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LOWELL OBSERVATORY NEAR-EARTH ASTEROID PHOTOMETRIC SURVEY (NEAPS) – 2009 JANUARY THROUGH 2009 JUNE

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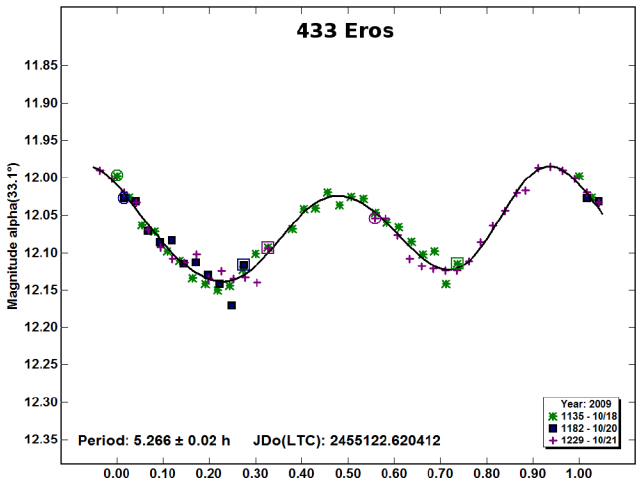
We report the results of the Lowell Observatory Near-Earth Asteroid Photometric Survey (NEAPS) for the period between 2009-01-01 and 2009-06-30. During this period, we obtained our first photometric data for 40 asteroids including 433 Eros, 1943 Anteros, 3554 Amun, 5011 Ptah, (5604) 1992 FE, 5620 Jasonwheeler, (5693) 1993 EA, (8566) 1996 EN, (14402) 1991 DB, (16834) 1997 WU22, (22753) 1998 WT, (35107) 1991 VH, (52768) 1998 OR2, (68350) 2001 MK3, (85867) 1999 BY9, (138883) 2000 YL29, (141052) 2001 XR1, (143651) 2003 QO104, (154244) 2002 KL6, 161989 Cacus, (162385) 2000 BM19, (163758) 2003 OS13, (175706) 1996 FG3, (194386) 2001 VG5, (203217) 2001 FX9, (207945) 1991 JW, (208023) 1999 AQ10, (212546) 2006 SV19, (256412) 2007 BT2, 2001 FE90, 2004 LV3, 2005 BC, 2005 SG19, 2008 QT3, 2008 WL60, 2009 DE47, 2009 DO111, 2009 EP2, 2009 FD, and 2009 JM2. We also report our analysis of 5261 Eureka, a Mars Trojan.

This is the second in a series of papers describing the results of Lowell Observatory's Near-Earth Asteroid Photometric Survey (NEAPS). In our first paper (Skiff 2012), we described our observing and data reduction techniques. We also described the 24-inch Schmidt telescope that was the workhorse of this survey.

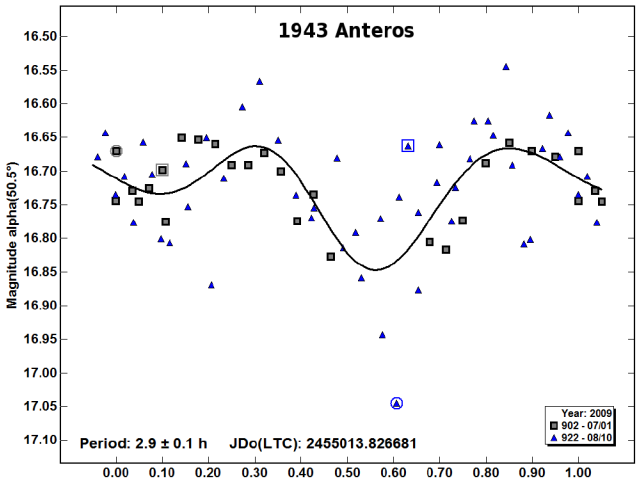
The following section describes the photometric results, including the rotational periods where possible, of all the asteroids we first

observed between 2009-01-01 and 2009-06-30 plus 5261 Eureka first observed in 2011. Many of the asteroids with periods also have period quality ratings denoted by the letter U. A full description of the meaning of U values is available (Warner 2009b). The values for the U codes were taken from the Lightcurve Database (Warner 2009c). All the reduced data for the asteroids in this paper can be found at the Minor Planet Center (MPC) web site (*http://www.minorplanetcenter.net/light_curve*).

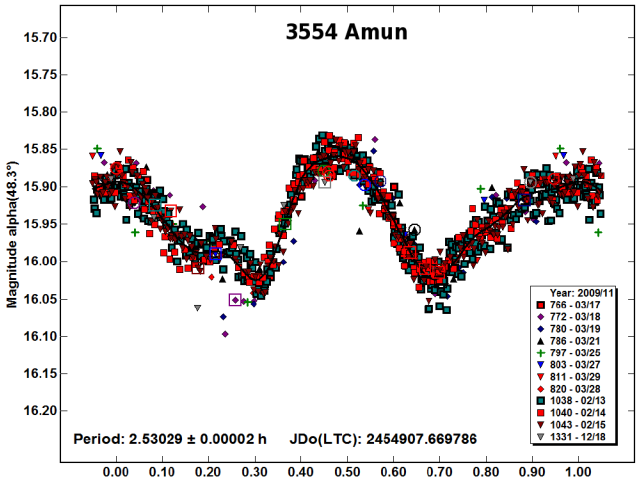
433 Eros. This well studied Amor asteroid has a published period of 5.270 h, U = 3, produced by Hicks (1999b) and supported by observations from a host of other astronomers, notably Behrend (2009) and Campa (1938). We observed this asteroid on 17 nights, with the LONEOS Schmidt, between 2009-06-18 and 2010-01-10 and obtained 265 usable observations. The observations from 2009-10-18 to 2009-10-21 provided the only useful data set and from that data set we obtained a period of 5.266 ± 0.02 h, generated with an order 4 fit. Other lunations were inconsistent or too sparse to be useful. The peak-to-peak amplitude is Δr' = 0.16 and the mean magnitude is r' = 12.06 (normalized to 2009-10-18). Other lunations suggest that the amplitude can be larger than Δr' = 0.50.



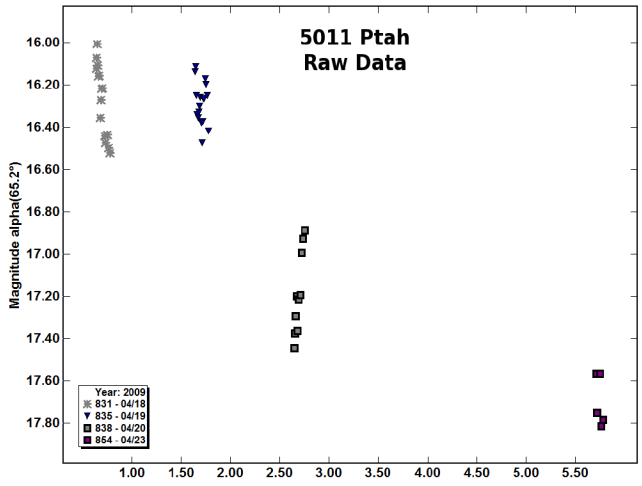
1943 Anteros. This Amor asteroid has a known period of 2.8695 h, U = 3 (Pravec 1998). We observed this asteroid on 5 nights between 2009-06-18 and 2009-08-10 using the LONEOS Schmidt and obtained 105 usable observations. None of the data produced a convincing lightcurve. The residuals from a third order fit using data from 2009-07-01 and 2009-08-10 (shown in the graph) were large and had a very broad minimum. The mean magnitude is r' = 16.76 and the amplitude is Δr' = 0.16. The period of 2.9 ± 0.1 h could not be duplicated using data from a single night nor from any other combinations of nights. The fact that our period matched Pravec's is probably accidental.



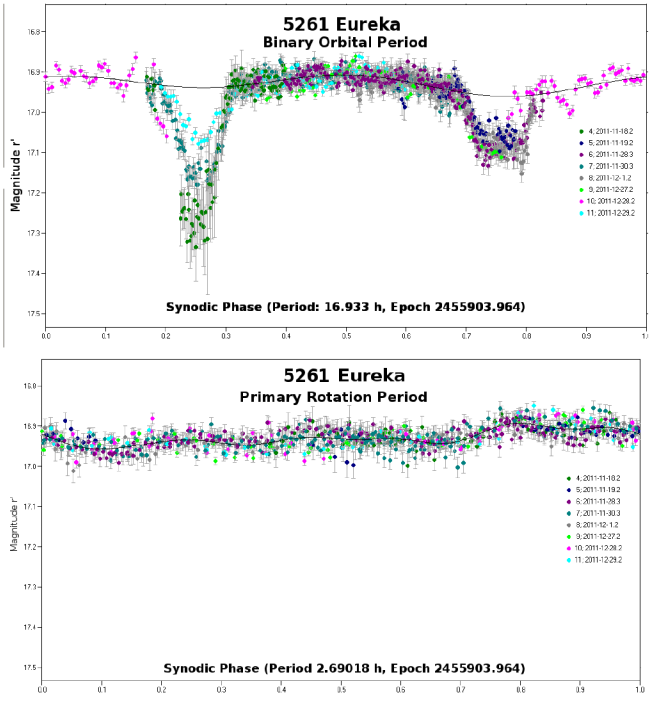
3554 Amun. This Aten asteroid has a published period of 2.53001, U = 3 (Behrend 2010; Wisniewski 1997). We observed this asteroid during three apparitions. During the first apparition we observed on 8 nights between 2009-03-17 and 2009-03-28 using the LONEOS Schmidt, and made 109 usable observations. We found a period of 2.530 ± 0.001 h with a mean magnitude r'=15.97 and an amplitude of Δr' = 0.22. Observations from the third apparition we obtained between 2011-02-13 and 2011-02-15 using the LONEOS Schmidt and the NURO telescope. We had three full nights and obtained 758 usable observations. In the third apparition, we found a period of 2.530 ± 0.002 h with a mean magnitude of r'=15.73 and an amplitude of Δr' = 0.13. We combined the two sets of observations to obtain a two year baseline for the period. Because we have a single night on the second apparition midway between the first and third (2009-12-18), we are reasonably sure that the two year baseline produces a valid period of 2.53029 ± 0.00002 h.



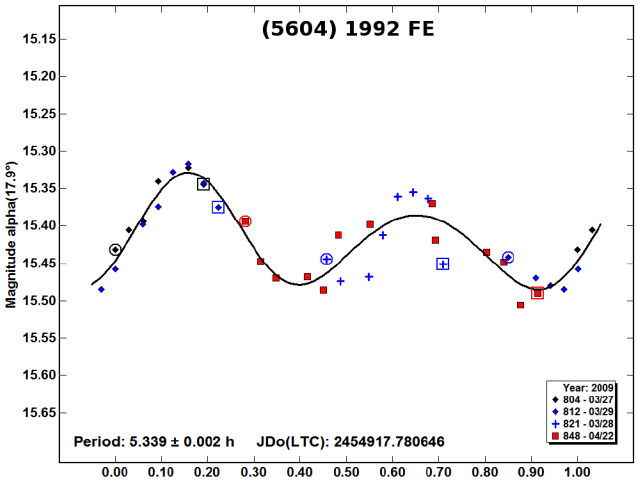
5011 Ptah. This Apollo and potentially hazardous asteroid (PHA) has no published period. We observed it on four nights from 2009-04-18 to 2009-04-23 using the LONEOS Schmidt and obtained 49 usable measurements. The nights of 2009-04-18 and 2009-04-20 show a monotonic change in magnitude of at least Δr' = 0.5. Our attempts to fit either of these single nights indicated that the period is at least 20 h. We could find no period consistent with all the data. Generalizing from our experience with large amplitude, hard to fit, slow rotators, it is possible that this asteroid is a tumbler. See the mean magnitudes and amplitudes in the tables at the end of this paper.



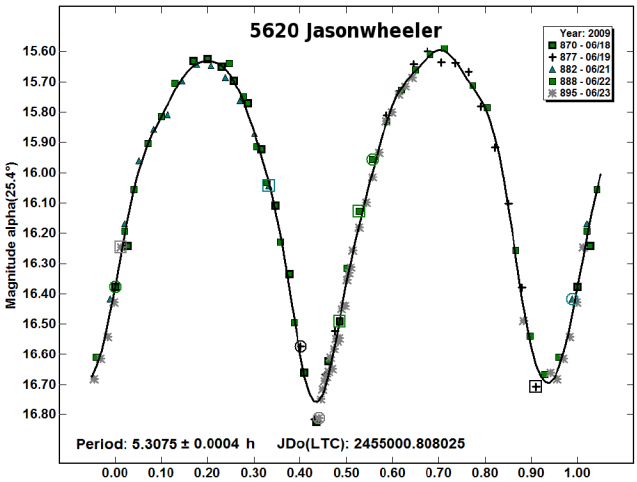
5261 Eureka. This Mars Trojan asteroid has a published period of 6 h, U = 1 but lack of data precluded any believable period analysis (Rivkin 2003). Bowell first noted Eureka was a Mars Trojan (Marsden 1990), and it received additional spectroscopic study by Rivkin (2003). We observed the asteroid on eight nights from 2011-11-28 to 2011-12-29 using the Lowell 0.7-m and 1.1-m reflectors and obtained 1302 usable measurement. The complex lightcurve was indicative of a binary, so we asked Petr Pravec to analyze the data. He found that the orbit period is 16.93 ± 0.01 h with minima approximately 0.2 and 0.15 mag deep. The nearly flat lightcurve of the primary has a period of 2.6902 ± 0.0003 h and amplitude 0.064 mag. The period uncertainties are dominated by the synodic-sidereal effect for both. The secondary-to-primary mean-diameter ratio has a lower limit of 0.39 ± 0.02.



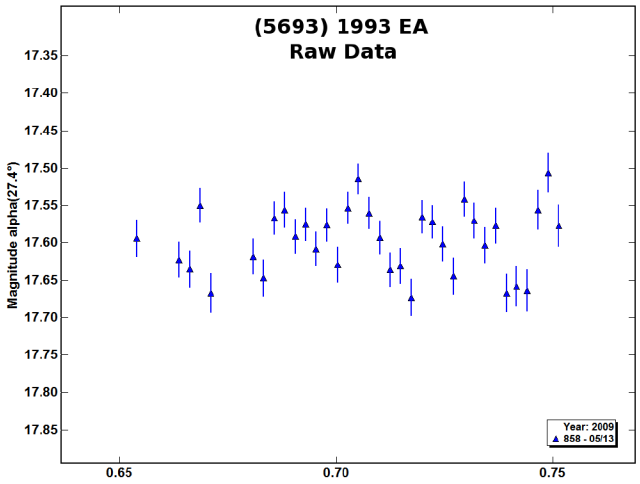
(5604) 1992 FE. This Aten (PHA) asteroid has a period of 5.3375 h, U = 3 (Higgins 2009). Another published period of 6.026 h, U = 2 was slightly longer (Bembrick 2003). We observed this asteroid on four nights between 2009-03-27 and 2009-04-22 using the LONEOS Schmidt and obtained 39 usable observations. The plot shown in this paper has been coerced to 5.339 ± 0.002 h in order to match Higgins' period. However, the small formal error is somewhat misleading. There were many periods between four and six hours that had essentially the same value for the residuals so we should more suggestively write the error as ±1 h. The night of 2009-04-22 was from the next lunation and required an offset of Δr' = 0.19 to fit the other nights. The mean magnitude, normalized to 2009-03-27 is r' =15.40 and the amplitude is Δr' = 0.15.



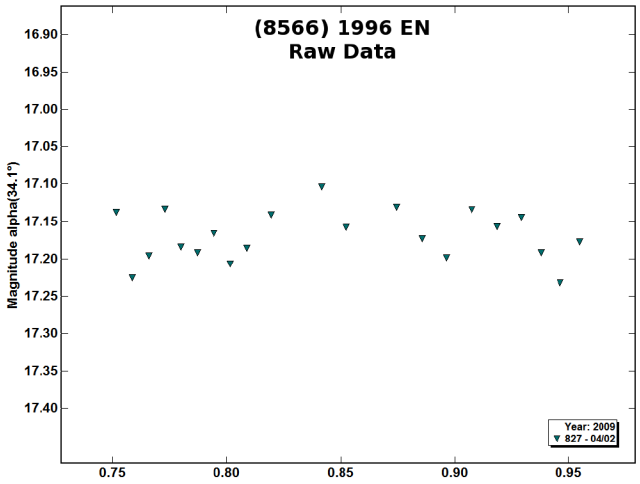
5620 Jasonwheeler. This Amor asteroid has a published period of 5.307 h, U = 3 (Durkee 2010). We observed this asteroid on 5 nights between 2009-06-18 and 2009-06-23 using the LONEOS Schmidt and obtained 102 usable observations. We found a period of 5.3075 ± 0.0004 h but, because we cover only 25 rotations, the formal error is optimistic and should probably be at least 0.005 h. The mean magnitude, normalized to 2009-06-09, is r'=16.20 with an amplitude of Δr' = 1.20.



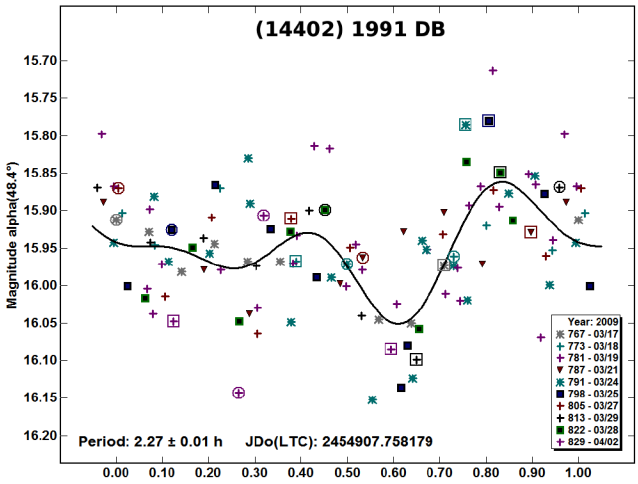
(5693) 1993 EA. This Apollo (PHA) asteroid has an uncertain published period of 2.497 h, U = 2 (Polishook 2012). We observed this asteroid on the single night of 2009-05-13 using the LONEOS Schmidt and obtained 35 usable measurements. From those, we found a mean magnitude of r'=17.57 with an amplitude, or more likely, scatter, of Δr' = 0.18. Although we tried to coerce the period to Polishook's value and tried very short periods, we could find none that were convincing. Because the magnitude of this asteroid was fainter than we like to use for the Schmidt, and because the amplitude is small, we cannot make any conjecture about the rotation of this asteroid.

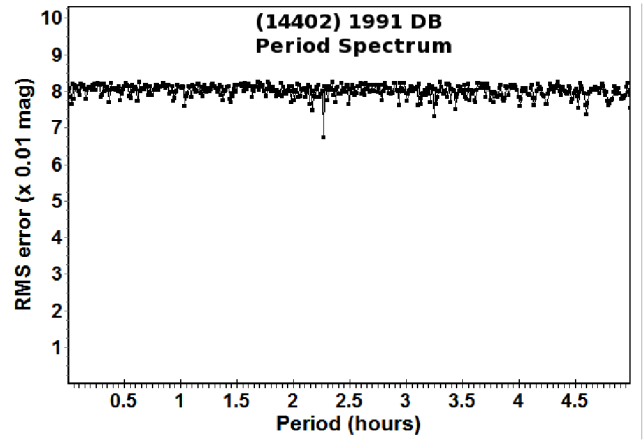


(8566) 1996 EN. This Apollo (PHA) asteroid has no published period. As the reader can see from the plot, we have insufficient data to make any conjectures about the period of this asteroid. Please refer to the table at the end of the paper for further details.



(14402) 1991 DB. This Amor asteroid has a published a period of 2.2656 h, U = 3 (Pravec 2000). Both Behrend (2009) and Durkee (2011) published periods that were more than an hour longer but they were more uncertain about their value than Pravec. We observed this asteroid between 2009-03-17 and 2009-04-02 using the LONEOS Schmidt and obtained 110 usable measurements over 10 nights. Our data were very noisy over the entire interval but we managed to duplicate Pravec's published period by forcing the correct period and then making small magnitude offsets to each night to minimize the residuals. We have included the period spectrum to indicate the frailness of our derived period.

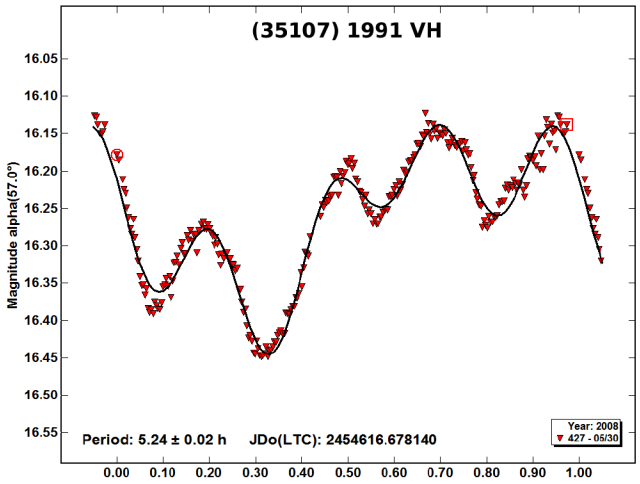




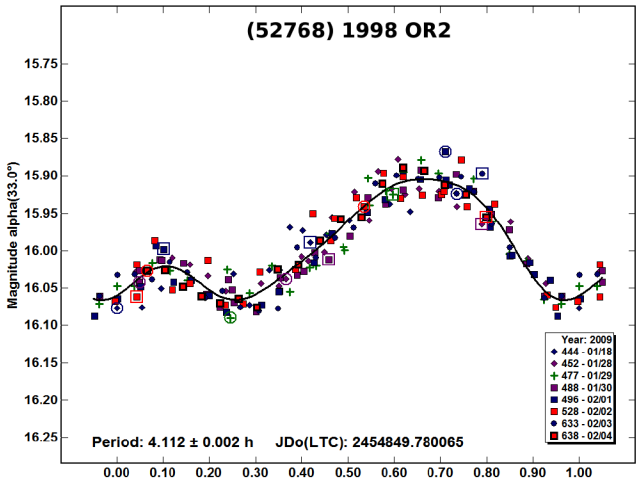
(16834) 1997 WU22. This Apollo asteroid has published period of 9.345 h, U = 3 (Pravec 2000). We had insufficient data to perform a meaningful period analysis so we present only the mean magnitudes and amplitudes for each of the four nights in a table at the end of the paper.

(22753) 1998 WT. This Apollo (PHA) has a published a period of 10.24 h, U = 2 (Galád 2005). Benner (2011) found a period of less than 11 hours. Our data proved insufficient to perform a meaningful period analysis so we present our summary data in the table at the end of the paper.

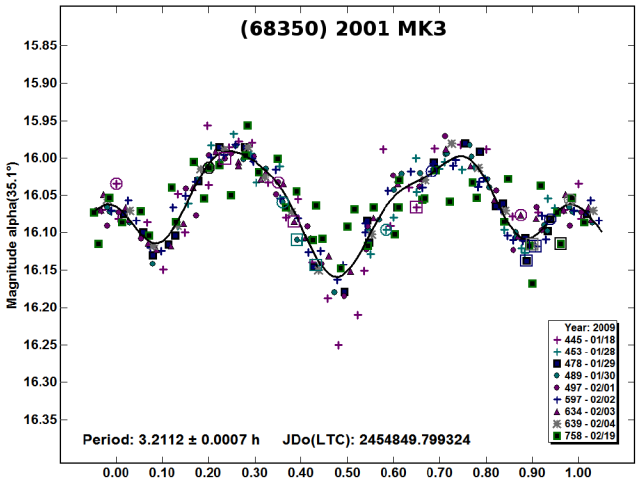
(35107) 1991 VH. This Apollo (PHA) asteroid has a published period of 2.6236 h, U = 3 (Pravec 2006). Vander Haagen (2010) studied this binary carefully and found a similar period for the primary He also found other periods associated with the system. We observed on 11 nights between 2009-05-08 and 2010-01-18 obtaining 575 usable observations. We did not attempt to disentangle the lightcurves of the two bodies. Hence, our data do not produce a cohesive lightcurve. We present a plot of the raw data from a single night, 2008-05-30, to hint at the complexity of the situation. The period is perfectly ignorable. It is nearly the same as the length of the observing run on that night. Our raw data are available at the MPC lightcurve database and our summary information is listed in the table at the end of the paper.



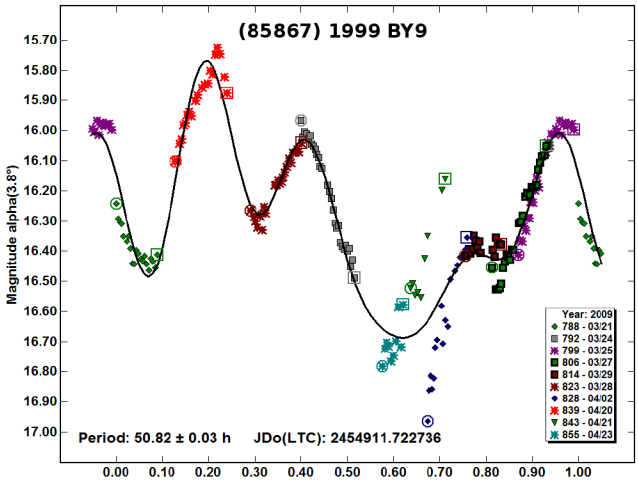
(52768) 1998 OR2. Betzler (2009) found a period of 3.198 h, U = 2, for this Amor (PHA) asteroid. We made observations between 2009-01-18 and 2009-02-04 and got 199 usable measurements over 9 nights. We found a period of 4.112 ± 0.002 h with an order 4 fit. The mean magnitude, normalized to 2009-01-18, is r' = 16.00 mag with an amplitude of Δr' =0.16 mag.



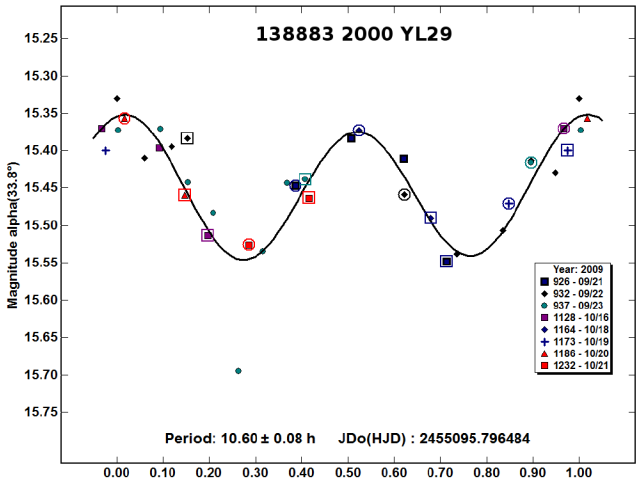
(68350) 2001 MK3. This Amor asteroid has a published period of 3.273 h, U = 3 from Carbognani (2011). We observed this asteroid between 2009-01-16 and 2009-02-19 and obtained 281 usable measurements over 10 nights. We found a period of 3.2112 ± 0.0007 h with an order 5 fit. The mean magnitude, normalized to 2009-01-18 is r' = 16.07 mag with an amplitude of Δr' =0.17 mag. The first and last nights shown in the graph are somewhat noisy but they allowed us to reduce the uncertainty by an order of magnitude. The graph shows two major and one minor maximum.



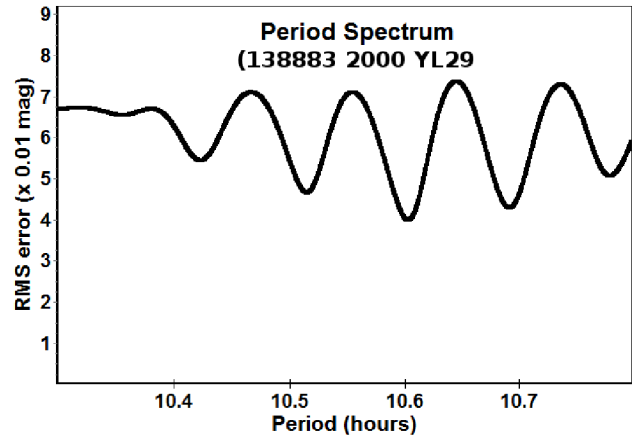
(85867) 1999 BY9. This Amor asteroid has no published period. We observed this asteroid between 2009-03-21 and 2009-04-23 and obtained 201 usable observations over 10 nights. As the reader can see from the graph, the asteroid may be a "slow" tumbler. The graph suggests one of the periods is about 25 h. The reader may find summary magnitude and amplitude data in the table at the end of the paper.



(138883) 2000 YL29. We targeted this Apollo asteroid between 2009-04-22 and 2009-10-21 and obtained 312 usable observations over 9 nights. This asteroid has no published period. The night of 2009-04-22 was isolated from all the other nights so we omitted it from our analysis. The best fit occurred when the period was 5.3 h but it had a single maximum. We forced the period to double that and the best fit indicated a period of 10.60 ± 0.08. The graph was created with an order 2 fit. It has a mean magnitude of r' = 15.45 mag and an amplitude of Δr' =0.20 mag normalized to 2009-09-21.

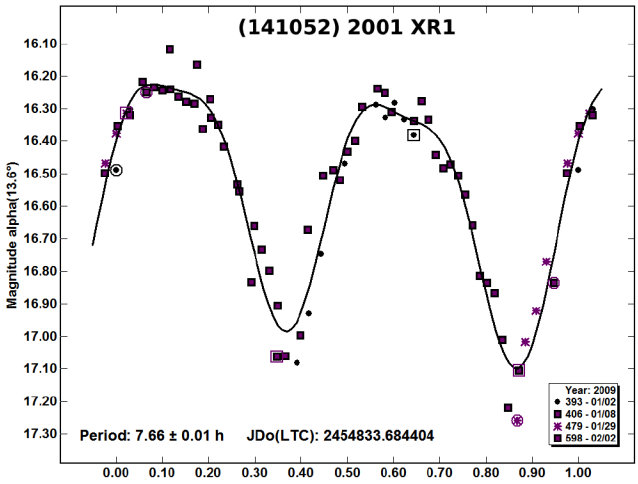


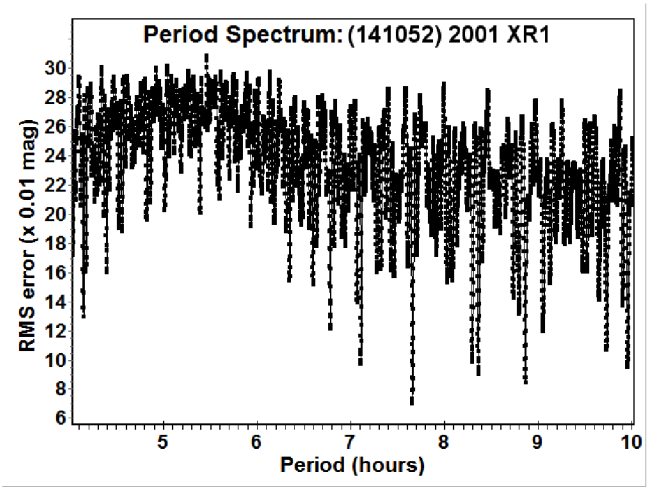
We felt the formal error returned by Canopus was too small. Because of the obvious noise in the fit, a phasing error between September and October was possible. Analysis of the period spectrum indicates a more suggestive error is 0.08 h.



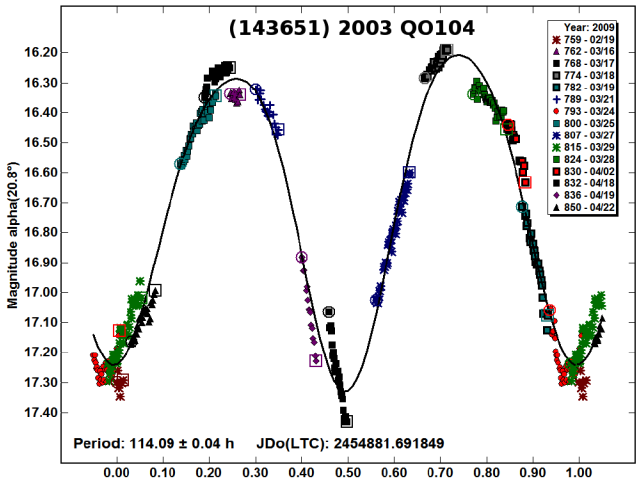
As the reader can see in the preceding graph, the minima near the best fit indicate residuals nearly as small as the best fit. These other minima are the result of a phase shift between September and October that occurs when the period is changed by about 0.08 h.

(141052) 2001 XR1. This Apollo asteroid has no published period. We made observations between 2009-01-02 and 2009-02-02 and obtained 72 usable measurements over 4 nights. We found a period of 7.66 ± 0.01 h. We believe this period is of low quality because the RMS values, seen in the period spectrum, show a number of minima with values near the absolute minima. When we forced the fit to match some of these minima, several graphs were as compelling as the one we present here. The mean magnitude, normalized to 2009-01-02 is r' = 16.66 mag with an amplitude of Δr' = 0.88 mag.

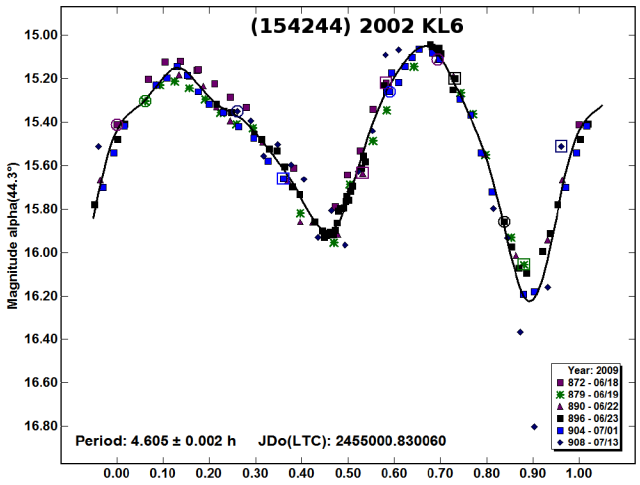




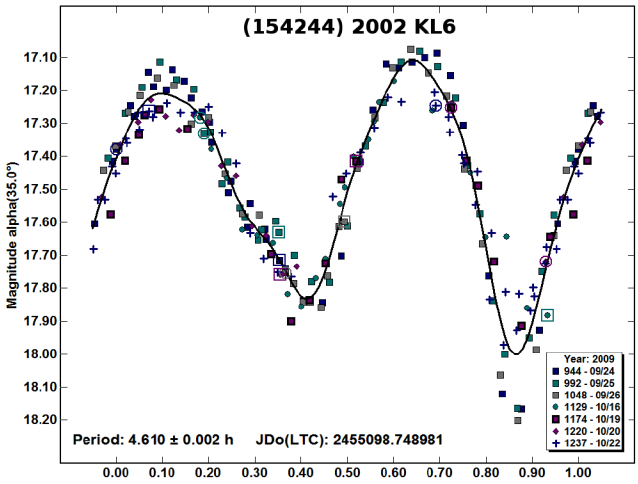
(143651) 2003 QO104. This Apollo (PHA) asteroid, a possible tumbler, has a published period of 115. h, U = 3, from Warner (2009a). Birtwhistle (2009) published a slightly smaller but more uncertain value. We observed this asteroid between 2009-02-19 and 2009-04-22 and obtained 403 usable observations over 15 nights. Our sparsely populated fit optimistically indicates a period of 114.09 ± 0.04h generated with an order 4 fit. The poor quality of the fit indicates the asteroid may be tumbling, in agreement with Warner's assessment. The summary magnitude data, found in a table at the end of this paper may be useful in planning observations.



(154244) 2002 KL6. We observed this Amor asteroid between 2009-06-18 and 2009-10-22 and obtained 360 usable measurements over 13 nights. This asteroid has a published period of 4.6063, U = 3 (Galád 2010). Our observations were spread over five lunations so we present graphs from the first two lunations, the last two lunations and a summary graph of all lunations. The two groupings combine observations where the observing circumstances were similar. The first graph indicates a period of 4.605 ± 0.002 h generated with an order 5 fit. The period is in agreement with Galád's value. The mean magnitude, normalized to 2009-06-18 is r' = 15.63 mag with an amplitude of Δr' = 1.15 mag.

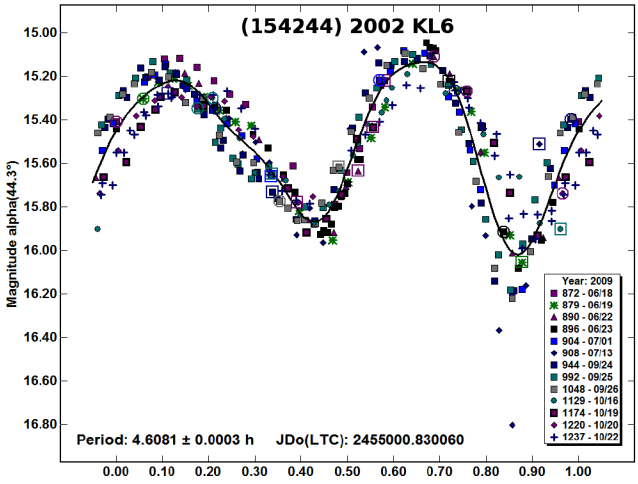


The second graph indicates a period of 4.610 ± 0.002 h generated with an order 5 fit. The mean magnitude, normalized to 2009-09-24 is r' = 17.55 mag with an amplitude of Δr' = 0.90 mag.

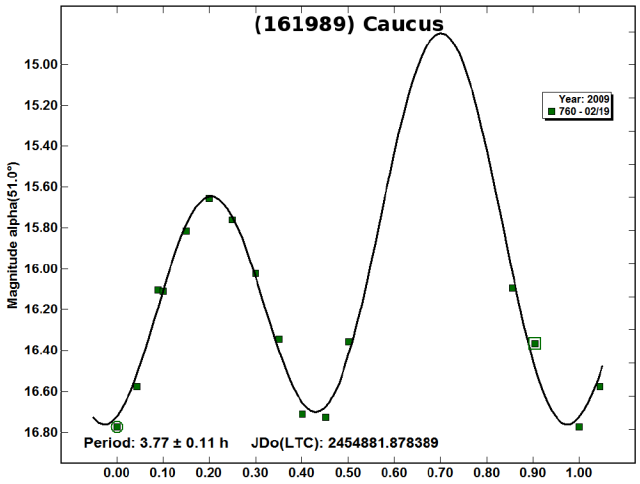


The period is in general agreement with Galád's value.

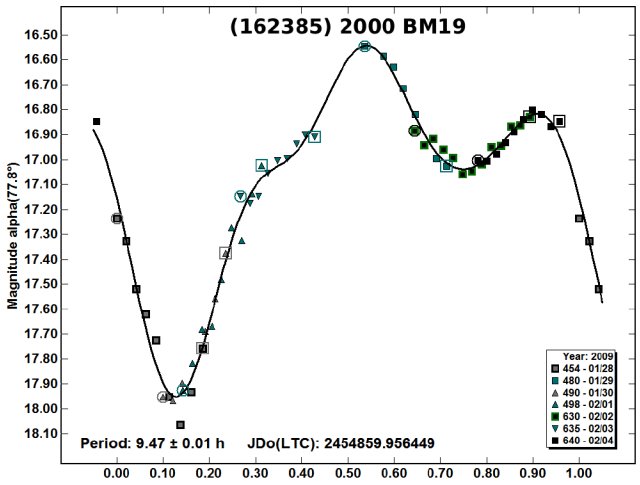
The third graph indicates the period when all the data are combined. Because there is a 73 day interval between the first and second data sets, we verified that the maximum accumulated formal error between data sets could not be greater than one hour. That fact allowed us to combine the data sets with the assurance that a rotational phasing error was highly unlikely. The result for all nights is a period of 4.6081 ± 0.0003 h. The unambiguous time span for observations is 126 days.



161989 Cacus. We observed this Apollo (PHA) asteroid on the single night of 2009-02-19 and obtained 14 usable measurements. This asteroid has a published period of 3.7538 h, U = 3 provided by Pravec (2003). Both Degewij (1978) and Schuster (1979) published similar values for the period. With our extremely limited dataset we found a period of 3.77 ± 0.11 h in relatively good agreement with the published period. The deep amplitude of the magnitude made our analysis possible. Since the graph is not well constrained, the mean magnitude and amplitude should be taken from the table at the end of the paper.

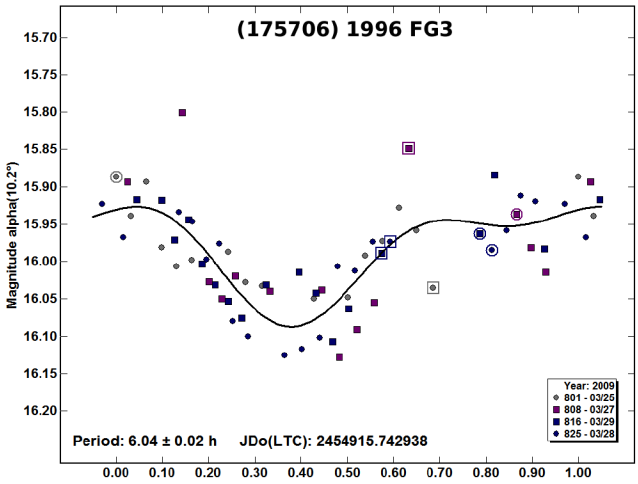


(162385) 2000 BM19. We observed this Aten asteroid between 2009-01-28 and 2009-02-04 and obtained 63 usable measurements over 7 nights. This asteroid has no published period. Our analysis produced a period of 9.47 ± 0.01 h. We know the quality of the fit is not robust because we have gaps in the coverage and we had to use some fairly large offsets in the order 4 fit. However, he residuals of the fitting routine clearly indicate the period we show. The mean magnitude, normalized to 2009-01-28 is r' = 17.24 mag with an amplitude of Δr' = 1.38 mag.

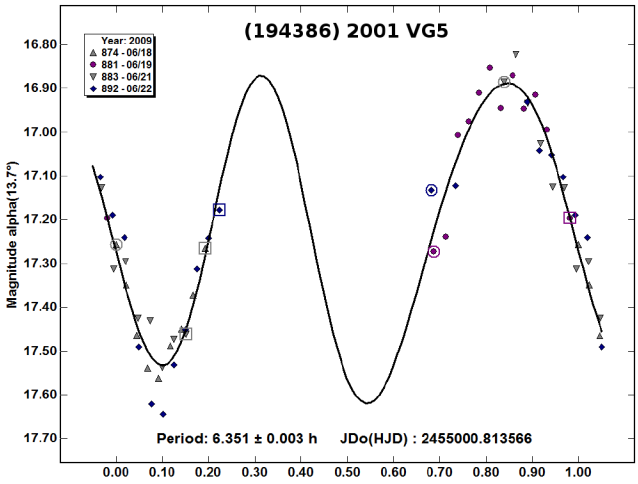


(163758) 2003 OS13. This Apollo asteroid has no published period. We targeted this asteroid on three nights between 2009-06-18 and 2009-06-22 and obtained 14 usable observations. The data provide no real hint of the period so we refer the reader to the summary information at the end of the paper.

(175706) 1996 FG3. This Apollo (PHA) asteroid has a published period of 3.5942 h, U = 3 by Pravec (2006). Mottola (2000) found a similar value. We made observations between 2009-03-25 and 2009-04-22 and obtained 88 usable measurements over 5 nights. In our fit analysis, we used only four nights because the last night was in the next lunation and it made the analysis much more difficult. We used an order 2 fit and found a period of 6.04 ±0.02 h. The fit residuals were rather large and there were at least four other minima in the residuals that were nearly as small as the one we chose. No single night could reproduce the indicated period and changing the order of fit also changed the period significantly.



(194386) 2001 VG5. This Apollo asteroid has a published period. 6.6 h, U = 2, found by Polishook (2009). We made observations between 2009-01-15 and 2009-06-22 with 121 usable observations over 6 nights. The first night was in January and the last five nights in June. Reductions for 2009-06-15 had problems and the night 2009-01-15 was so distant in time that we based our analysis primarily on 50 observations from the remaining four nights.

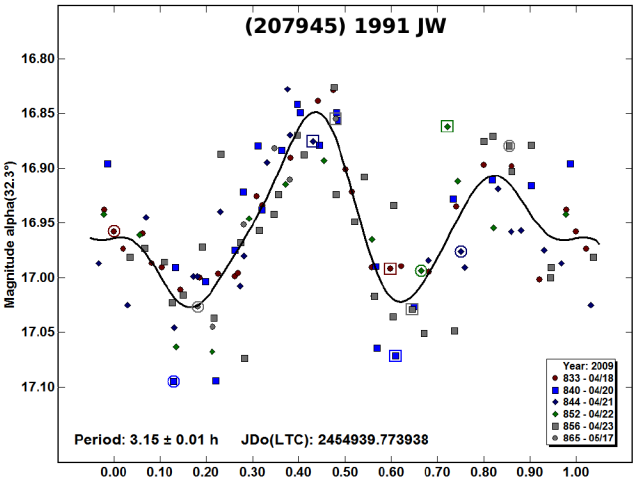


Although the phase coverage on this graph is poor, the remaining two nights provide almost full phase coverage and when those data are included, the period remains 6.351 ± 0.003 h using a third order solution. The large amplitude of the lightcurve made the period analysis easier. Because of reduction problems on the night of 2009-06-15, we cannot state the amplitude of this lightcurve.

(203217) 2001 FX9. This Amor asteroid has no published period. We observed this asteroid on 2009-01-28 and 2009-01-29 and obtained 14 usable observations. The data were insufficient to perform a meaningful period analysis so we present only our summary data in the table at the end of the paper.

(207945) 1991 JW. This Apollo (PHA) asteroid has no published period. We targeted this asteroid between 2009-04-18 and 2009-05-17 and obtained 119 usable measurements over 6 nights. From those measurements we found a period of 3.15 ± 0.01 h using an order 3 fit. The mean magnitude, normalized to 2009-04-18, is r' = 16.93 mag with amplitude Δr' = 0.17 mag. The sixth night is in the next lunation and the uncertainty in the first five nights is large

enough that a phasing error could occur so our formal uncertainty remains rather large.

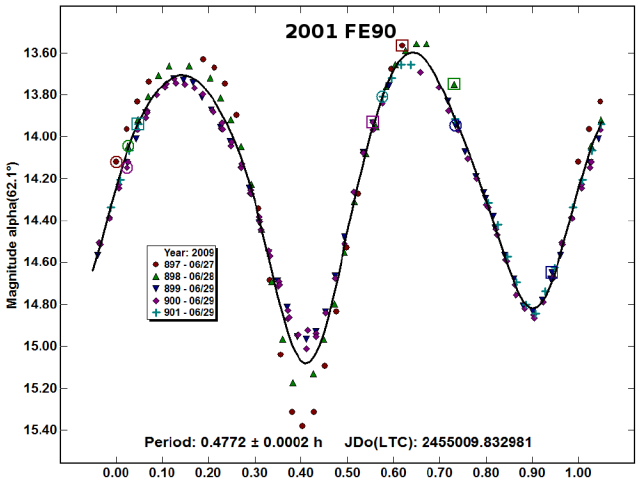


(208023) 1999 AQ10. This Aten (PHA) asteroid has a published period of 2.67 h, U = 2+ by Behrend (2009). Betzler (2009) found a slightly longer value. We made observations between 2009-01-30 and 2009-02-04, and obtained 53 usable observations in 5 nights. The lightcurve was flat to within our uncertainty. The mean magnitude, was r' = 16.95 mag normalized to 2009-01-03 with an uncertainty of ± 0.05 mag. We could not coerce the period to 2.67 h to match Behrend's period.

(212546) 2006 SV19. This Amor (PHA) asteroid has no published period. We observed this asteroid on two nights, 2009-06-21 and 2009-06-22 and obtained 24 usable observations. The asteroid was relatively faint with a mean magnitude of r' = 17.8 and an amplitude/uncertainty of about ±0.10 mag. We could find no believable period so refer to the summary information at the end of this paper.

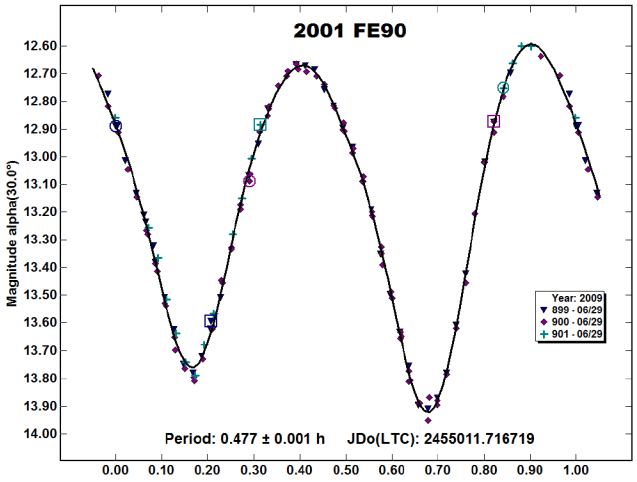
(256412) 2007 BT2. This Amor asteroid has no published period. We observed this asteroid on 4 nights between 2009-03-27 and 2009-04-22 and obtained 35 usable observations. Although we could not produce a publishable lightcurve, we believe the period is on the order of 18 hours. The asteroid had a mean magnitude, normalized to 2009-03-27, of r' = 16.4 mag and an amplitude of Δr' = 0.2 mag.

2001 FE90. This Apollo (PHA) asteroid has a published period of 0.4777 h, U = 3 by Hicks (2009). Oey (2011) also observed this asteroid and obtained a similar period. We observed this asteroid between 2009-06-21 and 2009-06-29 and obtained 202 usable observations over 5 nights. The first graph shows the period obtained from all the data.



The graph reveals the changing aspect of the asteroid by the scatter at the maxima and minima of the lightcurve.

The second graph shows the data from only 2009-06-29. The graph covers almost five full periods. The effects of changing aspect are almost undetectable and our confidence in the indicated uncertainty is good. Both curves were generated with an order six fit. The mean magnitude on the night of 2009-06-29 is r' = 13.25 and the peak-to-peak amplitude of the lightcurve is Δr' = 1.30 mag.



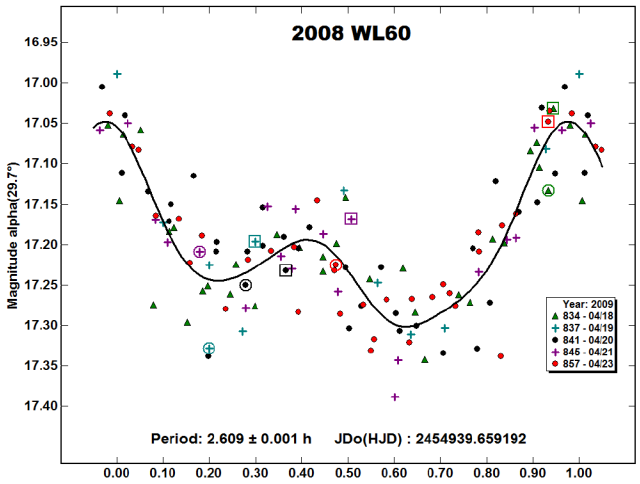
2004 LV3. This Apollo (PHA) asteroid has no published period. We observed the asteroid between 2009-01-01 and 2009-01-03 and obtained 14 usable observations over 3 nights. The observations were too sparse for an effective period analysis. The reader may find summary information at the end of this paper.

2005 BC. This Apollo (PHA) asteroid has no published period. We observed this asteroid on two nights between 2009-01-16 and 2009-01-18 and obtained 10 usable observations. The observations were too sparse for an effective period analysis. The reader may find summary information at the end of this paper.

2005 SG19. This Amor asteroid has no published period. We observed this asteroid on a single night, 2009-03-29 and obtained 11 usable observations. Again, the observations were too sparse for an effective period analysis. The reader may find summary information at the end of this paper.

2008 QT3. This Apollo (PHA) asteroid has no published period. We observed on three nights between 2009-01-18 and 2009-01-29 and obtained 25 usable observations. The observations were too sparse for an effective period analysis. The reader may find summary information at the end of this paper.

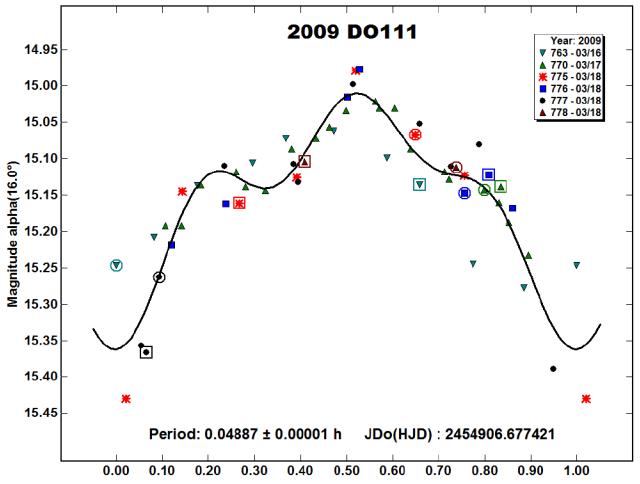
2008 WL60. This Amor asteroid has no published period. We observed this asteroid on five nights between 2009-04-18 and 2009-04-23 obtaining 129 usable observations. We found a period of P = 2.609 h ±0.002 h using an order 4 fit.



The mean magnitude is r' = 17.18, normalized to 2009-04-18. The amplitude of the lightcurve is Δr' = 0.12 mag.

2009 DE47. This Apollo asteroid has no published period. We observed this asteroid on 2 nights, 2009-04-20 and 2009-04-21, and obtained 17 usable observations. The observations were too sparse for an effective period analysis. The reader may find summary information at the end of this paper.

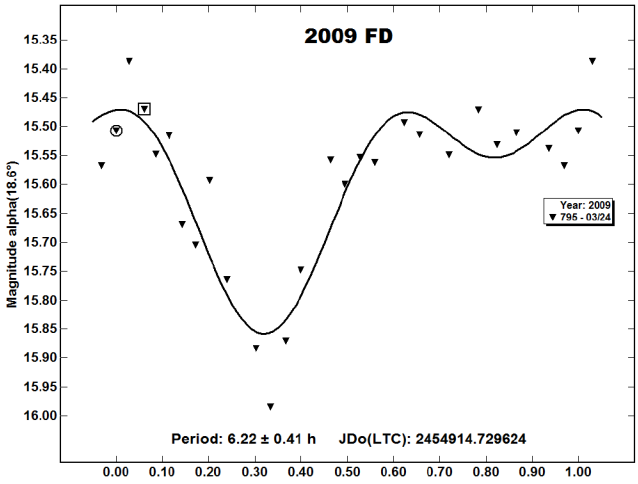
2009 DO111. This Apollo asteroid has a published period of 0.04890 h, U = 3 (Behrend 2009).



We have 58 usable observations obtained on three nights between 2009-03-16 and 2009-03-18. We were able to duplicate Behrend's period with P = 0.04887 h ± 0.00001 h shown above for each night considered independently. However, the magnitudes obtained each night had to be shifted significantly to produce the graph shown here. Most troubling is the fact that the night of the 2009-03-18 was broken into several sub-sessions and each session had to be significantly shifted in magnitude for the fit to work. The fit above may be an alias of a longer period of about 0.09 h. The longer period is more pleasing because it has two significant maxima.

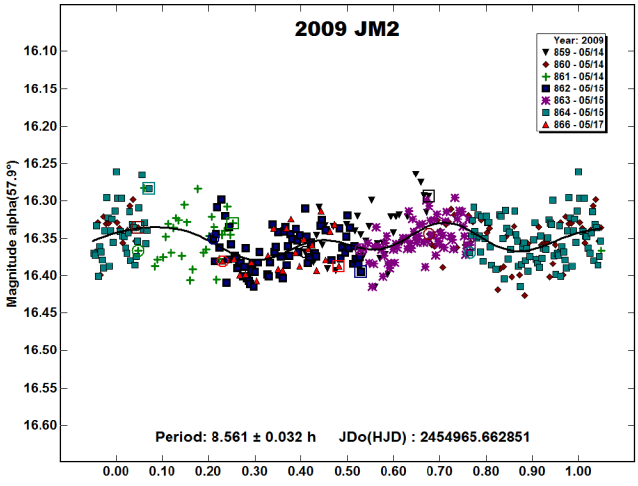
2009 EP2. This Aten (PHA) asteroid has no published period. We observed this asteroid on 2009-03-16 and obtained 8 usable observations. The reader may find summary information at the end of this paper.

2009 FD. This Apollo asteroid has a published periods of 4.0 h, U = 2+ by Behrend (2009) and 5.87 h, U = 2- by Carbognani (2011a). We observed this asteroid on the single night of 2009-03-24 and obtained 26 usable observations.



Our period analysis shows one strong unambiguous minimum. However, there is no evidence that we observed the minimum a second time. Because of the strength of the single minimum we can assert that the period is at least 6.22 h. We can place no upper limit on the period.

2009 JM2. This Apollo asteroid has no published period. We were able to observe on three nights between 2009-05-14 and 2009-05-17, and obtain 381 usable observations.



Although the graph indicates a period, we assert that the lightcurve is flat to within the errors. Each night plotted separately is flat. The structure within the graph shown here is likely due to minor night-to-night changes in seeing, and choice of reference stars.

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Minor Planet	Date of Observation	Sun Distance (AU)	Earth Distance (AU)	Phase Angle (deg)	BPAB (deg)	LPAB (deg)	Obs. Count (deg)	Avg. Mag.	Mag. Delta	Observer
433 Eros	2009-06-18	1.77845	1.25897	-33.93	1.6	327.8	13	13.45	0.43	Skiff
433 Eros	2009-06-19	1.77800	1.24833	-33.84	1.6	328.1	3	13.61	0.05	Skiff
433 Eros	2009-06-22	1.77653	1.21652	-33.53	1.9	329.0	15	13.22	0.39	Skiff
433 Eros	2009-10-10	1.59958	0.78084	29.64	13.5	341.5	13	11.88	0.12	Skiff
433 Eros	2009-10-11	1.59697	0.78585	30.11	13.5	341.7	24	11.88	0.18	Skiff
433 Eros	2009-10-18	1.57826	0.82291	33.13	13.6	343.2	28	12.08	0.15	Skiff
433 Eros	2009-10-20	1.57278	0.83403	33.90	13.7	343.7	11	12.15	0.14	Skiff
433 Eros	2009-10-21	1.57002	0.83965	34.27	13.7	344.0	31	12.14	0.15	Skiff
433 Eros	2009-11-17	1.49068	0.99684	41.14	13.6	353.6	22	12.49	0.08	Skiff
433 Eros	2009-11-21	1.47825	1.01950	41.75	13.6	355.4	18	12.54	0.04	Skiff
433 Eros	2009-11-22	1.47512	1.02509	41.90	13.6	355.9	19	12.57	0.08	Skiff
433 Eros	2009-11-24	1.46884	1.03616	42.16	13.5	356.8	12	12.58	0.05	Skiff
433 Eros	2009-11-25	1.46569	1.04165	42.29	13.5	357.3	14	12.59	0.05	Skiff
433 Eros	2009-11-26	1.46253	1.04709	42.41	13.5	357.7	18	12.32	0.06	Skiff
433 Eros	2009-12-19	1.38840	1.16011	44.31	12.9	10.0	8	12.70	0.12	Skiff
433 Eros	2009-12-20	1.38515	1.16443	44.36	12.8	10.6	9	12.49	0.12	Skiff
433 Eros	2010-01-10	1.31740	1.24239	45.07	11.8	23.8	7	12.77	0.13	Skiff
1943 Anteros	2009-06-18	1.22523	0.56488	-55.31	11.5	321.1	10	16.84	0.22	Sanborn
1943 Anteros	2009-06-19	1.22880	0.56385	-54.98	11.7	321.7	14	16.84	0.17	Sanborn
1943 Anteros	2009-06-22	1.23959	0.56055	-53.95	12.2	323.4	12	16.80	0.14	Sanborn
1943 Anteros	2009-07-01	1.27273	0.54907	-50.57	13.5	328.1	24	16.72	0.18	Vickowski
1943 Anteros	2009-08-10	1.42367	0.50106	-28.78	17.3	340.2	45	16.16	0.50	Sanborn
3554 Amun	2009-03-17	1.22039	0.41181	48.29	17.0	137.5	9	15.93	0.15	Sanborn
3554 Amun	2009-03-18	1.22204	0.41717	48.42	16.3	137.9	22	15.89	0.26	Sanborn
3554 Amun	2009-03-19	1.22364	0.42266	48.56	15.7	138.2	25	15.99	0.24	Sanborn
3554 Amun	2009-03-21	1.22668	0.43403	48.85	14.4	139.0	18	16.03	0.18	Koehn
3554 Amun	2009-03-25	1.23212	0.45813	49.49	12.0	140.6	11	16.29	0.21	Sanborn
3554 Amun	2009-03-27	1.23452	0.47079	49.83	10.8	141.5	9	16.26	0.17	Sanborn
3554 Amun	2009-03-28	1.23564	0.47726	50.00	10.2	141.9	7	16.35	0.15	Sanborn
3554 Amun	2009-03-29	1.23671	0.48381	50.17	9.7	142.4	8	16.33	0.17	Sanborn
3554 Amun	2009-12-18	0.95841	0.46372	-79.29	50.3	139.1	7	15.72	0.24	Nelson
3554 Amun	2011-02-13	1.21317	0.38540	-46.34	19.8	179.0	378	16.53	0.17	Skiff
3554 Amun	2011-02-14	1.21503	0.37938	-45.59	19.5	179.2	169	15.59	0.21	Skiff
3554 Amun	2011-02-15	1.21683	0.37339	-44.82	19.1	179.4	211	15.69	0.21	Skiff
5011 Ptah	2009-04-18	1.09270	0.30117	65.17	-0.6	159.8	16	16.28	0.52	Sanborn
5011 Ptah	2009-04-19	1.10026	0.30573	63.98	-0.9	161.3	17	16.60	0.36	Sanborn
5011 Ptah	2009-04-20	1.10784	0.31065	62.83	-1.2	162.7	11	17.17	0.76	Sanborn
5011 Ptah	2009-04-23	1.13074	0.32745	59.61	-2.0	167.0	5	17.79	0.25	Koehn
(5604) 1992 FE	2009-03-27	1.21313	0.22880	-17.93	-12.7	189.4	7	15.37	0.11	Sanborn
(5604) 1992 FE	2009-03-28	1.21667	0.23166	-17.53	-12.7	189.1	8	15.48	0.17	Sanborn
(5604) 1992 FE	2009-03-29	1.22015	0.23471	-17.30	-12.7	188.7	11	15.46	0.12	Sanborn
(5604) 1992 FE	2009-04-22	1.28184	0.35400	33.38	-10.9	186.3	13	16.78	0.14	Sanborn
5620 Jasonwheeler	2009-06-18	1.26500	0.28369	25.41	16.0	255.6	14	16.14	1.20	Sanborn
5620 Jasonwheeler	2009-06-19	1.26321	0.28214	25.61	15.8	256.1	16	16.10	1.22	Sanborn
5620 Jasonwheeler	2009-06-21	1.25986	0.27929	26.02	15.4	257.1	12	15.86	0.77	Vickowski
5620 Jasonwheeler	2009-06-22	1.25830	0.27799	26.22	15.2	257.7	25	16.01	1.08	Sanborn
5620 Jasonwheeler	2009-06-23	1.25681	0.27679	26.42	15.0	258.2	35	16.32	1.12	Vickowski
5261 Eureka	2011-11-10	1.48907	0.52701	-15.26	7.6	61.1	181	16.54	0.58	Skiff
5261 Eureka	2011-11-18	1.49607	0.51425	-7.57	4.8	61.4	107	16.51	2.22	Skiff
5261 Eureka	2011-11-19	1.49696	0.51371	-6.60	4.4	61.5	86	15.64	0.70	Skiff
5261 Eureka	2011-11-28	1.50499	0.52010	3.89	1.1	61.7	244	16.06	0.44	Skiff
5261 Eureka	2011-11-30	1.50679	0.52431	5.64	0.4	61.7	295	16.15	0.37	Skiff
5261 Eureka	2011-12-01	1.50769	0.52678	6.56	0.1	61.7	160	16.13	0.23	Skiff
5261 Eureka	2011-12-27	1.53116	0.66506	26.70	-8.0	64.8	77	17.25	0.33	Skiff
5261 Eureka	2011-12-28	1.53206	0.67262	27.24	-8.2	65.1	78	17.35	0.36	Skiff
5261 Eureka	2011-12-29	1.53295	0.68031	27.77	-8.4	65.3	75	17.37	0.55	Skiff
(5693) 1993 EA	2009-05-13	1.47093	0.55579	27.41	8.1	205.2	35	17.60	0.17	Skiff
(8566) 1996 EN	2009-04-02	1.39934	0.53838	34.03	21.6	164.8	21	17.17	0.13	Koehn
(14402) 1991 DB	2009-03-17	1.06683	0.11323	-48.28	24.3	193.2	9	15.97	0.14	Sanborn
(14402) 1991 DB	2009-03-18	1.06400	0.11376	-50.40	25.5	194.6	7	16.04	0.10	Sanborn
(14402) 1991 DB	2009-03-19	1.06126	0.11456	-52.48	26.8	196.0	12	16.03	0.28	Sanborn
(14402) 1991 DB	2009-03-21	1.05607	0.11693	-56.45	29.1	199.0	9	16.24	0.15	Koehn
(14402) 1991 DB	2009-03-24	1.04900	0.12218	-61.79	32.2	203.6	19	16.48	0.36	Koehn
(14402) 1991 DB	2009-03-25	1.04684	0.12432	-63.39	33.1	205.1	9	16.56	0.35	Sanborn
(14402) 1991 DB	2009-03-27	1.04283	0.12909	-66.29	34.7	208.2	9	16.77	0.20	Sanborn
(14402) 1991 DB	2009-03-28	1.04098	0.13169	-67.59	35.4	209.7	9	16.97	0.24	Sanborn
(14402) 1991 DB	2009-03-29	1.03923	0.13441	-68.79	36.1	211.2	7	16.92	0.22	Sanborn
(14402) 1991 DB	2009-04-02	1.03330	0.14630	-72.71	38.2	217.5	20	17.36	0.42	Koehn
(16834) 1997 WU22	2009-06-18	0.97670	0.51876	-79.16	17.7	335.8	4	16.89	0.19	Sanborn
(16834) 1997 WU22	2009-06-19	0.98290	0.52353	-78.36	18.0	336.5	7	17.18	0.52	Sanborn
(16834) 1997 WU22	2009-06-22	1.00184	0.53721	-76.06	19.0	338.6	9	16.88	0.33	Sanborn
(16834) 1997 WU22	2009-08-10	1.33782	0.63546	-46.70	27.3	2.0	4	17.31	0.64	Sanborn
(22753) 1998 WT	2009-01-30	1.44101	0.46010	-6.42	-0.7	136.5	10	17.22	0.15	Sanborn
(22753) 1998 WT	2009-02-02	1.41939	0.43468	-2.96	-0.8	136.1	7	16.89	0.23	Sanborn
(22753) 1998 WT	2009-02-19	1.28624	0.33396	23.38	-2.1	131.3	3	16.61	0.11	Sanborn

Minor Planet	Date of Observation	Sun Distance (AU)	Earth Distance (AU)	Phase Angle (deg)	BPAB (deg)	LPAB (deg)	Obs. Count (deg)	Avg. Mag.	Mag. Delta	Observer
(35107) 1991 VH	2009-01-01	1.17107	0.26784	40.62	-28.1	88.5	12	15.75	0.20	Sanborn
(35107) 1991 VH	2009-01-02	1.17328	0.26922	40.26	-27.6	88.8	15	15.72	0.05	Sanborn
(35107) 1991 VH	2009-01-03	1.17547	0.27072	39.92	-27.0	89.0	11	15.75	0.08	Sanborn
(35107) 1991 VH	2009-01-15	1.20083	0.29853	38.19	-20.3	92.7	13	15.95	0.10	Sanborn
(35107) 1991 VH	2009-01-16	1.20286	0.30168	38.22	-19.8	93.0	15	15.95	0.08	Sanborn
(35107) 1991 VH	2009-01-18	1.20686	0.30838	38.37	-18.7	93.7	17	16.08	0.22	Sanborn
(52768) 1998 OR2	2009-01-18	1.34705	0.47513	-33.10	11.4	148.2	14	15.85	0.14	Sanborn
(52768) 1998 OR2	2009-01-28	1.27776	0.38257	-34.16	12.4	155.6	27	15.31	0.17	Sanborn
(52768) 1998 OR2	2009-01-29	1.27107	0.37409	-34.33	12.5	156.5	28	15.26	0.21	Koehn
(52768) 1998 OR2	2009-01-30	1.26443	0.36576	-34.52	12.6	157.3	30	15.32	0.19	Sanborn
(52768) 1998 OR2	2009-02-01	1.25132	0.34954	-34.96	12.8	159.0	29	15.23	0.21	Koehn
(52768) 1998 OR2	2009-02-02	1.24485	0.34165	-35.20	12.9	159.9	27	15.03	0.19	Sanborn
(52768) 1998 OR2	2009-02-03	1.23844	0.33392	-35.46	13.0	160.8	26	14.96	0.19	Koehn
(52768) 1998 OR2	2009-02-04	1.23208	0.32634	-35.75	13.1	161.8	18	14.94	0.19	Sanborn
(68350) 2001 MK3	2009-01-16	1.30116	0.43852	-36.48	3.1	149.7	26	16.09	0.40	Sanborn
(68350) 2001 MK3	2009-01-18	1.30508	0.43251	-35.22	4.6	150.2	29	16.07	0.29	Sanborn
(68350) 2001 MK3	2009-01-28	1.32671	0.41680	-29.36	12.4	152.2	25	15.66	0.18	Sanborn
(68350) 2001 MK3	2009-01-29	1.32905	0.41666	-28.89	13.1	152.3	22	15.82	0.20	Sanborn
(68350) 2001 MK3	2009-01-30	1.33142	0.41679	-28.44	13.9	152.5	29	15.78	0.20	Sanborn
(68350) 2001 MK3	2009-02-01	1.33624	0.41785	-27.66	15.3	152.7	24	15.79	0.21	Sanborn
(68350) 2001 MK3	2009-02-02	1.33870	0.41879	-27.32	16.0	152.8	39	15.79	0.18	Sanborn
(68350) 2001 MK3	2009-02-03	1.34118	0.41999	-27.02	16.8	152.9	29	15.72	0.16	Sanborn
(68350) 2001 MK3	2009-02-04	1.34369	0.42147	-26.77	17.5	153.0	17	15.78	0.17	Sanborn
(68350) 2001 MK3	2009-02-19	1.38437	0.47290	-27.37	26.2	154.0	41	16.23	0.22	Sanborn
(85867) 1999 BY9	2009-03-21	1.27770	0.28228	-3.80	-2.5	182.2	22	16.39	0.22	Koehn
(85867) 1999 BY9	2009-03-24	1.27785	0.28133	3.18	-2.5	183.5	29	16.35	0.52	Koehn
(85867) 1999 BY9	2009-03-25	1.27801	0.28124	3.30	-2.5	183.9	27	16.17	0.44	Sanborn
(85867) 1999 BY9	2009-03-27	1.27849	0.28143	3.99	-2.4	184.7	26	16.50	0.47	Sanborn
(85867) 1999 BY9	2009-03-28	1.27881	0.28170	4.48	-2.4	185.1	24	16.64	0.07	Sanborn
(85867) 1999 BY9	2009-03-29	1.27919	0.28208	5.04	-2.4	185.5	16	16.30	0.28	Sanborn
(85867) 1999 BY9	2009-04-02	1.28124	0.28478	7.55	-2.3	187.1	17	17.04	0.60	Koehn
(85867) 1999 BY9	2009-04-20	1.30089	0.31879	18.95	-1.9	194.9	21	17.00	0.37	Sanborn
(85867) 1999 BY9	2009-04-21	1.30246	0.32169	19.52	-1.8	195.4	9	17.56	0.39	Koehn
(85867) 1999 BY9	2009-04-23	1.30575	0.32782	20.61	-1.8	196.3	10	17.92	0.20	Koehn
(138883) 2000 YL29	2009-04-22	1.27986	0.37864	-37.32	30.1	223.3	14	16.61	0.19	Sanborn
(138883) 2000 YL29	2009-09-21	1.19671	0.24320	-33.89	-3.9	22.7	39	15.45	0.28	Sanborn
(138883) 2000 YL29	2009-09-22	1.20143	0.24528	-32.68	-4.8	22.7	81	15.40	0.31	Koehn
(138883) 2000 YL29	2009-09-23	1.20617	0.24760	-31.52	-5.7	22.7	85	15.45	0.44	Koehn
(138883) 2000 YL29	2009-10-16	1.32008	0.35934	-22.28	-19.0	23.0	25	16.18	0.34	Nelson
(138883) 2000 YL29	2009-10-18	1.33024	0.37350	22.77	-19.7	23.1	18	16.22	0.35	McLelland
(138883) 2000 YL29	2009-10-19	1.33532	0.38080	23.04	-20.0	23.2	11	16.33	0.26	Bevins
(138883) 2000 YL29	2009-10-20	1.34040	0.38823	23.32	-20.3	23.3	20	16.36	0.29	Bevins
(138883) 2000 YL29	2009-10-21	1.34549	0.39581	23.61	-20.5	23.4	19	16.48	0.24	McLelland
(141052) 2001 XR1	2009-01-02	1.33357	0.36423	-13.62	3.7	113.1	11	16.51	0.81	Koehn
(141052) 2001 XR1	2009-01-08	1.28540	0.30412	-5.84	1.6	112.4	43	15.80	0.97	Koehn
(141052) 2001 XR1	2009-01-29	1.10055	0.17945	46.25	-13.6	101.5	7	15.79	0.94	Koehn
(141052) 2001 XR1	2009-02-02	1.06263	0.17698	59.80	-18.0	98.5	11	15.70	0.95	Sanborn
(141052) 2001 XR1	2009-01-02	1.33357	0.36423	-13.62	3.7	113.1	11	16.51	0.81	Koehn
(141052) 2001 XR1	2009-01-08	1.28540	0.30412	-5.84	1.6	112.4	43	15.80	0.97	Koehn
(141052) 2001 XR1	2009-01-29	1.10055	0.17945	46.25	-13.6	101.5	7	15.79	0.94	Koehn
(141052) 2001 XR1	2009-02-02	1.06263	0.17698	59.80	-18.0	98.5	11	15.70	0.95	Sanborn
(143651) 2003 QO104	2009-02-19	1.51499	0.58645	-20.75	21.4	157.7	6	17.30	0.09	Sanborn
(143651) 2003 QO104	2009-03-16	1.33683	0.42221	30.19	23.9	161.8	15	15.64	0.05	Koehn
(143651) 2003 QO104	2009-03-17	1.32993	0.41722	30.86	24.0	162.0	25	16.56	0.36	Sanborn
(143651) 2003 QO104	2009-03-18	1.32306	0.41232	31.55	24.0	162.2	29	15.50	0.10	Sanborn
(143651) 2003 QO104	2009-03-19	1.31622	0.40751	32.26	24.1	162.4	23	16.14	0.41	Sanborn
(143651) 2003 QO104	2009-03-21	1.30262	0.39814	33.71	24.1	162.8	21	15.61	0.15	Koehn
(143651) 2003 QO104	2009-03-24	1.28248	0.38466	35.97	24.2	163.5	39	16.39	0.25	Koehn
(143651) 2003 QO104	2009-03-25	1.27583	0.38030	36.74	24.2	163.7	40	15.60	0.24	Sanborn
(143651) 2003 QO104	2009-03-27	1.26267	0.37176	38.31	24.2	164.2	38	15.94	0.44	Sanborn
(143651) 2003 QO104	2009-03-28	1.25614	0.36756	39.11	24.2	164.4	38	16.23	0.33	Sanborn
(143651) 2003 QO104	2009-03-29	1.24967	0.36342	39.91	24.2	164.7	40	15.48	0.16	Sanborn
(143651) 2003 QO104	2009-04-02	1.22422	0.34724	43.17	24.0	165.8	18	15.55	0.19	Koehn
(143651) 2003 QO104	2009-04-18	1.13203	0.28463	56.66	22.4	171.7	26	15.10	0.11	Sanborn
(143651) 2003 QO104	2009-04-19	1.12690	0.28066	57.51	22.2	172.1	17	15.85	0.34	Sanborn
(143651) 2003 QO104	2009-04-22	1.11203	0.26864	60.06	21.6	173.5	28	15.85	0.18	Sanborn
(154244) 2002 KL6	2009-06-18	1.12613	0.16197	-44.09	11.9	293.3	15	15.34	0.67	Sanborn
(154244) 2002 KL6	2009-06-19	1.12159	0.15933	-45.44	12.2	294.9	19	15.38	0.91	Sanborn
(154244) 2002 KL6	2009-06-22	1.10861	0.15302	-49.70	13.1	299.9	18	15.48	0.90	Sanborn
(154244) 2002 KL6	2009-06-23	1.10450	0.15146	-51.18	13.4	301.6	52	15.54	1.05	Vickowski
(154244) 2002 KL6	2009-07-01	1.07580	0.14876	-62.89	15.0	316.0	28	15.59	1.13	Vickowski
(154244) 2002 KL6	2009-07-13	1.04828	0.17105	-74.67	14.6	335.9	19	16.74	1.74	Sanborn
(154244) 2002 KL6	2009-09-24	1.28889	0.37886	-35.17	2.7	31.3	39	17.44	1.08	Koehn
(154244) 2002 KL6	2009-09-25	1.29552	0.38152	-34.15	2.6	31.5	34	17.36	1.08	Nelson
(154244) 2002 KL6	2009-09-26	1.30219	0.38424	-33.12	2.5	31.7	31	17.46	1.13	Bevins
(154244) 2002 KL6	2009-10-16	1.44259	0.46110	-12.30	0.7	34.7	25	17.39	0.71	Nelson
(154244) 2002 KL6	2009-10-19	1.46444	0.47763	-9.31	0.5	35.0	18	17.41	0.66	Bevins
(154244) 2002 KL6	2009-10-20	1.47175	0.48350	-8.33	0.5	35.0	16	17.36	0.53	Bevins
(154244) 2002 KL6	2009-10-22	1.48642	0.49579	-6.40	0.3	35.2	46	17.37	0.77	Koehn
161989 Cacus	2009-02-19	1.12151	0.23878	-50.95	0.4	187.0	14	16.25	1.12	Sanborn

Minor Planet	Date of Observation	Sun Distance (AU)	Earth Distance (AU)	Phase Angle (deg)	BPAB (deg)	LPAB (deg)	Obs. Count (deg)	Avg. Mag.	Mag. Delta	Observer
(162385) 2000 BM19	2009-01-28	1.00442	0.13468	-77.84	35.6	160.8	9	17.68	0.83	Sanborn
(162385) 2000 BM19	2009-01-29	1.00503	0.13307	-77.58	36.2	160.7	7	16.84	0.48	Koehn
(162385) 2000 BM19	2009-01-30	1.00553	0.13152	-77.36	36.9	160.5	6	17.69	0.60	Sanborn
(162385) 2000 BM19	2009-02-01	1.00623	0.12861	-77.05	38.3	160.0	9	17.30	0.91	Koehn
(162385) 2000 BM19	2009-02-02	1.00641	0.12726	-76.97	39.0	159.7	13	16.82	0.23	Sanborn
(162385) 2000 BM19	2009-02-03	1.00650	0.12598	-76.94	39.6	159.3	9	16.76	0.27	Koehn
(162385) 2000 BM19	2009-02-04	1.00648	0.12478	-76.95	40.3	159.0	10	16.67	0.21	Sanborn
(163758) 2003 OS13	2009-06-18	1.07127	0.30153	-71.39	22.9	315.0	5	17.51	0.63	Sanborn
(163758) 2003 OS13	2009-06-19	1.08437	0.30264	-69.03	23.9	314.0	7	17.49	0.36	Sanborn
(163758) 2003 OS13	2009-06-22	1.12301	0.30959	-62.23	26.7	310.7	2	17.40	0.17	Sanborn
(175706) 1996 FG3	2009-03-25	1.24580	0.25354	-10.29	-5.4	190.1	16	15.99	0.15	Sanborn
(175706) 1996 FG3	2009-03-27	1.23722	0.24288	-8.86	-5.6	190.0	14	15.82	0.32	Sanborn
(175706) 1996 FG3	2009-03-28	1.23286	0.23779	-8.39	-5.8	189.8	21	15.63	0.21	Sanborn
(175706) 1996 FG3	2009-03-29	1.22845	0.23285	-8.16	-5.9	189.7	20	15.85	0.20	Sanborn
(175706) 1996 FG3	2009-04-22	1.10865	0.16280	47.26	-8.5	182.8	17	16.40	0.25	Sanborn
(194386) 2001 VG5	2009-01-15	1.22665	0.48446	49.51	-11.1	69.4	6	17.84	1.19	Sanborn
(194386) 2001 VG5	2009-06-15	1.45321	0.45093	11.71	5.1	254.4	65	16.11	0.85	Vickowski
(194386) 2001 VG5	2009-06-18	1.47967	0.48380	13.68	5.7	255.0	9	17.42	0.31	Sanborn
(194386) 2001 VG5	2009-06-19	1.48848	0.49505	14.30	5.9	255.2	12	17.10	0.42	Sanborn
(194386) 2001 VG5	2009-06-21	1.50609	0.51800	15.47	6.3	255.6	13	17.34	0.72	Vickowski
(194386) 2001 VG5	2009-06-22	1.51488	0.52970	16.03	6.4	255.8	16	17.43	0.72	Sanborn
(203217) 2001 FX9	2009-01-28	1.29984	0.32052	-9.30	-7.3	130.6	5	17.50	0.26	Sanborn
(203217) 2001 FX9	2009-01-29	1.30083	0.32104	-9.00	-7.2	131.0	9	17.45	0.16	Koehn
(207945) 1991 JW	2009-04-18	1.13281	0.15647	-32.38	14.5	223.6	27	16.95	0.20	Sanborn
(207945) 1991 JW	2009-04-20	1.13042	0.14939	-30.61	14.0	224.1	22	16.81	0.26	Sanborn
(207945) 1991 JW	2009-04-21	1.12920	0.14593	-29.68	13.7	224.4	20	16.70	0.21	Koehn
(207945) 1991 JW	2009-04-22	1.12795	0.14252	-28.71	13.4	224.6	12	16.66	0.21	Sanborn
(207945) 1991 JW	2009-04-23	1.12669	0.13917	-27.71	13.1	224.8	32	16.56	0.25	Koehn
(207945) 1991 JW	2009-05-17	1.09036	0.08423	19.52	-0.9	225.0	6	15.17	0.19	Koehn
2001 FE90	2009-06-21	1.00529	0.04570	102.68	31.7	223.7	9	17.35	0.94	Vickowski
2001 FE90	2009-06-22	1.00826	0.04044	100.43	31.0	226.1	8	17.22	0.98	Sanborn
2001 FE90	2009-06-27	1.02504	0.01930	63.54	18.4	249.0	20	14.34	1.82	Sanborn
2001 FE90	2009-06-28	1.02876	0.01797	47.11	13.6	255.4	28	13.56	1.62	Vickowski
2001 FE90	2009-06-29	1.03260	0.01849	30.08	7.1	263.7	41	13.27	1.24	Koehn
2001 FE90	2009-06-29	1.03260	0.01849	30.08	7.1	263.7	79	13.28	1.32	Koehn
2001 FE90	2009-06-29	1.03260	0.01849	30.08	7.1	263.7	17	13.25	1.19	Koehn
2004 LV3	2009-01-01	1.00722	0.09015	72.15	-14.1	61.7	6	15.90	0.15	Koehn
2004 LV3	2009-01-02	1.01116	0.09824	70.85	-17.3	64.2	2	15.89	0.04	Koehn
2004 LV3	2009-01-03	1.01514	0.10706	69.80	-19.8	66.4	6	16.21	0.05	Sanborn
2005 BC	2009-01-16	1.18897	0.24712	-30.37	-15.5	132.6	4	16.21	0.11	Sanborn
2005 BC	2009-01-18	1.19771	0.25484	-29.47	-17.4	132.0	6	16.36	0.09	Sanborn
2005 SG19	2009-03-29	1.37422	0.41707	-21.65	-4.3	207.9	11	16.81	0.16	Sanborn
2008 QT3	2009-01-18	1.03124	0.12876	65.05	-13.2	80.6	6	16.60	0.24	Sanborn
2008 QT3	2009-01-28	1.08402	0.16014	48.35	-15.8	101.1	9	16.50	0.21	Sanborn
2008 QT3	2009-01-29	1.08982	0.16495	47.12	-15.8	102.7	10	16.51	0.22	Koehn
2008 WL60	2009-04-18	1.26182	0.31040	29.74	23.6	206.5	32	17.19	0.31	Sanborn
2008 WL60	2009-04-19	1.26786	0.31329	28.72	22.9	206.9	11	17.13	0.34	Sanborn
2008 WL60	2009-04-20	1.27396	0.31642	27.73	22.1	207.4	34	17.12	0.33	Sanborn
2008 WL60	2009-04-21	1.28011	0.31978	26.78	21.4	207.7	19	16.92*	0.34	Koehn
2008 WL60	2009-04-23	1.29258	0.32723	25.00	19.8	208.6	33	17.19	0.30	Koehn
2009 DE47	2009-04-20	1.29122	0.29307	-10.72	-3.2	218.0	9	17.10	0.15	Sanborn
2009 DE47	2009-04-21	1.29413	0.29450	-9.66	-3.7	217.8	8	17.02	0.24	Koehn
2009 DO111	2009-03-16	1.01469	0.02071	-15.96	8.2	177.0	10	15.16	0.22	Koehn
2009 DO111	2009-03-17	1.00985	0.01556	18.16	9.4	176.6	21	14.42	0.24	Sanborn
2009 DO111	2009-03-18	1.00499	0.01050	23.27	11.5	175.4	7	14.11	0.47	Sanborn
2009 DO111	2009-03-18	1.00499	0.01050	23.27	11.5	175.4	7	13.61	0.26	Sanborn
2009 DO111	2009-03-18	1.00499	0.01050	23.27	11.5	175.4	11	13.74	0.40	Sanborn
2009 DO111	2009-03-18	1.00499	0.01050	23.27	11.5	175.4	2	13.57	0.02	Sanborn
2009 EP2	2009-03-16	1.05004	0.05645	11.58	-1.4	169.5	8	15.93	0.20	Koehn
2009 FD	2009-03-24	1.02707	0.03167	-18.44	5.1	192.1	26	15.60	0.63	Koehn
2009 JM2	2009-05-14	1.06554	0.11241	58.12	31.2	218.3	38	16.36	0.16	Koehn
2009 JM2	2009-05-14	1.06554	0.11241	58.12	31.2	218.3	55	16.35	0.13	Koehn
2009 JM2	2009-05-14	1.06554	0.11241	58.12	31.2	218.3	29	16.31	0.12	Koehn
2009 JM2	2009-05-15	1.07166	0.11105	54.32	29.0	220.1	75	16.27	0.11	Koehn
2009 JM2	2009-05-15	1.07166	0.11105	54.32	29.0	220.1	67	16.33	0.13	Koehn
2009 JM2	2009-05-15	1.07166	0.11105	54.32	29.0	220.1	94	16.25	0.16	Koehn
2009 JM2	2009-05-17	1.08422	0.11047	46.50	24.4	223.4	23	16.04	0.10	Koehn

Minor Planet	NEAPS Period (h)	NEAPS Period Uncert.	Period (h) Published Elsewhere	Published Period Quality	Reference
(433) Eros	5.266	0.02	5.270	3	Campa 1938
(1943) Anteros	2.9	0.1	2.8695	3	Pravec 1998
(3554) Amun	2.53029	0.00002	2.530	3	Behrend 2010
(5011) Ptah	> 20	-	-	-	
(5261) Eureka	2.6902	0.0003	6	1	Rivkin 2003
(5261) Eureka*	16.93	0.01	-	-	*Binary orbital period
(5604) 1992 FE	5	1	5.3375	3	Higgins 2009
(5620) Jasonwheeler	5.3075	0.0004	5.307	3	Durkee 2010
(5693) 1993 EA	-	-	2.497	2	Polishook 2012
(8566) 1996 EN	-	-	-	-	
(14402) 1991 DB	2.27	0.01	2.2656	3	Pravec 2000
(16834) 1997 WU22	-	-	9.345	3	Pravec 2000
(22753) 1998 WT	-	-	10.24	2	Galad 2005
(25107) 1991 VH	-	-	2.6236T	3	Vander Haagen 2010
(52768) 1998 OR2	4.112	0.002	3.198	2	Betzler 2009
(68350) 2001 MK3	3.2112	0.0007	3.273	3	Carbognani 2011
(85867) 1999 BY9	> 20T		-	-	
(138883) 2000 YL29	10.60	0.08	-	-	
(141052) 2001 XR1	7.66	0.01	-	-	
(143651) 2003 QO104	114.09	0.04	115	3	Warner 2009
(154244) 2002 KL6	4.6081	0.002	4.6063	3	Galad 2010
(161989) Cacus	3.77	0.11	3.7538	3	Pravec 2003
(162385) 2000 BM19	9.47	0.01	-	-	
(163758) 2003 OS13	-	-	-	-	
(175706) 1996 FG3	6.04	0.02	3.5942	3	Pravec 2006
(194386) 2001 VG5	6.351	0.003	6.6	2	Polishook 2009
(203217) 2001 FX9	-	-	-	-	
(207945) 1991 JW	3.15	0.01	-	-	
(208023) 1999 AQ10	-	-	2.67	2+	Behrend 2009
(212546) 2006 SV19	-	-	-	-	
(256412) 2007 BT2	> 18	-	-	-	
2001 FE90	4.772	0.0002	0.4777	3	Hicks 2009
2004 LV2	-	-	-	-	
2005 BC	-	-	-	-	
2005 SG19	-	-	-	-	
2008 QT3	-	-	-	-	
2008 WL60	2.608	0.002	-	-	
2009 DE47	-	-	-	-	
2009 DO111	0.04887	0.00001	0.04890	3	Behrend 2009
2009 EP2	-	-	-	-	
2009 FD	>6	-	4.0	2	Behrend 2009
2009 JM2	-	-	-	-	