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SUGGESTED REVISED H VALUES OF SELECTED ASTEROIDS: REPORT NUMBER 3

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We report results obtained by the “Magnitude Alert Project” (MAP) during the first ten years of activity, from 1996 to 2006. As of December 31, 2006 the MAP Database contained 430 asteroids and 4927 measures. 16 minor planets, for which visual and CCD measures indicate an average difference of H magnitude from the current predicted values, have been observed at least during three oppositions. These confirmed discrepancies are from 0.3 to 2.6 magnitudes. We suggest a revision of their catalogued H magnitude to permit better predicted magnitudes in ephemerides of these objects, notably by the Minor Planet Center.

Since its founding at late 1996, the Magnitude Alert Project (MAP) begun by Lawrence continuously accumulated many visual and CCD measures of minor planet magnitudes. The total number of minor planets observed to have a discrepancy of at least 0.3 magnitude between the predicted and the observed magnitudes has increased each year. The MAP is managed jointly by the ALPO Minor Planet Section (http://www.lpl.arizona.edu/~rhill/alpo/minplan.html) and by the French AUDE Association (Association des Utilisateurs de Détecteurs Electroniques)

As of December 31,2006 the MAP Database contained 4927 measures summarized as 3411 entries (consisting of individual or averaged measures). A total of 430 asteroids suspected to have a magnitude discrepancy are included. A first step when a discrepancy is reported is to confirm that a discrepancy exists. Follow-up observations find that 72 / 430 (or 17%) of the initial discrepancies are not confirmed. Thus we apply very careful practices to ensure the validity of our results. Statistically, about 1 asteroid on 10 among thousands asteroids observed by the MAP Observers seems to be in error.

TABLE I. Summary of Results

Minor Planet	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(612) Veronika	11.2	-0.4	10.8	3	15	3	?
(881) Athene	10.3	1.2	11.5	4	13	4	0.27
(921) Jovita	10.6	-0.9	9.7	6	30	5	0.06
(1166) Sakuntala	8.8	1.1	9.9	4	18	4	0.20
(1239) Queteleta	12.5	-0.6	11.9	3	10	4	?
(1296) Andree	10.9	0.4	11.3	4	10	4	0.14
(1353) Maartje	10.4	-0.4	10.0	4	12	2	0.20
(1384) Kniertje	9.7	1.7	11.4	3	121	6	0.26
(1388) Aphrodite	8.9	1.6	10.5	3	12	4	0.25
(1444) Pannonia	9.1	2.6	11.7	5	457	8	0.29
(1656) Suomi	12.4	0.5	12.9	3	9	3	0.10
(3904) Honda	11.3	0.7	12.0	4	42	8	0.14
(4483) Petofi	11.9	1.1	13.0	4	19	6	0.49
(5641) Mc Cleese	12.7	1.4	14.1	3	15	5	0.06
(6354) Vangelis	11.8	0.5	12.3	3	12	3	0.18
(9117) Aude	12.4	0.8	13.2	5	36	9	0.13

Column Legends:
M.P = Number and name of the asteroid
(1) = H MPC value
(2) = MAP difference of magnitude
(3) = Revised H value by the MAP
(4) = Total of observed oppositions
(5) = Total of MAP measures
(6) = Total of observers
(7) = Half-amplitude of the known light variability

Since the last report in the MPB on October 2001, the MAP pursues its quest for better accuracy of the received data. Nearly all the GSC measures have been removed for the computation of the revised H magnitudes; The USNO unfiltered CCD measures were corrected by R-V = +0.4 mag. The CCD observers were requested to use preferably the reference stars of the LONEOS or Tycho-2 catalogs. A website maintained by Bernard Guillaud-Saumur gives the dates of conjunctions between the MAP objects and the LONEOS stars in some tables which permit to image them together for a better accuracy. These lists are available at :

http://www.astrobgs.dyndns.org/astro/MAP/index.htm

Otherwise, all the MAP visual observers have observed 900 to 4500 asteroids and have a good experience in the estimation of the visual magnitudes of the minor planets. Lastly, Faure has CCD tests in progress to find an easy method which would permit an accuracy of at least 0.1 magnitude. For more information, the reader may go to the decennial MAP Report : http://astrosurf.com/aude/map/MAP_REPORT_1996-2006_ ENGLISH.htm

Various analyses of our data show an averaged difference of only 0.1 to 0.2 magnitude between visual and corrected unfiltered CCD measures now made more frequently with accurate reference stars. Thanks to other analyses on 2658 known lightcurves, the impact of the maximum light half-amplitude was found statistically smaller than 0.3 magnitude for nearly 90% of the concerned asteroids. More, they are at the maximum variability just during a short time of their rotation period (9 hours in average) and not at each opposition.

This recapitulating report of MAP Results include the 16 objects for which the measures show a continual difference between observed and predicted magnitudes at least during 3 oppositions and by 3 observers. This consistent offset implies the necessity for the H magnitude to be revised. Our reported offset values are based on the average magnitude discrepancy of all the discrepancies calculated night by night for each asteroid. The various averages reduce statistically the eventual errors.

Table I summarizes the results for the 16 asteroids.

Table II provides information on the observers of these objects.

Table III gives the details on the measures producing the results of these 16 asteroids. With the aim of reducing space in the article, this table only contains the averaged difference of magnitude of all the individual measures made during a same night, from 12H UT to12H UT of the next day.

TABLE II: List of the Observers

Name Observer	Country	T.O.	Tel.	CCD camera
AINWORTH Tony	Australia	C	T 23cm	Sbig ST7
ANTONINI Pierre	France	C	T 26cm	Hi-SiS22
BARNEY Pereghy	Australia	C	R 15cm	Pixcel 237
BEMBRICK Colin	Australia	C	T 40cm	with KAF1600
BOOKAMER Richard	USA	V	T 41cm	
BOSCH Jean-Gabriel	Swiss	C	T 20cm	?
BROCHARD Emmanuel	France	C	T 20cm	Audine K401E
CAHILL Allan	Great-Br.	C	T 20cm	Starlight MX5
CHASSAGNE Robin	France	C	T 21cm	Hi-SiS22
CHESNEY Dennis	USA	C	T 25cm	?
CHRISTOPHE Bernard	France	C	T 60cm	Hi-SiS22
DEMEAUTIS Christ.	France	C	T 20cm	Audine KAF400
FAURE Gérard	France	V/C	T 20cm	Sbig ST6
FLETCHER John	Great-Br.	C	T 25cm	Starlight MX916
GARRETT Lawrence	USA	V	T 32cm	
HARVEY Roger	USA	V	T 73cm	
LEYRAT Cédric	France	C	T 30cm	Sbig ST7
LLAPASSET Jean-M.	France	C	T 28cm	Sbig ST7
MARTINOLE Philippe	France	C	T 25cm	Hi-SiS22
MORATA Didier	France	C	T 30cm	Hi-SiS22
MORATA Stéphane	France	C	T 30cm	Hi-SiS22
PILCHER Frederick	USA	V	T 35cm	
PISES Observatory	France	C	T 25cm	Alpha 500
PONCY Raymond	France	C	T 20cm	?
ROY René	France	C	T 25cm	Hi-SiS22
SALTHOUSE Andrew	USA	V	T 44cm	
SPOSETTI Stefano	Swiss	C	T 20cm	Hi-SiS22
THISY Olivier	France	C	T 20cm	Sbig ST7E
VAN DEN ABBEEL F.	Belgium	C	T 20cm	Audine KAF400

T.O.= Type of observations : C = CCD and V = visual

TABLE III: Record of Observations

Column Legends:

Dates = observation date (year-month-day.part of day)
(1) = Magnitude type:
AMv=Visual magnitude with asteroid comparison
GMt= Unfiltered CCD mag with GSC corrected by Tycho 2
GMv=Visual magnitude with GSC corrected by Tycho 2
SMr=Unfiltered CCD mag with R mag USNO-SA comparison
TMv=Visual magnitude with Tycho 2 (mag V comparison)
UMv=Visual magnitude with USNO-SA comparison
UMr=Unfiltered CCD mag with R mag USNO-A comparison
UMu= Unfiltered CCD magnitude with USNO-SA comparison

(2) = Predicted V magnitude

(3) = MAP magnitude differences. Averaged by night :
x.xx F = x.xx magnitude fainter than predicted
-x.xx B = x.xx magnitude brighter than predicted

Adjustement V-R = 0.4 mag for the UMr and SMr magnitude type (USNO stars)

Adjustement ± 0.x magnitude for the GMv magnitudes

(4). = Number of measures made during the given day

The evolution of the official H magnitudes follows the record of observations for each asteroid, with the years of the publication of the MPC magnitudes in the "Ephemerides of Minor Planets"

Dates	(1)	(2)	(3)	(4)	Observers

(612) Veronika

Dates	(1)	(2)	(3)	(4)	Observers
00-06-01.9	AMv	15.4	-0.30B	2	Gérard FAURE
00-07-31.9	UMr	16.1	-0.67B	3	René ROY
01-10-16.0	AMv	14.4	-0.20B	1	Andrew SALTHOUSE
06-06-24.0	AMv	15.0	-0.40B	2	Gérard FAURE
06-07-01.9	TMu	14.9	-0.54B	7	Gérard FAURE

H= 11.2 (EMP 1988 => 2006)
H diff = 0.42 B Revised H MAP = 10.8

(881) Athene

Dates	(1)	(2)	(3)	(4)	Observers
89-09-02.1	AMv	13.1	1.40F	1	F.PILCHER
89-09-08.1	AMv	13.1	1.40F	1	F.PILCHER
00-02-27.9	UMr	15.0	1.55F	2	C.DEMEAUTIS
02-11-11.9	AMv	13.7	1.65F	2	Gérard FAURE
06-06-11.0	TMu	14.7	1.09F	4	Gérard FAURE
06-07-02.0	TMu	14.5	0.56F	1	Gérard FAURE
06-07-27.0	AMv	14.3	1.40F	1	Gérard FAURE
06-09-23.1	GMv	13.4	0.70F	1	Richard BOOKAMER

The 1989 discrepancy of magnitude was B/0.7 with H = 2.1 mag fainter than the actual H magnitude.
H = 12.4 (EMP 1988 => 1991); H = 11.6 (EMP 1992 => 97); H = 10.3 (EMP 98 => 2006)
H diff = 1.22 F Revised H MAP = 11.5

(921) Jovita

```
98-10-03.1 SMr 15.5 -1.30B   2 Dennis CHESNEY
98-10-24.0 AMv 15.9 -1.50B   2 Lawrence.GARRETT
00-12-27.0 AMv 16.1 -0.87B   3 Gérard FAURE
01-02-19.9 UMu 16.8 -0.70B   2 J-Gabriel BOSCH
03-05-29.9 AMv 14.7 -0.63B   3 Gérard FAURE
03-05-30.9 AMv 14.7 -0.55B   2 Gérard FAURE
03-06-07.1 AMv 14.8 -0.70B   1 Lawrence GARRETT
03-06-23.9 UMr 15.1 -0.70B  10 B.CHRISTOPHE
04-09-04.8 UMr 14.8 -0.70B  30 René ROY
04-11-11.9 TMu 15.8 -0.86B   5 Gérard FAURE
```

H = 10.03 (EMP 1988 => 1991); H= 10.6 (EMP1992 => 2006)
H MPC = 10.6 H diff = 0.87 B
Revised H MAP = 9.7

(1166) Sakuntala

```
98-02-26.2 AMv 13.1   0.97F   3 Andrew SALTHOUSE
98-02-26.9 AMv 13.1   1.40F   2 Gérard FAURE
98-02-27.1 AMv 13.1           1 Andrew SALTHOUSE
98-03-01.0 AMv 13.1   1.10F   1 Lawrence GARRETT
98-03-06.1 AMv 13.1   0.90F   1 Andrew SALTHOUSE
98-05-18.8 SMr 14.0   1.33F   2 René ROY
99-07-08.1 AMv 11.1   1.00F   1 Andrew SALTHOUSE
99-07-12.1 AMv 11.0   1.50F   1 Andrew SALTHOUSE
99-07-15.1 AMv 10.9   1.60F   1 Andrew SALTHOUSE
00-11-24.1 AMv 13.2   0.90F   1 Andrew SALTHOUSE
00-11-29.2 AMv 13.1   0.90F   1 Andrew SALTHOUSE
00-12-03.1 AMv 13.0   1.00F   1 Andrew SALTHOUSE
03-07-18.9 TMv 10.6   1.15F   2 Gérard FAURE
```

H = 11.5 (EMP 1988 => 1991); H = 11.3 (EMP 1992 => 97); H = 8.8 (EMP 1998 => 2006)
H diff = 1.15 F Revised H MAP = 9.9

(1239) Queteleta

```
97-01-06.1 AMv 14.4  -0.50B   2 F.PILCHER
97-01-08.1 AMv 14.3  -0.50B   2 F.PILCHER
98-05-18.9 SMr 16.6  -0.40B   1 Pierre ANTONINI
99-08-15.8 SMr 17.3  -0.70B   3 René ROY
00-12-26.8 AMv 16.2  -0.90B   2 Gérard FAURE
```

H = 12.6 (EMP 1988 => 1991); H = 12.5 (EMP 1992 => 2006)
H diff = 0.60 B Revised H MAP = 11.9

(1296) Andree

```
87-01-30.0 AMv 13.4   0.50F   3 F.PILCHER
87-02.03.à AMv 13.3   0.50F   3 F.PILCHER
97-12-28.0 AMv 13.2   0.50F   1 Lawrence GARRETT
97-12-29.8 AMv 13.2   0.40F   1 Gérard FAURE
99-05-16.0 AMv 14.3   0.30F   1 Gérard FAURE
06-03-05.1 GMv 13.6   0.20F   1 Richard BOOKAMER
```

B(1.0)=12.5 (EMP 1987); H = 11.5 (EMP 1988 => 1991); H = 10.9 (EMP 1992 => 2006)
H diff = 0.40 F Revised H MAP = 11.3

(1353) Maartje

```
00-09-28.1 AMv 14.3  -0.40B   2 Andrew SALTHOUSE
00-09-29.1 AMv 14.3  -0.60B   1 Andrew SALTHOUSE
00-09-30.1 AMv 14.3  -0.60B   1 Andrew SALTHOUSE
02-01-11.9 AMv 15.3   0.05F   2 Gérard FAURE
05-08-01.0 AMv 14.8  -0.20B   1 Gérard FAURE
06-09-02.1 TMu 16.2  -0.76B   5 Gérard FAURE
```

H = 10.0 (EMP 1988 => 1991); H = 10.4 (EMP 1992 => 2006)
H diff = 0.42 B Revised H MAP = 10.0

(1384) Kniertje

```
98-03-28.0 AMv 14.6   1.20F   1 Gérard FAURE
98-04-19.9 SMr 14.2   1.90F   1 Pierre ANTONINI
98-05-15.8 SMr 14.4   1.73F   3 Stefano SPOSETTI
98-05-16.9 AMv 14.4   1.30F   1 Gérard FAURE
98-05-17.9 SMr 14.4   1.80F   2 Jean-M.LLAPASSET
98-05-18.8 SMr 14.4   1.88F   2 Jean-M.LLAPASSET
98-05-18.9 SMr 14.4           2 Pierre ANTONINI
98-06-19.8 SMr 15.0   1.65F   2 Pierre ANTONINI
98-06-26.9 SMr 15.1   1.90F   2 René ROY
00-10-31.1 AMv 12.6   1.10F   1 Andrew SALTHOUSE
00-11-01.1 AMv 12.6   0.90F   2 Andrew SALTHOUSE
00-11-02.0 AMv 12.6   0.90F   2 Andrew SALTHOUSE
03-06-25.9 UMr 14.4   1.41F  16 René ROY
03-07-05.9 UMr 14.5   1.35F  12 René ROY
03-07-06.9 UMr 14.5   1.35F  44 René ROY
03-07-17.9 UMr 14.7   1.45F  30 René ROY
```

H = 11.7 (EMP 1988 => 1991); H = 11.2 (EMP 1992 => 97); H = 9.7 (EMP98 => 2006)
H diff = 1.45 F Revised H MAP = 11.4

(1388) Aphrodite

```
98-10-15.9 UMv 13.0   1.05F   2 Gérard FAURE
98-10-19.9 SMr 12.9   2.10F   3 Pierre ANTONINI
98-10-23.2 SMr 12.9   1.90F   2 Dennis CHESNEY
98-10-26.0 AMv 12.9   1.60F   2 Lawrence GARRETT
04-12-13.0 AMv 13.6   1.60F   1 Gérard FAURE
06-04-22.9 AMv 14.4   1.40F   2 Gérard FAURE
```

H = 11.10 (EMP 1988 => 1991); H = 10.81 (EMP 1992 => 97); H = 8.89 (EMP 98 => 2006)
H diff = 1.60 F Revised H MAP = 10.5

(1444) Pannonia

```
99-01-24.7 SMr 15.0   2.77F   3 René ROY
00-02-27.8 SMr 14.2   2.55F   2 C.DEMEAUTIS
01-04-17.x GMt 13.4   2.92F  78 BEMBRICK and al
01-04-27.x GMt 13.3   2.29F  63 BEMBRICK and al
01-05-02.x GMt 13.3   2.54F  35 BEMBRICK and al
02-08-14.0 AMv 13.2   2.30F   2 Gérard FAURE
02-09-29.8 UMr 14.1   2.72F   6 B.CHRISTOPHE
02-09-30.8 UMr 14.1   2.69F  14 B.CHRISTOPHE
02-10-06.8 UMr 14.2   2.84F 100 B.CHRISTOPHE
03-09-29.9 UMr 14.6   2.30F 147 Olivier THISY
03-10-23.8 UMr 14.4   2.20F   3 Alan CAHILL
03-10-26.7 UMr 14.4   2.55F   4 John FLETCHER
```

Bembrik et al = Bembrick, Ainworth and Barney
H = 11.0 (EMP 1988 => 1991); H = 10.6 (EMP 1992 => 1997); H = 9.1 (EMP 1998 => 2006)
H diff = 2.56 F Revised H MAP = 11.7

(1656) Suomi (Mars-crosser)

```
96-02-24.9 UMv 13.7   0.50F   2 Gérard FAURE
99-06-12.9 SMr 15.5   0.27F   3 René ROY
99-07-24.9 SMr 16.1   0.65F   2 B.CHRISTOPHE
04-04-25.1 AMv 14.9   0.50F   2 Gérard FAURE
```

```
H = 13.1 (EMP 1988 => 1991); H= 12.4 (EMP1992 =>
2006)
H diff = 0.48 F             Revised H MAP = 12.9
```

(3904) Honda

```
90-09-18.1 AMv 14.7   0.70F   1 Roger HARVEY
96-01-20.0 AMv 14.5   0.30F   1 Gérard FAURE
98-07-26.0 SMr 15.5   1.00F   2 Pierre ANTONINI
98-07-29.9 SMr 15.4   1.00F   2 Ph.MARTINOLE
98-07-30.0 SMr 15.4           2 Jean-M.LLAPASSET
98-08-05.0 SMr 15.3   1.10F   2 Jean-M.LLAPASSET
98-08-06.0 SMr 15.3   0.85F   2 Jean-M.LLAPASSET
98-08-07.0 SMr 15.3   1.05F   2 Jean-M.LLAPASSET
98-08-08.0 SMr 15.2   0.70F   2 Jean-M.LLAPASSET
98-08-16.9 SMr 15.0   0.70F   2 Jean-M.LLAPASSET
98-08-19.0 SMr 15.0   0.53F   2 Jean-M.LLAPASSET
98-08-19.9 SMr 15.0   0.70F   1 Pierre ANTONINI
98-08-21.0 SMr 14.9   0.75F   2 Jean-M.LAPASSET
98-08-22.9 SMr 14.9   0.80F   1 B.CHRISTOPHE
98-08-23.9 SMr 14.9   0.60F   3 Ph.MARTINOLE
98-09-12.9 SMr 14.8   0.68F  11 Robin CHASSAGNE
04-02-15.9 UMr 15.0   0.13F   4 René ROY
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```
The original discrepancies of 1990 and 1996 were
respectively 0.8 and 0.4 magnitude.
H = 11.5 (EMP 1990 => 1991); H  = 11.1 (EMP 1992
=> 1997); H = 11.3 (EMP 1998 => 2006)
H diff = 0.72 F             Revised H MAP = 12.0
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(4483) Petofi (Hungaria)

```
91-06-08.1 AMv 14.7   1.00F   1 Roger HARVEY
99-06-12.9 SMr 14.8   1.58F   2 René ROY
99-06-12.9 UMv 14.8           2 Gérard FAURE
99-08-12.8 SMr 15.3   1.15F   2 B.CHRISTOPHE
02-08-??.? AMv 13.4   0.80F   2 Andrew SALTHOUSE
02-09-07.0 AMv 13.4   0.80F   2 Lawrence GARRETT
02-09-29.8 UMr 13.7   1.45F   6 B.CHRISTOPHE
04-04-25.0 AMv 14.6   0.95F   2 Gérard FAURE
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```
H = 11.9 (EMP 1992 -> 2006)
H diff = 1.10 F             Revised H MAP = 13.0
```

(5641) Mc Cleese (Mars-crosser)

```
95-03-25.1 AMv 14.0   1.70F   1 Roger HARVEY
98-07-26.0 SMr 15.2   1.60F   2 Pierre ANTONINI
98-07-29.9 SMr 15.1   1.05F   2 Ph.MARTINOLE
98-08-19.9 SMr 14.5   1.90F   2 Pierre ANTONINI
98-08-25.8 SMr 14.3   1.83F   3 René ROY
00-04-02.0 AMv 13.9   1.00F   2 Gérard FAURE
00-04-19.8 SMr 14.2   0.80F   3 René ROY
```

```
H = 12.7 (EMP 1995 => 1997); H = 12.7 (EMP 1998 =>
2006)
H diff = 1.41 F             Revised H MAP = 14.1
```

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MPB 2006-1: The Observatory of Ondrejov found a H
= 14.4 (with assumed V-R = 0.4)
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(6354) Vangelis

```
93-12-17.1 AMv 14.8   0.20F   6 Roger HARVEY
99-04-16.9 AMv 15.0   0.70F   2 Gérard FAURE
03-02-22.8 AMv 14.9   0.40F   1 Gérard FAURE
03-02-25.8 UMu 15.0   0.53F   3 F.VAN DEN ABBEEL
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Original magnitude discrepancy in 1993 was 1.5
magnitude fainter with a H magnitude = 10.5 for
the non-referenced object 1934 GA.
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```
H = 11.5 (EMP 1997); H = 11.8 (EMP 1998 => 2006)
H diff = 0.46 F             Revised H MAP = 12.3
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(9117) Aude

```
97-03-30.9 UMu 15.0   0.50F   1 D+S.MORATA/R.ROY
97-04-13.9 UMu 15.4   0.70F   1 D+S.MORATA/R.ROY
97-04-29.9 UMu 15.8   0.90F   1 D+S.MORATA/R.ROY
97-05-01.8 UMu 15.8   0.80F   1 D+S.MORATA/R.ROY
97-05-02.8 UMu 15.8   1.00F   1 D+S.MORATA/R.ROY
97-05-29.8 UMu 16.4   1.30F   1 D+S.MORATA/R.ROY
98-07-23.0 SMu 16.2   0.97F   3 René ROY
99-12-07.7 SMu 16.1   0.50F   3 René ROY
01-03-30.9 SMr 15.7   0.86F   3 Cédric LEYRAT
01-04-01.1 SMr 15.7   0.72F   1 Pierre ANTONINI
01-04-01.1 SMr 15.7           4 Observ.des Pises
01-04-20.9 SMr 15.3   0.82F   3 Raymond PONCY
01-04-21.0 TMu 15.3           1 E.BROCHARD
01-04-26.9 AMv 15.3   0.30F   1 Gérard FAURE
01-05-27.9 UMu 15.9   0.85F   4 René ROY
01-06-13.8 SMu 16.3   0.98F   6 René ROY
03-12-01.2 AMv 14.9   0.60F   2 Roger HARVEY
```

```
H = 12.4 (EMP 2000 => 2006)
H diff = 0.80 F             Revised H MAP = 13.2
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NOTE FROM THE RECORDER: This is a masterpiece of amateur accomplishment for which all the observers in the MAP program are to be congratulated. The thoroughly professional conduct of this program and its analysis has provided valuable corrections for the H values of the included asteroids and demonstrates that experienced visual observers can obtain magnitude measures correct within 0.1 to 0.3 magnitudes.

LIGHTCURVE ANALYSIS OF 335 ROBERTA

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(Received: 27 March)

Observations of asteroid 335 Roberta show the synodic period to be 12.054 ± 0.003 hr. The amplitude of the somewhat unusually shaped lightcurve is 0.13 ± 0.02 mag.

Independent observations of 335 Roberta were made by Warner and Roy in February 2007. Due to the period being nearly commensurate with 24 hours and bad weather, Warner asked for assistance from Reddy, Dyvig, and Heathcote in hopes of extending the coverage and resolving the period without ambiguity. The table below shows the observation details. The third column shows the phase angle and Phase Angle Bisector (PAB) longitude and latitude respectively.

Roy	March 3, 4	15.6, 118.8, -2.2
Warner	March 4, 5	15.8, 118.9, -2.2
Dyvig/Reddy	March 6	16.2, 119.0. –2.1
Heathcote	March 12	17.4, 119.5, -2.0

Several possible periods had been reported previously: 8.03 hr (Binzel 1987), 12.035 hr (Harris et al 1992), and 4.349 hr (Ricciolli 2001). The combined data set from the 2007 apparition seems to verify the longest period. Using the Fourier analysis algorithm developed by Harris (1989), our data showed a synodic period of 12.054 ± 0.003 hr with a lightcurve amplitude of 0.13 ± 0.02 mag.

Acknowledgements

Funding for observations at the Palmer Divide Observatory is provided by NASA grant NNG06GI32G, National Science Foundation grant AST-0607505, and by a 2007 Gene Shoemaker NEO Grant from the Planetary Society.

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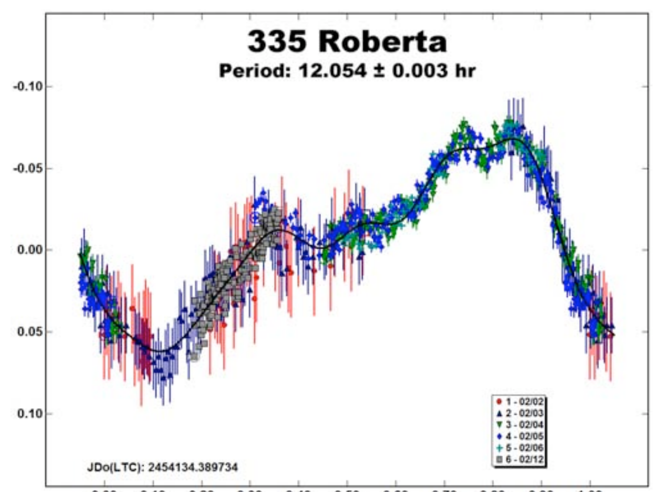

LIGHTCURVE ANALYSIS OF 235 CAROLINA

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(Received: 17 April Revised: 3 June)

The lightcurve of main-belt asteroid 235 Carolina was obtained by an international group of observers in January-February 2007. The synodic period was found to be 17.1600 ± 0.0004 hr with the lightcurve having an amplitude of 0.30 ± 0.02 mag.

Initial observations made in January 2007 by observers in the group lead by Behrend indicated the possibility that this object might be a contact synchronous binary asteroid. Authors Warner and Stephens began observations to supplement those from the Behrend group in order to confirm that possibility. Those supplemental observations found no evidence of eclipse or occultation events or a lightcurve shape that might otherwise indicate a binary. This prompted a re-examination of the original Behrend group data, which showed that that the suspected events were the result of reduction errors and did not represent actual eclipse events. Despite this, the effort shows how collaboration among observers can quickly resolve any uncertainties.

The two figures show the data sets of Warner-Stephens and the Behrend group. The Warner-Stephens data set is not as complete and found a period of 17.613 ± 0.002 hr. The more complete data set from Behrend et al shows a slightly more precise period of 17.6100 ± 0.0004 hr, which is the one adopted for this paper. These agree with a previous result of 17.56 hr (Schroll 1983).

Acknowledgements

Funding for observations at the Palmer Divide Observatory is provided by NASA grant NNG06GI32G, National Science Foundation grant AST-0607505, and by a Gene Shoemaker NEO Grant from the Planetary Society. The use of the TAROT automated telescope at Haute-Provence Observatory and the Uranoscope at Gretz-Armainvilliers is gratefully acknowledged.

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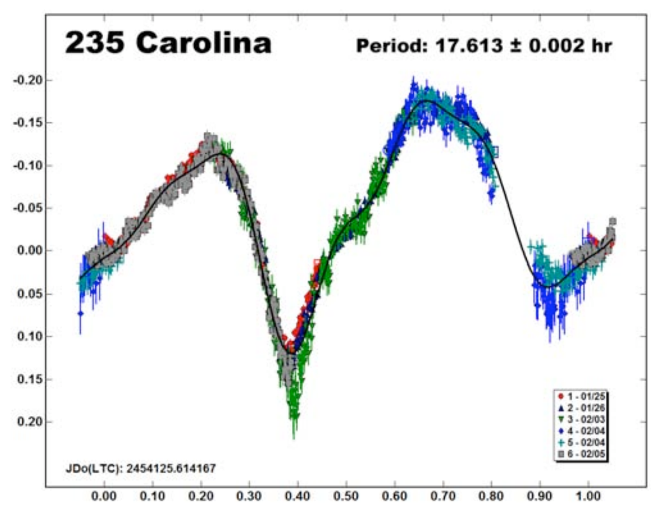

Fig. 1. Lightcurve for 235 Carolina based on Warner/Stephens.

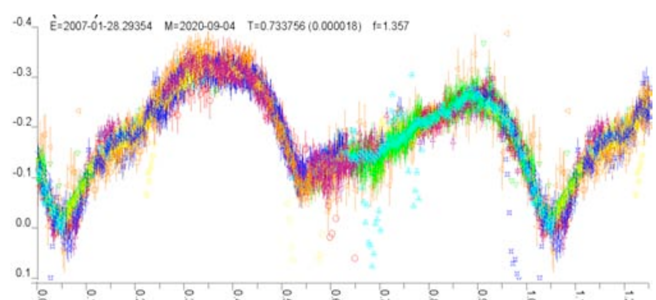

Fig. 2. Lightcurve for 235 Carolina based on Behrend et al.

6615 PLUTARCHOS, A SUSPECT BINARY ASTEROID

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6615 Plutarchos was observed from Leura and Carbuncle Hill Observatories in April and May 2007. The synodic period is reported to be 2.3247 ± 0.0001 h. This asteroid also has a partial solution as a binary with asynchronous orbital period of 40.02h ± 0.1h.

6615 Plutarchos was selected from the list of suggested targets for the Photometric Survey of Asynchronous Binary Asteroids, Pravec (2006). Observations were started on April 10, 2007, from Leura Observatory. By then the asteroid was past opposition and receding. Since the target was fading, it was possible with the available instruments to follow it until only the end of May. At that time it was no longer possible to reach the level of detection required by the survey. All nightly observations were sent to Pravec for analysis, which included checking for signs of attenuations of more then 0.02 magnitude (see Fig. 2). In this lightcurve, the attenuations are plotted into a half orbit for clarity. In a near-zero eccentricity orbit, these attenuations are caused by a primary and secondary event. In addition to that, at moderate solar phase angle, when these events occurred, the incidences of both occultations and eclipses were unlikely. This, in effect, explained the similarity in the depth of the attenuations observed on the three occasions.

During this recent campaign, the three attenuations that were captured consisted of two transit events and one occultation event or vice versa. Therefore, from the above observations, it was deduced that the orbital period is 40.02h ± 0.10h and the amplitude of the events is 0.07 mag. An orbital period of 20h or less is not likely due to geometrical constraints. The lightcurve in Fig. 1 shows the rotation period of the primary body to be 2.3247h ± 0.0001 hr with an amplitude of 0.06m ± 0.01m. September 2008 and February 2010 are the dates of the next close approaches of this asteroid.

The location and instruments used at Leura Observatory have been previously described (Oey 2006). Pray joined in the search when it was determined that the asteroid was a suspect binary. His data are shown as sessions 8 and 9. Carbuncle Hill Observatory's location and its instrumentation were documented by Pray et al (2006).

Acknowledgement

Thanks are given to Brian Warner for his tireless work in improving the Canopus program and great support for its users.

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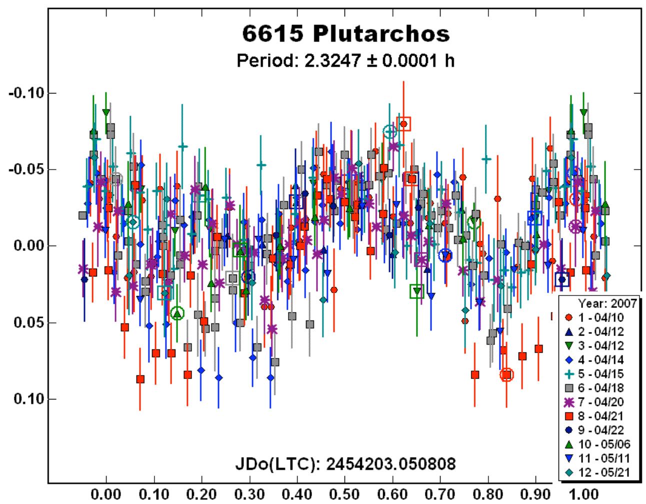

Fig. 1 Rotation period of the main body showing signs of primary or secondary events around phase 0.20.

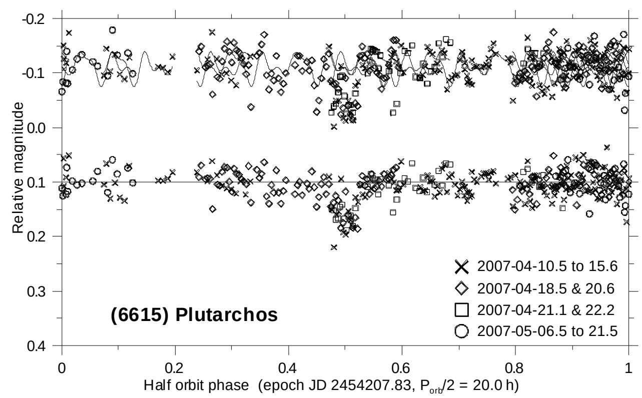

Fig. 2 The lightcurve illustrating the event captured during the campaign as shown in phase 0.50.

Date (2007)	Session	PA	LPAB	BPAB
April 10	1	13.5	179.9	2.2
April 14	4	15.7	180.4	2.2
April 18	6	17.7	181.0	2.3
April 21	8	19.2	181.4	2.3
May 21	12	29.0	188.4	2.2

Table 1. Aspects of 6615 Plutarchos during the start, the three observed events, and the end of campaign.

PHOTOMETRY FROM GMARS AND SANTANA OBSERVATORIES – APRIL TO JUNE 2007

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Lightcurve period and amplitude results from Santana and GMARS Observatories are reported for 2007 April-June. 348 May: 7.3812 ± 0.0008 hr, 0.16 mag. 502 Sigune: 10.922 ± 0.002 hr, 0.44 mag. 542 Susanna: 10.069 ± 0.003 hr, 0.11 mag. 1096 Reunerta: 13.036 ± 0.002 hr, 0.26 mag. 3028 Zhangguoti: 4.826 ± 0.001 hr, 0.20 mag. (7055) 1989 KB: 4.16845 ± 0.00005 hr, 0.20 mag. 2006 VV2: 2.413 ± 0.002 hr, 0.32 mag.

The author operates telescopes at two observatories. Santana Observatory is located in Rancho Cucamonga, California and GMARS (Goat Mountain Astronomical Research Station) located at the Riverside Astronomical Society's observing site. Details of the equipment are in Stephens (2007).

Asteroids 348 May, 502 Signue, and 3028 Zhangguoti were selected from the list of asteroid photometry opportunities published by Brian Warner and Alan Harris on the Collaborative Asteroid Lightcurve Link website (CALL 2007). 1096 Reunerta was selected to follow up on the author's observations described in Stephens (2001). (7055) 1989 KB was selected from the Binary Asteroid Survey list Parvec (2007). 2006 VV2 was a target of opportunity. The author measured the images using MPO Canopus, which employs differential aperture photometry to produce the raw data. Period analysis was done using Canopus, which incorporates the Fourier analysis algorithm (FALC) developed by Harris (1989).

The results are summarized in the table below. Column 2 gives the dates over which the observations were made, Column 3 gives the number of actual runs made during that time span and column 4 gives the number of observations used. Column 5 is the range of phase angles over the full data range. If there are three values in the column, this means the phase angle reached a minimum with the middle valued being the minimum. Columns 6 and 7 give the range of values for the Phase Angle Bisector (PAB) longitude and latitude respectively. Column 8 gives the period and column 9 gives the error in hours. Columns 10 and 11 give the amplitude and error in magnitudes.

348 May. The period of 7.3812 hours agrees with the 7.38528 hour period of Demeautis (Behrend 2007).

502 Sigune. The period of 10.922 hours appears to update the 10.5 hour period estimate by Tedesco (1979).

542 Susanna. The 10.069 hour period agrees with a 10.084 hour period obtained by Don Pray between May 23 and June 7, 2007 (private communications) and a 10.0747 hour period reported by Sheridan (CALL 2007).

1096 Reunerta. The period of 13.036 hours agrees with previously reported periods of 13.02 hours by the author (Stephens 2001) and 13.03 hours by Crippa and Manzini (Behrend 2007).

3028 Zhangguoxi. The period of 4.826 hours does not support the previously reported period of 4.401 hours by Gross (CALL 2007).

(7055) 1989 KB. The data presented is the author's only. It was combined with other observers of the Binary Asteroid Survey to generate the reported period of 4.16845 hours.

2006 VV2. This asteroid was imaged during its close flyby on March 31, 2007. Due to its rapid motion, twelve sessions were created using different comparison stars. These sessions were normalized to each other. However, Session 119 had an unknown 0.06 magnitude shift which could not be reconciled.

Acknowledgements

Thanks are given to Dr. Alan Harris of the Space Science Institute, Boulder, CO, and Dr. Petr Pravec of the Astronomical Institute, Czech Republic, for their ongoing support of all amateur asteroid. Also, thanks to Brian Warner for his continuing work and enhancements to the software program "Canopus" which makes it possible for amateur astronomers to analyze and collaborate on asteroid rotational period projects and for maintaining the CALL Web site which helps coordinate collaborative projects between amateur astronomers.

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Asteroid	Dates (2007)	Sess	Phase	L_{PAB}	B_{PAB}	Per (h)	PE	Amp	AE
348 May	05/15–06/07	4	13.0,17.5	199.3,201.2	10.5,9.6	7.3812	0.0008	0.16	0.04
502 Sigune	06/10–15	7	13.2,12.0	275.2,275.1	22.6,22.2	10.922	0.002	0.44	0.04
542 Susanna	06/19-26	6	9.8,11.6	246.0,246.1	14.6,14.4	10.069	0.003	0.11	0.04
1096 Reunerta	04/26–05/11	8	6.6,11.6	203.7	9.9,9.3	13.036	0.002	0.26	0.05
3028 Zhangguoti	04/17–04/25	4	5.0,8.0	194.3	1.4,1.7	4.826	0.001	0.20	0.04
(7055) 1989 KB	05/12–13	2	9.9,9.5	242.3	12.4,12.2	4.16845	0.00005	0.20	0.02
2006 VV2	03/31	1	43.9,42.9	169.2,169.5	9.9,9.1	2.413	0.002	0.32	0.03

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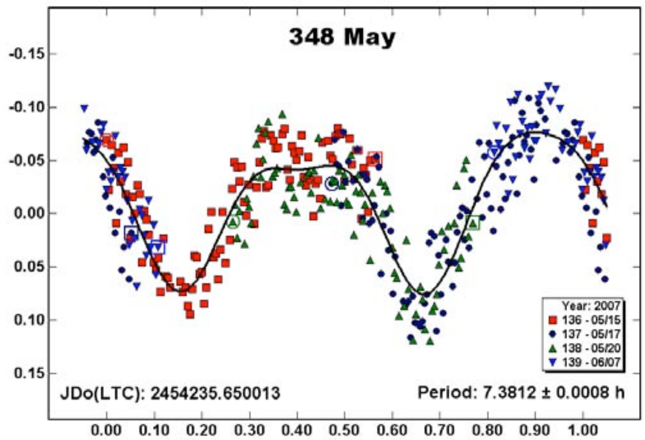

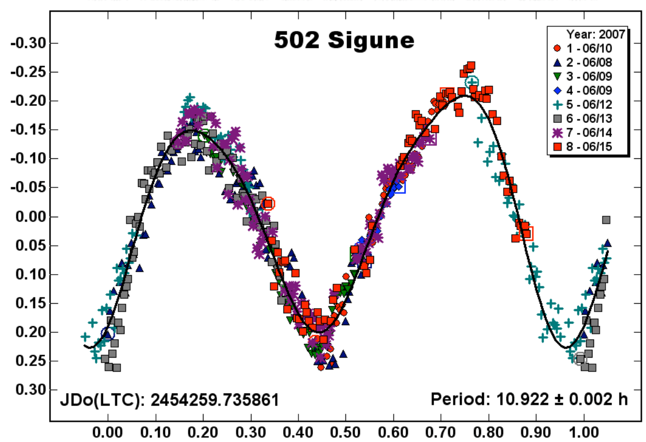

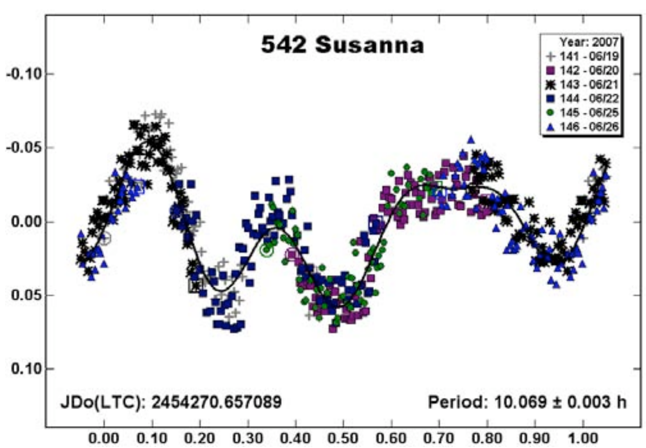

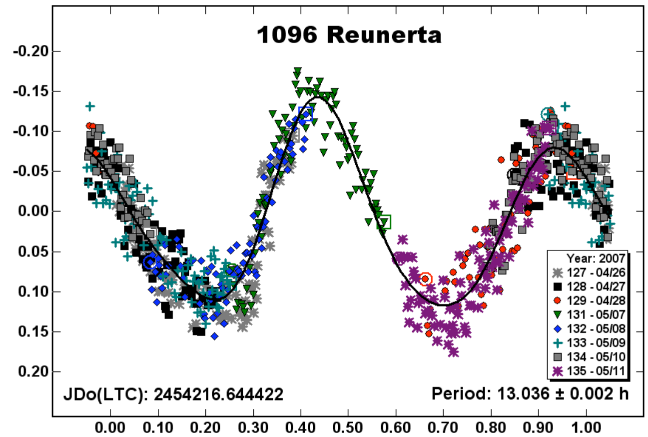

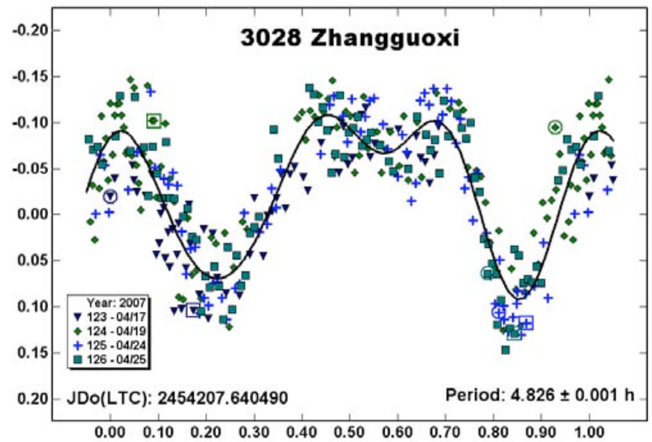

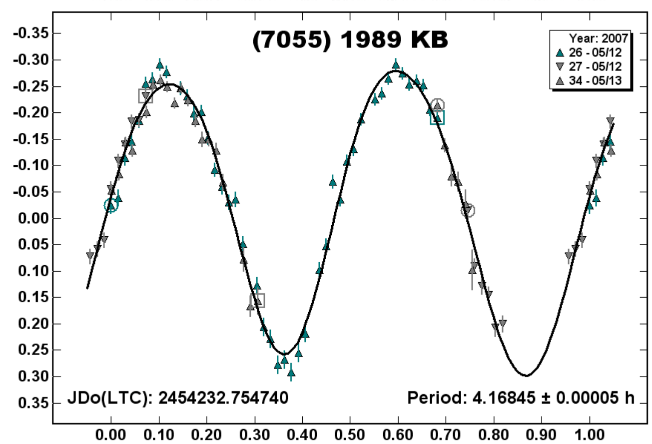

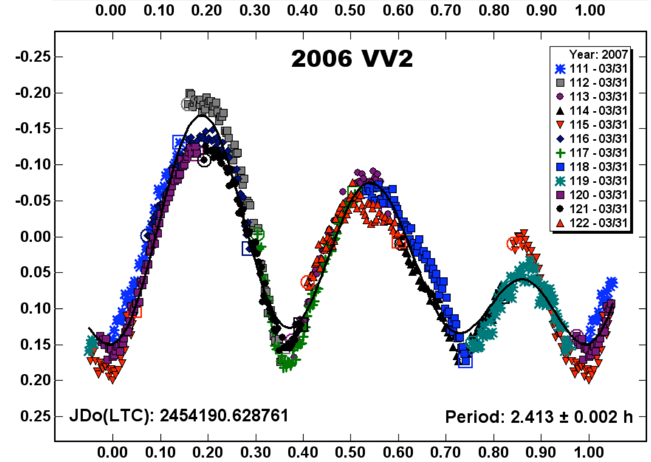

ASTEROID LIGHTCURVE ANALYSIS AT THE PALMER DIVIDE OBSERVATORY – MARCH – MAY 2007

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Lightcurves for 12 asteroids were obtained at the Palmer Divide Observatory from March through May 2007: 28 Bellona, 56 Melete, 148 Gallia, 223 Rosa, 273 Atropos, 747 Winchester, 3940 Larion, (5384) 1957 VA, 5390 Huichiming, 6029 Edithrand, (15822) 1994 TV15, and (29515) 1997 YL7. In addition, a revised period is given for 10261 Nikdollezhal'.

Observations of 12 asteroids were made at the Palmer Divide Observatory from March through May 2007. One of four telescopes/camera combinations was used: 0.5m Ritchey-Chretien/FLI IMG-1001E, 0.35m SCT/FLI IMG-1001E, 0.35m SCT/ST-9E, or 0.35m SCT/STL-1001E. The scale for each was about 2.5 arcseconds/pixel. Exposure times were 20–300s. Observations were made with a Clear filter. Guiding was used when exposures exceeded 60 seconds. All images were measured using MPO Canopus, which employs differential aperture photometry to determine the values used for analysis. Period analysis was also done using Canopus, which incorporates the Fourier analysis algorithm developed by Harris (1989).

The results are summarized in the table below, as are individual plots. The data and curves are presented without comment except when warranted. Column 3 gives the full range of dates of observations; column 4 gives the number of data points used in the analysis. Column 5 gives the range of phase angles. If there are three values in the column, the phase angle reached a minimum with the middle value being the minimum. Columns 6 and 7 give the range of values, or average if the range was relatively small, for the Phase Angle Bisector (PAB) longitude and latitude respectively. Columns 8 and 10 give the period and amplitude of the curve while columns 9 and 11 give the respective errors in hour and magnitudes. An "(H)" follows the name of an asteroid in the table if it is a member of the Hungaria group or family.

28 Bellona. This asteroid was worked to determine which of two periods that had been previously reported, 16.523 hr (Van Houten-Groenveld 1979) and 15.695 (Harris 1983), was correct – if either. The data obtained during this apparition yield a period 15.707 ± 0.002 hr, in good agreement with the Harris period. The attempt to fit the data to the longer period was decidedly worse and so that solution was rejected.

56 Melete. Harris (1979) reported a period of 13.7 hr, while Belskya (1993) and Behrend (2007) both reported a period near 18.1 hr. The data obtained at PDO fit a period of 18.151 ± 0.002 hr, in agreement with the longer solution.

148 Gallia. The only previously reported period for this asteroid was 20.664 hr by Surdej (1979). The PDO data yield a period of 20.666 ± 0.002 hr. The amplitude of 0.21 mag is less than the 0.32 mag reported by Surdej.

223 Rosa. Based on the lightcurve data base from Harris et al (2007), no previous period had been reported for this asteroid. The plot shows the data phased to a period of 9.91 ± 0.06 hr and shows a monomodal curve. A fit of slightly lesser quality can be made assuming a bimodal curve and period of 19.83 ± 0.06 hr. The low amplitude allows for the possibility that the viewing aspect was nearly pole-on, which would make the monomodal curve a more acceptable solution.

273 Atropos. Tedesco (1979) reported a period of 20 hr. While the data obtained at PDO cover only a small section of the total lightcurve, the best solution is 23.852 ± 0.003 hr., based on an assumption of a bimodal curve. The attempt to fit the data to a period near Tedesco's clearly indicated that it was in need of revision.

747 Winchester. This asteroid was observed primarily to add to existing lightcurves in order to allow shape and spin axis modeling. Previously reported periods were 8.0 hr (Harris 1980); 9.40 hr (Zappala 1983); 9.402 hr (Michalowski 1993); and 9.334 hr (Behrend 2007).

3940 Larion. The author worked this asteroid in 2004 but could not find a period due to noisy data and low amplitude. Despite a

#	Name	Date Range (mm/dd) 2007	Data Pts	Phase	L_{PAB}	B_{PAB}	Per (h)	PE	Amp (m)	AE
28	Bellona	04/28–05/10	645	8.9,12.8	201.0	10.5	15.707	0.002	0.27	0.03
56	Melete	04/28–05/13	859	7.9,14.5	201.7	2.5	18.151	0.002	0.15	0.02
148	Gallia	04/28–05/11	773	12.2,14.6	187.2	22.6	20.666	0.002	0.21	0.02
223	Rosa	03/26–04/15	178	5.3,12.2	172.1	1.8	9.91/19.83	0.06	0.06	0.01
273	Atropos	04/28–05/09	557	13.7,16.6	208.7	23.0	23.852	0.003	0.60	0.03
747	Winchester	03/23–04/14	607	7.7,5.9	200.4	19.8	9.4146	0.0002	0.16	0.02
3940	Larion (H)	05/18–19	95	20.2	258.0	27.2	4.04	0.01	0.04	0.01
(5384)	1957 VA (H)	03/23–04/15	319	21.3,17.7	194.2	25.2	12.5121	0.0005	0.74	0.03
5390	Huichiming (H)	05/11–19	449	15.5	221.4	22.6	33.6	0.1	0.25	0.03
6029	Edithrand (H)	03/13–18	220	23.4	172.2	34.1	14.472	0.005	0.15	0.03
10261	Nikdollezhal'	09/14–10/08 (2004)	639	7.0,5.1,11.5	359.8	7.1	16.747	0.004	0.07	0.02
(15822)	1994 TV15 (H)	05/12–19	174	14.8,17.9	213.5	16.1	2.9597	0.0004	0.26	0.03
(29515)	1997 YL7	03/21–04/15	147	11.1	174.4	19.9	12.231	0.001	0.67	0.03

low amplitude in 2007, the data appear to allow a solution of 4.04 ± 0.01 hr. However, the 2004 data do not fit this period. The Phase Angle Bisector (PAB) values were similar during the two apparitions, and, unfortunately, the PAB longitude will differ by about 180° at the next opposition in late 2008. The PAB latitude will differ by nearly 60° but only by going from +30 to -30°.

5390 Huichiming. The phased plot is against the period of 33.6 ± 0.1 hr and shows a bimodal curve. This was checked by looking at the plot for the half-period (16.8 hr, monomodal curve). The relatively large amplitude and individual runs preclude the shorter solution and so the period is not considered to be ambiguous.

10261 Nikdollezhal'. The author previously reported a period of 12.56 hr for this asteroid (Warner 2005). A chance re-analysis of the original data showed that solution was most likely incorrect and that a considerably better fit of the data was obtained with a period of 16.747 ± 0.004 hr, 4/3 of the previous value.

Acknowledgements

Funding for observations at the Palmer Divide Observatory is provided by NASA grant NNG06GI32G, by National Science Foundation grant AST-0607505, and by a Gene Shoemaker NEO Grant from the Planetary Society.

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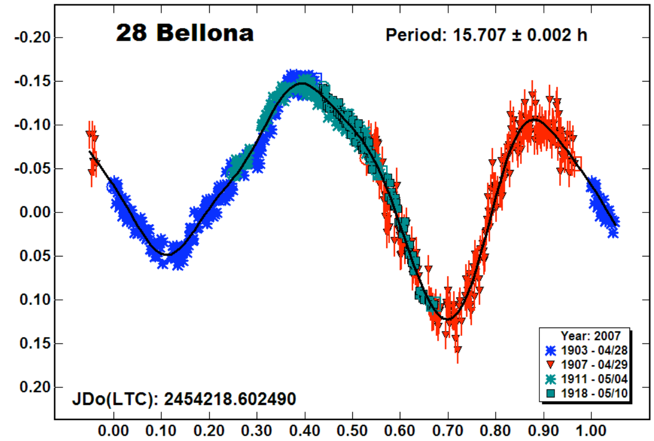
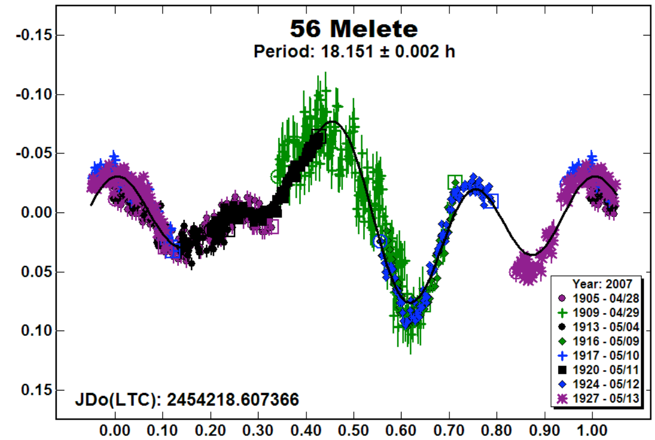
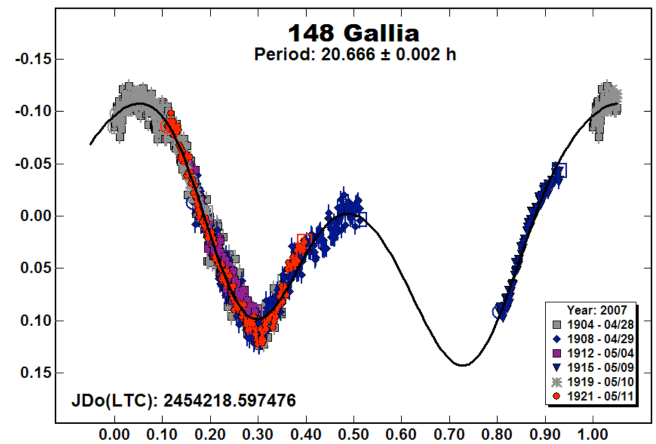
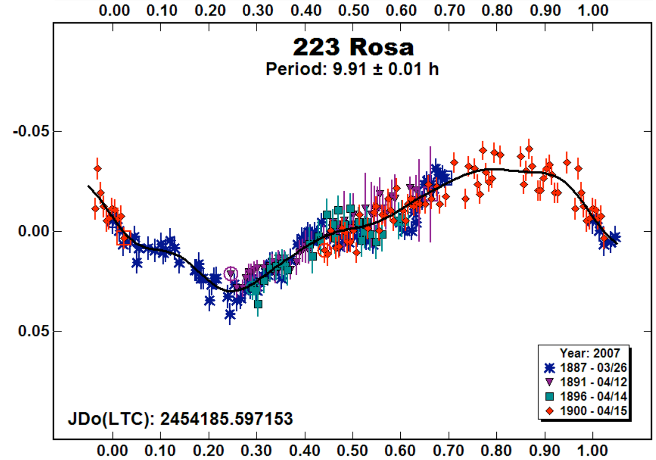
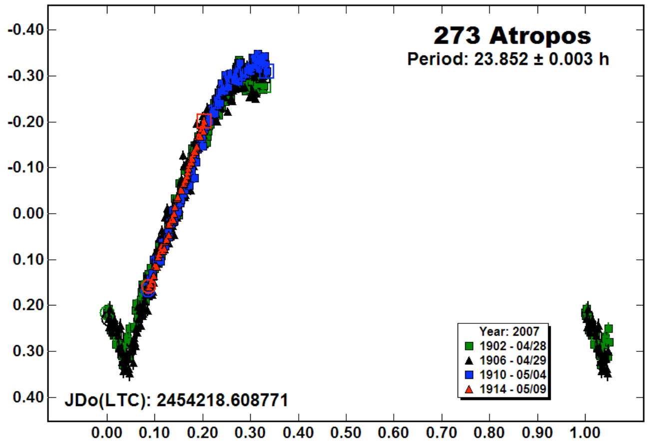
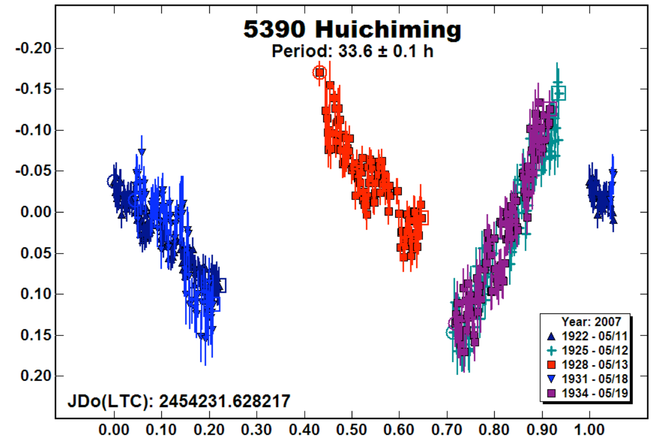


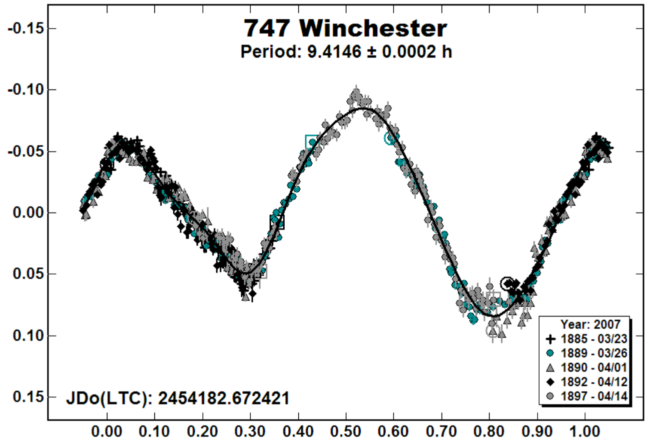


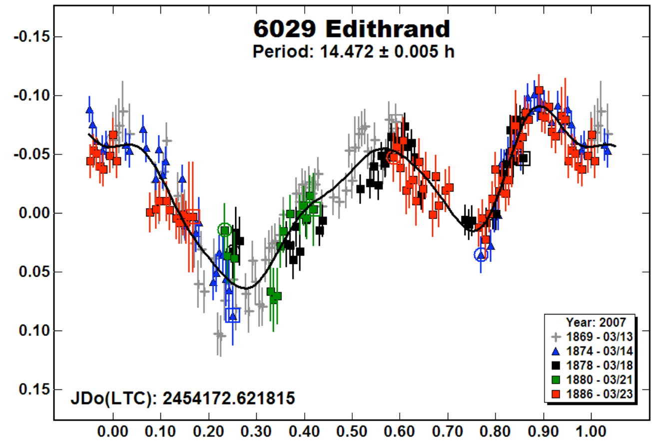


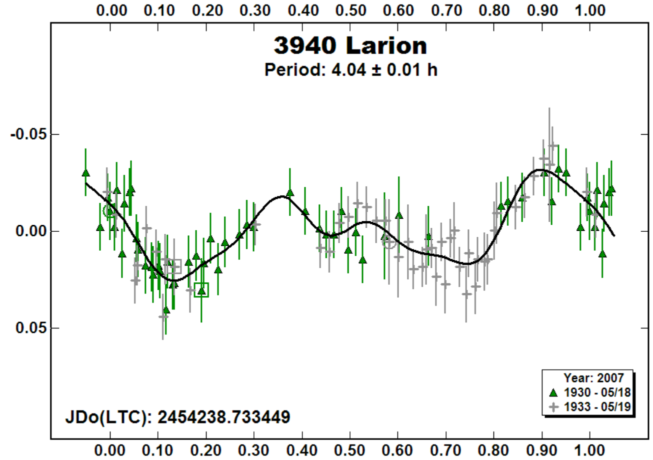


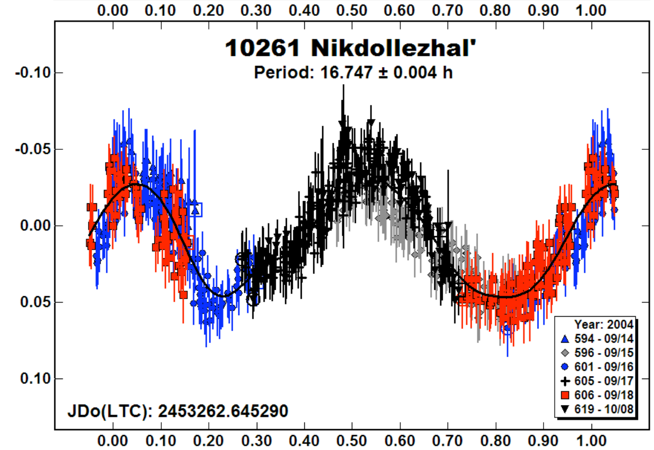

273 Atropos
Period: 23.852 ± 0.003 h
Year: 2007
1902 - 04/28
1906 - 04/29
1910 - 05/04
1914 - 05/09
JDo(LTC): 2454218.608771

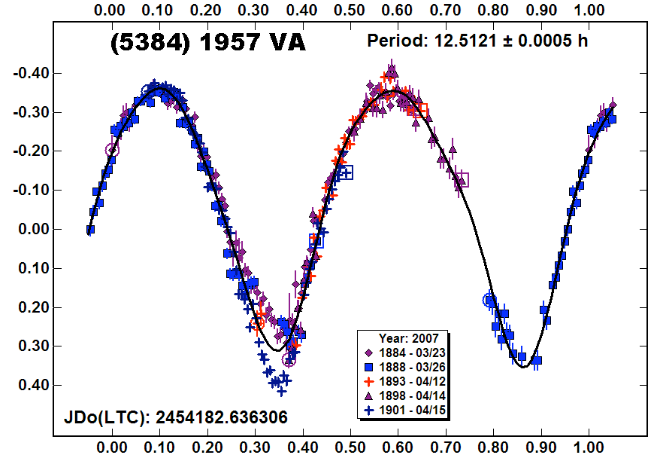

5390 Huichiming
Period: 33.6 ± 0.1 h
Year: 2007
1922 - 05/11
1925 - 05/12
1928 - 05/13
1931 - 05/18
1934 - 05/19
JDo(LTC): 2454231.628217

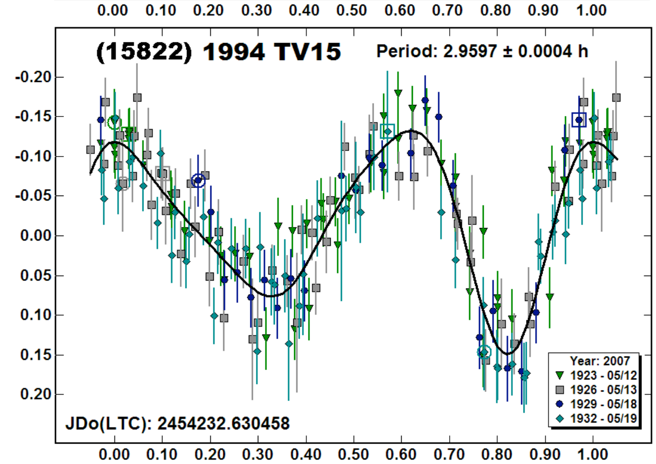

747 Winchester
Period: 9.4146 ± 0.0002 h
Year: 2007
1885 - 03/23
1889 - 03/26
1890 - 04/01
1892 - 04/12
1897 - 04/14
JDo(LTC): 2454182.672421

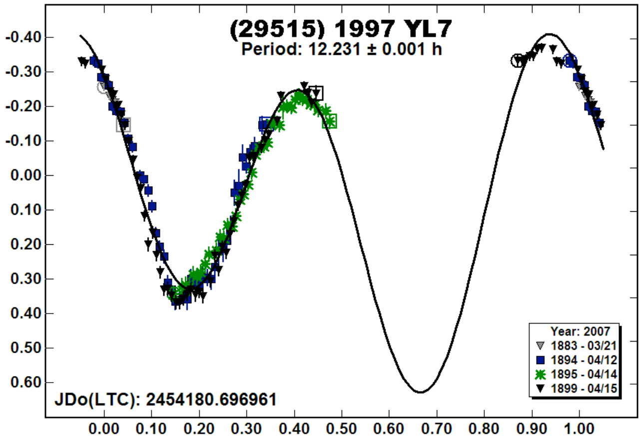

6029 Edithrand
Period: 14.472 ± 0.005 h
Year: 2007
1869 - 03/13
1874 - 03/14
1878 - 03/18
1880 - 03/21
1886 - 03/23
JDo(LTC): 2454172.621815


3940 Larion
Period: 4.04 ± 0.01 h
Year: 2007
1930 - 05/18
1933 - 05/19
JDo(LTC): 2454238.733449


10261 Nikdollezhal'
Period: 16.747 ± 0.004 h
Year: 2004
594 - 09/14
596 - 09/15
601 - 09/16
605 - 09/17
606 - 09/18
619 - 10/08
JDo(LTC): 2453262.645290


(5384) 1957 VA
Period: 12.5121 ± 0.0005 h
Year: 2007
1884 - 03/23
1888 - 03/26
1893 - 04/12
1898 - 04/14
1901 - 04/15
JDo(LTC): 2454182.636306


(15822) 1994 TV15
Period: 2.9597 ± 0.0004 h
Year: 2007
1923 - 05/12
1926 - 05/13
1929 - 05/18
1932 - 05/19
JDo(LTC): 2454232.630458



LIGHTCURVES OF MINOR PLANETS 559 NANON AND 1602 INDIANA

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Lightcurves of 559 Nanon reveal a rotation period of 10.059 ± 0.001 hr and amplitude of 0.26 ± 0.03 mag. Lightcurves of 1602 Indiana reveal a rotation period of 2.601 ± 0.001 hr and an amplitude of 0.17 ± 0.03 mag.

Photometric data were collected using a 36 cm Celestron C-14, a SBIG ST-10XME camera, and clear filter at Stonegate Observatory. The camera was binned 2X2 with a resultant image scale of 1.3 arc-seconds per pixel. The camera temperature was held at –15C for all measurements. All image exposures were 60 seconds and unguided.

559 Nanon. This asteroid was chosen as an opportunity for low phase angle opposition study (Warner et al, 2007). However, extensive periods of clouds prevented getting useful data during the low phase portion. Data for 559 Nanon were collected on every available clear night from January 17 through March 12, 2007, resulting in seven data sets. During this time, 559 Nanon started at magnitude 13 and phase angle 0.7° and ended at magnitude 14.2 and phase angle 18.6°. In all, 1127 data points were collected. The photometric data were obtained using MPO Canopus (Warner 2006). A period of 10.059 ±0.001 hours was determined. This matches closely the pervious result by Behrend (2007) of 10.061±0.001 hours.

1602 Indiana. Data were collected from March 23 through April 20, 2007, resulting in five data sets and 715 data points. 1602 Indiana started at magnitude 14.8 and dropped to magnitude 15.6 on the final night. The photometric data were also obtained using MPO Canopus. A period of 2.601 ± 0.001 hours was determined. In checking references (*Minor Planet Bulletin*) there are no previously reported data on period or lightcurve characteristics.

Acknowledgments

The author appreciates the help from Brian Warner on Canopus period analysis and his continued encouragement on asteroid photometric studies.

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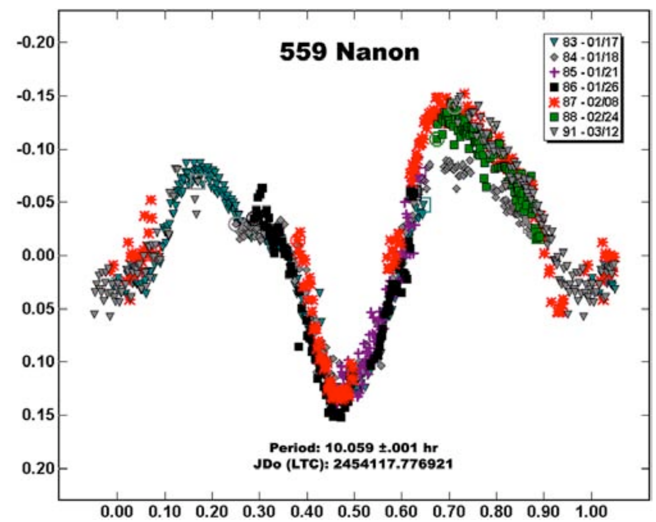

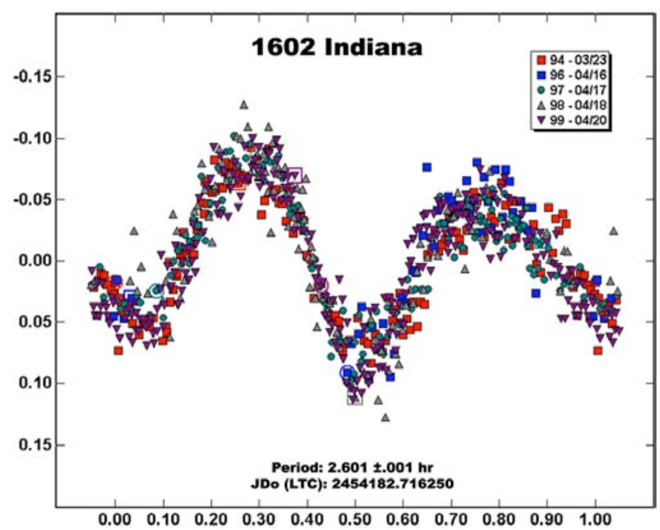

LIGHTCURVE OF MINOR PLANET 7304 NAMIKI

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Lightcurve measurements of 7304 Namiki were performed April – May 2007. Data analysis produced a lightcurve with a synodic period of 8.8586 ± 0.0006 hrs and amplitude about 0.73 mag.

Our lightcurve of 7304 Namiki is the second attempt of photometry observations from Osservatorio Astronomico Margherita Hack, Firenze (MPC code A57). The target was selected from the list of asteroid photometry opportunities published by Warner et al. (2007). This list doesn't show any available information about Namiki. In addition, no information was found on the Minor Planet Center "Minor Planet Lightcurve Parameters" web page.

The observations were obtained with a SC Meade 0.25m LX200 Classic + Focal reducer f/6.3 and Optec TCF-S electronic focuser. The CCD camera was SBIG ST7 XME. Exposure times varied between 120 – 240 s. All the observations were performed on 5 nights between 25 April and 08 May 2007.

Analysis of the combined data sets was made using the MPO Canopus software. The derived synodic rotation period was 8.8586 ± 0.0006 hrs, which agrees with the one published by Brinsfield (2007) and Wagner (2007). The 19th session was performed under less than perfect weather conditions and a nearly full moon (phase = 94%) only 35° away. This resulted in more scatter within the data set due to lower S/N ratios. Regardless, the derived synodic rotation period was unchanged when using the data from the 19th session.

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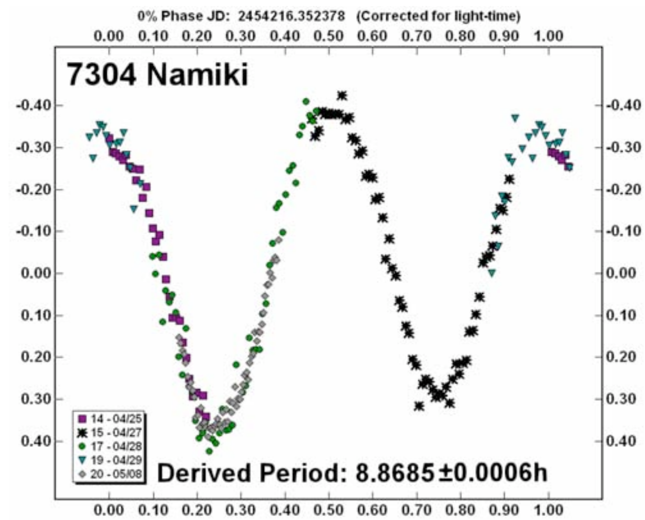

THE ROTATION PERIODS OF 872 HOLDA, 3028 ZHANGGUOXI, 3497 INNANEN, 5484 INODA, 5654 TERNI, AND 7304 NAMIKI

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(Received: 28 May)

Lightcurves for 872 Holda, 3028 Zhangguoxi, 3497 Innanen, 5484 Inoda, 5654 Terni, and 7304 Namiki were obtained at the Via Capote Observatory in April and May 2007. The derived synodic periods were: 872 Holda, 5.943 ± 0.002 hr; 3028 Zhangguoxi, 4.827 ± 0.001 hr; 3497 Innanen, 7.181 ± 0.001 hr; 5484 Inoda, 14.144 ± 0.009 hr; 5654 Terni, 9.99 ± 0.01 hr; 7304 Namiki, 8.90 ± 0.02 hr.

Observations reported here were made using a Takahashi Cassegrain at prime focus with a focal length of 136 inches and focal ratio of 11.5. The CCD imager was an Alta U6 featuring a 1024x1024 array of 24 μ-meter pixels. The CCD was operating at a temperature of –30°C. All observations were made at 1x binning yielding an image scale of 1.43" per pixel. All images were guided, 120 second exposures except where noted. Images were dark and flat field corrected. Images were measured using MPO Canopus (Bdw Publishing). All observations were made using unfiltered differential photometry and all data were light-time corrected. Period analysis was done with Canopus, incorporating the Fourier analysis algorithm by Harris (1989).

872 Holda. The observations were conducted on six nights from May 5 thru May 18, 2007. A total of 138 observations were made spanning approximately 318 hours or 54 rotational cycles. The

synodic period was found to be 5.943 ± 0.002 hr with an estimated amplitude of 0.22 ± 0.02 mag. These results agree well with a recently reported period of 5.94054 hr and amplitude of 0.20 mag. by Sheridan (2007). Casulli (2007) reported a period of 0.24770 ± 0.0001 day (5.94 ± 0.0024 hr). Finally, Lagerkvist et al. (1998) reported "ambiguous" periods of 6.78 and 7.2 hours and curve amplitudes of 0.2 and 0.4 mag depending on the aspect angle.

3028 Zhangguoxi. A total of 122 observations were made, from May 6 thru May 19, 2007, spanning approximately 318 hours or 66 rotational cycles. The synodic period was found to be 4.827 ± 0.001 hr with an estimated amplitude of 0.29 ± 0.05 mag. These results agree well with recently reported periods of 4.826 ± 0.001 hr, amplitude 0.20 ± 0.03 mag (Stephens 2007) and 4.401 ± 0.003 hr, amplitude 0.12 mag (Gross 2005). Additionally, Antonini (2007a) reports very similar provisional results of 0.20108 ± 0.00005 day (4.826 ± 0.001 hr).

3497 Innanen. The observations were conducted on five nights from April 10 thru April 17, 2007. A total of 251 observations were made, spanning approximately 126 hours or 18 rotational cycles. The synodic period was found to be 7.181 ± 0.001 hr. The amplitude of the curve was 0.60 ± 0.05 mag. These values agree reasonably well with a recently submitted reported period of 7.310 ± 0.001 hr, and amplitude 0.0562 ± 0.0430 mag (Fleenor 2007). based on a single session during the same observation time. Antonini and Casulli (2007d) report very similar results 0.298936 ± 0.000018 day (7.1745 ± 0.0004 hr).

5484 Inoda. The observations were conducted on six nights from April 10 thru April 28. A total of 287 observations were made spanning approximately 384 hours or 27 rotational cycles. Due to equipment limitations at the time this data was acquired, 90 seconds was the maximum available data integration time and the images were unguided. This restriction, combined with high sky background levels due to moon light, resulted in low S/N data. Furthermore, restrictions in the field of view at the Via Capote Observatory limited maximum on target times for any one session to approximately 4 hours. With these limitations in view, the synodic period was found to be 14.144 ± 0.009 hr. The amplitude of the curve was 0.17 ± 0.1 mag. Pravec (2007) reported similar findings of 14.1479 ± 0.0008 hr. and amplitude of 0.16. Antonini (2007b) reports provisional_findings of 0.458 ±0.023 day (10.99 ± 0.55 hr).

5654 Terni. The observations were conducted on five nights from May 6 thru May 10, 2007. A total of 149 observations were made spanning approximately 102 hours or 10 rotational cycles. Due to equipment limitations at the time this data was acquired, 120 seconds was the maximum available data integration time available. This restriction, combined with the low magnitude of the target of interest, resulted in poor S/N data. With these limitations in view, the synodic period was found to be 9.99 ± 0.01 hr with and estimated amplitude of 0.41 ± 0.07 mag. Antonini (2007c) reports similar provisional findings of 0.411 ± 0.022 day (9.86 ± 0.53 hr) Additionally, these findings agree reasonably well with a reported period of 9.255 ± 0.02 hr and amplitude of 0.33 ± 0.06 mag by Pietschnig (2007).

7304 Namiki. The observations were conducted on three nights from May 15 thru May 20, 2007. A total of 52 observations were made, spanning approximately 120 hours or 14 rotational cycles. The synodic period was found to be 8.90 ± 0.02 hr with an estimated amplitude of 0.66 ± 0.01 mag. These results agree well with recently reported periods of 8.8586 ± 0.0006 hr, amplitude 0.73 mag (Mannucci 2007) and 8.8754 ± 0.0001 hr, amplitude 0.30 ± 0.025 mag (Sheridan 2007). Additionally, these findings agree reasonably well with provisional data indicating a period of 0.376 ± 0.005 day, or 9.02 ± 0.12 hr (Poncy 2007).

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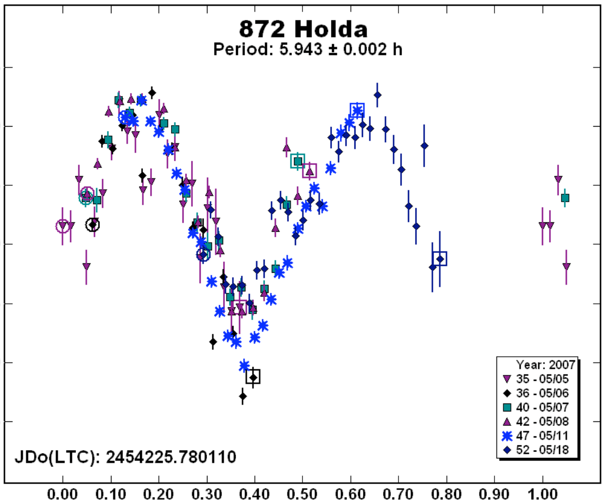
872 Holda
Period: 5.943 ± 0.002 h
Year: 2007
35 - 05/05
36 - 05/06
40 - 05/07
42 - 05/08
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52 - 05/18
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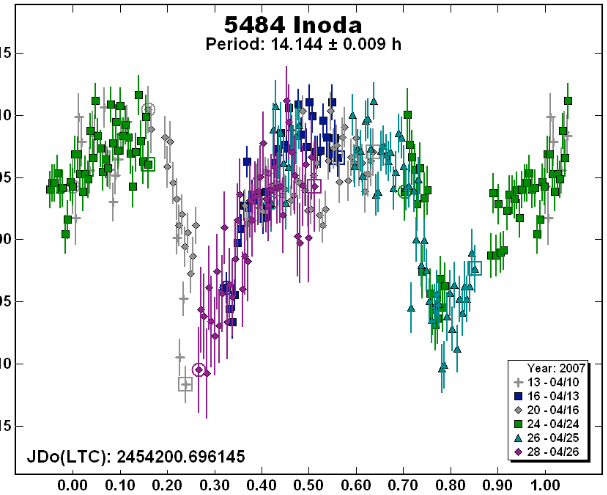
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Period: 14.144 ± 0.009 h
Year: 2007
13 - 04/10
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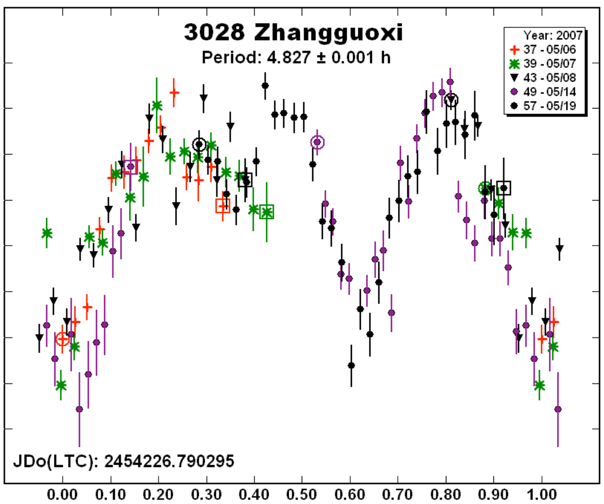
3028 Zhangguoxi
Period: 4.827 ± 0.001 h
Year: 2007
37 - 05/06
39 - 05/07
43 - 05/08
49 - 05/14
57 - 05/19
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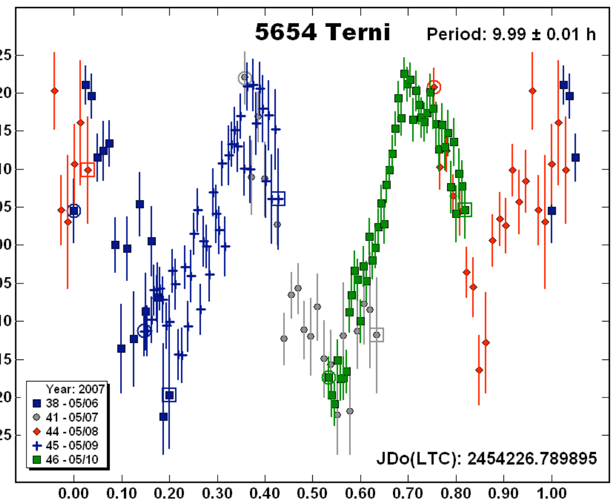
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Period: 9.99 ± 0.01 h
Year: 2007
38 - 05/06
41 - 05/07
44 - 05/08
45 - 05/09
46 - 05/10
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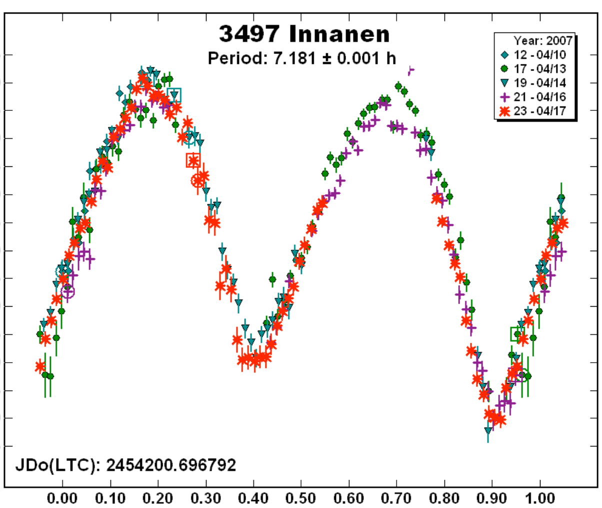
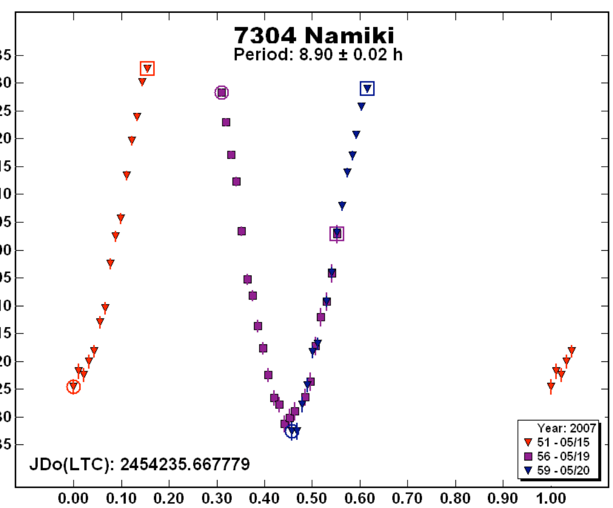

3497 Innanen
Period: 7.181 ± 0.001 h
Year: 2007
12 - 04/10
17 - 04/13
19 - 04/14
21 - 04/16
23 - 04/17
JDo(LTC): 2454200.696792


7304 Namiki
Period: 8.90 ± 0.02 h
Year: 2007
51 - 05/15
56 - 05/19
59 - 05/20
JDo(LTC): 2454235.667779

LIGHTCURVE ANALYSIS OF 1102 PEPITA

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(Received: 26 June)

Observations of 1102 Pepita were made in June 2007. Analysis yields a lightcurve with a period of 5.1054 ± 0.0002 hr and amplitude of 0.34 ± 0.03 mag.

The authors independently selected 1102 Pepita from the list of asteroid photometry opportunities published by Brian Warner and Alan Harris on the Collaborative Asteroid Lightcurve Link (CALL) website (Harris 2007). Stephens observed on June 9, 10 and 17 using a 0.35m SCT/RCX with SBIG ST9e CCD camera operating at –5 to -10C. Sada observed on June 12 and 17 using a 0.35m SCT and ST9e CCD camera operating at -8 to -10C. Both instruments were operating at F/6.3 providing a resolution of 1.7 arcseconds per pixel. All images were unfiltered. The table gives the viewing aspects. Note that the asteroid reached a minimum phase angle (α) of ~6.1° on June 14, 2007.

Date	Phase	PAB_L	PAB_B
2007 June 09	6.4	263.7	14.4
2007 June 10	6.3	263.7	14.4
2007 June 12	6.2	263.7	14.5
2007 June 17	6.2	263.7	14.8

Each author measured his images using MPO Canopus, which employs differential aperture photometry to produce the raw data. Period analysis by Warner was done using Canopus, which incorporates the Fourier analysis algorithm (FALC) developed by Harris (1989). The resulting lightcurve reveals a perioid of 5.1054 ± 0.0002 hr and an amplitude of 0.34 ± 0.03 mag.

Acknowledgements

Thanks are given to Brian Warner for his continuing work and enhancements to the software program “Canopus” which made it possible for the authors to analyze and collaborate on this project and for maintaining the CALL Web site which alerted them that they were both working the same object.

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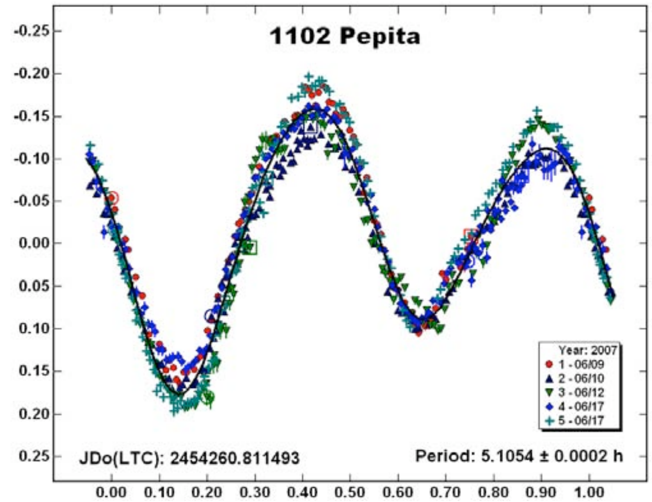

LIGHTCURVE OF MINOR PLANET 2167 ERIN

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Lightcurve measurements of 2167 Erin were performed March – April 2007. Data analysis produced a lightcurve with a synodic period of 6.493 ± 0.001 hrs and an amplitude of 0.6 mag.

Our observations of 2167 Erin represent the first attempt of photometry observations from Osservatorio Astronomico Margherita Hack, Firenze (MPC code A57). The target was selected from the list of asteroid photometry opportunities published by Warner et al. (2007). This list show a period of 7.0 hrs with uncertainty parameter (U) of 2 for 2617 Erin.

The observations for this paper were obtained with a SC Meade 0.25m LX200 Classic + Focal reducer f/6.3 and Optec TCF-S electronic focuser. The CCD camera was SBIG ST7 XME. Exposure times varied between 120 – 240 s. All the observations were performed on 9 nights between 09 March and 16 April 2007.

Analysis of the combined data sets was made using the MPO Canopus software. The derived synodic rotation period was 6.493 ± 0.001 hrs. This result is comparable to the value published in the list by Harris (2006). During some of 30 images of the 9th session on 16 April 2007, the asteroid was passing near a bright star. For this reason the photometric measurements of these images were made using a different diameter of the circular apertures and plotted as the 10th session. In any case the derived synodic rotation period was unchanged from the 10th session.

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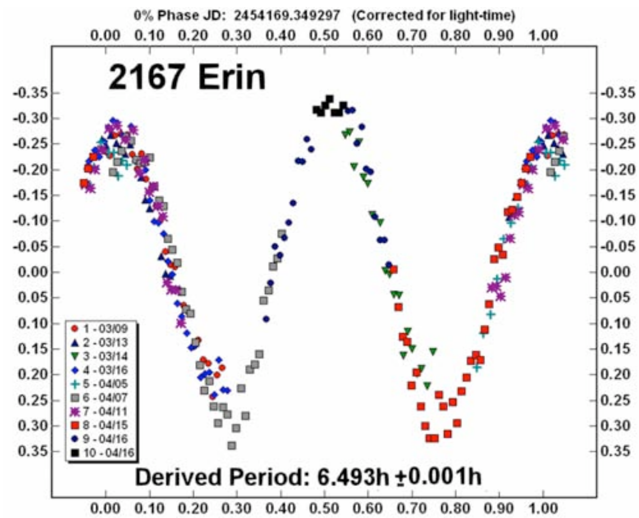

Figure 1: Composite lightcurve of asteroid 2167 Erin derived from 9 nights of observations and a rotation period of 6.493 hours.

LIGHTCURVE OF 7304 NAMIKI

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7304 Namiki was observed on 7 nights in May 2007. The synodic period was determined to be 8.8712 ± 0.0014 hr. The lightcurve amplitude was 0.74 ± 0.02 magnitudes, peak to peak.

Asteroid 7304 Namiki was observed at Teakdale Astrophysical Observatory (MPC Code H90) in suburban Ottawa during an unusual string of clear weather on seven nights in May 2007. This target was chosen as one of the most northerly asteroids on the MPB list of photometry opportunities (Warner et al. 2007).

On the first five nights, data were collected with a 9cm f/5.6 apochromatic refractor on a German equatorial mount with an SBIG ST2000XM CCD camera and Custom Scientific clear filter. Image scale was 3.07 arc-seconds per pixel. Photometric data from these 5 nights were too noisy to clearly discern whether the curve was monomodal or bimodal, so an additional two nights of data were collected using a recently repaired 200mm f/5.6 Newtonian with the same camera and filter at an image scale of 1.36 arc-seconds per pixel. Typical sessions were approximately 5.5 hours in duration, interrupted by a meridian flip near local midnight. Two nights were cut short by cloudy skies. Exposures throughout were 120 sec. All exposures were auto-guided. Camera temperature was maintained at -10C for all exposures. Maxim DL/CCD Version 4.59 was used for telescope and camera control, for image calibration (bias, dark, and flat-field), and for differential photometry using three comparison stars for each data series. Observations were light-time corrected based on distances indicated by the Earth Centred Universe Version 5.0 Pro planetarium program. In all, 499 observations were collected.

Data were analyzed using Period04 Version 1.0.1 (Lenz and Breger, 2005). A frequency of 5.41074 ± 0.0008 d^{-1} was found by Period04. By examination of the folded light curve, this was determined to be one half of the bimodal period of 8.8712 ± 0.0014 hr. Period04 found an amplitude of 0.74 ± 0.02 magnitudes. The period agrees well with previous results of 8.90 ± 0.02 hr (Brinsfield 2007), 8.8586 ± 0.0006 hr (Montigiana 2007), and 8.8754 ± 0.0001 hr (Sheridan 2007).

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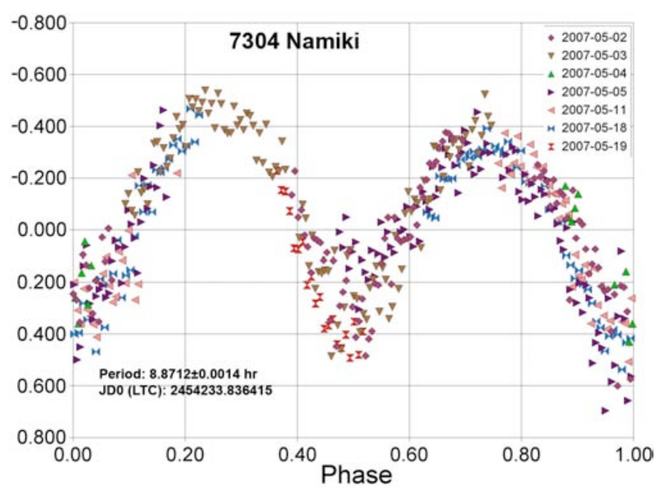

INITIAL RESULTS FROM A DEDICATED H-G PROJECT

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One of the main obstacles to studies of the asteroid population, NEAs in particular, is the lack of good H (absolute magnitude) and G (phase slope) values. Starting in early 2007, the Palmer Divide Observatory began a dedicated program for determining the H-G values for as many asteroids as possible. The initial efforts involved MBA asteroids as a control group where the results were compared to values given in the MPCORB file (MPC 2007). Subsequent observations will concentrate on brighter targets within the NEA and inner main-belt populations. A consequence of these observations is also the determination of the V-R color index for almost all targeted asteroids. This paper discusses the details of the project, from strategy to implementation, as well as reporting some initial findings.

Introduction

The H-G system of absolute magnitude and phase slope parameter was developed by Bowell et al (1989). The H value took on the meaning of being the Johnson V magnitude of a given asteroid when moved to unity distance from the Sun and Earth and viewed at 0° phase angle. The phase slope parameter (G) was defined so that it is a continuous function, even through very small phase angles, and is valid for phase angles up to approximately 120°.

When phase angles are <7°, the so-called “opposition effect” comes into play, causing the asteroid to brighten in a manner different from what pure geometry would dictate. The value of G models the behavior of the asteroid's brightness both well away from and near opposition. The smaller the value of G, the steeper the slope of the phase curve line. It is even possible for G to be negative, e.g., –0.04 for 163 Erigone. The value of G along with the behavior of the curve near opposition can be used to develop models that explain the opposition effect and general scattering laws. The latter come into play when inverting lightcurves, i.e., generating a shape and spin axis model based on a number of lightcurves.

In order to establish a valid value for G, one must have observations near opposition, i.e., when the phase angle is near as possible to 0°. If such observations are not available, e.g., most observations are at phase angles >7°, then a value for G must be assumed. This still allows a value for H to be found. The adopted default value for G is 0.15, though it has been shown that this is merely a compromise and that the actual value can be dependent on taxonomic class (see pg. 553 of Bowell 1989).

The determination of the H value of an asteroid has many direct ramifications. Chief among them is the determination of the approximate size of the asteroid based on the formula

$$\log D\ (km) = 3.1235 - 0.2H - (0.5 * \log(pv))$$

where H is the absolute magnitude of the asteroid and pv is the geometric albedo in the V band.

If not known directly, the albedo can be assumed based on the taxonomic class of the asteroid. A large number of such classifications are available using either the Tholen (1989) or SMASS II (Bus 2002) catalogs. Lacking a direct classification, the albedo can be assumed based on the orbit of the asteroid, e.g., following the method of Harris (2007) in which A and M orbit classes or main belt asteroids with a <2.6 AU are assumed to be Tholen "S" class with an albedo 0.18. Orbit classes C, T, K, or main-belt asteroids with a > 2.7 AU are assumed "C" or "D", with and albedo 0.058. Main-belt asteroids with a semi-major axis in the range 2.6-2.7 are classed "SC" and an albedo of 0.10 is assumed. Hungaria asteroids lacking any other taxonomic information are assumed to have an albedo of 0.30, intermediate between S and E classes.

Finding the H magnitude and value of G requires using the reduced magnitude of the asteroid at various phase angles. The reduced magnitude is the observed V magnitude converted to unity distance using

$$Vr = Vo - 5.0 \log(Rr)$$

where Vr is the reduced magnitude, Vo is the observed magnitude, R is the Sun-asteroid distance, and r is the Earth-asteroid distance, both in AU. The values for H and G are found using the algorithm described by Bowell and implemented in the FAZ program written by Alan Harris (see Bowell 1989). Figure 1 shows a plot of the reduced magnitude versus phase for 160 Una.

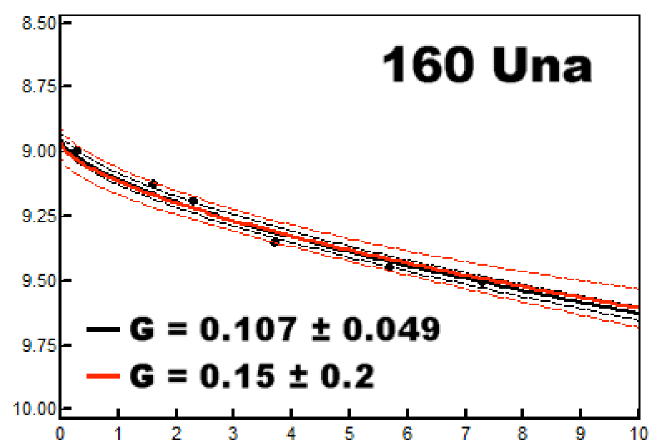

Figure 1. A plot of the reduced magnitude of 160 Una versus the phase angle. The slope of the line when the phase is >7° is the phase slope parameter, G. The value of H is the magnitude when the phase angle is 0°. Here H = 8.95 ± 0.02 and G = 0.11 ± 0.05.

The best results are achieved if, for a given night, the mean magnitude for the asteroid is used. This implies that the rotation period, amplitude, and phase at a given epoch are known. This is often not the case. It would be easy enough to follow an asteroid for several nights to obtain this information, but then the number of asteroids that could be covered during a given lunation would be reduced significantly. The problem can be overcome by getting numerous data points for the asteroid, e.g., every possible night over several weeks, and letting the amplitude variation “average out” over time (see pg. 550 of Bowell 1989).

Observation and Reduction Methods

All observations were made using a 0.35m Meade LX-200 GPS Schmidt-Cassegrain telescope and Finger Lakes Instrumentation CCD camera with a Kodak KAF-1001E chip (1024x1024x24m). The camera was run at –30°C and 2x2 binning (48m pixels), which gave a pixel scale of approximately 3.0 arcseconds. FWHM seeing is often around 6 arcseconds, so this scaling works for most cases. On exceptional nights, the camera was run a 1x1 binning (1.5"/pixel) but only the central 3/4 of the full frame was downloaded in order to increase throughput and conserve disc space. All images were guided using an external 80mm f/7 guide scope with SBIG ST-402. Guide exposures were fixed at 5 seconds using 1x1 binning to give maximum pixel scale and, therefore, guiding accuracy. A typical sequence involved shooting three images each in V and R, i.e., (VRVRVR), with the same exposure used for both filters. The exposures ranged from 90 to 180 seconds for targets of 10.5 to 14.5 V magnitude. A custom program was written to generate scripts used by MPO Connections (Bdw Publishing). That program automatically generated a multiplier that changed the exposure for each asteroid based on its predicted magnitude. Furthermore, the application kept track of which asteroids had been observed and the interval since the last observation. A report using this information formed the first step in generating the Connections script.

Depending on the length of the night, anywhere from 20 to 40 asteroids were observed. The observations started with the westernmost object and moved eastward, concluding at the start of twilight the following morning. At the start of a new lunation (third quarter to first quarter), a new set of asteroids was selected, those being east of opposition so that they could be followed for another two or three months. After the third lunation, the oldest set of asteroids was dropped from the list. A standard reference field (M67) was observed on several nights at the start of the program in order to determine the v-r to V-R transform. A new transform will be determined about every three to four months to assure the best possible accuracy and consistency. This transform allows a direct conversion of an instrumental v-r magnitude to the standard V-R as long as a good value for the first order v-r extinction (k'vr) is known (Warner 2006). It is not required to know the true values of k'v and k'r but only the differential value, k'vr. Furthermore, this value tends to be stable on a seasonal level, though occasional checks were made to assure this was the case.

For each night's observation of a given asteroid, the three V and R images were measured to find an average v-r value and standard deviation. This was converted to a V-R value with the total error being the standard deviation and error of the v-r to V-R transform added in quadrature. The final V-R value was found by using the Gaussian weighted average of the individual nights, using the aforementioned errors for the weighting and to determine the overall error.

The v instrumental magnitudes were converted to V using a modification of the method described by Binzel (2005) as modified by the author (Warner 2006). In general, the v-V magnitudes of several stars in the field, usually 5 to 10, were averaged to find a constant offset. The standard deviation of this average was also computed. Before computing the v-V value for each star in each image, the instrumental v magnitude was corrected for both first order extinction and V-R color index, thus reducing the values to instrumental exoatmospheric standard magnitudes. Since the value of air mass, X, was essentially identical for all stars and the target, the true value of k'v was not critical since any error would be absorbed into the v-V offset value. For computing the V-R color index, the critical factor was having a valid differential first order extinction, i.e, k'vr, to apply to the differential v-r magnitude. The v-V magnitude offset was then applied to the v instrumental magnitude of the asteroid, but only after the same corrections had been applied, i.e., those for first order extinction and V-R color index. The final result was the average V magnitude and standard deviation. This value was then stored along with the reduced V-R magnitude and error in the observations data base table for future calculations.

Converting 2MASS J-K Magnitudes to the BV(RI)c System

As noted above, field stars were used to derive the v-V offset for each night and field. Since asteroids move, the same comparison stars cannot be used over an entire lunation and, most times, not even on consecutive nights. Furthermore, asteroids are rarely so obliging as to wander through a Landolt or other well-calibrated field. While the best results would be obtained with all-sky photometry, that presents several problems, the foremost being that photometric nights are not that common at the PDO location.

Richard Miles (2005) developed a useful solution by working with Hipparcos catalog stars and using two guide scopes with CCD cameras simultaneously with the main scope. One guide scope shoots in V while the other shoots in I in order to determine the magnitudes and color index of field stars and asteroid as well as nearby Hipparcos stars. At the same time, the main scopes shoots in V or Clear. The guide scope images are used to find the necessary reduction values so that the main scope instrumental magnitudes can be converted to standard V magnitudes. While elegant in approach and implementation, it is more complex than was desired and required additional equipment (expense). Therefore, an alternate method was attempted.

Since there were already excellent conversion formulae available, it was first though that using the Sloan Digital Sky Survey catalog magnitudes converted to BV(RI)c would be practical but the sky coverage was too limited. The JHK magnitudes in the 2MASS catalog (Neugebauer & Leighton 1969) seemed a good second choice. The DVD version of the catalog was obtained and a set of conversion formulae was found. This involved using high-quality Landolt field stars that were included in the LONEOS catalog prepared by Brian Skiff (Skiff 2007). Any star with an uncertain identification or close companion was immediately rejected. Using that subset of about 300 stars, the corresponding star in the 2MASS catalog was found for each star in the subset. The 2MASS catalog includes several flags for each star that indicate the quality of the photometry or if the star had a close companion. If any flag indicated a problem with the J or K magnitude, that star was rejected. The final result was a set of 128 high-quality stars with BV(RI)c and J-K magnitudes.

The color-color plots show the results of comparing various combinations against J-K. It was immediately obvious that linear fits would not be ideal. Instead, third-degree polynomials were applied to find the conversion formulae. The J-K values were limited to a range of –0.1 to 1.0 in order to avoid excessively blue and, more important, red stars. Table 1 shows the final results for converting J-K to BV(RI)c magnitudes, including the correlation fit of the polynomial and the standard deviation of the errors. The latter were found by applying the conversion formula to find the appropriate value for a given star and then finding the difference between that computed value and the Landolt catalog value.

	$(J-K)^3$ C3	$(J-K)^2$ C2	(J-K) C1	Co	R	S.D.
B-J	1.7495	-2.7785	5.2150	0.1980	0.9934	±0.080
B-V	0.2807	-0.4535	1.7006	0.0484	0.9838	±0.034
V-J	1.4688	-2.3250	3.5143	0.1496	0.9936	±0.050
R-J	1.1230	-1.7849	2.5105	0.1045	0.9914	±0.040
V-R	0.3458	-0.5401	1.0038	0.0451	0.9877	±0.021
I-J	0.2963	-0.4866	1.2816	0.0724	0.9844	±0.034
V-I	1.0770	-1.6902	2.1652	0.0856	0.9913	±0.034

Table 1. Terms for converting J-K to BV(RI)c system and resulting errors. R is the correlation of the fit for the third-degree polynomial while S.D. is the standard deviation of the average of the errors when back-fitting the computed magnitudes to the Landolt standards.

This is not the first time such formulae have been found. For example, Caldwell et al (1993) used standard stars from several catalogs covering the southern sky, e.g., E and F regions, and applied ninth-order polynomials to find the conversion factors. Within the range of $-0.1 < J\text{-}K < 1.0$, the converted magnitudes based on this paper generally agree with those of Caldwell to 0.01 mag. Caldwell also found no need for separate formulae for dwarfs versus giants when converting J-K to the BV(RI)c system. This was not the case when converting color indices within the BV(RI)c system, e.g., V-I to V-R. There, separate formulae were definitely required. It should be noted that there may have been insufficient data to establish the need for separate formulae for the J-K conversions.

Using the derived formulae, a custom version of the 2MASS catalog was created that stores the converted BV(RI)c magnitudes. The restrictions placed on the stars, i.e., high-quality photometry and no confusing stars in both J and K magnitudes, produced about 300 M stars. Unfortunately, the density of coverage was not uniform and some fields were found lacking. Fortunately, the UCAC2 catalog (Zacharias 2004) also contains JHK magnitudes and (modified) photometry and confusion flags that allow converting the entries from that catalog as well. Although UCAC2 coverage does not extend to the North Celestial Pole, its coverage – especially when combined with the modified 2MASS catalog – is such that it's rare to have a field with less than five to seven stars with sufficient SNR available.

Effects of Interstellar Reddening

Because the 2MASS magnitudes are in the near-IR region, the effects of interstellar reddening cannot be ignored. The formulae were derived without correcting for reddening, i.e., they are based on the apparent J-K magnitude and not one that would be derived based on spectroscopic analysis. However, the reference fields were mostly in areas where interstellar reddening is not significant, and so the conversion formulae can be taken at face value.

One possible way to correct for reddening would be to locate stars of known solar color (from a spectroscopic catalog) near the target fields that are also in the 2MASS catalog. According to Pfau (1994), a color excess E(B-V) = 1.0 is equivalent to E(J-K) = 0.54. Using this, the 2MASS data and conversion formulae could then be used to determine the derived B-V and then E(J-K) via E(B-V). The corrected J-K magnitudes could then be used to find V-J instead of the actual catalog values. This does require having solar analogs nearby, which is not always likely, and is further complicated by the extreme non-uniformity of reddening near the galactic plane. Since the J-K relationships are based on, approximately, non-reddened J-K magnitudes, another possibility would be to compare the derived V-R magnitudes for field stars, which are derived from v-r and do not use the J-K relationship, against those computed from the J-K magnitude. Since the J and K magnitudes will be reddened less severely than those in v and r, the derived V-R magnitude will differ from the directly measured value. The differences could be used to establish a correlation that would provide corrected J-K magnitudes and, therefore, better V magnitudes. An investigation of this concept is planned, with results to be published at a later time.

Initial Results

During the first two months of the project, in early 2007, data were obtained on more than 50 asteroids. Of these, only ten had sufficient data near and away from opposition to derive what were considered to be acceptable values for the phase slope parameter (G). For the remaining asteroids, the value of G was held constant at 0.15 to determine H magnitudes. A minimum of two nights was required to find and report a derived V-R color index though most of those reported here had at least three. The results are shown in Table 2.

Columns 3 and 4 are the H and error found at PDO. Column 5 is the H value from the MPCORB data file (2007) while column 6 is the difference (PDO-MPC) between the two H values. Columns 7 and 8 are, respectively, the derived G and error values. Note that the error defaults to ±0.2 when assuming the default value of G. Column 9 is the derived V-R magnitude and column 10 is the error. Column 11 shows the minimum and maximum phase angles over which data were obtained. Column 12 is the number of nights on which data for the asteroid were obtained. The actual number of observations is greater than that since three images each were taken in V and R to obtain averages and standard deviations.

The first set of plots shows the data and derived third order polynomial for the J-K conversions. The second set of plots show the phase curves for those asteroids for which a G value other than the default was found. The plots show the phase curve and error envelope for both the new value of G and for the default value of G = 0.15.

Acknowledgements

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#	Name	H	HE	MPC	H-MPC	G	GE	V-R	V-R E	Phase Min/Max	N
17	Thetis	7.78	0.15	7.76	0.03	0.15	0.2	0.474	0.011	11.3,22.3	5
23	Thalia	7.45	0.13	6.95	0.50	0.15	0.2	0.363	0.041	7.9,9.9	3
31	Euphrosyne	6.74	0.21	6.74	0.00	0.15	0.2	0.447	0.008	18.2,22.4	4
36	Atalante	8.46	0.15	8.46	0.00	0.15	0.2	0.373	0.010	11.9,15.9	7
43	Ariadne	8.24	0.15	7.93	0.31	0.15	0.2	0.475	0.013	8.6,23.7	6
47	Aglaja	8.09	0.04	7.84	0.25	0.15	0.2	0.398	0.005	1.1,7.3	7
51	Nemausa	7.17	0.08	7.35	-0.18	-0.037	0.053	0.403	0.010	8.7,24.7	4
55	Pandora	7.93	0.09	7.80	0.13	0.15	0.2	0.411	0.010	6.1,9.1	4
61	Danae	7.56	0.10	7.68	-0.12	0.15	0.2	0.501	0.014	7.6,16.4	5
65	Cybele	6.58	0.06	6.62	-0.04	0.15	0.2	0.400	0.007	0.7,4.9	5
66	Maja	9.44	0.09	9.36	0.08	0.15	0.2	0.374	0.010	6.6,9.1	4
89	Julia	6.48	0.07	6.60	-0.12	0.005	0.064	0.468	0.005	6.7,17.7	5
93	Minerva	7.95	0.08	7.70	0.25	0.253	0.092	0.375	0.003	8.4,18.5	6
99	Dike	9.43	0.10	9.43	0.00	0.15	0.2	0.394	0.005	7.1,10.9	5
116	Sirona	7.67	0.07	7.82	-0.15	0.139	0.063	0.494	0.022	9.9,22.7	3
124	Alkeste	8.09	0.04	8.11	-0.02	0.317	0.054	0.530	0.014	7.4,20.3	5
142	Polana	10.28	0.12	10.27	0.01	0.15	0.2	0.361	0.004	1.8,24.4	4
148	Gallia	7.72	0.10	7.63	0.09	0.15	0.2	0.492	0.004	7.7,9.8	5
160	Una	8.95	0.02	9.08	-0.13	0.107	0.049	0.413	0.008	0.3,7.3	6
164	Eva	8.84	0.12	8.89	-0.05	0.15	0.2	0.395	0.006	10.0,13.8	3
165	Loreley	7.76	0.09	7.65	0.11	0.15	0.2	0.389	0.006	5.6,7.1	3
173	Ino	7.80	0.05	7.66	0.14	0.15	0.2	0.404	0.005	3.4,9.4	8
175	Andromache	8.06	0.06	8.31	-0.25	-0.230	0.059	0.366	0.004	6.0,13.4	5
190	Ismene	7.77	0.05	7.59	0.18	0.15	0.2	0.433	0.007	0.2,8.0	4
223	Rosa	9.72	0.04	9.68	0.04	0.15	0.2	0.400	0.027	2.4,5.4	2
287	Nephthys	8.26	0.07	8.30	-0.04	0.15	0.2	0.501	0.006	3.3,11.6	6
306	Unitas	9.06	0.10	8.96	0.10	0.15	0.2	0.487	0.007	2.4,21.4	5
316	Goberta	9.87	0.01	9.80	0.07	0.253	0.009	0.384	0.009	1.2,10.3	4
332	Siri	9.65	0.14	9.50	0.15	0.15	0.2	0.425	0.018	10.0,18.6	5
352	Gisela	10.22	0.11	10.01	0.21	0.15	0.2	0.517	0.006	6.4,23.8	4
363	Padua	8.88	0.06	9.01	-0.13	0.15	0.2	0.421	0.006	3.2,12.0	4
374	Burgundia	8.68	0.08	8.67	0.01	0.15	0.2	0.504	0.006	5.6,8.7	3
399	Persephone	8.91	0.11	9.00	-0.09	0.15	0.2	0.416	0.005	4.3,7.8	4
404	Arsinoe	9.11	0.18	9.01	0.10	0.15	0.2	0.372	0.005	13.5,25.6	6
412	Elisabetha	8.97	0.10	9.00	-0.03	0.15	0.2	0.406	0.003	7.9,9.2	6
442	Eichsfeldia	9.94	0.05	10.03	-0.09	0.300	0.095	0.378	0.004	3.8,9.0	6
449	Hamburga	9.79	0.07	9.47	0.32	0.15	0.2	0.382	0.003	3.6,7.7	4
471	Papagena	6.72	0.14	6.73	-0.01	0.15	0.2	0.503	0.018	11.0,14.7	6
481	Emita	8.66	0.09	8.60	0.06	0.15	0.2	0.376	0.004	4.9,9.8	5
490	Veritas	8.53	0.06	8.32	0.19	0.15	0.2	0.384	0.014	2.3,5.0	2
563	Suleika	8.63	0.13	8.50	0.13	0.15	0.2	0.501	0.003	8.7,21.0	5
579	Sidonia	8.07	0.07	7.85	0.22	0.15	0.2	0.478	0.008	5.1,6.6	4
604	Tekmessa	9.29	0.06	9.20	0.09	0.15	0.2	0.410	0.014	3.7,6.2	3
665	Sabine	8.61	0.11	8.10	0.51	0.15	0.2	0.434	0.027	9.0,11.8	5
675	Ludmilla	8.04	0.07	7.91	0.13	0.15	0.2	0.505	0.013	5.1,7.6	4
705	Erminia	8.31	0.16	8.39	-0.08	0.15	0.2	0.445	0.012	13.2,20.2	6
715	Transvaalia	10.07	0.09	9.80	0.27	0.15	0.2	0.403	0.009	7.6,9.6	3
720	Bohlinia	9.71	0.10	9.71	0.00	0.433	0.147	0.474	0.017	1.8,10.6	2
784	Pickeringia					0.15	0.2	0.416	0.023	3.9,6.7	2
803	Picka	9.53	0.05	9.60	-0.07	0.15	0.2	0.488	0.011	3.9,5.6	3
814	Tauris							0.402	0.011	7.8,8.8	2
818	Kapteynia					0.15	0.2	0.460	0.010	7.0,7.8	2
856	Backlunda	10.79	0.15	10.69	0.10	0.15	0.2	0.411	0.010	11.8,14.6	3
912	Maritima	9.21	0.08	8.40	0.81	0.15	0.2	0.390	0.005	6.9,9.6	8
924	Toni	9.45	0.15	9.37	0.08	0.15	0.2	0.424	0.011	6.6,15.6	2
927	Ratisbona	9.19	0.09	9.54	0.35	0.15	0.2	0.407	0.016	5.4,10.0	3
965	Angelica	10.08	0.19	9.80	0.28	0.15	0.2	0.386	0.005	17.1,22.2	4
1263	Varsavia	10.09	0.12	10.50	-0.41	0.15	0.2	0.434	0.035	7.1,14.9	2
1487	Boda	11.07	0.06	10.60	0.47	0.15	0.2	0.356	0.013	2.2,5.3	3
1884	Skip	12.51	0.23	11.70	0.81	0.15	0.2	0.491	0.032	17.8,27.5	3

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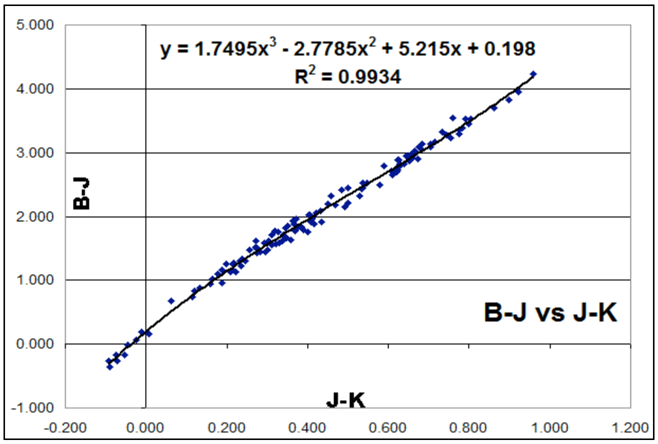

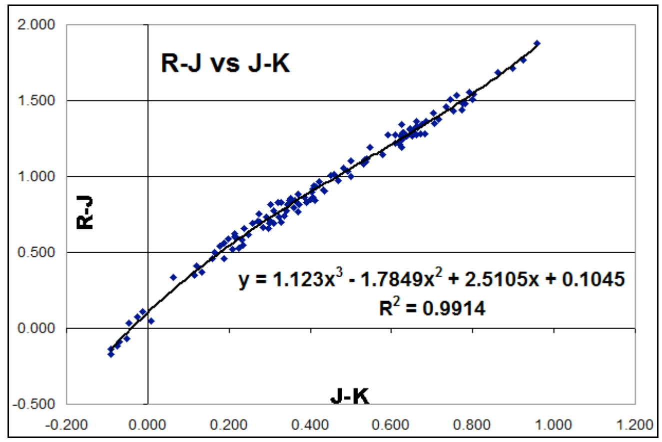

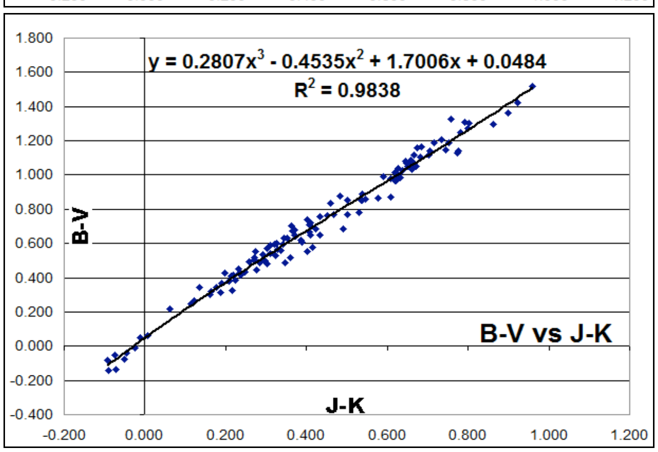

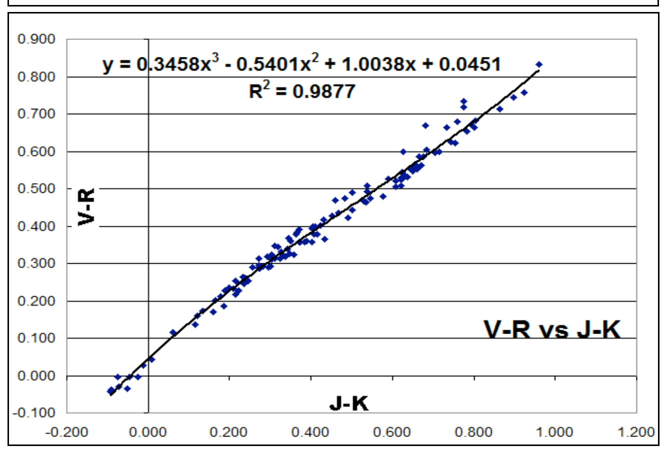

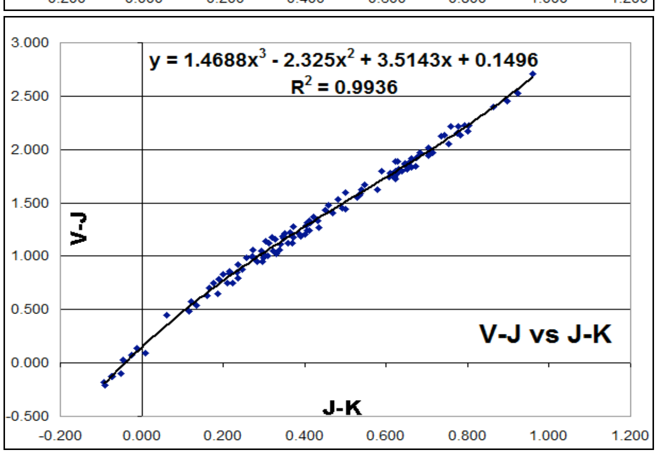

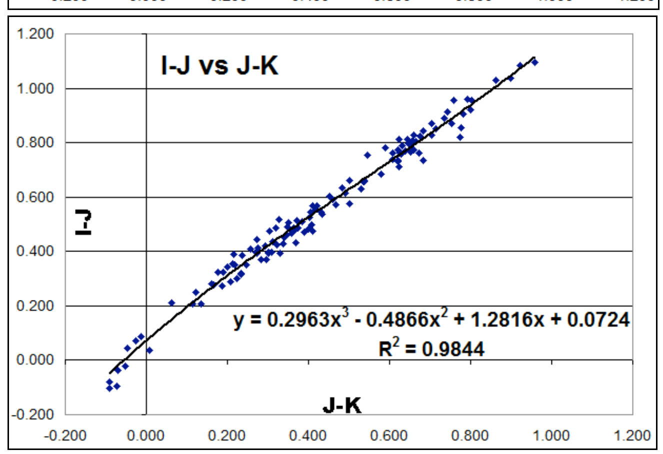

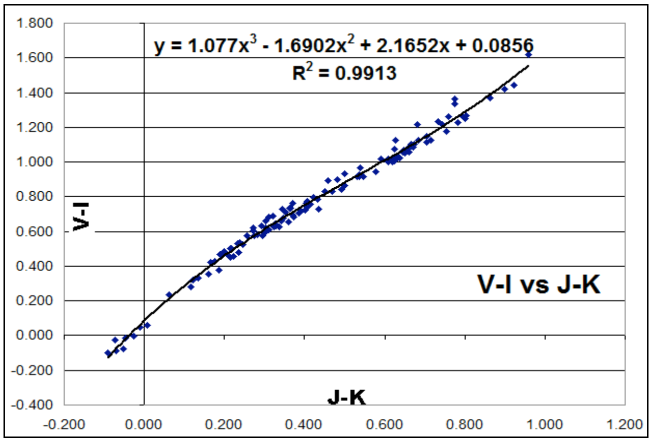
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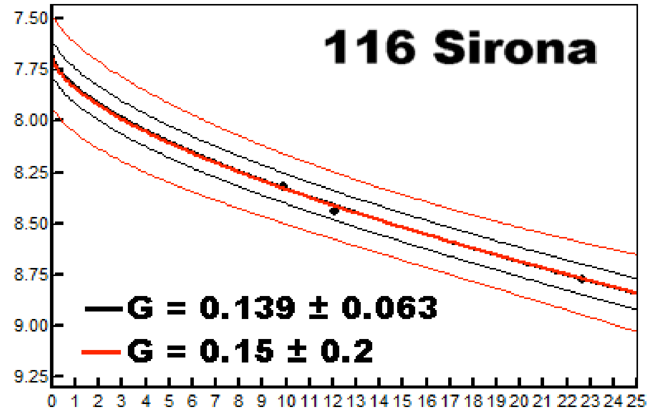
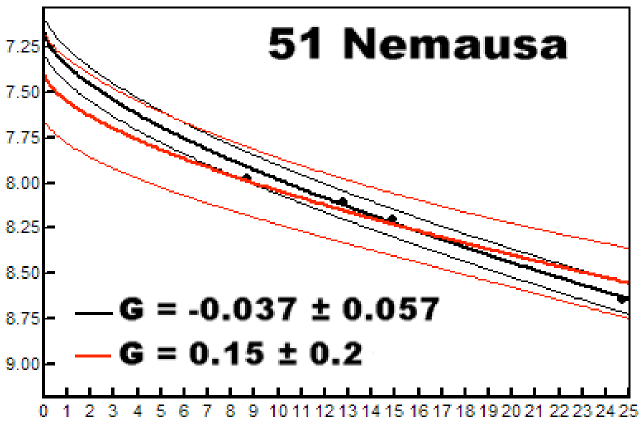
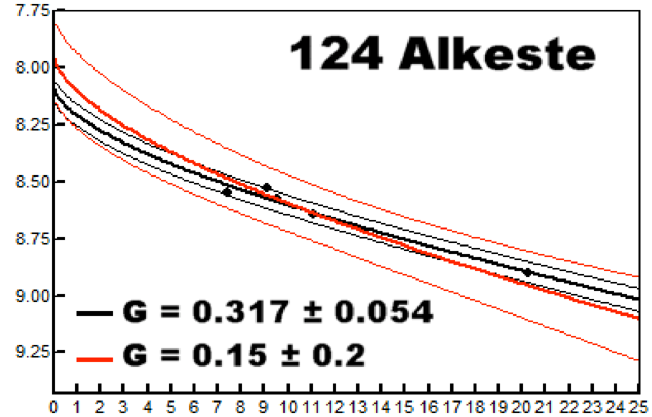
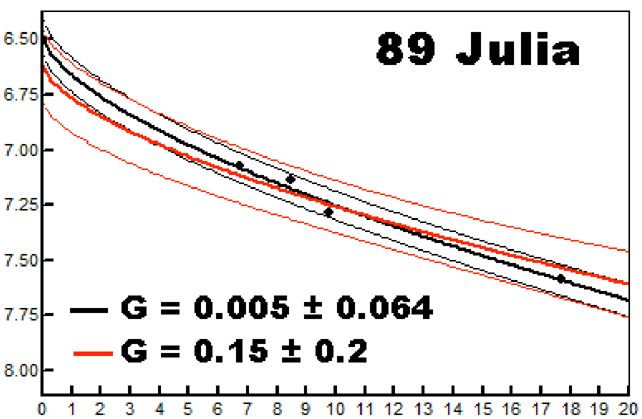
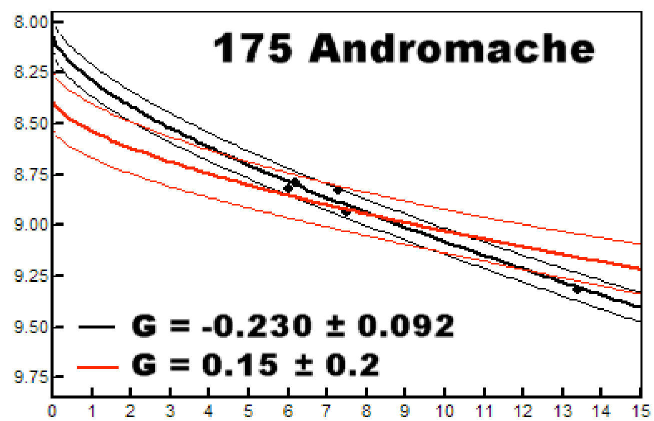
R2 = 0.9913
V-I vs J-K
V-I
J-K


116 Sirona
G = 0.139 ± 0.063
G = 0.15 ± 0.2


51 Nemausa
G = -0.037 ± 0.057
G = 0.15 ± 0.2


124 Alkeste
G = 0.317 ± 0.054
G = 0.15 ± 0.2


89 Julia
G = 0.005 ± 0.064
G = 0.15 ± 0.2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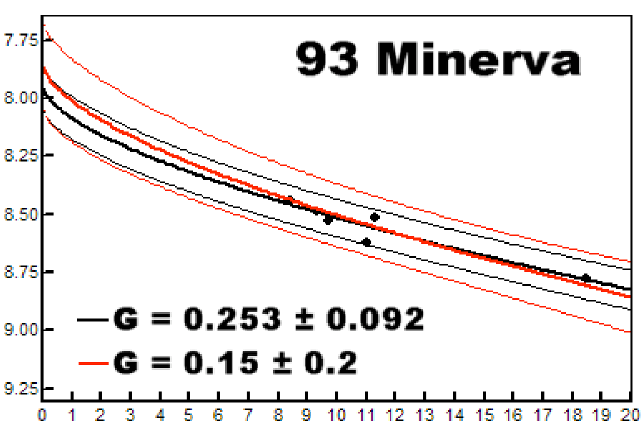
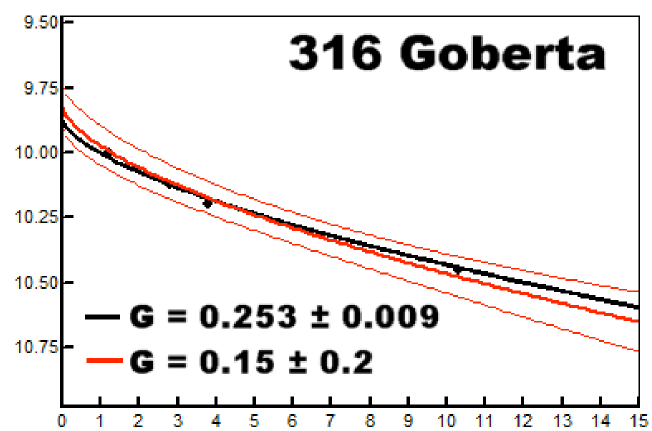
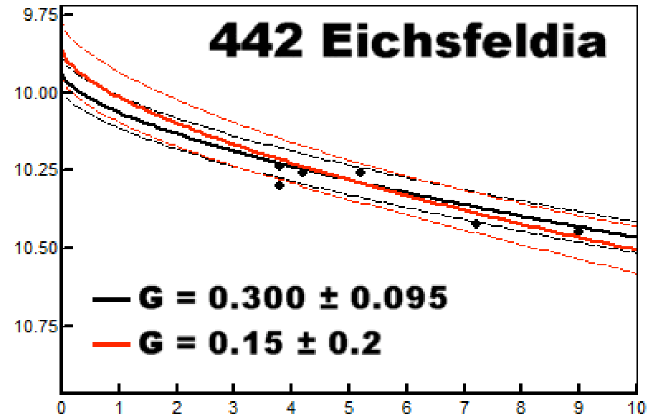
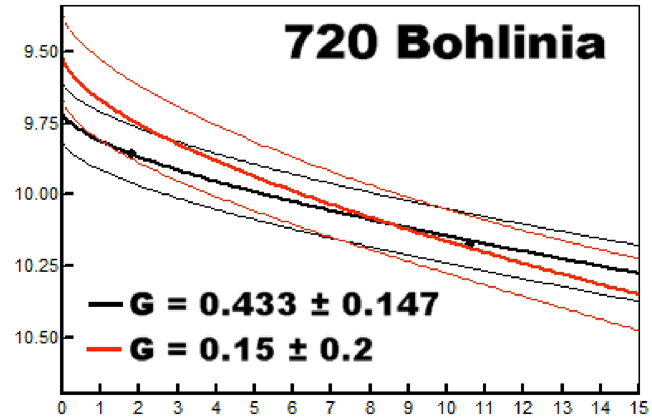
G = -0.230 ± 0.092
G = 0.15 ± 0.2


93 Minerva
G = 0.253 ± 0.092
G = 0.15 ± 0.2


316 Goberta
G = 0.253 ± 0.009
G = 0.15 ± 0.2





ASTEROID LIGHTCURVE ANALYSIS AT THE OAKLEY OBSERVATORY – MARCH/APRIL 2007

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Lightcurves for 24 asteroids were collected over six nights of observing during March and April of 2007 at the Oakley Observatory. The asteroids were: 234 Barbara, 279 Thule, 303 Josephina, 348 May, 621 Werdandi, 715 Transvaalia, 791 Ani, 1132 Hollandia, 1164 Kobolda, 1184 Gaea, 1385 Gelria, 1534 Nasi, 2341 Aoluta, 2582 Harimaya-Bashi, 2887 Krinov, 3166 Klondike, 3310 Patsy, 3451 Mentor, 3497 Innanen, 3575 Anyuta, 5484 Inoda, (7792) 1995 WZ3, (9873) 1992 GH, and (41577) 2000 SV2.

Twenty-four main-belt asteroids were observed over the course of six nights in March-April 2007. Twelve asteroids were observed on the nights of March 8 and 9, while another twelve were observed during April on the nights of the 17, 20, 21, and 22. The observations were taken from the Oakley Observatory at Rose-Hulman Institute of Technology in Terre Haute, Indiana. From the data that were collected, we were able to find lightcurves for 18 asteroids. Out of the 18 lightcurves, five were reasonably close to previously published periods, two differed significantly from previous results, and 11 were previously unrecorded results.

For the six nights of observing, three telescopes were used. Each telescope was a 14-inch Celestron optical tube assembly mounted on a Paramount ME. One telescope used an Apogee AP-8p camera. This CCD was unfiltered with an image scale of 2.00 arcseconds per pixel. The other two telescopes used SBIG STL-1001E cameras with a clear filter. One telescope had an image scale of 1.94 arcseconds per pixel while the other had an image pixel scale of 2.24 arcseconds per pixel. The exposure times varied from two to four minutes. Calibration of the images was done using master twilight flats, darks, and bias frames. All calibration frames were created using MaximDL and the images were calibrated using CCDSoft. MPO Canopus was used to measure the processed images.

Selection of asteroids was based on their sky position about one hour after sunset. Asteroids without previously published lightcurves were given higher priority than asteroids with known periods, but asteroids with uncertain periods were also selected in the hopes that we would be able to validate previous results.

As far as we are aware, these are the first reported observations for the period of the following asteroids: 715 Transvaalia, 791 Ani, 2341 Aoluta, 2582 Harimaya-Bashi, 2887 Krinov, 3166 Klondike, 3310 Patsy, 3451 Mentor, 3575 Anyuta, 5484 Inoda, and (41577) 2000 SV2. No repeatable pattern was found for the following asteroids: 234 Barbara, 279 Thule, 303 Josephina, 1184 Gaea, 1385 Gelria, or (7792) 1995 WZ3. This was due to noisy data and a less-than-ideal number of data points.

All results are listed in the table below. Comments have been included if they were necessary.

348 May. Our data gives a derived period matching the period given by Behrend (2006).

621 Werdandi. While the data seem to indicate a period that is different than that of Almeida, et al. (2004), the small number of data points that we have means our result may be incorrect.

1132 Hollandia. Although our data are somewhat noisy, it agrees fairly well with the reported period in Behrend (2006).

1164 Kobolda. Our result agrees with the period 4.141 ± 0.002 h given by Higgins and Oey (2007).

1534 Nasi. Our data are a little noisy, but they don't appear to agree with De Sanctis, et al. (1994)

3497 Innanen. Our result is close to the period 7.310 ± 0.001 h given by Fleenor (2007).

(9873) 1992 GH. The data are fairly noisy, but they support the period reported by Warner (2007).

Number	Name	Dates (2007)	Data Points	Period (h)	P.E. (h)	Amp. (mag)	A.E. (mag)
234	Barbara	3/8-3/9	63	Not Found		0.04	0.01
279	Thule	3/8-3/9	28	Not Found		0.14	0.04
303	Josephina	3/8-3/9	26	Not Found		0.11	0.02
348	May	4/17,4/20-4/22	82	7.385	0.004	0.16	0.03
621	Werdandi	3/8-3/9	27	14.82	0.05	0.54	0.05
715	Transvaalia	3/8-3/9	73	11.80	0.04	0.24	0.03
791	Ani	4/17,4/20-4/21	83	16.72	0.03	0.32	0.05
1132	Hollandia	3/8-3/9	64	5.326	0.015	0.2	0.1
1164	Kobolda	3/8-3/9	52	4.154	0.011	0.22	0.03
1184	Gaea	3/8-3/9	28	Not Found		0.25	0.05
1385	Gelria	4/17,4/20-4/22	78	Not Found		0.36	0.15
1534	Nasi	4/17,4/20-4/22	72	7.94	0.02	0.40	0.05
2341	Aoluta	3/8-3/9	59	3.00	0.02	0.30	0.08
2582	Harimaya-Bashi	4/17,4/20-4/21	60	7.238	0.004	0.24	0.04
2887	Krinov	4/17,4/20-4/22	80	16.71	0.02	0.65	0.08
3166	Klondike	4/17,4/20-4/22	76	11.72	0.05	0.12	0.04
3310	Patsy	3/8-3/9	61	9.36	0.04	0.18	0.06
3451	Mentor	4/17,4/20-4/22	74	7.70	0.02	0.50	0.05
3497	Innanen	4/17,4/20-4/21	80	7.177	0.003	0.52	0.03
3575	Anyuta	4/17,4/20-4/22	77	6.321	0.003	0.38	0.07
5484	Inoda	4/17,4/20-4/22	48	23.41	0.06	0.3	0.1
(7792)	1995 WZ3	3/8-3/9	71	Not Found		0.30	0.08
(9873)	1992 GH	3/8-3/9	64	2.92	0.01	0.3	0.1
(41577)	2000 SV2	4/17,4/20-4/21	90	34.59	0.03	0.36	0.04

Acknowledgement

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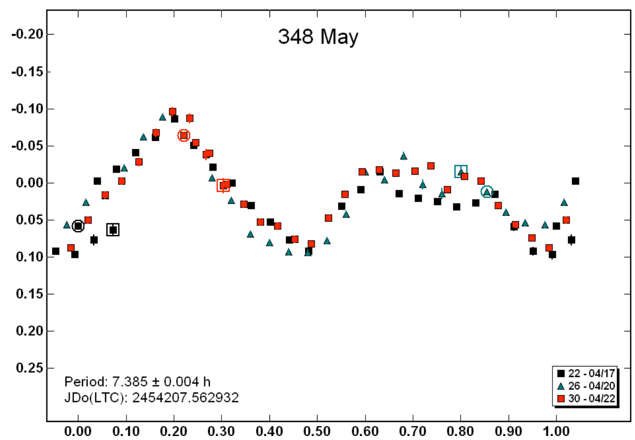
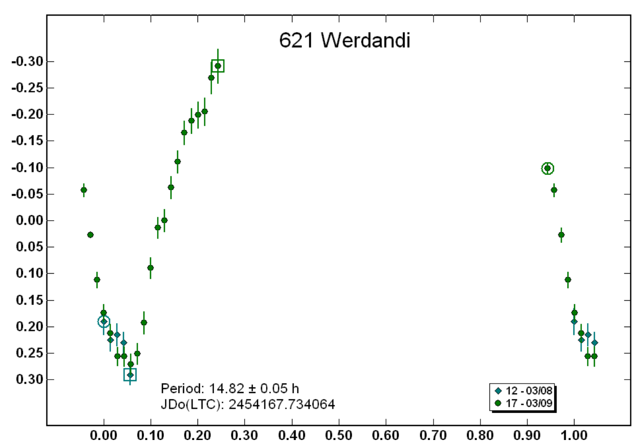
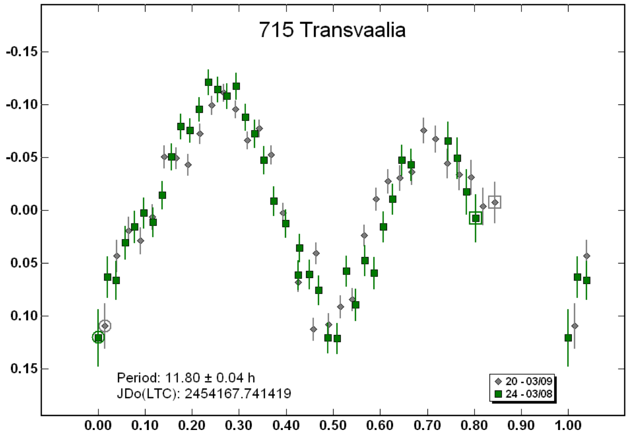
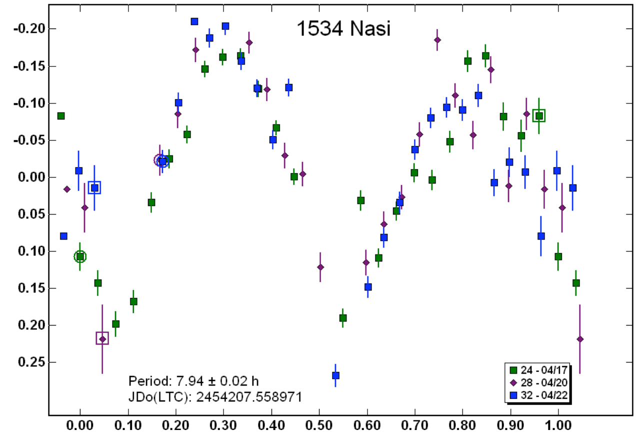
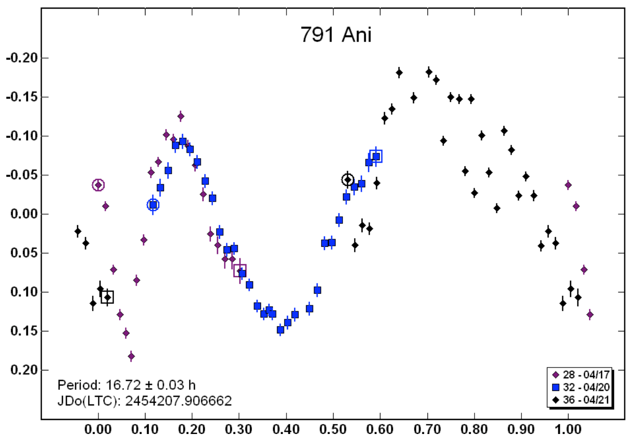





715 Transvaalia
Period: 11.80 ± 0.04 h
JDo(LTC): 2454167.741419
20 - 03/09
24 - 03/08


1534 Nasi
Period: 7.94 ± 0.02 h
JDo(LTC): 2454207.558971
24 - 04/17
28 - 04/20
32 - 04/22


791 Ani
Period: 16.72 ± 0.03 h
JDo(LTC): 2454207.906662
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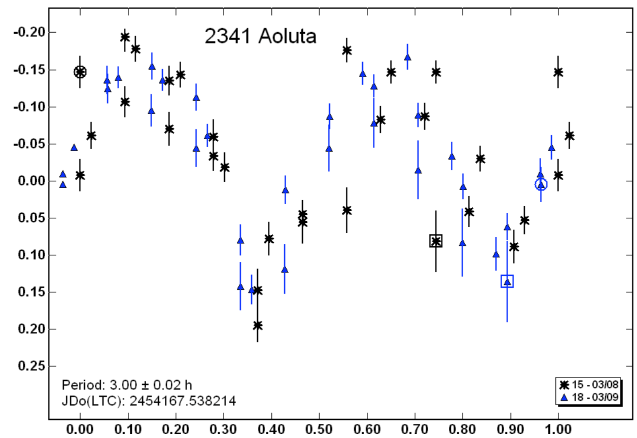
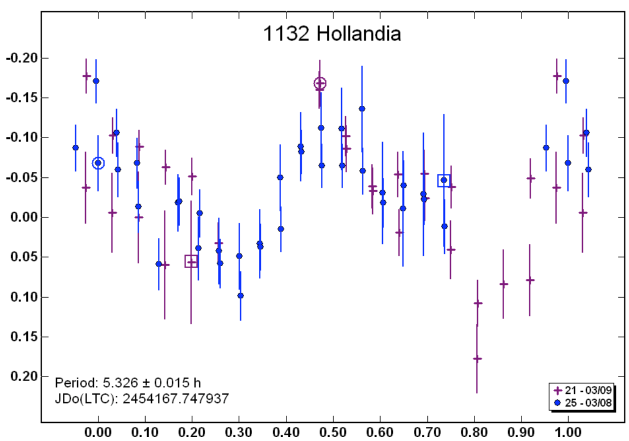
32 - 04/20
36 - 04/21


2341 Aoluta
Period: 3.00 ± 0.02 h
JDo(LTC): 2454167.538214
15 - 03/08
18 - 03/09


1132 Hollandia
Period: 5.326 ± 0.015 h
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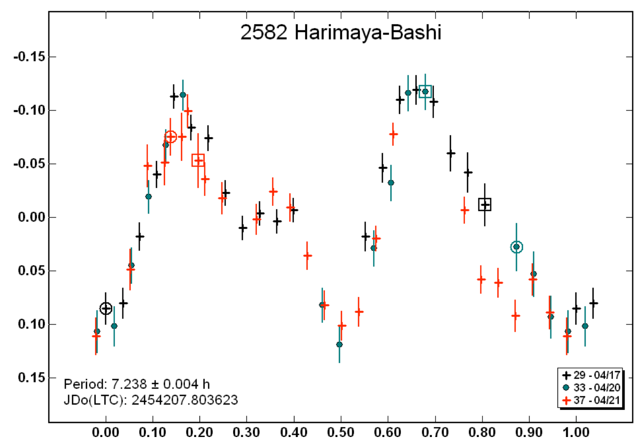
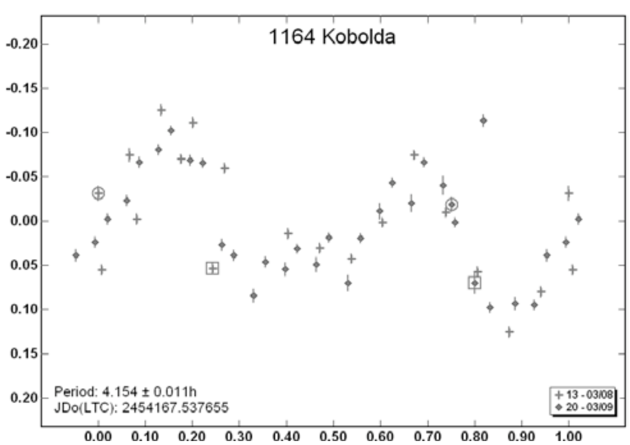
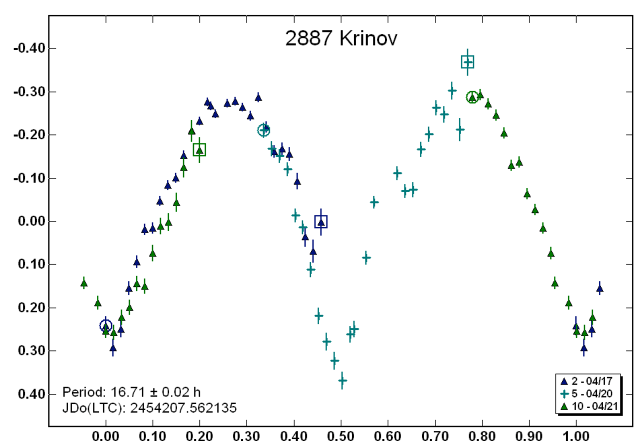
21 - 03/09
25 - 03/08


2582 Harimaya-Bashi
Period: 7.238 ± 0.004 h
JDo(LTC): 2454207.803623
29 - 04/17
33 - 04/20
37 - 04/21


1164 Kobolda
Period: 4.154 ± 0.011h
JDo(LTC): 2454167.537655
13 - 03/08
20 - 03/09


2887 Krinov
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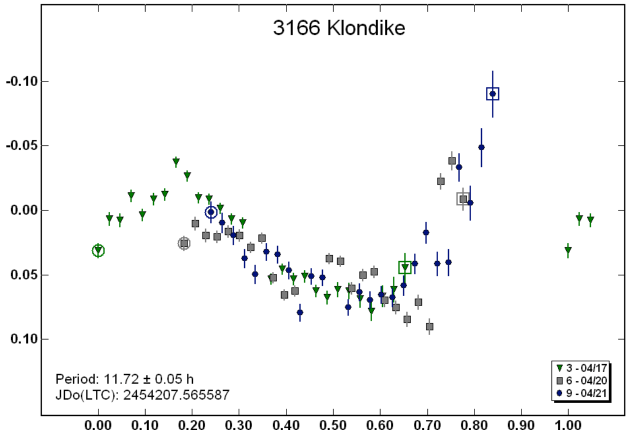
2 - 04/17
5 - 04/20
10 - 04/21


3166 Klondike
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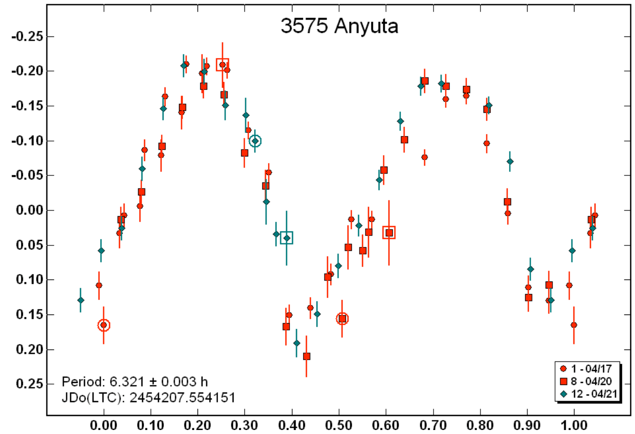
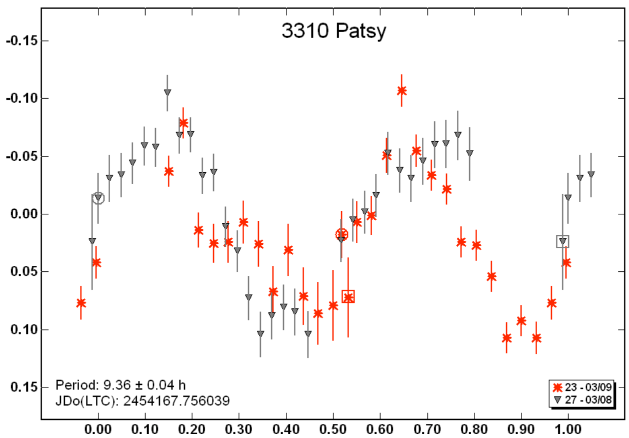
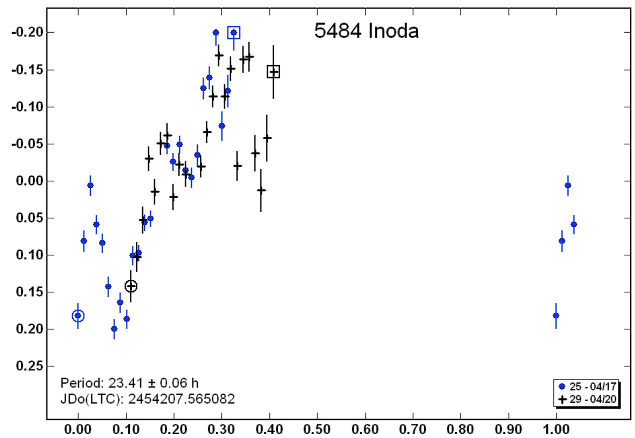
3 - 04/17
6 - 04/20
9 - 04/21


3575 Anyuta
Period: 6.321 ± 0.003 h
JDo(LTC): 2454207.554151
1 - 04/17
8 - 04/20
12 - 04/21


3310 Patsy
Period: 9.36 ± 0.04 h
JDo(LTC): 2454167.756039
23 - 03/09
27 - 03/08


5484 Inoda
Period: 23.41 ± 0.06 h
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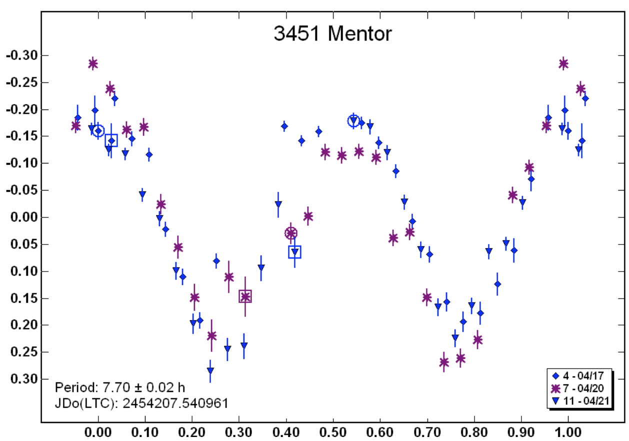
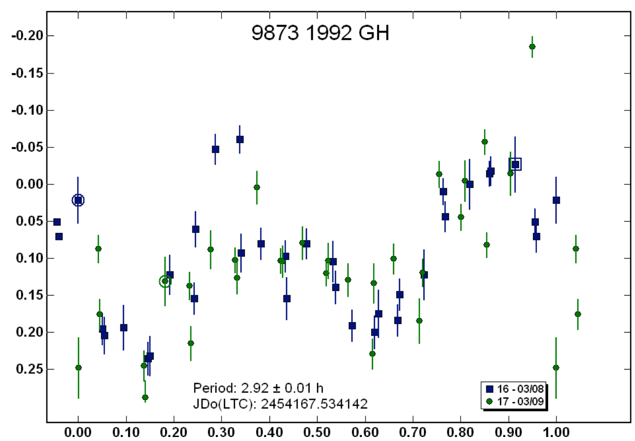
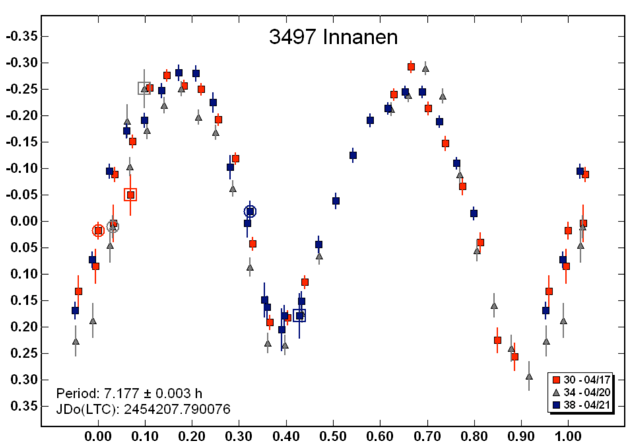
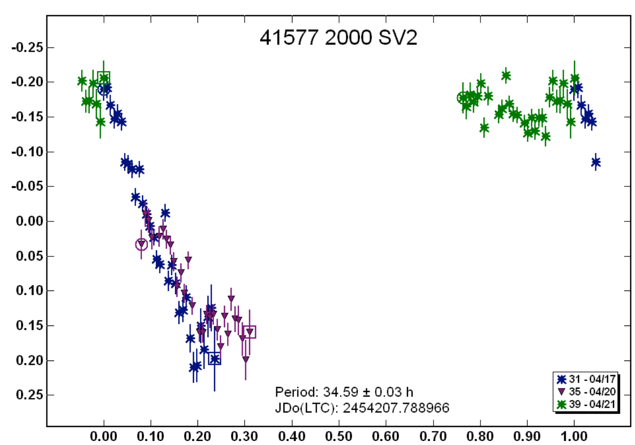
25 - 04/17
29 - 04/20


3451 Mentor
Period: 7.70 ± 0.02 h
JDo(LTC): 2454207.540961
4 - 04/17
7 - 04/20
11 - 04/21


9873 1992 GH
Period: 2.92 ± 0.01 h
JDo(LTC): 2454167.534142
16 - 03/08
17 - 03/09


3497 Innanen
Period: 7.177 ± 0.003 h
JDo(LTC): 2454207.790076
30 - 04/17
34 - 04/20
38 - 04/21


41577 2000 SV2
Period: 34.59 ± 0.03 h
JDo(LTC): 2454207.788966
31 - 04/17
35 - 04/20
39 - 04/21

OBSERVING PROGRAM "T3": FINDING COMETS IN THE ASTEROID POPULATION

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An observing program to search for cometary features among the asteroidal population is presented. No additional instruments other than those normally used for minor planet observations are necessary. The involved observers periodically receive an observing planner by email and the observing results are shared over the internal mailing list. Once confirmed, results are communicated to the professional community.

The "T3" project is an observing program with the main purpose of discovering cometary objects "hidden" in the asteroidal population. Specifically, we direct our attention to objects having a Tisserand parameter respect to Jupiter (Tj) less than 3. Accordingly with Levison (1996), Tj = 3 is approximately the boundary between asteroidal and cometary orbits; minor bodies with Tj < 3 are under the Jupiter's gravitational influence and are possibly cometary nuclei of the Jupiter Family Comet class.

The goal of this project is to observe nearly all the objects having Tj < 3 but reported as asteroidal in appearance at the time of discovery. Most of the surveys looking for minor planets cannot readily detect low levels of cometary activity. G. Masi serves as principal investigator of this project.

As soon as the program was started, it provided a positive result. On 7 and 29 Dec. 2005, CCD images of asteroid 2005 SB216, obtained and checked by S. Foglia, showed that the object, listed in a preliminary database of "T3" targets, showed a full-width at half-maximum (FWHM) larger than that of nearby stars. On 4 Feb. 2006, L. Buzzi confirmed the observations, as well as – a few days later - F. Bernardi, D. Tholen, J. Pittichova (IfA, University of Hawaii), who used the 2.24-m telescope of the University of Hawaii. The following day, IAUC no. 8668 and MPEC no. 2006-C48 were issued with what was the first discovery of the "T3" observing team The latter result was officially presented at the Meeting on Asteroids and Comets in Europe (MACE), held in May, 2006 in Wien.

The evaluation of the FWHM of candidates against that of the stars in the same field-of-view is a promising technique, which has been intensively used by G. Masi over the last few years (see, for example, IAUC no. 8104) and during his PhD work. Thanks mainly to S. Foglia, a special software routine has been developed to extract all the objects with Tj < 3 from the MPCOrb.dat file, with some constraints on their magnitude and elongation from the Sun. A text-format file is created including all the data of interest for each object (see below) and sent through a special mailing-list (hosted at the Geneva Observatory by R. Behrend) by the coordinator (L. Buzzi). Thus, observers can choose which targets are suitable for their equipment and locations.

Objects listed on the Minor Planet Center's Near Earth Object Confirmation Page (NEOCP) are suitable to be T3 targets. Usually on a daily basis, a message is sent to the mailing-list by S. Foglia with the NEOCP objects possibly on a cometary orbit. In these cases, the discovery of cometary features is a time-critical event because usually an object does not stay too long on the NEOCP and a MPEC is issued by the MPC as soon as a reasonable orbit is obtained from the available observations. If a cometary signature is found, these findings are included in the IAUC.

Observing Planner

Usually twice a month (sometimes more frequently) the Observing Planner (OP) as text-format file is distributed over the mailing list by the coordinator. It contains the following information: asteroid catalog number, name or designation; the orbit code according to the MPC (that reveals the dynamical type of orbit); an observing status flag that will be equal to 1 if no cometary feature was detected in the last two week, 2 if no cometary feature was detected in the last month, 3 if no cometary feature was detected previous to last month, 9 if there are special notes (listed at the end of the OP) about the possible cometary feature. This flag is maintained by the coordinator in the "T3" database using feedback from observers about their positive or negative observations. Thanks to A. Morbidelli (Observatoire de la Cote d'Azur, France) it is possible to also include in the OP the sum of 'Outer Main Belt' and 'Jupiter Family' NEO's source region probability (Bottke W. F. Jr et al 2002). Perihelion date, Tj, number of observed oppositions, semi-major axis, eccentricity, inclination, current sky position and magnitude, apparent motion, geocentric and heliocentric distances, elongation from Sun are also reported in the OP. Thank to G. Matarazzo and R. Serpilli (Italy) the OP also includes the Minimum Orbital Intersection Distance (MOID) with Jupiter.

Observing Technique

One must take at least two or more series of images for each object (under good seeing for the observer's location) in order to obtain the highest signal-to-noise ratio (SNR) possible (at least 10, the more the better), in order to avoid false detections, always possible with the average seeing at many amateur observing sites. Also, it is important to choose the right integration time, to limit the trailing effects, which would make the final images difficult to judge. All the good, collected frames have to be calibrated (with bias and dark frames subtraction and flat-field normalization), and then (using Astrometrica, CCDsoft and similar software) stacked according to the apparent motion of the object. If the cometary appearance is not obvious by visual inspection of the resulting images, it is necessary to measure the FWHM of the object. If its value is at least 25% greater than that of stars (obviously stacked with a zero motion) of similar SNR and possibly close to the target - to limit optical effects – then it is a probable detection of a coma. Obviously, in order to make reliable assumptions about the presence of this feature, the results from the different series of images must be very similar. We're also testing different approaches to reveal cometary features to be used as possible, independent confirmation techniques of the FWHM measurement.

Astrometry for every observed object must be obtained in the traditional way and sent, as usual, to the MPC. In case a cometary feature is found, the observer must send a message to MPC and CBAT and also send a message to the mailing list for independent confirmation in a short time period (if the cometary feature is suspicious, one must send an e-mail only to the mailing-list); a copy of the measures, together with the FWHM of the object, FWHM of the comparison stars and the SNR of the object should be reported. The last step is taken by the coordinator: once confirmation is received a definitive report is sent to the MPC. Confirmed negative reports are similarly important.

Interested observers will find additional information on the T3 Pogram and how to join at the following URL:

http://asteroidi.uai.it

Acknowledgement

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HIGH-SPEED PHOTOMETRIC ANALYSIS FOR MINOR PLANETS 1586 THIELE, 4246 TELEMANN, (10662) 3201 T-2, AND (49880) 1999 XP135

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Photometric observations of 1586 Thiele, 4246 Telemann, (10662) 3201 T-2, and (49880) 1999 XP135 were performed in September and October of 2005. The periods and amplitudes found were: 1586 Thiele 3.086 ± 0.038 h, 0.136 ± 0.011 mag; 4246 Telemann 8.960 ± 0.038 h, 0.109 ± 0.027 mag; (10662) 3201 T-2, 3.072 ± 0.038 h, 0.151 ± 0.04 mag; and (49880) 1999 XP135, 11.111 ± 0.038 h, 0.102 ± 0.035mag.

High-speed photometry of asteroids, with the aim of accurately determining rotation periods, is an ongoing research project involving undergraduate students from Delaware Community College. Students are involved in the data collection, reduction, and analysis.

The observations of 1586 Thiele, 4246 Telemann, 10662 (3201 T-2), and (49880) 1999 XP135 were obtained over two consecutive nights at Mount Cuba Astronomical Observatory (MCAO) in Greenville Delaware. 1586 Thiele was chosen as a target since it was reported to have a short period of 3.37 hr. While preparing the finder charts for 1586 Theile, we found that several additional asteroids brighter than 18th magnitude could be included in the field of view. We decided to include the additional targets and determine the usable detection limit of our instrument and site. We determined target coordinates using TheSky software. Finder charts were prepared using the STScI Digitized Sky Survey. Our targets and magnitudes are given as follows: 1586 Thiele at 15.9 m, 4246 Telemann at 16.2m, (10662) 3201 T-2 at 17.4m, and (49880) 1999 XP135 at 16.7 m.

Data were collected using an Apogee Alta CCD unfiltered at the prime focus of the 24" Tinsley telescope at MCAO. Images were binned 2 by 2. Images were taken continuously, with either 12 or 20-second exposures followed by ~1 second downloads. This resulted in a cycle time of ~13 and ~21 seconds. With this process we were acquiring 3 to 4 images a minute giving a reasonably well-covered rotation of the faster rotating asteroids on a single nights run. The local sky brightness limited the exposure times for a reasonably high signal to noise ratio. The data were processed using the AIP (Astronomical Image Processing) software program (Berry and Burnell, 2000) and then analyzed and graphed with the Excel™ spreadsheet program. Dr. J.L. Provencal used a discrete Fourier Transform (DFT) to determine the periods and amplitudes of any variation. For the observations reported here, times given are not corrected for light travel time from the asteroid.

1586 Thiele. This asteroid showed a period of 3.086 ± 0.038 hours and amplitude of 0.136 ± 0.011 magnitude. The Ephemeredes of Minor Planets (2005) reported a period of 3.370 with 0.35 magnitude amplitude.

4246 Telemann. The lightcurve revealed a period of 8.960 ± 0.038 hours with a 0.109 ± 0.027 magnitude variation.

(10662) 3201 T-2. A period of 3.072 ± 0.038 h with an amplitude of 0.151 ± 0.04 mag was derived.

(49880) 1999 XP135. The DFT program showed an 11.111 ± 0.038 hr period and variation of 0.102 ± 0.035 mag. based on the data for the two nights. The 11 plus hour period is longer than the observing run for each session and should be considered suspect; it is most likely longer than 5 hours.

Acknowledgement

The authors would like to thank J. L. Provencal from Mount Cuba and the University of Delaware for running the FT program.

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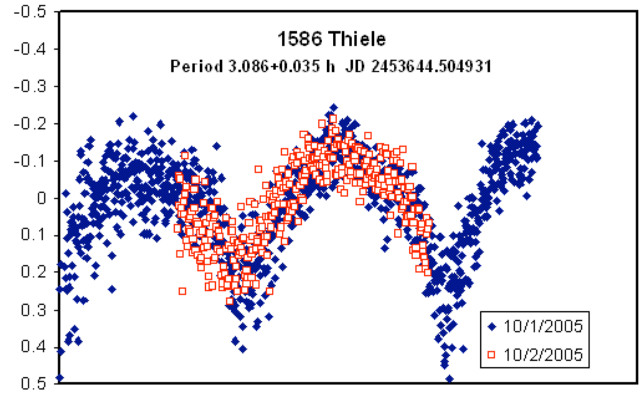

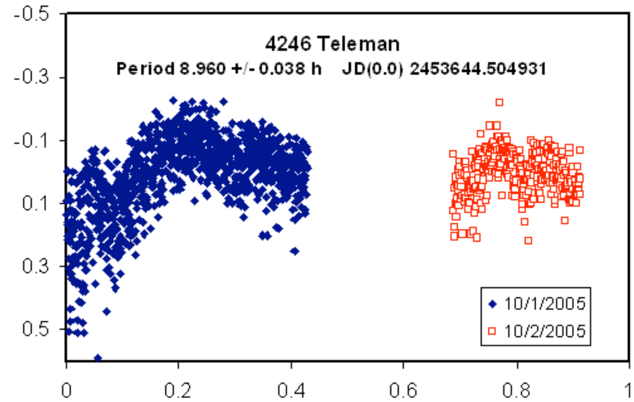

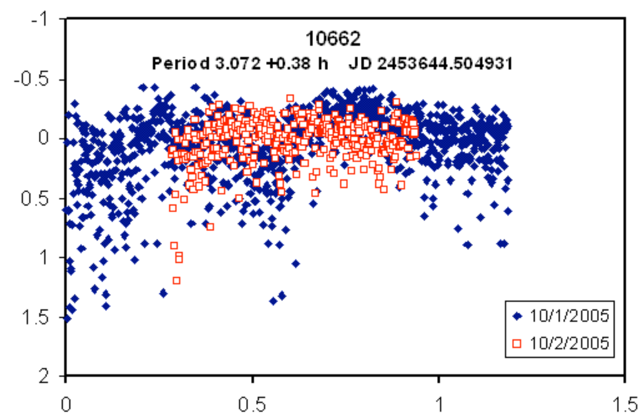

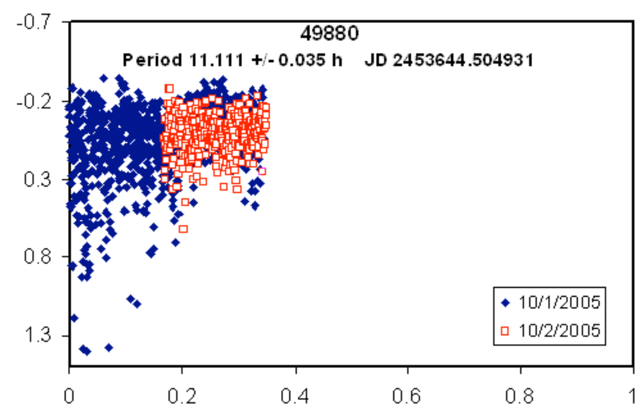

LIGHTCURVE ANALYSIS OF FIVE MAIN BELT ASTEROIDS AT THE CALVIN-REHOBOTH OBSERVATORY

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Synodic rotation periods and amplitudes for five main-belt asteroids observed at the Calvin-Rehoboth Observatory are reported: 1335 Demoulina, 2658 Gingerich, 3091 van den Heuvel, 8887 Scheeres, and (12168) 5141 T-2. The asteroid 2658 Gingerich is a binary candidate, having exhibited a possible eclipse. The asteroid (12168) 5141 T-2 has an amplitude of 1.44 mag, matching the largest value established for main belt objects.

Calvin College operates a robotic observatory located in Rehoboth, NM, at an elevation of 2024 m. Data were taken using a 0.4 m OGS Ritchey-Chretien telescope and an SBIG ST-10XE camera. All images were taken with no filter at a pixel scale of 1.31 arcseconds per pixel (excepting 1335 Demoulina, which was observed with an R filter at a pixel scale of 1.97 arcseconds per pixel). Exposure times ranged from 60 to 300 s. Standard image calibration and differential aperture photometry were done with MaxIm DL. Period analysis was done with Peranso 2.02 (Vanmunster 2006), using the Fourier algorithm (FALC) developed by Harris et al. (1989).

Previously published light curves exist for only one of the five asteroids, 1335 Demoulina (cf. the catalog of Harris et al. 2007). Our results are summarized below.

1335 Demoulina. Data were taken on 11 nights in January and February of 2006. For asteroids with periods much greater than the length of an observing session, it is important to tie the calibration scale of successive sessions together as much as possible to reduce the degrees of freedom in the period analysis. We connected adjoining days by calibrating the reference stars from one night to those of the following. For observations separated by more than one day, this was not possible. We found a best fit period of 74.86 h and an amplitude of 0.78 mag. A number of cycles were covered and there is no ambiguity in the period. However, the presence of gaps in the phase coverage makes the standard approach to determining the uncertainty an underestimate. (The shape of the light curve requires a higher order fit, but a higher order fit misbehaves in the gaps.) We therefore quote a more conservative uncertainty of 0.10 h which is based on the change in the best fit period as the order of the solution is varied.

Behrend (2007) cites provisional evidence for two different periods (0.15 and 0.23 h), each based on a single night of data. Either of these values would be noteworthy, as they are much shorter than the approximately 2.1 hour lower limit to periods found in any but the smallest asteroids. However, the amplitudes cited by Behrend, about 0.1 mag, are consistent with the measurement uncertainties of those data and are not inconsistent with the gradual rate of change we find.

2658 Gingerich. Data were taken for this asteroid on two nights in November 2005 and then again for five nights in June 2007. The 2005 data contained more than one cycle per observing session, and so yielded an unambiguous period of 2.9392 ± 0.0011 h with an estimated amplitude of 0.39 mag. (The last 2.5 hours of the first night of observation were omitted from the period fit and from the figure for reasons described below.) The 2007 data consisted of shorter observing sessions (as the asteroid was well past opposition) but spanned a greater total time. Analysis of these data (using the 2005 period to resolve ambiguities) yielded a more precise period of 2.9415 ± 0.0006 h, again with an estimated amplitude of 0.39 mag.

In the 2005 data, we observed a decrease in the asteroid's brightness in the last few hours of the first night that could not be traced to any problems with the data (such as variations in sky quality or close passage by a star). The figures show the asteroid's lightcurve for that night and the residuals to a periodic fit based on binned averages of all but the late data. The most likely interpretation of this dip is that it was due to an eclipse by a binary companion. Pravec et al. (2006) show binaries to be quite common among small, rapidly rotating NEAs, and they give more limited evidence that this extends to larger, main belt objects as well. Furthermore, the depth and duration of the event are within the range of eclipses observed in other systems. Additional observations at the next opposition are desirable to confirm the binary nature of 2658 Gingerich and determine the orbital period.

3091 van den Heuvel. Data were taken of this object on eight of a string of nine nights in June 2006. As with Demoulina, it was both possible and necessary to tie the calibration scale from successive nights together. Variations of this relatively faint asteroid were slow and of small amplitude, so the data points in the figure each represent the average of ten images. With the combination of short June nights and a long rotation period, even eight full nights of data were inadequate to completely fill in all phases of the folded lightcurve. Nonetheless, only one period was found to be consistent with the entire data set: 30.9 ± 0.2 h.

8887 Scheeres. Data were taken of this object on two successive nights in May 2006. This asteroid, like 2658 Gingerich, has a very short rotation period, so multiple cycles were observed each night, and an unambiguous period of 2.9827 ± 0.0017 h was determined. Color is used in the figure to distinguish data from successive

#	Name	Dates of observation	Data pts	Period (h)	P. error (h)	Est. amp. (mag)
1335	Demoulina	Jan 2006: 21-24,27,29-31	709	74.86	0.10	0.78
		Feb 2006: 7,8,12				
2658	Gingerich	Nov 2005: 20-21	282	2.9392	0.0011	0.39
		Jun 2007: 4,5,8-10	81	2.9415	0.0006	0.39
3091	van den Heuvel	Jun 2006: 15,17-23	469	30.9	0.2	0.30
8887	Scheeres	May 2006: 7-8	110	2.9827	0.0017	0.18
12168	5141 T-2	Jan 2007: 9,10,15-17	307	9.4071	0.0007	1.44

cycles within a single night.

(12168) 5141 T-2. Data were taken of this object on five nights in January 2007. A complete cycle could be observed each night, and an unambiguous period of 9.4071 ± 0.0007 h was determined. As can be seen in the plot, the first few hours of 16 January showed a small unexplained decrease in magnitude, but the event is less well covered than the 2658 Gingerich event, so definite conclusions cannot be drawn from it. Data from 16 January were omitted from the period fit. The amplitude of the average rotation was 1.44 mag, greater than all but two other well observed main belt object (see the catalog of Harris et al. 2007). The asteroid 1742 Schaifers has a period of 8.56 h and showed an amplitude of 1.46 mag (Binzel 1987), while 5247 Krylov is tumbling with periods of 68.5 and 81.5 hours and an amplitude of about 1.5 mag (Pravec et al. 2007).

Acknowledgements

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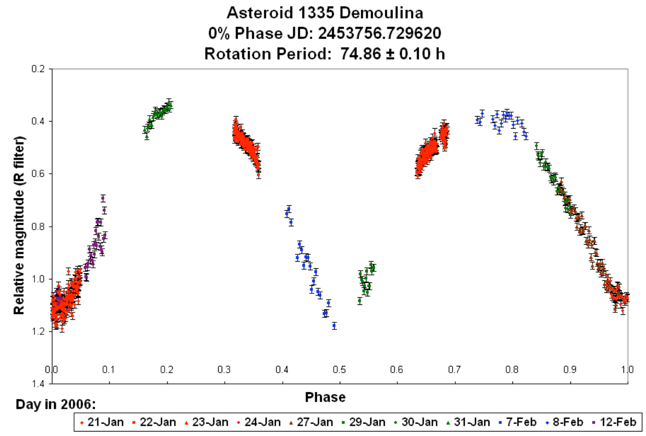

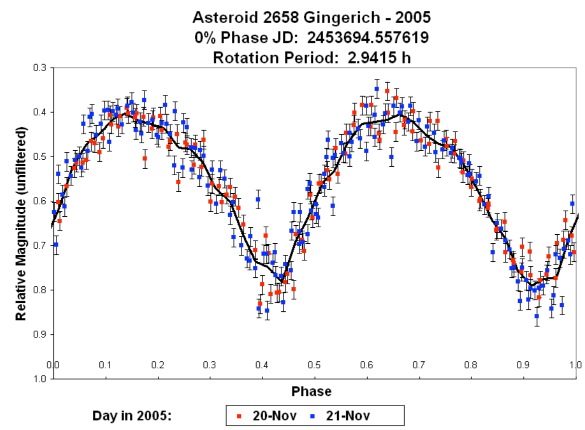

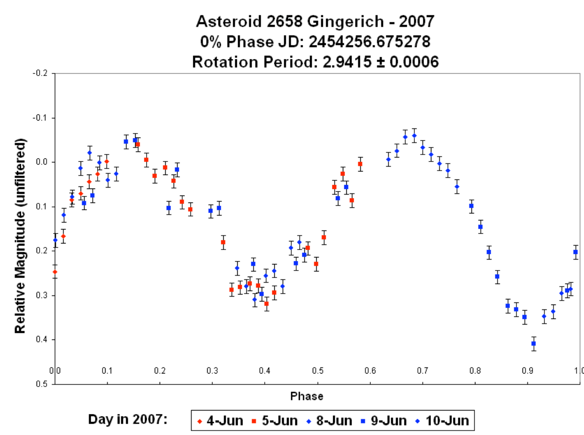

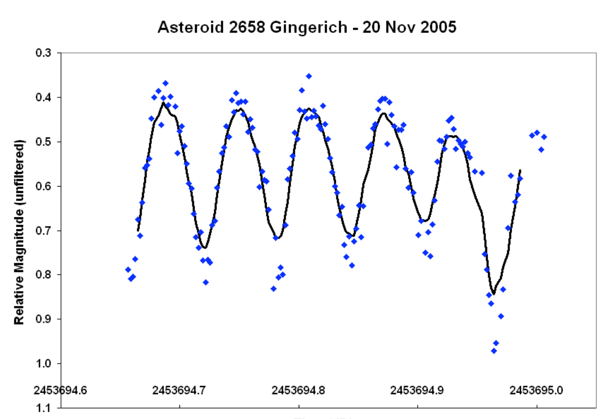

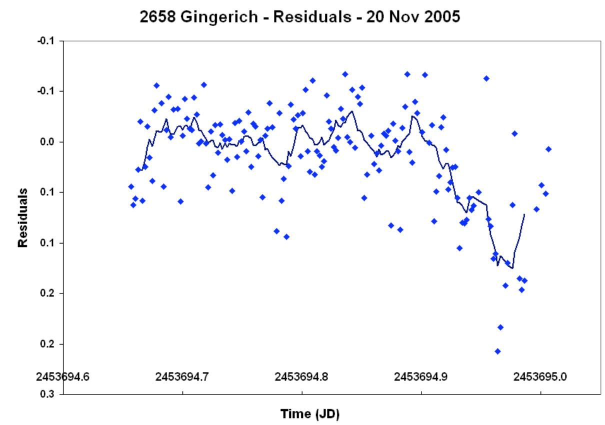

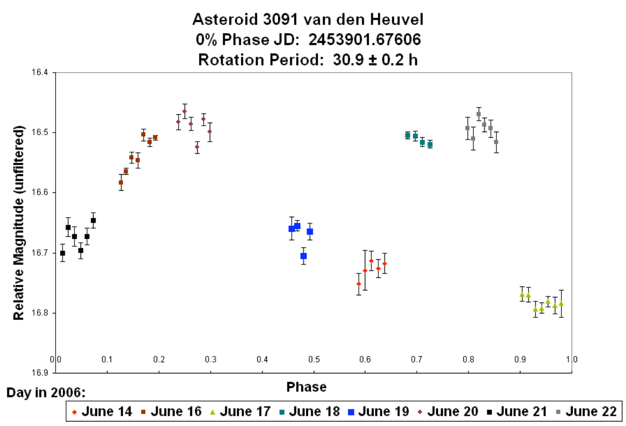

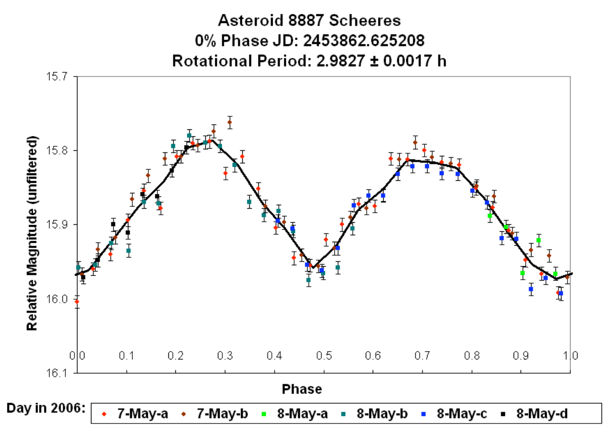

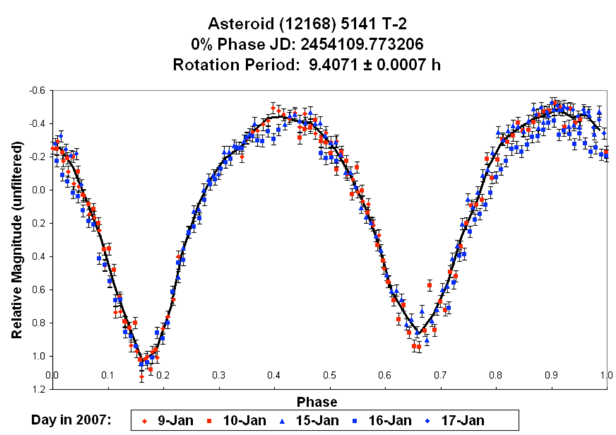

THE ROTATION PERIOD OF 3406 OMSK

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Minor planet 3406 Omsk was observed over six nights in May 2007. The synodic period was determined as 7.275 ± 0.006 hr. The peak to peak amplitude was approximately 0.28 magnitudes, implying an axial ratio (a/b) of 1.3.

Observations of this asteroid were conducted from two sites in Australia – Mt Tarana Observatory undertook unfiltered observations and Bagnall Beach Observatory observed in V band. All observations were light-time corrected. The aspect data (Table I) also shows the percentage of the light curve observed each night. Analysis was carried out using the "Peranso" software (Vanmunster, 2006), using various routines available including the "FALC" routine (based on Harris, et al, 1989).

The final analysis determined a synodic period of 7.275 ± 0.006 hours which was used to compile the composite light curve, with the arbitrary epoch of maximum at JD 2454231.60298. The peak to peak variation in the lightcurve implies an axial ratio (a/b) of 1.3 if we are observing at near-equatorial aspect. Full phase coverage was achieved and this is considered a secure result. At 3.3 rev/day Omsk is an average asteroid with regards to spin rate vs. size (Pravec et al 2002). The latest list of parameters (Harris & Warner, 2007) has no data for this asteroid.

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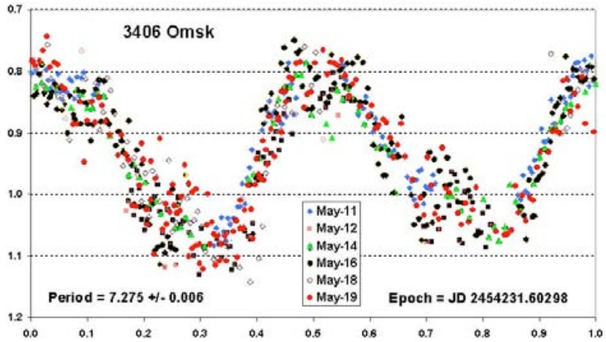

Table I. Aspect data for Omsk in 2007.

UT Date	L_{PAB}	B_{PAB}	Phase Angle	%Phase Coverage
2007 May 11	229.8	-7.3	3.8	82
2007 May 12	229.8	-7.3	3.9	66
2007 May 14	229.9	-7.2	4.1	86
2007 May 16	229.9	-7.1	4.6	89
2007 May 18	230.0	-7.0	5.2	58
2007 May 19	230.0	-6.9	5.5	124

ASTEROID LIGHTCURVE ANALYSIS FROM VOLUNTEER OBSERVATORY DURING APRIL AND MAY 2007

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(Received: 15 July)

Lightcurve period and amplitude results for asteroid 533 Sara are reported. The derived period is 11.654 ± 0.001hrs and the amplitude is 0.280 ± 0.015mag.

The author operates Volunteer Observatory at Knoxville, Tennessee at an elevation of 330 meters. Instrumentation used for asteroid photometry includes a 0.35m Meade SCT mounted on an Astrophysics 1200 GTO mounting and an SBIG ST10XME CCD camera. The image scale for all observations was approximately 1.21 arc-seconds per pixel with 2x2 binning. Data were acquired with a custom blue-blocking clear filter inline using 45-second exposures. The CCD operating temperature was maintained at –20°C. Image acquisition and observatory automation is accomplished with Maxim DL and Astronomer's Control Panel software. Additional details of the equipment used are located at the author's personal website: http://www.mikefleenor.com. All images were measured using MPO Canopus, which employs differential aperture photometry to determine the values used for analysis. The period determination was accomplished with Canopus incorporating the Fourier analysis algorithm developed by Harris (1989). Amplitude determination was accomplished using photometry data generated by Canopus and the author's custom MS Excel spreadsheets.

533 Sara was selected from a list of asteroid photometry opportunities published by Brian Warner and Alan Harris on the Collaborative Asteroid Lightcurve Link (CALL 2007). The asteroid was chosen principally based on its favorable declination. 533 Sara was also listed in the lightcurve opportunities table in the *Minor Planet Bulletin* (Warner 2007), where the period was given as 12 hrs with an amplitude of 0.26 mag. Analysis of observations covering four nights in April and May 2007 resulted in a synodic period determination of 11.654 ±0.001 hrs. and amplitude 0.280 ±0.015 mag. Full coverage of the asteroid's rotation was secured and found to be especially important in determining the synodic period to a high degree of precision.

References

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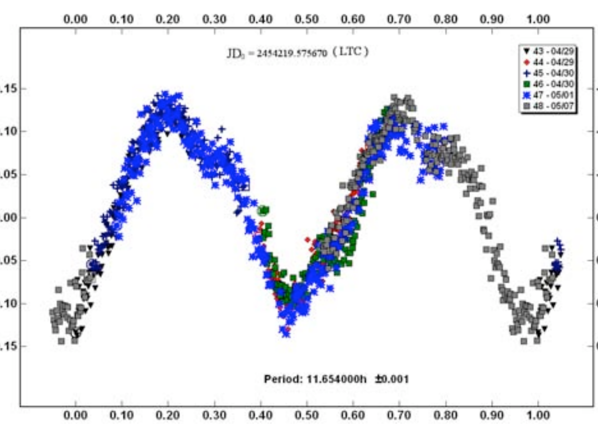

LIGHTCURVE PHOTOMETRY OPPORTUNITIES OCTOBER-DECEMBER 2007

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We present here four lists of "targets of opportunity" for the period 2007 October-December. The first list is those asteroids reaching a favorable apparition during this period, are <15m at brightest, and have either no or poorly constrained lightcurve parameters. By "favorable" we mean the asteroid is unusually brighter than at other times. In many cases, a favorable apparition may not come again for many years. The goal for these asteroids is to find a well-determined rotation rate, if at all possible. Don't hesitate to solicit help from other observers at widely spread longitudes should the initial finding for the period indicated that it will be difficult for a single station to find the period.

The Low Phase Angle list includes asteroids that reach very low phase angles. Getting accurate, calibrated measurements (usually V band) at or very near the day of opposition can provide important information for those studying the "opposition effect", which is when objects near opposition brighten more than simple geometry would predict.

The third list is of those asteroids needing only a small number of lightcurves to allow Kaasalainen and others to complete a shape model. Some of the asteroids have been on the list for some time, so work on them is strongly encouraged in order to allow models to be completed. For these objects, we encourage you to do absolute photometry, meaning that the observations are not differential but absolute values put onto a standard system, such as Johnson V. If this is not possible or practical, accurate relative photometry is also permissible. This is where all differential values are against a calibrated zero point that is not necessarily on a standard system.

When working any asteroid, keep in mind that the best results for shape and spin axis modeling are obtained when lightcurves are obtained over a range of phase angles, let alone viewing aspects at different apparitions. Higher phase angles allow shadowing effects to influence the lightcurve and help constrain the modeling solution. If at all possible, try to get lightcurves not only close to opposition when the asteroid is usually near its brightest, but before and after, e.g., when the phase angle is 15° or more. This can be difficult because of the geometry involved, especially main belt asteroids where the maximum phase angle is about 30°. However, the extra effort can and will pay off.

The fourth list gives a brief ephemeris for planned radar targets. Supporting optical observations made to determine the lightcurve's period, amplitude, and shape are needed to supplement the radar data. Reducing to standard magnitudes is not required but high precision work usually is, i.e., on the order of 0.01-0.03mag. A *geocentric* ephemeris is given for when the asteroid is brighter than 16.0 (in most cases). The date range may not always coincide with the dates of planned radar observations, which – for Arecibo – are limited to a relatively narrow band of declinations.

Those obtaining lightcurves in support of radar observations should contact Dr. Benner directly at the email given above. There are several web sites of particular interest for coordinate radar and optical observations. Future targets (up to 2010) can be found at *http://echo.jpl.nasa.gov/~lance/future.radar.nea.periods.html*. Past radar targets, for comparison to new data, can be found at *http://echo.jpl.nasa.gov/~lance/radar.nea.periods.html*. Slightly different information for Arecibo, e.g., principal investigators and the need for astrometry, is given at *http://www.naic.edu/~pradar/sched.shtml*. For Goldstone, visit *http://echo.jpl.nasa.gov/asteroids/goldstone_asteroid_schedule.html*.

Once you have data and have analyzed them, it's important that you publish your results, if not part of a pro-am collaboration, then in the *Minor Planet Bulletin*. It's also important to make the data available at least on a personal website or upon request.

Note that the lightcurve amplitude in the tables could be more, or less, than what's given. Use the listing as a guide and double-check your work.

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<u>Lightcurve Opportunities</u>

		Brightest				Lightcurve Data	
#	Name	Date	V	Dec	U	Period	Amp
339	Dorothea	10 01.0	12.8	+ 0	2	5.5	0.10
1475	Yalta	10 03.5	14.4	+ 5	0		
41223	1999 XD16	10 04.5	13.9	- 6	0		
493	Griseldis	10 05.9	13.7	+11	0		
11780	1942 TB	10 06.4	14.4	- 7	0		
1405	Sibelius	10 11.9	14.1	+19	0		
917	Lyka	10 13.4	12.7	+14	2	7.92	0.14
1539	Borrelly	10 14.9	13.8	+ 6	0		
1352	Wawel	10 15.1	14.3	+ 7	0		
905	Universitas	10 15.8	12.8	+ 6	2	10.	0.22
2648	Owa	10 16.5	14.4	+18	0		
102	Miriam	10 18.6	10.9	+11	2	15.789	0.08-0.16
1433	Geramtina	10 18.9	14.4	+21	0		
763	Cupido	10 21.2	13.9	+19	0		
4388	Jurgenstock	10 24.4	14.3	+15	0		
271	Penthesilea	10 25.6	13.3	+16	0		
13441	2098 P-L	10 25.7	14.5	+ 5	0		
1160	Illyria	10 25.7	13.9	+25	0		
2118	Flagstaff	10 27.7	14.1	+22	0		
4618	Shakhovskoj	10 29.7	14.6	+32	0		
3285	Ruth Wolfe	10 31.0	14.6	+32	2	3.94	0.20
7517	1989 AD	11 06.2	14.4	+24	0		
1006	Lagrangea	11 06.9	13.6	+35	1	32.8	0.18
5105	Westerhout	11 08.4	14.7	+17	0		
2140	Kemerovo	11 08.8	14.7	+24	2	5.308	0.20
13512	1989 TH1	11 10.8	14.9	+32	0		
1136	Mercedes	11 12.6	13.0	+12	0		
959	Arne	11 12.6	13.2	+17	1	8.60	0.24
5539	Limporyen	11 12.6	14.5	+21	0		

Lightcurve Opportunities (continued)

		Brightest				Lightcurve Data	
#	Name	Date	V	Dec	U	Period	Amp
6905	Miyazaki	11 14.4	13.8	+19	0		
9193	Geoffreycopland	11 14.5	15.0	+22	0		
398	Admete	11 14.7	12.8	+30	0		
651	Antikleia	11 15.3	13.6	+23	2	20.287	0.40
5358	1992 QH	11 15.4	14.5	+36	0		
907	Rhoda	11 16.3	13.1	+24	2	22.44	0.16
1741	Giclas	11 17.2	14.5	+19	0		
2347	Vinata	11 18.3	14.6	+36	0		
7409	1990 BS	11 24.9	14.2	+21	0		
5076	Lebedev-Kumach	11 25.2	14.6	+ 5	2	3.219	0.14
2445	Blazhko	11 28.5	13.8	+17	0		
362	Havnia	11 28.7	12.1	+30	2	18.	0.1
5331	Erimomisaki	11 29.2	13.4	+ 4	0		
19755	2000 EH34	11 29.6	14.6	+27	0		
1544	Vinterhansenia	12 02.5	13.7	+23	2	13.77	0.18
1900	Katyusha	12 04.2	13.7	+29	?		
2378	Pannekoek	12 06.6	14.2	+ 0	0		
971	Alsatia	12 08.3	12.4	+19	2	9.60	0.21
4162	SAF	12 10.5	14.7	+21	2	7.54	0.16
4293	Masumi	12 11.2	14.3	+29	1		<0.1
7520	1990 BV	12 15.4	14.6	+17	0		
1156	Kira	12 19.5	14.4	+23	0		
180	Garumna	12 21.4	12.9	+24	0		
1464	Armisticia	12 22.0	14.7	+24	0		
6823	1988 ED1	12 23.8	13.4	+26	0		
76	Freia	12 24.1	11.7	+20	2	9.972	0.10-0.33
3335	Quanzhou	12 26.8	14.0	+25	0		
3475	Fichte	12 27.0	14.7	+11	0		
1116	Catriona	12 27.2	12.8	+51	2	8.832	0.10-0.20
2009	Voloshina	12 27.6	14.1	+22	0		
1846	Bengt	12 27.7	14.9	+29	0		

Low Phase Angle Opportunities

#	Name	Date	α	V	Dec
105	Artemis	10 05.0	0.77	11.7	+03
231	Vindobona	10 07.1	0.95	13.3	+08
734	Benda	10 13.0	0.81	13.6	+10
1539	Borrelly	10 14.9	0.92	13.8	+06
540	Rosamunde	10 17.4	0.20	13.5	+09
102	Miriam	10 18.7	0.55	11.0	+11
1332	Marconia	10 28.9	0.50	13.7	+15
396	Aeolia	10 29.8	0.73	13.8	+16
1150	Achaia	11 03.7	0.66	13.9	+14
208	Lacrimosa	11 04.4	0.55	12.8	+17
767	Bondia	11 05.9	0.81	13.6	+14
509	Iolanda	11 07.1	0.97	12.1	+14
797	Montana	11 08.3	0.60	13.7	+18
131	Vala	11 10.6	0.96	13.3	+15
959	Arne	11 12.6	0.48	13.2	+17
168	Sibylla	11 13.6	0.86	12.3	+15
6905	Miyazaki	11 14.5	0.61	13.8	+20
222	Lucia	11 17.6	0.37	14.0	+18
1542	Schalen	11 21.1	0.65	14.0	+18
492	Gismonda	11 25.5	0.26	13.7	+21
566	Stereoskopia	11 25.8	0.68	12.3	+19
562	Salome	11 27.4	0.60	14.0	+19
1544	Vinterhansenia	12 02.5	0.52	13.7	+23
1197	Rhodesia	12 05.3	0.44	13.7	+24
248	Lameia	12 14.0	0.61	13.5	+22
149	Medusa	12 21.4	0.82	12.7	+22
180	Garumna	12 21.4	0.46	12.9	+24

Shape/Spin Modeling Opportunities

		Brightest			Per		
#	Name	Date	V	Dec	(h)	Amp.	U
3415	Danby	10 17.2	14.7	+11	2.851	0.09-0.14	3
83	Beatrix	11 16.8	11.9	+22	10.16	0.18-0.27	4
34	Circe	11 17.6	12.1	+12	12.15	0.24	3
76	Freia	12 24.1	11.7	+20	9.972	0.10-0.33	2
5	Astraea	12 31.	11.4	+04	16.800	0.10-0.30	4
24	Themis	12 31.	12.6	+10	8.374	0.09-0.14	3
48	Doris	12 31.	11.9	+08	11.89	0.35	3
369	Aeria	12 31.	13.1	-03	4.787	0.08	2
409	Aspasia	12 31.	12.7	+09	9.020	0.10-0.14	4

Radar-Optical Opportunities

2340 Hathor

No lightcurve parameters have been reported for this asteroid, which has an estimated diameter of about 0.5 km. Larger instruments, probably 0.5-m or more, will be needed to get good data.

Date	Geocentric					
2007	RA(2000)	DC(2000)	E.D.	V	α	E
10/22	18 22.21	-12 16.4	0.060	17.14	108.9	68
10/26	20 27.71	-13 58.0	0.068	16.25	82.4	94
10/30	21 49.58	-12 55.0	0.090	16.36	66.1	109
11/03	22 36.69	-11 31.5	0.118	16.74	57.9	116
11/07	23 05.79	-10 21.0	0.148	17.17	53.7	119
11/11	23 25.61	- 9 22.4	0.181	17.58	51.6	120
11/15	23 40.34	- 8 31.4	0.214	17.96	50.6	120
11/19	23 52.07	- 7 45.0	0.248	18.30	50.2	119

4954 Eric

We repeat the notice for this asteroid that was included in the previous issue of the *Minor Planet Bulletin* since an extended campaign for this asteroid is planned for Arecibo in October and November. Photometry will help estimate the pole position. It will be brighter than 15th magnitude until mid-March 2008. The solar elongation is greater than 100° for most of the ephemeris period below, so it should be a workable target for months. The period is well-known, 12.057 hr, so it makes better sense to observe it one to three nights every few weeks in order to get both the entire curve – if possible – and any changes in the curve as it moves through a very large range of PAB values.

Date	Geocentric						
2007/08	RA(2000)	DC(2000)	V	α	E	LPAB	BPAB
08/30	23 28.22	-26 36.3	12.41	15.3	158	339.7	-13.8
09/29	22 15.63	-11 53.0	11.67	26.3	146	344.7	-0.6
10/29	21 29.73	+15 59.0	12.26	53.6	112	358.6	20.1
11/28	21 50.28	+39 53.8	12.82	61.9	99	27.7	35.6
12/28	23 33.38	+58 03.8	13.12	55.6	103	62.6	38.5
01/27	3 19.16	+61 46.4	13.57	45.2	112	90.6	30.8
02/26	6 01.90	+49 07.8	14.42	39.2	111	111.0	20.6
03/27	7 29.22	+36 20.9	15.41	36.6	101	127.1	12.7
04/16	8 13.08	+29 32.4	16.00	34.7	93	136.5	8.8

(11500) 1989 UR

This 0.6 km asteroid will be within range of backyard telescopes for ~3 weeks in November. It's southerly motion means that observers on both sides of the equator will have a chance to provide supporting observations. Pravec reports a period of ~73 hours. Such a period usually requires a collaboration among observers at widely different longitudes to get a complete lightcurve. It's possible this is also a "tumbler" (non-principal axis rotation), which adds to the challenge *and* the importance of finding a solution.

Date	Geocentric					
2007	RA(2000)	DC(2000)	E.D.	V	α	E
11/08	6 19.82	+27 59.8	0.150	16.16	43.5	131
11/10	6 31.94	+25 59.9	0.137	15.96	44.6	130
11/12	6 45.75	+23 28.7	0.123	15.76	46.2	129
11/14	7 01.63	+20 16.8	0.111	15.57	48.6	127
11/16	7 20.05	+16 12.2	0.099	15.39	51.8	124
11/18	7 41.55	+11 01.3	0.089	15.26	56.4	119
11/20	8 06.68	+ 4 32.7	0.081	15.20	62.5	113
11/22	8 35.90	- 3 14.2	0.075	15.25	70.2	106
11/24	9 09.33	-11 56.5	0.071	15.44	79.4	97
11/26	9 46.48	-20 44.1	0.071	15.78	89.1	87
11/28	10 26.05	-28 36.7	0.075	16.26	98.3	77

3200 Phaethon

The period for this object is about 3.6 hours. The value is well-established. However, data obtained near the time of the radar observations will help establish the phase of the lightcurve at the time of the radar observations. The pole position has been reported, so the primary interest here is that, due to the faster rotation, there's a possibility the asteroid is binary. Careful photometry may help answer that question.

Date 2007	Geocentric RA(2000)	DC(2000)	E.D.	V	α	E
11/08	7 53.01	+31 22.5	0.702	16.19	41.5	110
11/12	8 02.66	+31 06.1	0.617	15.86	42.7	112
11/16	8 13.95	+30 43.3	0.532	15.50	44.1	114
11/20	8 27.89	+30 09.2	0.449	15.09	46.1	115
11/24	8 46.28	+29 14.0	0.367	14.63	49.1	115
11/28	9 12.66	+27 34.9	0.288	14.13	53.8	113
12/02	9 54.54	+24 09.5	0.213	13.60	62.4	107
12/06	11 07.48	+15 55.6	0.151	13.28	79.7	92

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THE MINOR PLANET BULLETIN (ISSN 1052-8091) is the quarterly journal of the Minor Planets Section of the Association of Lunar and Planetary Observers – ALPO. Beginning with volume 32, the current and most recent issues of the *MPB* are available on line, free of charge at http://www.minorplanetobserver.com/mpb/default.htm . Subscription information for conventional printed copies is given below.

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* * * * *

The deadline for the next issue (35-1) is October 15, 2007. The deadline for issue 35-2 is January 15, 2008.