

CCD LIGHTCURVE ANALYSIS OF 40 HARMONIA

Kevin B. Alton
UnderOak Observatory
70 Summit Ave
Cedar Knolls, NJ 07927

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Filtered (Ic) CCD images for 40 Harmonia were obtained over six sessions from 2009 February to March. A folded lightcurve was produced and the synodic period estimated by Fourier analysis to be 8.9091 h.

First discovered in 1856, 40 Harmonia (107.2 km) is an S-type main belt asteroid. More recent investigations on this minor planet include those by Lagerkvist et al. (1986), McCheyne et al. (1985), Gallardo and Tancredi (1987), Mellilo (1995), and López-González and Rodríguez (1999) and Tedesco et al. (2004).

For this study, the equipment included a focal reduced (f/6.3) 0.2-m Schmidt-Cassegrain telescope with a thermoelectrically cooled (5°C) SBIG ST 402ME CCD camera mounted at the Cassegrain focus. Filtered (Ic) imaging was conducted on six nights with exposures automatically taken every 45 seconds. Image acquisition (raw lights, darks and flats) was performed by *CCDSOFT 5* (SBIG) while calibration and registration were accomplished with *AIP4WIN* (Berry and Burnell, 2006). Further data reduction with *MPO Canopus* (Warner, 2008) used at least four non-varying comparison stars to generate lightcurves by differential aperture photometry. Data were light-time corrected but not reduced to standard magnitudes.

A total of 1407 photometric values were generated over 25 days. Relevant aspect parameters for 40 Harmonia taken at the mid-point from each session are tabulated below. *MPO Canopus* provided a period solution for the folded data sets using Fourier analysis (Harris, 1989). The calculated synodic period, $P = 8.9091 \pm 0.0005$ h, is in good agreement with the most recent value for 40 Harmonia published by López-González and Rodríguez (1999) as well as that found at the JPL Solar System Dynamics website. The peak amplitude was estimated at 0.33 ± 0.02 mag. Phased data are available by request at <http://underoakobservatory.com>.

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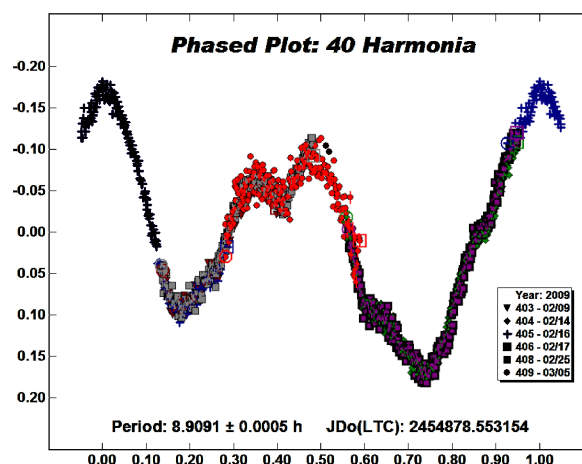
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LIGHTCURVES OF 494 VIRTUS, 556 PHYLLIS, 624 HEKTOR, 657 GUNLOD, 1111 REINMUTHIA, 1188 GOTHLANDIA, AND 1376 MICHELLE

Hiromi Hamanowa, Hiroko Hamanowa
Hamanowa Astronomical Observatory
4-34 Hikarigaoka Nukazawa Motomiya Fukushima Japan
hamaten@poplar.ocn.ne.jp

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Lightcurves for seven asteroids were obtained at the Hamanowa Astronomical Observatory from 2008 March to 2009 February. Synodic rotation periods and amplitudes have been found for 494 Virtus 5.570 ± 0.003 h, 0.033 ± 0.005 mag; 556 Phyllis 4.2909 ± 0.0003 h, 0.222 ± 0.005 mag; 624 Hektor 6.9210 ± 0.0001 h, 0.590 ± 0.005 mag; 657 Gunlod 15.6652 ± 0.0001 h, 0.193 ± 0.003 mag; 1111 Reinmuthia 4.0075 ± 0.0001 h, 0.945 ± 0.003 mag; 1188 Gothlandia 3.4915 ± 0.0001 h, 0.776 ± 0.005 mag; 1376 Michelle 5.9748 ± 0.0002 h, 0.199 ± 0.003 mag.

The observations reported here were made with the 40-cm telescope of the Hamanowa Astronomical Observatory (MPC D91). The CCD imager was a SBIG ST-8E featuring a 1530×1020 array of 9-micron pixels. All observations were made with R-band filter (UBVRI) at 2x binning yielding an image scale of 2.0 arc seconds per pixel. All images were dark and flat-field corrected. Images were measured using *Stella Image* v5 (Astro Arts) and *IRAF*. The data were light-time corrected. The period analysis was done with *Cycrocode*, which was developed by B. Dermawan (2003). The results are summarized in the table below and include average phase angle information across the observational period. Individual lightcurve plots along with additional comments, as required, are also presented.

494 Virtus. Our period is consistent with those in the asteroid lightcurve database (LCDB, Harris et al., 2007), which listed reported periods of 5.57 h and 5.570 h, but our amplitude, $A = 0.033$ mag., is smaller than the $A = 0.12$ mag reported previously, most likely indicating a different viewing aspect.

556 Phyllis. Data were collected from 2008 October 13 through November 14 resulting in 4 data sets. A period of 4.2909 ± 0.0003 h was determined. This result is nearly consistent with those in the LCDB.

624 Hektor. Lightcurve observations of the Trojan asteroid 624 Hektor were obtained from 2008 December 29 through 2009 January 28 resulting in 11 data sets. A period of 6.9210 ± 0.0001 h with two un-symmetrical peaks and amplitude of 0.590 ± 0.005 mag were determined. These agree with previous results.

657 Gunlod. Data were collected from 2008 December 1 through 2009 January 1 resulting in 9 data sets. A period of 15.6652 ± 0.0001 h was determined. This result is consistent with Pilcher (1980).

1111 Reinmuthia. A period of 4.0075 ± 0.0001 h was derived from 6 nights of photometric observations. The only previous lightcurve of Reinmuthia was reported to have a period of 4.02 h (Binzel, 1987). Our observations from 2009 January through February 14 found a period of 4.0074 ± 0.0001 h.

1188 Gothlandia. Data were collected from 2008 December 10 through 2009 January 7 resulting in 7 data sets. A period of 3.4915 ± 0.0001 h was determined. The only previous lightcurve of Gothlandia was reported to have a period of 3.493 h (Di Martino et al., 1994).

1376 Michelle. Data were collected from 2008 December 1 through October 21 resulting in 5 data sets. A period of 5.9748 ± 0.0002 h was determined. The only previous lightcurve of Michelle was reported to have a period of 6.0 h (Wisniewski et al., 1997).

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