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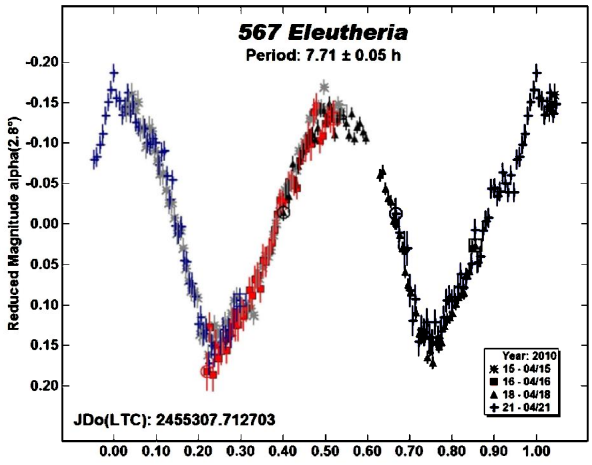

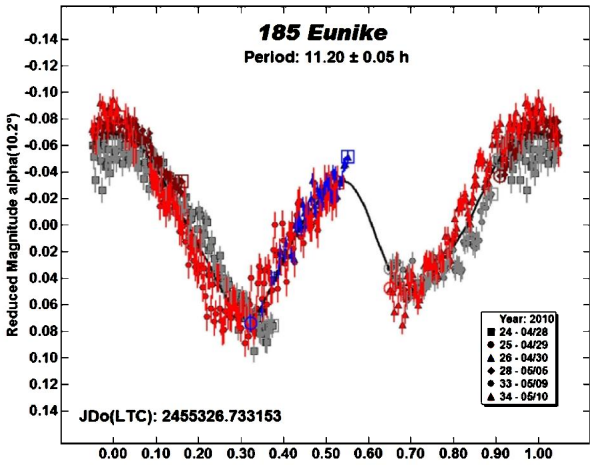

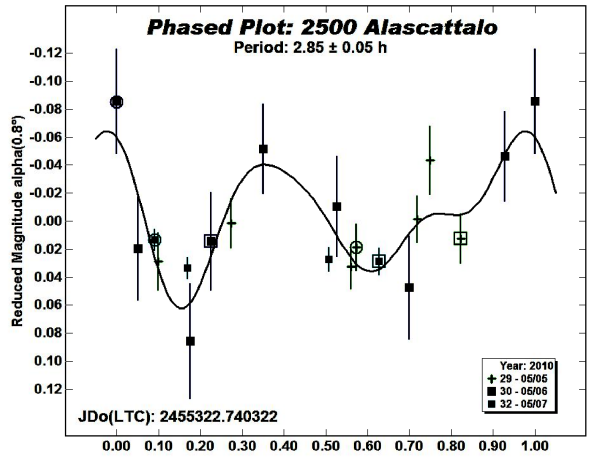

ASTEROIDS OBSERVED FROM GMARS AND SANTANA OBSERVATORIES: 2010 APRIL - JUNE

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Lightcurves for five asteroids were obtained from Santana and GMARS Observatories from 2010 April to June: 824 Anastasia, 869 Mellena, 996 Hilaritas, 1451 Grano, and 2114 Wallenquist.

Observations at Santana Observatory (MPC Code 646) were made with a 0.30-m Schmidt-Cassegrain (SCT) with a SBIG STL-1001E. Observations at GMARS (Goat Mountain Astronomical Research Station, MPC G79) were made with two telescopes, both 0.35-m SCT using SBIG STL-1001E CCD Cameras. All images were unguided and unbinned with no filter. Measurements were made 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). Except for 824 Anastasia, the asteroids were selected from the list of asteroid photometry opportunities published on the Collaborative Asteroid Lightcurve Link (CALL) website (Warner et al., 2010).

The results are summarized in the table below, as are individual plots. The plots are "phased", i.e., they range from 0.0 to 1.0 of the stated period. Most of the plots are scaled such that 1.0 mag has the same linear size as the horizontal axis from 0.0 to 1.0. This is done to avoid the visual impression that the amplitude variation is greater than it actually is, which can create the impression of a physically implausible lightcurve. The scale was shrunk for high amplitude lightcurves. Night-to-night calibration of the data (generally < ±0.05 mag) was done using field stars converted to approximate Cousins R magnitudes based on 2MASS J-K colors (Warner 2007 and Stephens 2008).

824 Anastasia. Observations of Anastasia were undertaken in support of an occultation project organized by the International Occultation and Timing Association (IOTA). 824 Anastasia occulted Zeta Ophiuchi on April 6, 2010 through a path crossing Southern California. Unfortunately, the path of the occultation was west of the prediction and more than 60 observers missed viewing the occultation. Only four observers well outside the path observed chords across the profile (IOTA 2010). Even though the observing group did not get the results it wanted, the four chords give a result consistent with the previously estimated 34 km radius.

#	Name	mm/dd 2010	Data Pts	α	L_{PAB}	B_{PAB}	Per (h)	PE	Amp (mag)	AE
824	Anastasia	04/04 - 05/22	3,060	17.7, 5.5	242	10	250	1	1.20	0.05
869	Mellena	05/02 - 06/06	766	18.6, 7.0	256	11	6.5155	0.005	0.27	0.03
996	Hilaritas	03/15 - 03/17	521	2.1, 1.3, 5.4	310	3	10.05	0.01	0.63	0.03
1451	Grano	03/18 - 04/08	1,443	0.6, 13.2	177	1	138.00	0.05	0.65	0.01
2114	Wallenquist	04/10 - 04/17	275	1.1, 4.1	198	0	5.510	0.005	0.22	0.03

Images on 04/14, 04/15, 04/25, 04/26, 04/27, 05/03, 05/04, 05/05, 05/06, 05/20, 05/21, and 05/22 were taken at Santana Observatory. All others were taken at GMARS. Based upon a single night's observations in March 2007, Behrend (2010) reported the period was greater than 20 h.

The occultation occurred at approximately 0.20 on the phase plot. Since this was near a minimum, it implies a small cross section during the occultation. The IOTA chords suggest an elongation of 1.5:1. The amplitude of the complete lightcurve suggests an overall elongation of 3:1

869 Mellena. Images on 06/02, 06/03 and 06/04 were obtained at Santana Observatory. All others were at GMARS. There was no previous period reported.

996 Hilaritas. All images were taken at Santana Observatory. Angeli (2001) obtained two nights in April 1999 and based upon a partial lightcurve estimated the period to be 17.2 h which appears to be an alias of this 10.05 h period.

1451 Grano. Images on 03/20, 04/02 and 04/03 were obtained at GMARS. All others were at Santana Observatory. Behrend (2010) reported a period of 5.109 hours with an amplitude of 0.06 magnitudes over three nights between May 19 and July 9, 2007. The formal errors were as large as the reported amplitude. Using night-to-night data calibrated to an internal standard, it is apparent Grano has a long period. The best fit of the data was approximately 138 hours with three sessions, notably the first and last sessions well off the trend line. This gives a suggestion that Grano is in a non-principal axis state of rotation (tumbling).

2114 Wallenquist. All Images were obtained at GMARS. Behrend (2010) reported a period of 5.49 hours with an amplitude of 0.3 magnitudes over three nights between May 19 and July 9, 2007. This is in good agreement with this period.

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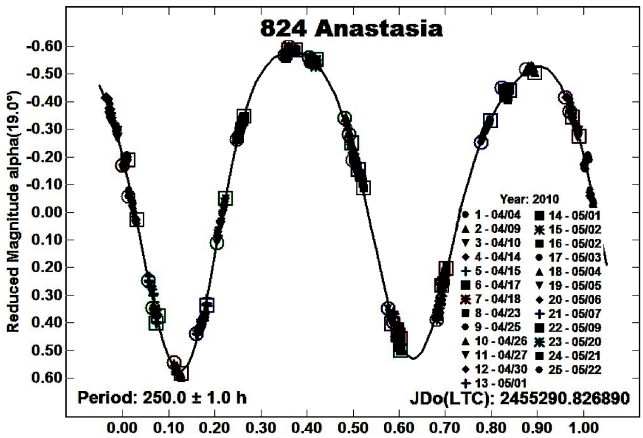

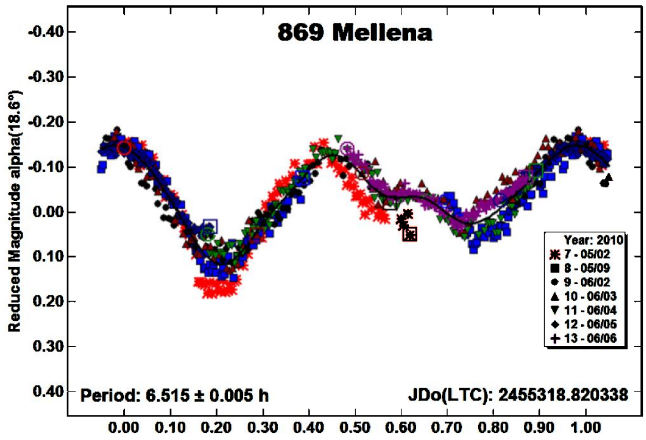

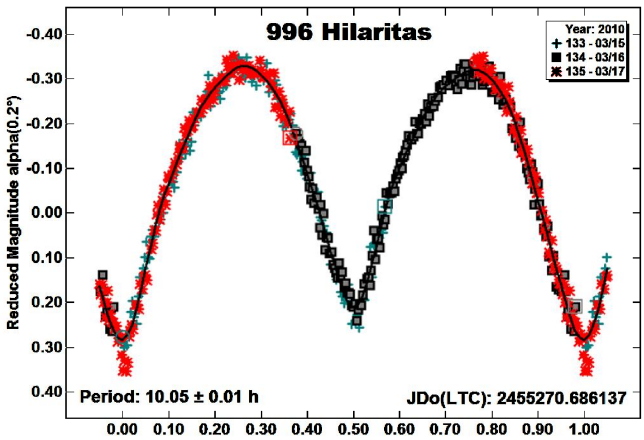

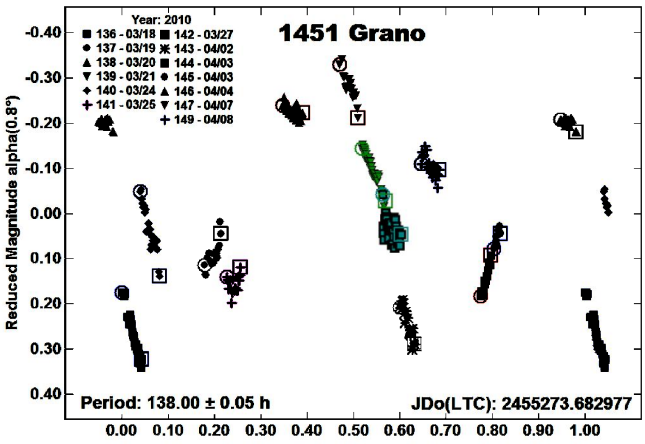

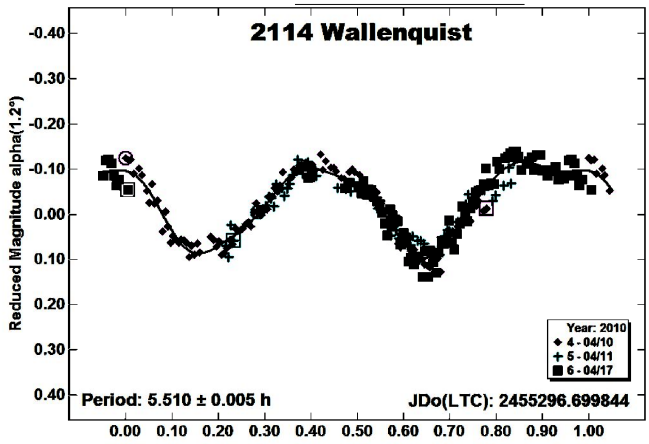

ASTEROID LIGHTCURVE ANALYSIS AT THE PALMER DIVIDE OBSERVATORY: 2010 MARCH – JUNE

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Lightcurves for 19 asteroids were obtained at the Palmer Divide Observatory (PDO) from 2010 March through June: 413 Edburga, 2204 Lyyli, 2449 Kenos, 3225 Hoag, 3416 Dorrit, 3483 Svetlov, 3800 Karayusuf, 4461 Sayama, 4713 Steel, 5081 Sanguin, 5427 Jensmartin, 5641 McCleese, 6249 Jennifer, 6635 Zuber, 6911 Nancygreen, (29147) 1988 GG, (30856) 1991 XE, (48147) 2001 FO160, and (103501) 2000 AT245.

CCD photometric observations of 19 asteroids were made at the Palmer Divide Observatory (PDO) from 2010 March through June. See the introduction in Warner (2010) for a discussion of equipment, analysis software and methods, and overview of the plot scaling. The "Reduced Magnitude" in the plots uses R magnitudes corrected to unity distance using -5 * log (Rr) with R and r being, respectively, the Sun-asteroid and Earth-asteroid distances in AU. The magnitudes were normalized to the phase angle given in parentheses, i.e., alpha(X°), using G = 0.15 unless otherwise stated.

413 Edburga. This asteroid was observed as a "full moon project" to resolve the ambiguity between two previously reported periods: 15 h (Hainaut-Rouelle et al., 1995) and 12.1 h (Behrend, 2010). The PDO data gave a convincing solution of P = 15.773 h and A = 0.36 mag.

2204 Lyyli. Mohamed et al. (1994) reported P = 10 h for this Mars-crosser while Gil-Hutton and Canada (2003) found P = 9.51 h. Neither of these could be fit to the PDO data, which gave P = 11.063 h with A = 0.40 mag.

2449 Kenos. Wisniewski et al. (1997) found P = 4.188 h but with P = 3.862 h as a possible solution. Warner (2007) found P = 3.8492 h. The latest PDO data gave P = 3.846 h with A = 0.23 mag.

3225 Hoag. Warner (2007, 2009b) previously reported P ~ 2.372 h. The asteroid was observed in 2010 for additional modeling data and to check if it might be binary (see Warner et al., 2010, for a serendipitous story concerning 2131 Mayall and repeated follow-up). The 2010 PDO data gave P = 2.3722 and A = 0.12.

3416 Dorrit. Bennefeld (2009) found P = 2.714 h based on two consecutive nights but with data point errors of ~0.04 mag. Using the PDO data, which consisted of two consecutive nights and a third three days removed from the first two, there was a much weaker solution in the period spectrum around that value, but it was obviously not a good fit. Instead, the data gave P = 2.574 h with A = 0.21 mag.

3800 Karayusuf. Warner (2008) found P = 2.2319 h with some suspicious data that might have been attributed to a satellite. No evidence of such was found in the 2010 apparition. The latest data gave P = 2.232 h with A = 0.15 mag.

4713 Steel. The PDO data gave P = 5.199 h with A = 0.42 mag. The period is reasonable agreement with that from Behrend (2010) of P = 5.186 h.

5427 Jensmartin. Warner (2009a) found P = 5.810 h from observations in 2008. The 2010 follow-up observations gave P = 5.813 h with A = 0.55 mag.

5641 McCleese. Warner et al. (2006a) found P = 7.268 h with A = 0.06 mag. Behrend (2010), using data from 2005 and 2007, found P = 28.8 h. The 2010 PDO data set benefited from well-linked data over the nearly six weeks of observations. These gave P = 418 h with A = 1.3 mag, thus making this Hungaria asteroid a very slow rotator and demonstrating the need to provide accurate linking and prolonged observations when the data indicate only a small but steady change over each session. One must also avoid the temptation to find solutions based on what is mostly noise in the data.

6249 Jennifer. Both Warner et al. (2006b) and Behrend (2010) previously reported a period of approximately 4.6 h. In both cases, the amplitudes were $A \leq 0.11$ mag. Such low amplitude curves, especially if monomodal (as Behrend found), leave open the possibility that the true period solution is something other than what was found, often one-half. The 2010 PDO data produced a lightcurve amplitude of A = 0.32 mag, which almost assures that the lightcurve is bimodal and so a period solution featuring such a curve is very likely correct. The period of P = 4.961 h confirmed