

ROTATION PERIOD DETERMINATION FOR 827 WOLFIANA

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For previously unstudied 827 Wolfiana a rotation period of 4.0654 ± 0.0001 hours and amplitude 0.20 ± 0.03 magnitude have been found.

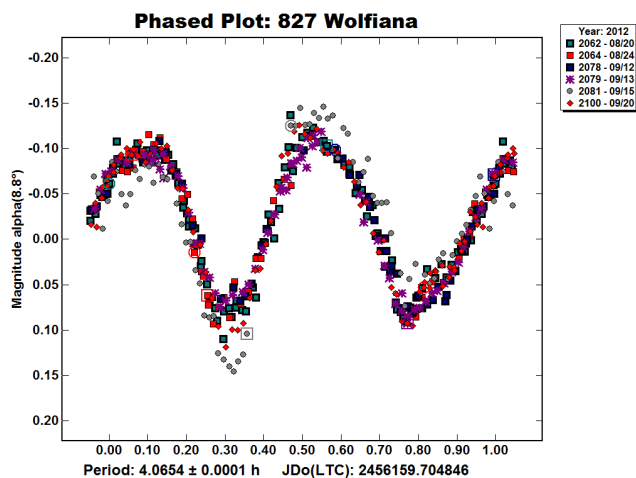
Minor planet 827 Wolfiana was selected for observation because Warner et al. (2012) show no previous photometric observations and because at its 2012 September opposition it was considerably brighter than at any time for the next several years. Observations by Pilcher were made at the Organ Mesa Observatory with a Meade 35 cm LX200 GPS S-C, SBIG STL-1001E CCD, unguided exposures. Martinez used a Celestron CPC 1100 28 cm Schmidt Cassegrain, SBIG ST8XME CCD, clear filter. Both observers used differential photometry only.

MPO Canopus software was used by both observers to measure the images photometrically, share data, adjust instrumental magnitudes up or down to produce the best fit, and prepare the lightcurve. Due to the large number of data points acquired the lightcurve has been binned in sets of three data points with a maximum of five minutes between points.

When data for 6 nights 2012 Aug. 20 - Sept. 20 were combined they produced a very well defined asymmetric bimodal lightcurve with period 4.0654 ± 0.0001 hours, amplitude 0.20 ± 0.03 magnitudes.

References

Warner, B. D., Harris, A. W., and Pravec, P. (2012) "Asteroid Lightcurve Data File, June 24, 2012."
<http://www.minorplanet.info/lightcurvedatabase.html>



MINOR PLANETS AT UNUSUALLY FAVORABLE ELONGATIONS IN 2013

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A list is presented of minor planets which are much brighter than usual at their 2013 apparitions.

The minor planets in the lists which follow will be much brighter at their 2013 apparitions than at their average distances at maximum elongation. Many years may pass before these planets will be again as bright as in 2013. Observers are encouraged to give special attention to those which lie near the limit of their equipment.

These lists have been prepared by an examination of the maximum elongation circumstances of minor planets computed by the author for all years through 2060 with a full perturbation program written by Dr. John Reed, and to whom he expresses his thanks. Elements are from EMP 1992, except that for all planets for which new or improved elements have been published subsequently in the Minor Planet Circulars or in electronic form, the newer elements have been used. Planetary positions are from the JPL DE-200 ephemeris, courtesy of Dr. E. Myles Standish.

Any planets whose brightest magnitudes near the time of maximum elongation vary by at least 2.0 in this interval and in 2013 will be within 0.3 of the brightest occurring, or vary by at least 3.0 and in 2013 will be within 0.5 of the brightest occurring; and which are visual magnitude 14.5 or brighter, are included. For planets brighter than visual magnitude 13.5, which are within the range of a large number of observers, these standards have been relaxed somewhat to include a larger number of planets. Magnitudes have been computed from the updated magnitude parameters published in MPC28104-28116, on 1996 Nov. 25, or more recently in the Minor Planet Circulars.

Oppositions may be in right ascension or in celestial longitude. Here we use still a third representation, maximum elongation from the Sun, instead of opposition. Though unconventional, it has the advantage that many close approaches do not involve actual opposition to the Sun near the time of minimum distance and greatest brightness and are missed by an opposition-based program. Other data are also provided according to the following tabular listings: Minor planet number, date of maximum elongation from the Sun in format yyyy/mm/dd, maximum elongation in degrees, right ascension on date of maximum elongation, declination on date of maximum elongation, both in J2000 coordinates, date of brightest magnitude in format yyyy/mm/dd, brightest magnitude, date of minimum distance in format yyyy/mm/dd, and minimum distance in AU.

Users should note that when the maximum elongation is about 177° or greater, the brightest magnitude is sharply peaked due to enhanced brightening near zero phase angle. Even as near as 10 days before or after minimum magnitude the magnitude is generally about 0.4 greater. This effect takes place in greater time interval for smaller maximum elongations. There is some interest in very small minimum phase angles. For maximum elongations E

near 180° at Earth distance Δ , an approximate formula for the minimum phase angle ϕ is $\phi = (180^\circ - E)/(\Delta + 1)$.

The year 2013 will be a banner year for close approaches. Ten numbered asteroids can be predicted become brighter than magnitude 14.5 during close approaches. These are provided in a separate Table III at the end of this paper.

Table I. Numerical Sequence of Favorable Elongations

Planet	Max	Elon	D	Max	E	RA	Dec	Br	Mag	D	Br	Mag	Min	Dist	D	Min	Dist
9	2013/01/01	174.4°	6h51m	+28°	2013/01/01	8.5	2012/12/30	1.136									
14	2013/03/19	163.2°	12h25m	+15°	2013/03/20	9.0	2013/03/21	1.185									
25	2013/05/13	164.6°	15h48m	-4°	2013/05/16	10.0	2013/05/25	1.042									
47	2013/07/26	172.8°	20h32m	-26°	2013/07/27	11.0	2013/07/27	1.494									
76	2013/11/23	178.1°	3h56m	+18°	2013/11/23	11.8	2013/11/25	1.947									
86	2013/10/10	172.4°	1h13m	-0°	2013/10/10	11.7	2013/10/11	1.489									
89	2013/09/23	156.4°	23h29m	+22°	2013/09/22	9.1	2013/09/21	1.128									
93	2013/08/07	168.9°	21h24m	-26°	2013/08/07	10.8	2013/08/03	1.417									
128	2013/10/05	170.4°	0h58m	-4°	2013/10/05	10.5	2013/10/04	1.418									
137	2013/09/26	172.8°	0h 0m	+7°	2013/09/26	11.5	2013/09/19	1.626									
156	2013/05/09	175.6°	14h57m	-21°	2013/05/09	10.7	2013/05/08	1.106									
157	2013/01/14	161.6°	8h 8m	+38°	2013/01/14	13.0	2013/01/13	1.122									
166	2013/11/19	159.0°	3h52m	-1°	2013/11/17	12.6	2013/11/14	1.196									
176	2013/10/05	173.8°	0h30m	+9°	2013/10/05	11.4	2013/10/05	1.679									
204	2013/04/13	179.5°	13h25m	-9°	2013/04/13	11.5	2013/04/20	1.358									
211	2013/01/01	178.1°	6h48m	+21°	2013/01/01	11.1	2012/12/30	1.595									
216	2013/11/15	172.1°	3h35m	+11°	2013/11/15	9.5	2013/11/11	1.136									
225	2013/06/11	149.5°	17h36m	+7°	2013/06/16	12.6	2013/06/19	1.677									
324	2013/09/12	170.3°	23h12m	+5°	2013/09/13	8.2	2013/09/17	0.810									
330	2013/08/28	175.9°	22h33m	-13°	2013/08/28	14.5	2013/09/06	1.044									
350	2013/12/07	168.6°	4h56m	+11°	2013/12/07	11.9	2013/12/06	1.646									
351	2013/02/11	169.1°	9h56m	+24°	2013/02/10	11.9	2013/02/10	1.375									
358	2013/10/25	176.2°	2h 5m	+8°	2013/10/25	12.2	2013/10/27	1.503									
378	2013/10/18	174.4°	1h22m	+14°	2013/10/18	12.8	2013/10/17	1.431									
387	2013/07/12	168.0°	19h12m	-10°	2013/07/12	9.7	2013/07/12	1.086									
394	2013/09/09	168.5°	23h30m	-15°	2013/09/09	12.0	2013/09/06	1.143									
417	2013/04/12	179.4°	13h24m	-8°	2013/04/12	12.1	2013/04/12	1.429									
418	2013/09/21	168.6°	23h32m	+9°	2013/09/21	12.6	2013/09/22	1.305									
435	2013/09/13	178.1°	23h28m	-5°	2013/09/13	12.1	2013/09/13	1.068									
445	2013/11/06	148.5°	1h46m	+44°	2013/11/03	13.3	2013/11/01	1.738									
455	2013/07/12	166.9°	19h40m	-34°	2013/07/14	11.1	2013/07/23	1.082									
470	2013/05/10	168.8°	15h21m	-6°	2013/05/10	12.6	2013/05/10	1.181									
479	2013/09/27	168.2°	0h37m	-8°	2013/09/28	12.2	2013/10/02	1.236									
488	2013/01/16	170.2°	8h 4m	+30°	2013/01/17	11.6	2013/01/20	1.766									
505	2013/12/04	173.6°	4h42m	+15°	2013/12/04	10.6	2013/12/03	1.042									
510	2013/08/12	163.9°	21h 5m	+0°	2013/08/11	12.2	2013/08/07	1.146									
511	2013/12/01	163.7°	4h37m	+5°	2013/12/02	9.8	2013/12/03	1.629									
539	2013/09/17	167.6°	23h22m	+9°	2013/09/18	12.2	2013/09/19	1.187									
542	2013/09/17	172.4°	23h54m	-8°	2013/09/17	12.6	2013/09/17	1.513									
543	2013/01/12	179.3°	7h38m	+22°	2013/01/12	13.0	2013/01/08	1.831									
560	2013/12/13	174.0°	5h24m	+17°	2013/12/13	13.4	2013/12/16	1.361									
572	2013/10/27	172.9°	2h19m	+6°	2013/10/27	12.9	2013/10/25	1.037									
576	2013/07/12	177.0°	19h28m	-24°	2013/07/12	12.4	2013/07/16	1.461									
599	2013/09/26	156.9°	0h35m	-21°	2013/09/23	11.0	2013/09/19	1.030									
686	2013/06/30	161.3°	18h42m	-4°	2013/07/03	12.0	2013/07/10	1.052									
709	2013/09/14	167.4°	23h12m	+8°	2013/09/14	12.5	2013/09/12	1.600									
722	2013/07/20	168.2°	20h 8m	-32°	2013/07/20	13.6	2013/07/20	0.851									
736	2013/09/11	174.8°	23h27m	-9°	2013/09/11	12.9	2013/09/08	0.839									
758	2013/01/09	179.5°	7h23m	+12°	2013/01/09	11.8	2013/01/05	1.841									
776	2013/12/22	174.0°	6h 7m	+29°	2013/12/22	11.1	2013/12/17	1.685									
784	2013/05/20	164.7°	15h38m	-35°	2013/05/21	12.0	2013/05/23	1.368									
788	2013/03/05	174.9°	10h55m	+1°	2013/03/05	12.2	2013/03/10	1.899									
839	2013/09/01	179.7°	22h41m	-7°	2013/09/01	12.4	2013/08/29	1.225									
899	2013/12/07	179.0°	4h54m	+21°	2013/12/06	13.1	2013/11/30	1.519									
937	2013/05/29	179.4°	16h25m	-21°	2013/05/29	13.3	2013/06/09	0.935									
941	2013/11/05	178.1°	2h45m	+14°	2013/11/05	14.0	2013/11/02	1.268									
955	2013/09/13	179.7°	23h25m	+4°	2013/09/13	13.3	2013/08/31	1.199									
989	2013/10/20	162.3°	1h 4m	+25°	2013/10/21	14.1	2013/10/24	1.058									
994	2013/09/30	177.4°	0h24m	+5°	2013/09/30	12.7	2013/09/27	1.256									
1011	2013/01/27	178.5°	8h36m	+17°	2013/01/27	12.6	2013/01/27	0.569									
1035	2013/09/24	179.7°	0h 6m	+0°	2013/09/24	13.5	2013/09/19	1.606									
1040	2013/01/12	173.9°	7h35m	+15°	2013/01/12	13.7	2013/01/09	1.603									
1058	2013/08/05	171.5°	20h52m	-8°	2013/08/05	13.1	2013/08/05	0.775									
1065	2013/08/06	173.7°	21h 9m	-22°	2013/08/06	13.7	2013/08/08	0.652									
1074	2013/10/31	179.7°	2h23m	+12°	2013/10/31	13.2	2013/11/02	1.637									
1099	2013/11/06	172.6°	2h39m	+23°	2013/11/05	13.4	2013/10/30	1.437									
1125	2013/11/22	177.0°	3h52m	+17°	2013/11/22	14.5	2013/11/27	1.611									
1133	2013/08/28	168.0°	22h48m	-20°	2013/08/29	13.6	2013/09/02	0.812									
1241	2013/08/15	179.3°	21h41m	-13°	2013/08/15	13.2	2013/08/13	1.906									
1270	2013/09/10	167.1°	23h36m	-16°	2013/09/10	13.7	2013/09/10	0.779									
1277	2013/05/23	178.9°	16h 0m	-21°	2013/05/23	13.3	2013/06/01	1.194									
1326	2013/12/01	163.7°	4h32m	+5°	2013/11/29	13.6	2013/11/24	1.227									
1354	2013/05/23	174.5°	15h54m	-25°	2013/05/23	14.5	2013/05/28	1.527									
1358	2013/08/20	176.6°	22h 2m	-15°	2013/08/20	14.1	2013/08/16	1.067									
1387	2013/08/30	170.8°	22h19m	-0°	2013/08/30	14.1	2013/08/27	0.786									
1496	2013/07/09	179.2°	19h13m	-23°	2013/07/09	13.9	2013/07/10	0.833									
1510	2013/02/05	174.5°	9h22m	+21°	2013/02/05	13.8	2013/02/06	1.295									
1539	2013/12/04	177.4°	4h43m	+19°	2013/12/04	14.0	2013/11/29	1.666									
1590	2013/07/28	170.9°	20h23m	-10°	2013/07/28	13.3	2013/07/24	0.894									
1610	2013/09/29	179.2°	0h24m	+3°	2013/09/29	13.9	2013/09/30	0.767									

Planet	Max	Elon	D	Max	E	RA	Dec	Br	Mag	D	Br	Mag	Min	Dist	D	Min	Dist
1626	2013/12/08	150.8°	3h50m	+48°	2013/12/08	12.0	2013/12/07	0.787									
1627	2013/10/15	156.4°	1h48m	-14°	2013/07/07	12.5	2013/07/06	0.322									
1638	2013/08/23	179.5°	22h 7m	-11°	2013/08/23	14.0	2013/08/16	1.310									
1653	2013/10/07	171.4°	0h39m	+13°	2013/10/08	12.6	2013/10/11	0.798									
1668	2013/08/27	179.0°	22h23m	- 8°	2013/08/27	14.5	2013/08/29	1.214									
1683	2013/08/21	179.2°	22h 2m	-11°	2013/08/21	13.9	2013/08/18	1.247									
1709	2013/08/09	175.3°	21h11m	-11°	2013/08/09	14.2	2013/08/13	0.890									
1719	2013/10/08	158.3°	0h25m	+26°	2013/10/08	13.8	2013/10/07	1.113									
1727	2013/01/17	172.1°	7h26m	+ 4°	2013/01/17	13.8	2013/01/15	0.719									
1761	2013/01/03	178.1°	6h59m	+24°	2013/01/03	14.4	2013/01/07	1.487									
1792	2013/12/11	178.1°	5h13m	+24°	2013/12/11	14.1	2013/12/03	1.134									
1874	2013/08/24	178.1°	22h11m	- 9°	2013/08/24	13.4	2013/08/28	1.271									
1886	2013/07/11	166.8°	19h41m	-34°	2013/07/12	14.5	2013/07/12	1.212									
1902	2013/08/24	161.6°	22h42m	-28°	2013/08/24	14.0	2013/08/23	2.109									
1909	2013/05/20	179.0°	15h52m	-19°	2013/05/20	14.1	2013/05/20	0.866									
1994	2013/06/18	173.2°	17h48m	-16°	2013/06/18	14.4	2013/06/26	1.346									
2036	2013/07/18	173.1°	19h55m	-27°	2013/07/18	13.9	2013/07/17	0.814									
2121	2013/07/22	175.6°	20h 3m	-15°	2013/07/22	13.9	2013/07/23	0.780									
2212	2013/10/26	109.8°	21h54m	-22°	2013/10/05	14.1	2013/09/28	0.300									
2213	2013/07/29	179.5°	20h36m	-18°	2013/07/29	14.5	2013/08/07	0.764									
2231	2013/09/12	178.0°	23h18m	- 2°	2013/09/12	14.3	2013/09/14	1.063									
2409	2013/09/08	176.7°	23h14m	- 8°	2013/09/08	14.3	2013/09/07	0.829									
2505	2013/06/20	178.1°	17h53m	-25°	2013/06/20	14.5	2013/06/20	1.582									
2543	2013/07/09	155.7°	19h38m	-46°	2013/07/13	14.1	2013/07/17	1.340									
2546	2013/04/13	161.8°	13h 1m	-26°	2013/04/13	14.5	2013/04/12	1.137									
2568	2013/06/09	177.1°	17h10m	-20°	2013/06/09	14.1	2013/06/14	0.796									
2672	2013/07/10	170.3°	19h 9m	-12°	2013/07/10	14.2	2013/07/09	1.213									
2728	2013/06/07	175.9°	17h 3m	-18°	2013/06/07	14.5	2013/06/13	1.104									
2771	2013/10/03	171.1°	0h19m	+10°	2013/10/02	14.4	2013/09/25	1.186									
2829	2013/07/27	171.3°	20h30m	-27°	2013/07/27	13.5	2013/07/26	1.489									
2830	2013/04/25	164.1°	14h16m	+ 2°	2013/04/24	14.5	2013/04/23	0.926									
2831	2013/09/18	170.4°	23h58m	-10°	2013/09/18	13.8	2013/09/17	0.788									
2880	2013/05/08	178.1°	23h58m	-18°	2013/05/08	14.1	2013/05/16	0.951									
3106	2013/12/12	163.3°	5h17m	+ 6°	2013/12/11	14.1	2013/12/08	1.489									
3169	2013/12/27	178.9°	6h22m	+22°	2013/12/17	13.6	2013/12/28	0.800									
3224	2013/05/31	177.1°	16h36m	-19°	2013/05/31	14.1	2013/05/30	1.319									
3267	2013/01/14	175.7°	7h53m	+25°	2013/01/13	14.3	2013/01/04	0.836									
3284	2013/10/02	166.5°	0h53m	- 8°	2013/09/29	14.2	2013/09/18	0.792									
3300	2013/09/01	157.0°	23h15m	-29°	2013/08/30	14.2	2013/08/26	1.682									
3444	2013/12/13	166.8°	5h15m	+36°	2013/12/12	14.1	2013/12/09	0.920									
3581	2013/06/26	121.3°	19h33m	+32°	2013/08/14	14.4	2013/08/14	0.915									
3632	2013/11/04	175.4°	2h44m	+11°	2013/11/04	14.4	2013/11/12	0.999									
3702	2013/11/23	154.8°	4h 6m	- 4°	2013/11/19	14.3	2013/11/14	1.172									
3737	2013/11/26	137.1°	1h34m	+51°	2013/11/07	14.2	2013/10/28	0.645									
3738	2013/05/20	170.7°	15h47m	-22°	2013/05/20	13.9	2013/05/25	0.863									
3739	2013/07/18	179.4°	19h49m	-21°	2013/07/18	14.5	2013/07/16	0.858									
3744	2013/12/15	175.6°	5h34m	+18°	2013/12/15	14.4	2013/12/09	0.968									
3752	2013/02/15	127.0°	13h34m	+29°	2013/02/13	13.3	2013/02/12	0.148									
3768	2013/08/25	178.1°	22h20m	-12°	2013/08/25	14.4	2013/08/29	1.517									
3855	2013/09/16	165.5°	0h 2m	-15°	2013/09/15	14.4	2013/09/12	0.787									
3935	2013/01/03	175.0°	6h56m	+27°	2013/01/02	14.3	2012/12/26	1.145									
4511	2013/09/16	172.7°	23h38m	- 9°	2013/09/15	13.8	2013/09/06	0.914									
4729	2013/09/01	175.1°	22h33m	- 3°	2013/09/01	14.4	2013/09/06	0.893									
4905	2013/10/17	177.5°	1h35m	+ 7°	2013/10/17	14.3	2013/10/15	1.174									
4925	2013/11/29	179.1°	4h21m	+20°	2013/11/29	14.4	2013/11/22	1.445									
5118	2013/07/25	161.6°	20h 6m	- 1°	2013/07/25	14.3	2013/07/26	1.061									
5153	2013/01/21	168.0°	8h30m	+31°	2013/01/21	14.3	2013/01/22	1.232									
5247	2013/05/06	175.3°	15h 4m	-12°	2013/05/06	14.2	2013/05/10	0.981									
5452	2013/05/09	166.4°	14h46m	-30°	2013/05/11	14.3	2013/05/16	0.753									
5468	2013/04/07	160.8°	13h37m	+10°	2013/04/08	14.5	2013/04/09	1.266									
5622	2013/08/02	172.3°	20h41m	-10°	2013/08/02	14.1	2013/08/03	1.330									
5647	2013/12/16	156.3°	6h 5m	+ 0°	2013/12/18	13.8	2013/12/20	0.846									
5764	2013/06/24	169.0°	0h11m	-12°	2013/06/23	14.5	2013/06/20	0.802									
5847	2013/08/22	168.8°	21h55m	- 0°	2013/08/25	14.4	2013/09/02	0.006									
5851	2013/09/10	176.5°	23h17m	- 6°	2013/09/10	14.5	2013/09/03	1.274									
5913	2013/09/04	172.8°	22h43m	- 0°	2013/09/04	14.2	2013/09/04	1.114									
6063	2013/10/25	149.7°	4h 4m	+ 2°	2013/11/08	12.3	2013/11/11	0.079									
6246	2013/11/24	167.3°	4h 3m	+31°	2013/11/25	14.4	2013/11/29	0.808									
6406	2013/09/06	174.6°	23h 8m	-11°	2013/09/06	13.9	2013/09/06	0.869									
7262	2013/08/05	174.8°	21h10m	-21°	2013/08/04	13.6	2013/07/29	0.686									
7536	2013/07/26	179.5°	20h25m	-19°	2013/07/26	14.5	2013/07/25	1.396									
7731	2013/12/06	174.1°	4h51m	+28°	2013/12/06	14.4	2013/12/02	1.000									
7888	2013/05/14	115.6°	14h12m	+23°	2013/03/28	14.4	2013/03/20	0.126									
8400	2013/08/06	176.7°	21h12m	-49°	2013/08/07	14.4	2013/08/13	1.301									
12832	2013/10/03	179.9°	0h37m	+ 4°	2013/10/03	14.4	2013/10/03	0.776									
14309	2013/10/03	175.8°	0h44m	+ 0°	2013/10/01	14.5	2013/09/05	0.613									
14339	2013/07/13	177.4°	19h27m	-19°	2013/07/13	13.9	2013/07/13	1.126									
17188	2013/06/24	153.8°	19h12m	- 1°	2013/06/16	13.7	2013/06/12	0.101									
24367	2013/08/16	178.5°	21h44m	-15°	2013/08/15	14.5	2013/08/11	0.825									
26859	2013/10/18	167.7°	2h39m	+ 3°	2013/10/30	13.8	2013/11/09	0.716									
52762	2013/01/16	127.2°	11h23m	+ 6°	2013/01/27	13.6	2013/01/31	0.207									
105158	2013/08/20	146.2°	21h59m	+ 1°	2013/08/12	13.8	2013/07/26	0.439									
137126	2013/09/09	168.3°	21h13m	-18°	2013/08/26	14.4	2013/08/23	0.064									
138095	2013/11/09	110.9°	13h44m	-34°	2013/11/10	13.6	2013/11/10	0.126									
163364	2013/06/09	159.1°	15h39m	-22°	2013/05/27	13.9	2013/05/23	0.039									

Table II. Temporal Sequence of Favorable Elongations

Planet	Max	Elon	D	Max	E	RA	Dec	Br	Mag	D	Br	Mag	Min	Dist	D	Min	Dist
9	2013/01/01	174.4°	6h51m	+28°	2013/01/01	8.5	2012/12/30	1.136									
211	2013/01/01	178.1°	6h48m	+21°	2013/01/01	11.1	2012/12/30	1.595									
1761	2013/01/03	178.1°	6h59m	+24°	2013/01/03	14.4	2013/01/07	1.487									
3935	2013/01/03	175.0°	6h56m	+27°	2013/01/02	14.3	2012/12/26	1.445									
758	2013/01/09	179.5°	7h23m	+22°	2013/01/09	11.8	2013/01/05	1.841									
543	2013/01/12	179.3°	7h38m	+22°	2013/01/12	13.0	2013/01/08	1.831									
1040	2013/01/12	173.9°	7h35m	+15°	2013/01/12	13.7	2013/01/09	1.603									
157	2013/01/14	161.6°	8h 8m	+38°	2013/01/14	13.0	2013/01/13	1.122									
3267	2013/01/14	175.7°	7h53m	+25°	2013/01/13	14.3	2013/01/04	0.836									
488	2013/01/16	170.2°	8h 4m	+30°	2013/01/17	11.6	2013/01/20	1.766									
52762	2013/01/16	127.2°	11h23m	+ 6°	2013/01/27	13.6	2013/01/31	0.207									
1727	2013/01/17	162.1°	7h26m	+ 4°	2013/01/17	13.8	2013/01/15	0.719									
5153	2013/01/21	168.0°	8h30m	+31°	2013/01/21	14.3	2013/01/21	1.232									
1011	2013/01/27	178.5°	8h36m	+17°	2013/01/27	12.6	2013/01/27	0.569									
1510	2013/02/05	174.5°	9h22m	+21°	2013/02/05	13.8	2013/02/06	1.295									
351	2013/02/11	169.1°	9h56m	+24°	2013/02/10	11.9	2013/02/10	1.375									
3752	2013/02/15	127.0°	13h34m	+29°	2013/02/13	13.3	2013/02/12	0.148									
798	2013/03/05	174.9°	10h55m	+ 1°	2013/03/05	12.2	2013/03/10	1.899									
14	2013/03/19	163.2°	12h25m	+15°	2013/03/20	9.0	2013/03/21	1.185									
5468	2013/04/07	160.8°	13h37m	+10°	2013/04/08	14.5	2013/04/09	1.266									
417	2013/04/12	179.4°	13h24m	- 8°	2013/04/12	12.1	2013/04/12	1.429									
204	2013/04/13	179.5°	13h25m	- 9°	2013/04/13	11.5	2013/04/20	1.358									
2546	2013/04/13	161.8°	13h 1m	-26°	2013/04/13	14.5	2013/04/12	1.137									
2830	2013/04/25	164.1°	14h16m	+ 3°	2013/04/24	14.5	2013/04/23	0.926									
5247	2013/05/06	175.3°	15h 4m	-12°	2013/05/06	14.2	2013/05/10	0.981									
2880	2013/05/08	178.3°	14h59m	-18°	2013/05/08	14.1	2013/05/16	0.951									
156	2013/05/09	175.6°	14h57m	-21°	2013/05/09	10.7	2013/05/08	1.106									
5452	2013/05/09	166.4°	14h46m	-30°	2013/05/11	14.3	2013/05/16	0.753									
470	2013/05/10	168.8°	15h21m	- 6°	2013/05/10	12.6	2013/05/10	1.181									
25	2013/05/13	164.6°	15h48m	- 4°	2013/05/16	10.0	2013/05/25	1.042									
7888	2013/05/14	115.6°	14h12m	+43°	2013/03/28	14.4	2013/03/20	0.126									
784	2013/05/20	164.7°	15h39m	-35°	2013/05/21	12.0	2013/05/23	1.368									
1909	2013/05/20	179.0°	15h52m	-19°	2013/05/20	14.1	2013/05/20	0.866									
3738	2013/05/20	177.6°	15h47m	-22°	2013/05/20	13.9	2013/05/25	0.863									
1277	2013/05/23	178.9°	16h 0m	-21°	2013/05/23	13.3	2013/06/01	1.194									
1354	2013/05/23	174.5°	15h54m	-25°	2013/05/23	14.5	2013/05/28	1.527									
937	2013/05/29	179.4°	16h25m	-21°	2013/05/29	13.3	2013/06/09	0.935									
3224	2013/05/31	177.1°	16h36m	-19°	2013/05/31	14.1	2013/05/30	1.319									
2728	2013/06/07	175.9°	17h 3m	-18°	2013/06/07	14.5	2013/06/13	1.104									
2568	2013/06/09	177.1°	17h10m	-20°	2013/06/09	14.1	2013/06/14	0.796									
163364	2013/06/09	159.1°	15h39m	-22°	2013/05/27	13.9	2013/05/23	0.039									
225	2013/06/11	149.5°	17h36m	+ 7°	2013/06/16	12.6	2013/06/19	1.677									
1994	2013/06/18	173.2°	17h48m	-16°	2013/06/18	14.4	2013/06/26	1.346									
2505	2013/06/20	178.2°	17h53m	-25°	2013/06/20	14.5	2013/06/20	1.582									
5764	2013/06/24	169.0°	18h11m	-12°	2013/06/23	14.5	2013/06/20	0.802									
17188	2013/06/24	153.8°	19h12m	- 1°	2013/06/16	13.7	2013/06/12	0.101									
3581	2013/06/26	121.3°	19h33m	+32°	2013/08/14	14.4	2013/08/14	0.915									
686	2013/06/30	161.3°	19h42m	- 4°	2013/07/03	12.0	2013/07/10	1.052									
14496	2013/07/09	179.2°	19h13m	-23°	2013/07/09	13.9	2013/07/10	0.833									
2543	2013/07/09	155.7°	19h38m	-46°	2013/07/13	14.1	2013/07/17	1.340									
2672	2013/07/10	170.3°	19h 9m	-12°	2013/07/10	14.2	2013/07/09	1.213									
1886	2013/07/11	166.8°	19h41m	-34°	2013/07/12	14.5	2013/07/12	1.212									
387	2013/07/12	168.0°	19h12m	-10°	2013/07/12	9.7	2013/07/12	1.086									
455	2013/07/12	166.9°	19h40m	-34°	2013/07/14	11.1	2013/07/23	1.082									
576	2013/07/12	177.0°	19h28m	-24°	2013/07/12	12.4	2013/07/16	1.461									
14339	2013/07/13	177.4°	19h27m	-19°	2013/07/13	13.9	2013/07/13	1.126									
2036	2013/07/18	173.1°	19h55m	-27°	2013/07/18	13.9	2013/07/17	0.814									
3739	2013/07/18	179.4°	19h49m	-21°	2013/07/18	14.5	2013/07/16	0.858									
722	2013/07/20	168.2°	20h 8m	-32°	2013/07/20	13.6	2013/07/20	0.851									
2121	2013/07/22	175.6°	20h 3m	-15°	2013/07/22	13.3	2013/07/23	0.780									
5118	2013/07/25	161.6°	20h 6m	- 1°	2013/07/25	14.3	2013/07/26	1.061									
47	2013/07/26	172.8°	20h32m	-26°	2013/07/27	11.0	2013/07/27	1.494									
7536	2013/07/26	178.5°	20h35m	-19°	2013/07/26	14.5	2013/07/25	1.396									
2829	2013/07/27	171.2°	20h30m	-27°	2013/07/27	13.5	2013/07/26	1.489									
1590	2013/07/28	170.9°	20h23m	-10°	2013/07/28	13.3	2013/07/24	0.894									
2213	2013/07/29	179.5°	20h36m	-18°	2013/07/29	14.5	2013/08/07	0.764									
5622	2013/08/02	172.3°	20h41m	-10°	2013/08/02	14.1	2013/08/03	1.330									
1058	2013/08/05	171.5°	20h52m	- 8°	2013/08/05	13.1	2013/08/05	0.775									
7262	2013/08/05	174.8°	21h10m	-21°	2013/08/04	13.6	2013/07/29	0.686									
1065	2013/08/06	173.7°	21h 9m	-22°	2013/08/06	13.7	2013/08/08	0.652									
8400	2013/08/06	176.6°	21h12m	-19°	2013/08/07	14.4	2013/08/13	1.301									
93	2013/08/07	168.9°	21h24m	-26°	2013/08/07	10.8	2013/08/03	1.417									
1709	2013/08/09	175.3°	21h11m	-11°	2013/08/09	14.2	2013/08/13	0.890									
510	2013/08/12	163.9°	21h 5m	+ 0°	2013/08/11	12.2	2013/08/07	1.146									
1241	2013/08/15	179.3°	21h41m	-13°	2013/08/15	13.2	2013/08/13	1.906									
24367	2013/08/16	178.5°	21h44m	-15°	2013/08/15	14.5	2013/08/11	0.825									
1358	2013/08/20	176.6°	22h 2m	-15°	2013/08/20	14.1	2013/08/16	1.067									
105158	2013/08/20	166.2°	21h59m	+ 3°	2013/08/12	13.8	2013/07/26	0.439									
1683	2013/08/21	178.2°	22h 2m	-11°	2013/08/21	13.9	2013/08/18	1.247									
5847	2013/08/22	168.8°	21h55m	- 0°	2013/08/25	14.4	2013/09/02	0.906									
1638	2013/08/23	179.5°	22h 7m	-11°	2013/08/23	14.0	2013/08/16	1.310									
1874	2013/08/24	178.8°	22h11m	- 9°	2013/08/24	13.4	2013/08/28	1.271									
1902	2013/08/24	161.6°	22h42m	-28°	2013/08/24	14.0	2013/08/23	2.109									
3768	2013/08/25	178.1°	22h20m	-12°	2013/08/25	14.4	2013/08/29	1.517									
1668	2013/08/27	179.0°	22h23m	- 8°	2013/08/27	14.5	2013/08/29	1.214									