

140 SIWA – A PROBLEMATIC ASTEROID

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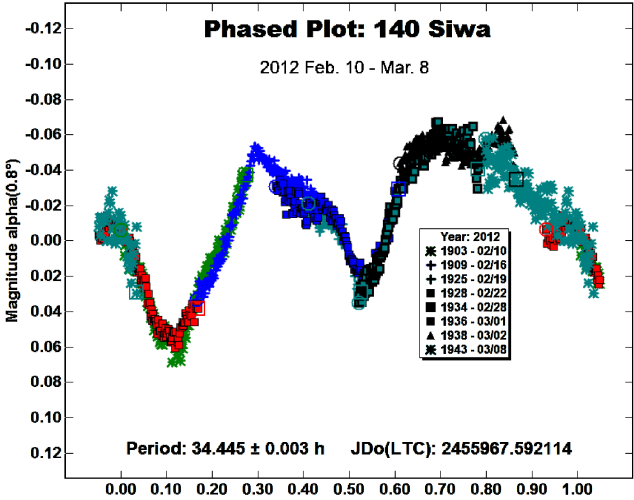
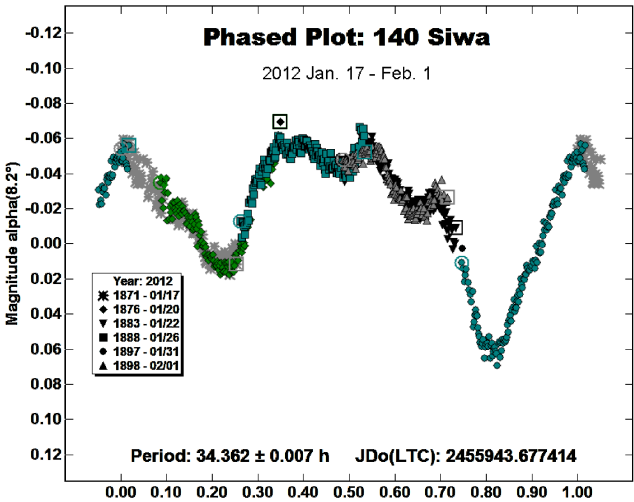
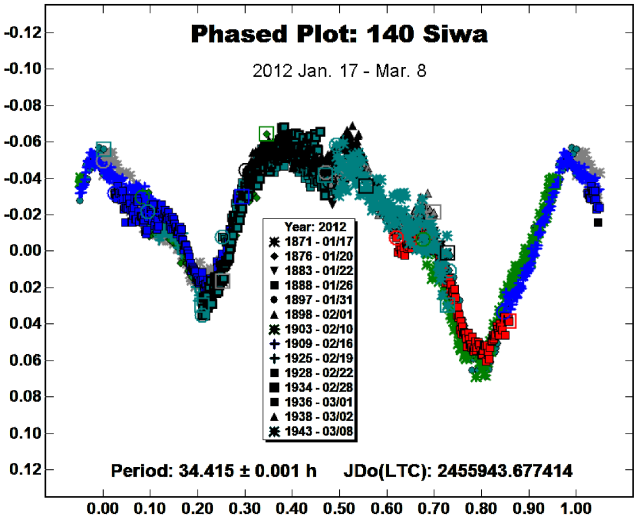
Analysis of observations of 140 Siwa obtained between 2012 Jan 17 and Mar 8 shows a synodic rotation period of 34.415 hours, amplitude 0.12 ± 0.01 mag. However, the subset in the interval Jan 17 – Feb 1 shows a period 34.362 ± 0.007 h, and one in the interval Feb 10 – Mar 8 a period 34.445 ± 0.003 h. With allowance for this large shift of synodic period with changing viewing aspect and phase angle, the synodic rotation period with reasonable error should be stated as 34.41 ± 0.04 hours.

Nearly every previous investigation of 140 Siwa has yielded a different period. Harris and Young (1980) and Schober and Stanzel (1979) independently obtained single night 7-hour lightcurves separated by 32 hours which looked similar and surmised a 32 hour period. Other periods were obtained by Lagerkvist *et al.* (1992; 18.5 h), Le Bras *et al.* (2001; 18.495 h), Riccioli *et al.* (2001; 14.654 h), Behrend (2012; 17.16 h with one maximum and minimum per cycle), Pilcher (2011; 34.407 h), and Durech *et al.* (2011; a sidereal period of 11.38834 h). New observations by the author were made at the Organ Mesa Observatory with a Meade 0.35-m LX-200 GPS Schmidt-Cassegrain and SBIG STL-1001E CCD. Exposures used a clear filter and were unguided. Differential photometry was used to determine instrumental magnitudes for the asteroid. Image measurement and lightcurve analysis were done with *MPO Canopus* software.

Observations were obtained on 14 nights between 2012 Jan 17 and Mar 8. When phased to a single set over the entire interval, the result was a period of 34.415 ± 0.001 h, amplitude 0.12 ± 0.01 mag with the usual two asymmetric maxima and minima per cycle. However, a large change in the synodic period, accompanied with very small changes in the overall shape of the lightcurve, was noted during the full interval of observations. The subset of six nights, 2012 Jan 17 – Feb 1, shows a period 34.362 ± 0.007 h. A second subset of eight nights, 2012 Feb 10 – Mar 8, shows a period 34.445 ± 0.003 h. The phase angle bisector changed very little and with nearly uniform time rate of motion over the entire interval of observation, as summarized in Table 1. Hence the observed change in synodic period is caused almost entirely by changes in the *viewing aspect*, i.e., the direction of the asteroid pole versus the line of sight, and phase angle. This result is consistent with the 34.407-hour rotation period found by the author (Pilcher 2011) at the 2010 apparition, and would seem to rule out all the other period determinations. While the period itself now seems reliably established, the error is still large and may reasonably be expressed as 34.41 ± 0.04 h.

UT Date	Phase	PABL	PABB
2012 Jan 17	8.2	140.7	1.8
2012 Feb 01	3.2	140.4	2.0
2012 Feb 10	0.7	140.0	2.1
2012 Mar 08	9.5	139.4	2.2

Table 1. All values are degrees. Phase = phase angle; PABL = longitude of phase angle bisector; PABB = latitude of phase angle bisector.



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SPECTROPHOTOMETRIC CLASSIFICATION AND LIGHTCURVE ANALYSIS OF 9983 RICKFIENBERG

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We have obtained contemporaneous BVR photometry and lightcurve measurements for the main-belt asteroid 9983 Rickfienberg, which came to opposition in 2011 November. Photometric images were obtained using the WIYN 0.9-meter telescope at Kitt Peak National Observatory; the facility’s S2KB CCD camera; and Harris B, V, and R filters. Landolt reference stars were used to calibrate the imaging system. These observations were conducted in parallel with CCD imaging done at Phillips Academy Observatory and Smith River Observatory to determine a rotational lightcurve and to further calibrate the photometry. The asteroid’s lightcurve has a period of 5.2963 ± 0.0001 h and an amplitude of 1.4 ± 0.1 mag. The object is unusually blue as a result of strong absorption in the red, but more data are needed to pin down its taxonomic classification.

Main-belt asteroid 1995 DA was discovered by Dennis di Cicco from Sudbury, Massachusetts, and was eventually numbered 9983 and named Rickfienberg for the former editor in chief of *Sky & Telescope* magazine (now press officer of the American Astronomical Society). A search of the Asteroid Lightcurve Database (LCDB) and the SAO/NASA Astrophysics Data System (ADS) failed to turn up any published lightcurves, multicolor photometric data, or spectra. Noting that his namesake asteroid would come to opposition in 2011 November, coauthor Fienberg made plans to collect lightcurve data from Smith River Observatory (IAU code 459) in New Hampshire. He enlisted his colleague Odden to do the same from Phillips Academy Observatory (IAU code I12) in Massachusetts. Coauthors Arion

and Tatge were already scheduled to use the WIYN 0.9-m telescope at Kitt Peak National Observatory in mid-November, and they agreed to obtain BVR photometry of the asteroid.

Lightcurve Analysis

Observations. Imaging at Phillips Academy Observatory (PAO) was done with a DFM Engineering 0.4-m f/8 Cassegrain reflector and an SBIG STL-1301E CCD camera with a 1280 x 1024 array of 16-micron pixels and a clear filter. At Smith River Observatory (SRO) unfiltered imaging was done with a Meade RCX400 0.35-m aplanatic Schmidt-Cassegrain telescope at f/5 and an SBIG ST-8XME CCD camera with a 1530 x 1050 array of 9-micron pixels. Both setups provided an unbinned image scale of 1.0 arcsec per pixel. Autoguided exposures were 300 s (PAO) or 360 s (SRO) at a CCD temperature of -30° C. All images were calibrated with dark frames and flat fields.

Method. Image capture and calibration for all the lightcurve data was accomplished with Diffraction Limited’s *MaxIm DL5* software. Lightcurve analysis was accomplished with Bdw Publishing’s *MPO Canopus* software; the asteroid’s varying brightness was measured against the fixed brightness of field stars using differential photometry. Data merging and period analysis were done with *MPO Canopus* using an implementation of the Fourier analysis algorithm of Harris et al. (1989).

Results. The combined set of 439 brightness measurements collected during the period 2011 November 5–22 was analyzed by Odden and is presented in Figure 1. According to A. Harris

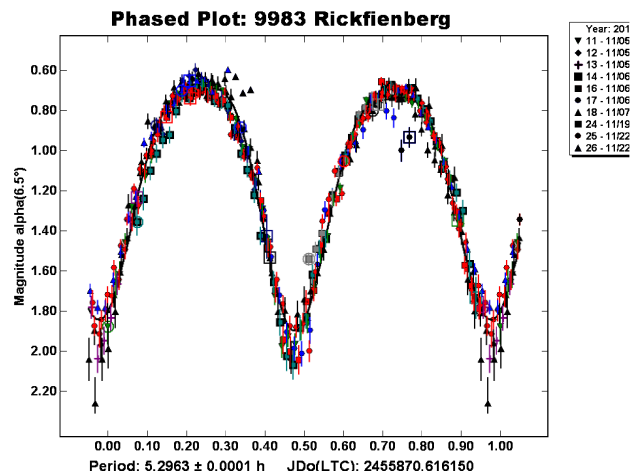


Figure 1. Lightcurve of 9983 Rickfienberg.