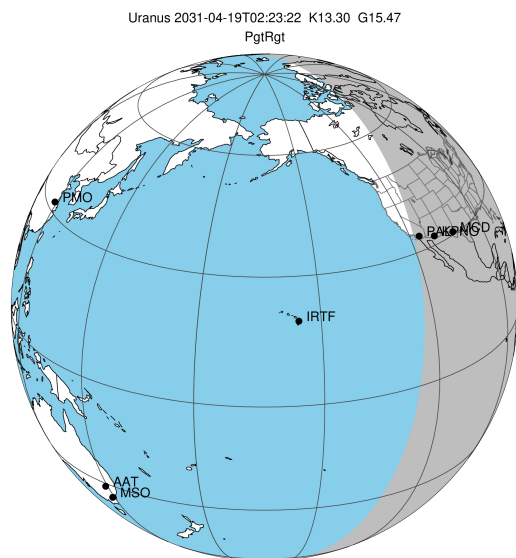


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-04-19T02:23:22.610  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3415554192182895104  
 2Mass ID (if available) : 05143551+2307544

Uranus 2031-04-19T02:23:22 K13.30 G15.47 PgtRgt

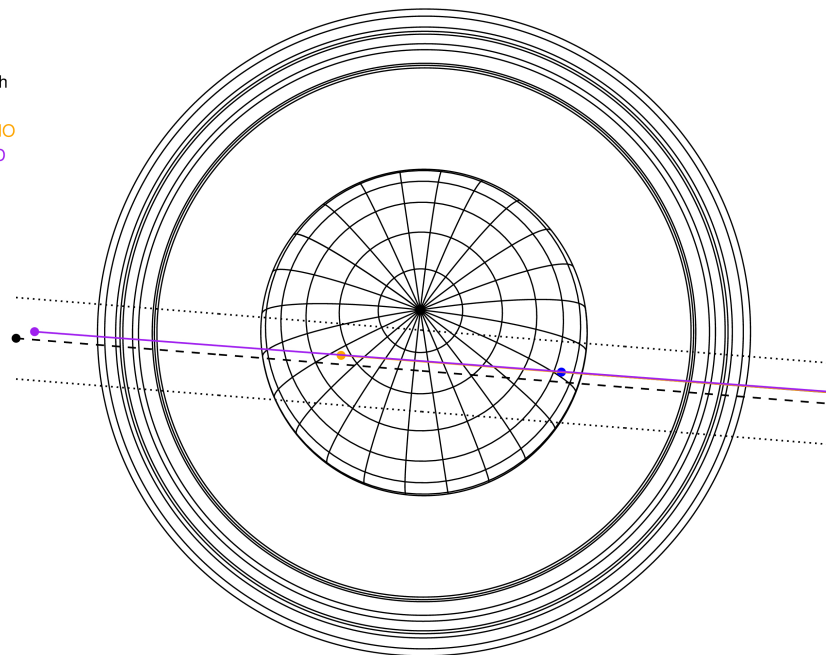
ICRS Star Coord at Epoch: 05h 14m 35.52103s +23:07:54.54431s

RUWE (>1.4 is poor) : 0.99  
 K magnitude : 13.303  
 G magnitude : 15.466  
 RP magnitude : 14.735  
 BP magnitude : 16.045  
 DUPflag : 0  
 Distance (au) : 19.745  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 25.02  
 Sun-Target sep (deg) : 51.15  
 Sun-Moon sep (deg) : 82.70  
 B (ring opening deg) : 81.94  
 PA of pole (deg) : 9.25



2031-04-19T02:23:22.6100 ex: 05 14 35.5210 s: +23 07 54.544 C/A 0.416° PA 355.41 deg v\_sky +25.02 km/s D 19.75 AU  
 Credit: Styled after SORA/Lucky Star

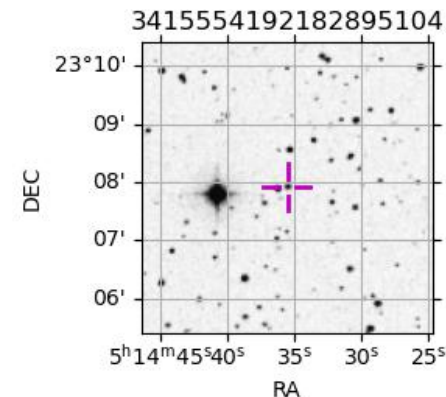
Earth  
 PAL  
 KPNO  
 MCD



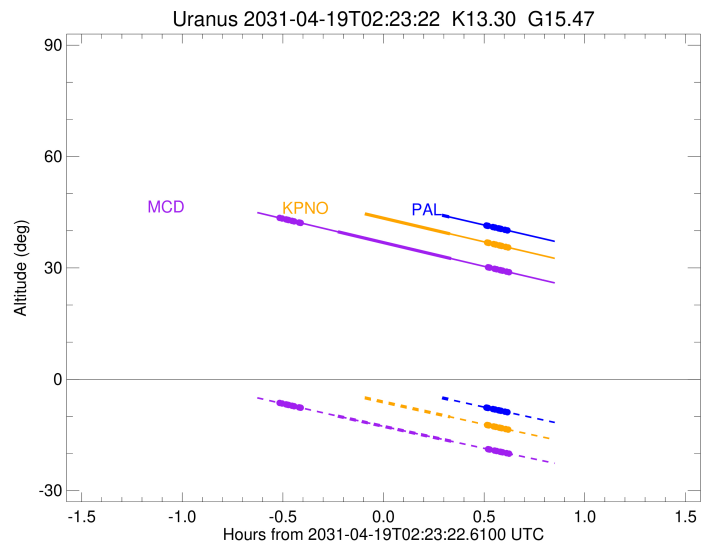
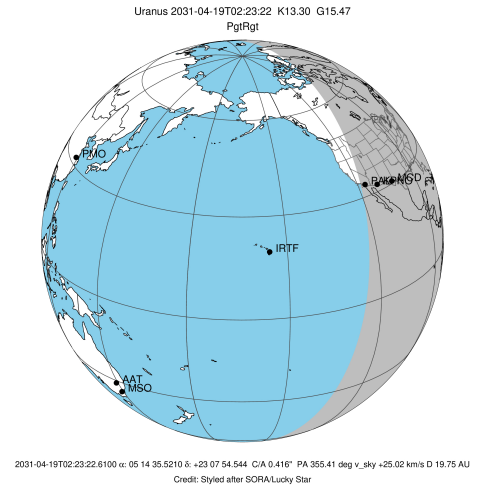
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon

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 19 02:42 - APR 19 03:00	PneRne
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4		+	+++++	APR 19 02:43 - APR 19 03:00	PneRne
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	APR 19 01:52 - APR 19 03:01	PieRie
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					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



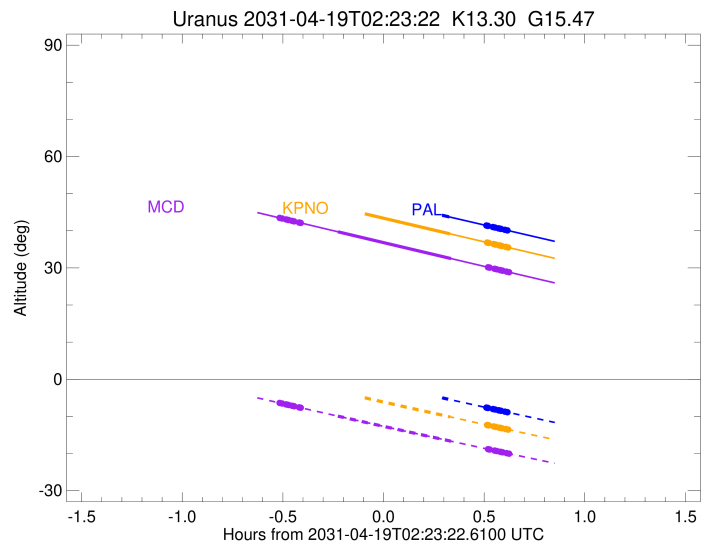
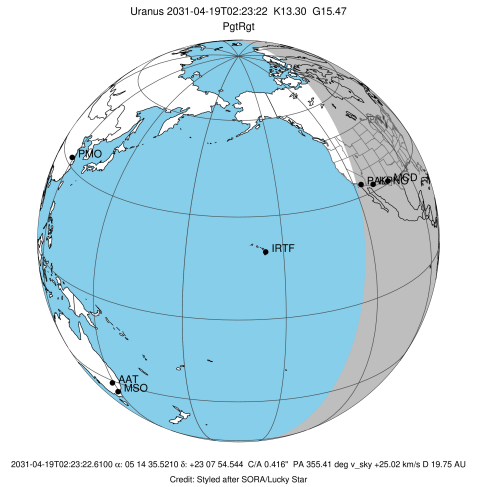
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-04-19T02:26:05.640  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 3415554192182895104  
 2Mass ID (if available) : 05143551+2307544  
 ICRS Star Coord at Epoch: 05h 14m 35.52103s +23:07:54.54431s  
 RUWE (>1.4 is poor) : 0.99  
 K magnitude : 13.303  
 G magnitude : 15.466  
 RP magnitude : 14.735  
 BP magnitude : 16.045  
 DUPflag : 0  
 Distance (au) : 19.745  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 25.02  
 Sun-Target sep (deg) : 51.15  
 Sun-Moon sep (deg) : 83.47  
 B (ring opening deg) : 81.94  
 PA of pole (deg) : 9.25  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.317  
 C/A sky separation (km) : 4541.2  
 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\_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	2031-04-19T01:52:01.167		54.41	4.93x	50772.45	-24.61		
lambda	I	2031-04-19T01:52:31.479		54.31	4.83x	50026.71	-24.60		
delta	I	2031-04-19T01:53:41.662		54.06	4.58x	48300.35	-24.59		
gamma	I	2031-04-19T01:54:09.284		53.97	4.49x	47621.05	-24.59		
eta	I	2031-04-19T01:54:27.377		53.91	4.43x	47176.12	-24.59		
beta	I	2031-04-19T01:55:28.345		53.69	4.22x	45677.17	-24.58		
alpha	I	2031-04-19T01:56:06.313		53.56	4.09x	44743.75	-24.58		
4	I	2031-04-19T01:57:32.931		53.26	3.79x	42615.78	-24.57		
5	I	2031-04-19T01:57:46.086		53.21	3.75x	42291.99	-24.57		
6	I	2031-04-19T01:58:05.058		53.15	3.68x	41827.18	-24.56		
Uranus	I	2031-04-19T02:09:08.797		50.83	1.42x	25556.90		0.48	0.50
Uranus	E	2031-04-19T02:42:57.546		43.74	-5.42	25462.05		-3.25	-3.41
6	E	2031-04-19T02:54:02.815		41.42	-7.63	41856.04	24.65		
5	E	2031-04-19T02:54:16.538		41.37	-7.68	42191.50	24.65		
4	E	2031-04-19T02:54:30.065		41.32	-7.72	42525.95	24.65		
alpha	E	2031-04-19T02:55:57.819		41.02	-8.01	44689.17	24.67		
beta	E	2031-04-19T02:56:36.670		40.88	-8.14	45647.86	24.67		
eta	E	2031-04-19T02:57:38.601		40.67	-8.34	47176.12	24.68		
gamma	E	2031-04-19T02:57:57.036		40.60	-8.40	47631.20	24.69		
delta	E	2031-04-19T02:58:24.140		40.51	-8.49	48300.35	24.69		
lambda	E	2031-04-19T02:59:34.045		40.26	-8.72	50026.71	24.70		
epsilon	E	2031-04-19T03:00:35.576		40.05	-8.93	51546.83	24.71		

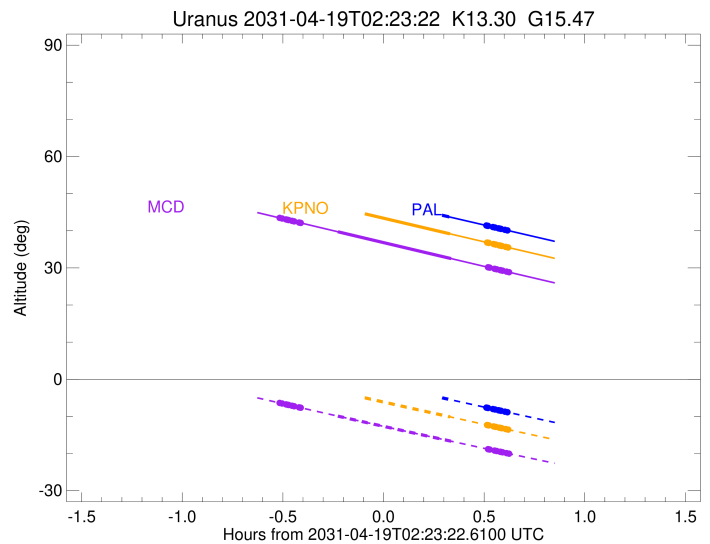
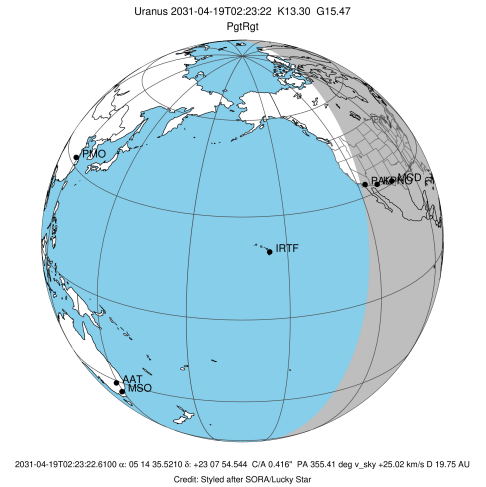
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-04-19T02:26:21.080
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       : 3415554192182895104
2Mass ID (if available) : 05143551+2307544
ICRS Star Coord at Epoch: 05h 14m 35.52103s +23:07:54.54431s
RUWE (>1.4 is poor) : 0.99
K magnitude          : 13.303
G magnitude          : 15.466
RP magnitude         : 14.735
BP magnitude         : 16.045
DUPflag             : 0
Distance (au)        : 19.745
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : 25.02
Sun-Target sep (deg) : 51.15
Sun-Moon sep (deg)   : 83.43
B (ring opening deg) : 81.94
PA of pole (deg)     : 9.25
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.318
C/A sky separation (km) : 4560.1
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_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	2031-04-19T01:52:18.412		50.01	0.24x	50772.59	-24.63		
lambda	I	2031-04-19T01:52:48.707		49.90	0.14x	50026.71	-24.62		
delta	I	2031-04-19T01:53:58.839		49.65	-0.10x	48300.35	-24.61		
gamma	I	2031-04-19T01:54:26.440		49.55	-0.20x	47621.05	-24.61		
eta	I	2031-04-19T01:54:44.520		49.49	-0.26x	47176.12	-24.61		
beta	I	2031-04-19T01:55:45.443		49.27	-0.47x	45677.19	-24.60		
alpha	I	2031-04-19T01:56:23.385		49.14	-0.60x	44743.73	-24.59		
4	I	2031-04-19T01:57:49.937		48.83	-0.90x	42615.77	-24.58		
5	I	2031-04-19T01:58:03.080		48.78	-0.94x	42292.05	-24.58		
6	I	2031-04-19T01:58:22.038		48.72	-1.01x	41827.22	-24.58		
Uranus	I	2031-04-19T02:09:25.286		46.36	-3.28x	25556.99		0.47	0.49
Uranus	E	2031-04-19T02:43:11.847		39.18	-10.12	25461.94		-3.26	-3.41
6	E	2031-04-19T02:54:16.478		36.83	-12.32	41856.04	24.67		
5	E	2031-04-19T02:54:30.186		36.78	-12.37	42191.50	24.68		
4	E	2031-04-19T02:54:43.699		36.74	-12.41	42525.95	24.67		
alpha	E	2031-04-19T02:56:11.364		36.43	-12.70	44689.17	24.69		
beta	E	2031-04-19T02:56:50.174		36.29	-12.83	45647.86	24.70		
eta	E	2031-04-19T02:57:52.040		36.07	-13.03	47176.12	24.71		
gamma	E	2031-04-19T02:58:10.457		36.01	-13.09	47631.20	24.71		
delta	E	2031-04-19T02:58:37.532		35.91	-13.18	48300.35	24.72		
lambda	E	2031-04-19T02:59:47.363		35.67	-13.41	50026.71	24.73		
epsilon	E	2031-04-19T03:00:48.828		35.45	-13.61	51546.82	24.74		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-04-19T02:26:39.940  
 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 : 3415554192182895104  
 2Mass ID (if available) : 05143551+2307544  
 ICRS Star Coord at Epoch: 05h 14m 35.52103s +23:07:54.54431s  
 RUWE (>1.4 is poor) : 0.99  
 K magnitude : 13.303  
 G magnitude : 15.466  
 RP magnitude : 14.735  
 BP magnitude : 16.045  
 DUPflag : 0  
 Distance (au) : 19.745  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 25.02  
 Sun-Target sep (deg) : 51.15  
 Sun-Moon sep (deg) : 83.35  
 B (ring opening deg) : 81.94  
 PA of pole (deg) : 9.25  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.313  
 C/A sky separation (km) : 4485.0  
 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	2031-04-19T01:52:40.130		43.41	-6.43	50772.46	-24.67		
lambda	I	2031-04-19T01:53:10.373		43.30	-6.53	50026.71	-24.66		
delta	I	2031-04-19T01:54:20.395		43.05	-6.77	48300.35	-24.65		
gamma	I	2031-04-19T01:54:47.953		42.95	-6.87	47621.05	-24.65		
eta	I	2031-04-19T01:55:06.004		42.89	-6.93	47176.12	-24.65		
beta	I	2031-04-19T01:56:06.830		42.67	-7.14	45677.17	-24.64		
alpha	I	2031-04-19T01:56:44.710		42.54	-7.27	44743.75	-24.63		
4	I	2031-04-19T01:58:11.122		42.23	-7.56	42615.78	-24.62		
5	I	2031-04-19T01:58:24.246		42.18	-7.61	42291.98	-24.63		
6	I	2031-04-19T01:58:43.173		42.11	-7.67	41827.18	-24.62		
Uranus	I	2031-04-19T02:09:45.215		39.74	-9.93	25556.83		0.49	0.51
Uranus	E	2031-04-19T02:43:29.615		32.52	-16.68	25463.52		-3.23	-3.38
6	E	2031-04-19T02:54:32.819		30.17	-18.83	41855.95	24.72		
5	E	2031-04-19T02:54:46.497		30.12	-18.88	42191.34	24.72		
4	E	2031-04-19T02:54:59.990		30.07	-18.92	42525.95	24.72		
alpha	E	2031-04-19T02:56:27.483		29.76	-19.20	44689.21	24.74		
beta	E	2031-04-19T02:57:06.214		29.63	-19.33	45647.82	24.75		
eta	E	2031-04-19T02:58:07.960		29.41	-19.52	47176.12	24.76		
gamma	E	2031-04-19T02:58:26.340		29.34	-19.58	47631.21	24.76		
delta	E	2031-04-19T02:58:53.362		29.25	-19.67	48300.35	24.77		
lambda	E	2031-04-19T03:00:03.057		29.00	-19.89	50026.71	24.78		
epsilon	E	2031-04-19T03:01:04.396		28.79	-20.09	51546.65	24.79		