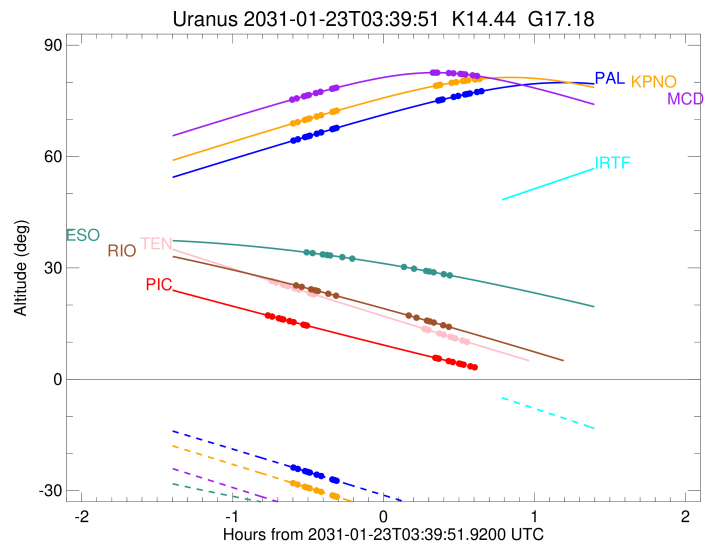
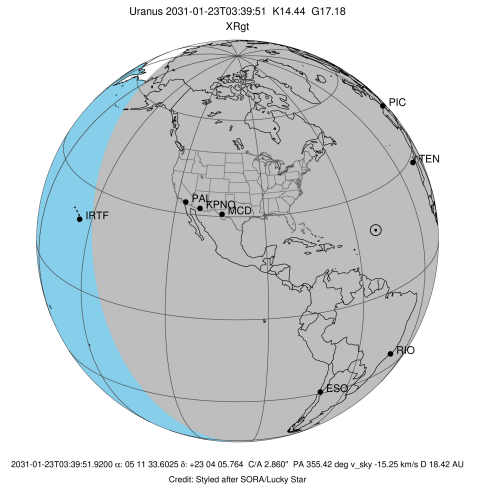


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-23T03:04:58.904		25.30	-47.74	51235.74	-8.71		
lambda	I	2031-01-23T03:07:23.468		24.89	-47.73	50026.71	-8.11		
delta	I	2031-01-23T03:11:07.534		24.24	-47.71	48300.35	-7.28		
gamma	I	2031-01-23T03:12:42.320		23.96	-47.69	47628.04	-6.90		
eta	I	2031-01-23T03:13:49.127		23.77	-47.68	47176.12	-6.63		
beta	I	2031-01-23T03:17:59.659		23.03	-47.61	45651.78	-5.51		
alpha	I	2031-01-23T03:20:56.535		22.51	-47.55	44748.19	-4.67		

No planet occultations

alpha	E	2031-01-23T03:49:54.017		17.17	-46.32	44733.33	4.66		
beta	E	2031-01-23T03:52:52.936		16.61	-46.13	45642.33	5.49		
eta	E	2031-01-23T03:57:06.305		15.80	-45.84	47176.12	6.59		
gamma	E	2031-01-23T03:58:13.918		15.59	-45.76	47631.33	6.87		
delta	E	2031-01-23T03:59:48.718		15.28	-45.65	48300.35	7.24		
lambda	E	2031-01-23T04:03:34.079		14.56	-45.36	50026.71	8.06		
epsilon	E	2031-01-23T04:06:36.064		13.97	-45.12	51549.78	8.65		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-23T03:37:35.580  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3415723860570736896  
 2Mass ID (if available) : 05113359+2304055  
 ICRS Star Coord at Epoch: 05h 11m 33.60253s +23:04:05.76379s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 14.443  
 G magnitude : 17.176  
 RP magnitude : 16.323  
 BP magnitude : 17.945  
 DUPflag : 0  
 Distance (au) : 18.423  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.25  
 Sun-Target sep (deg) : 136.38  
 Sun-Moon sep (deg) : 136.73  
 B (ring opening deg) : 82.09  
 PA of pole (deg) : 4.06  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 3.238  
 C/A sky separation (km) : 43264.6  
 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	2031-01-23T03:09:07.615		34.21	-35.14	51248.36	-8.27		
lambda	I	2031-01-23T03:11:42.378		33.98	-35.43	50026.71	-7.61		
delta	I	2031-01-23T03:15:43.993		33.62	-35.87	48300.35	-6.66		
gamma	I	2031-01-23T03:17:28.307		33.47	-36.05	47628.27	-6.22		
eta	I	2031-01-23T03:18:42.942		33.35	-36.18	47176.12	-5.89		
beta	I	2031-01-23T03:23:34.888		32.88	-36.67	45650.65	-4.52		
alpha	I	2031-01-23T03:27:22.892		32.50	-37.04	44746.71	-3.37		

No planet occultations

alpha	E	2031-01-23T03:48:01.793		30.25	-38.82	44736.09	3.37		
beta	E	2031-01-23T03:51:51.543		29.79	-39.10	45642.90	4.52		
eta	E	2031-01-23T03:56:45.872		29.19	-39.44	47176.12	5.88		
gamma	E	2031-01-23T03:58:01.174		29.04	-39.53	47631.23	6.21		
delta	E	2031-01-23T03:59:45.297		28.82	-39.64	48300.35	6.64		
lambda	E	2031-01-23T04:03:47.666		28.31	-39.89	50026.71	7.59		
epsilon	E	2031-01-23T04:06:59.358		27.89	-40.07	51546.69	8.24		