

ASTEROIDS OBSERVED FROM SANTANA, CS3 AND GMARS OBSERVATORIES: 2012 APRIL - JUNE

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Lightcurves of seven asteroids were obtained from Santana Observatory, Goat Mountain Astronomical Research Station (GMARS), and the Center for Solar System Studies (CS3): 412 Elisabetha, 1055 Tynka, 1424, Sundmania, 3493 Stepanov, (6254) 1993 UM3, and (33736) 1999 NY36.

Observations were made at Santana Observatory (MPC Code 646) using a 0.30-m Schmidt-Cassegrain (SCT) with a SBIG STL-1001E CCD camera, GMARS (MPC Code G79) or CS3 using a 0.40-m or 0.35-m SCT with a SBIG STL-1001E CCD camera. 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 (Harris et al., 1989). Except for (1055) Tynka, the asteroids were selected from the list of asteroid photometry opportunities published on the Collaborative Asteroid Lightcurve Link (CALL) website (Warner et al., 2012).

The results are summarized in the table below, as are individual plots. Night-to-night calibration of the data (generally $< \pm 0.05$ mag) was done using field stars converted to approximate Cousins V magnitudes based on 2MASS J-K colors (Warner 2007 and Stephens 2008).

412 Elisabetha. All images were acquired at Santana Observatory. Lagerkvist (1992) observed 412 Elisabetha on ten nights in August 1990 but did not report a period. Cooney (Cooney 2002) obtained data over five nights in January and February of 2002 reporting a period of 19.67 h; in good agreement with this result. Bernasconi (Behrend 2012) obtained data on two nights in June 2003 reporting a period of 13.99 h.

1055 Tynka. Tynka was in the field of view of the primary target, 412 Elisabetha and could only be followed for two nights. A third night was obtained over a month later to refine the period. Higgins and Pilcher (2009) obtained data over six nights from April to June 2009 reporting a period of 11.893 h which this result is in good agreement with. Roy (Behrend 2012) obtained data over two nights in April 2012 and reported a period of 5.98 h which appears to be the half period.

1424 Sundmania. Images on April 20 were acquired at GMARS. All others were acquired at Santana. Roy (Behrend 2012) obtained data over two nights in March 2012 and reported a period of 47 h which appears to be the half period.

1428 Mombasa. Observations on June 29 and 30 were obtained at CS3. All other observations were obtained from Santana. Roy (Behrend 2012) obtained data over two nights in February 2006 and reported a period of 17.57 h which is in fair agreement with this result. Hawkins (Hawkins 2007) obtained observations on four nights in May 2007 and reported a period of 17.12 h which is in good agreement with this result.

Although the observations refined previously published results, the period spectrum revealed a strong alias to either 25.3 h or 25.6 h. Using a 6th order fit, the 16.67 h solution is dominated by even-order harmonics while the 25 h solutions has odd and even harmonics of significant strength; unlikely at this amplitude and phase angle. Given the previously published results and a half-period of 8.33 h being found; the 16.67 h period is preferred. The plot is binned with the average of five data points presented as one for clarity in subtle features in the lightcurve.

3493 Stepanov. This asteroid does not have a previously reported period in the LCDB (Warner et al., 2012). All images were acquired at GMARS using the 0.35-m telescope.

(6254) 1993 UM3. All images were acquired at GMARS using the 0.35-m telescope. This asteroid does not have a previously reported period in the LCDB (Warner et al., 2012).

(33736) 1999 NY36. All images were acquired at GMARS using either the 0.4-m or 0.35-m telescopes. This asteroid does not have a previously reported period in the LCDB (Warner et al., 2012). Observations from April 20 to May 28, 2012 showed a typical bimodal lightcurve with an amplitude of about 0.5 magnitudes. However, observations obtained on June 9 and 10 showed a dramatic drop in magnitude suggesting that 33736 has non-principal axis of rotation.

The data for each of these asteroids was uploaded to the ALCDEF database (see Warner et al., 2011) on the Minor Planet Center's web site (MPC 2012).

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#	Name	mm/dd/12	Data Pts	α	L_{PAB}	B_{PAB}	Per (h)	PE	Amp (mag)	AE
412	Elisabetha	05/10 - 05/17	1,145	6.9, 6.8	232	15	19.635	0.005	0.10	0.02
1055	Tynka	03/27 - 05/09	266	4.8, 2.8, 16.9	194	5	11.75	0.01	0.34	0.05
1424	Sundmania	03/22 - 04/30	1,207	5.0, 1.8, 8.0	195	5	93.73	0.03	0.42	0.03
1428	Mombasa	06/18 - 07/04	1,330	6.0, 10.2	260	12	16.67	0.01	0.16	0.02
3493	Stepanov	4/20 - 4/21	315	9.2, 8.8	221	9	6.112	0.002	0.82	0.02
6254	1993 UM3	4/22 - 4/29	395	4.3, 2.1	221	4	7.040	0.001	0.31	0.03
33736	1999 NY36	04/20 - 06-10	1,071	8.2, 4.3, 17.5	222	7	211	5		

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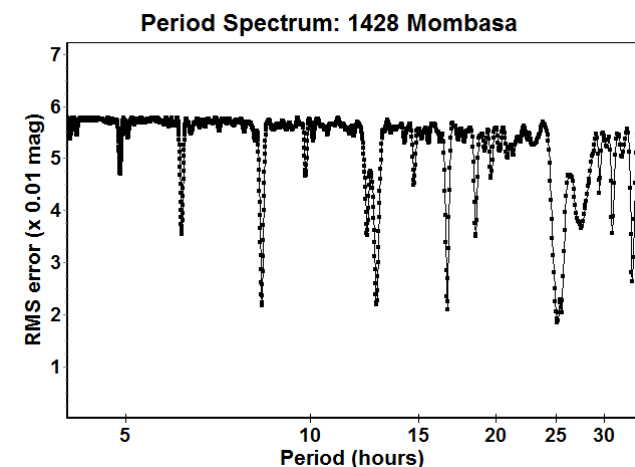
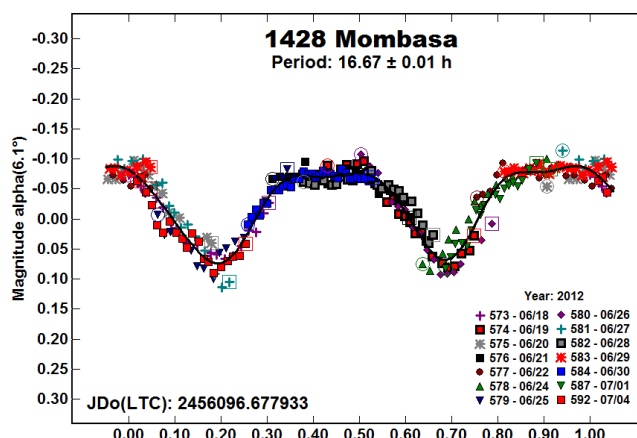
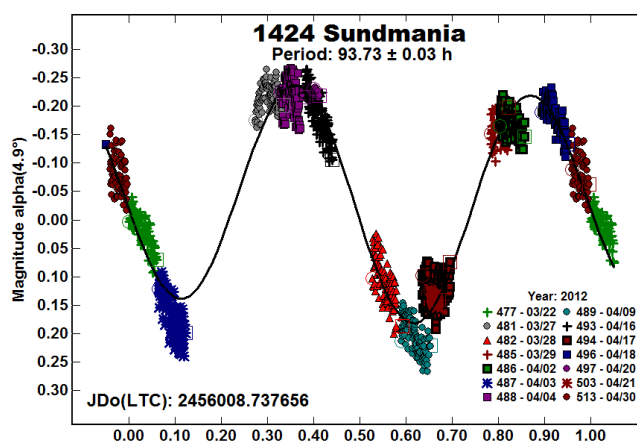
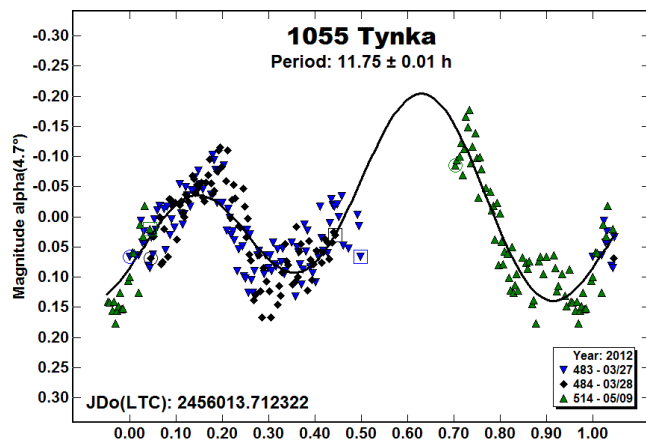
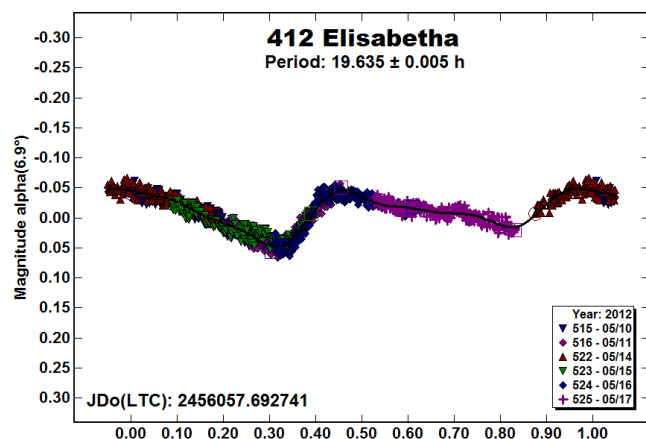
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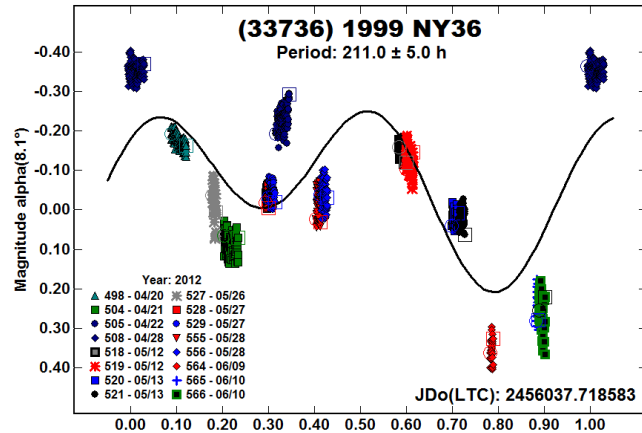
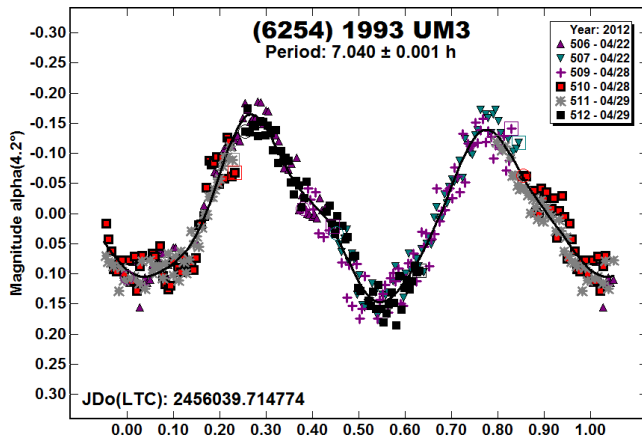
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Combining these new results with those of Buchheim (2007) and Stephens (2009) provides much information about the rotational properties of 482 Petrina. It can be shown that the data presented in the 15.73 hour period lightcurve by Buchheim (2007) and in the 9.434 hour period lightcurve by Stephens (2009) are both consistent with a period of 11.794 hours. Buchheim's