FIVE LIGHTCURVES FROM THE SHED OF SCIENCE: 2017 NOVEMBER - 2018 APRIL

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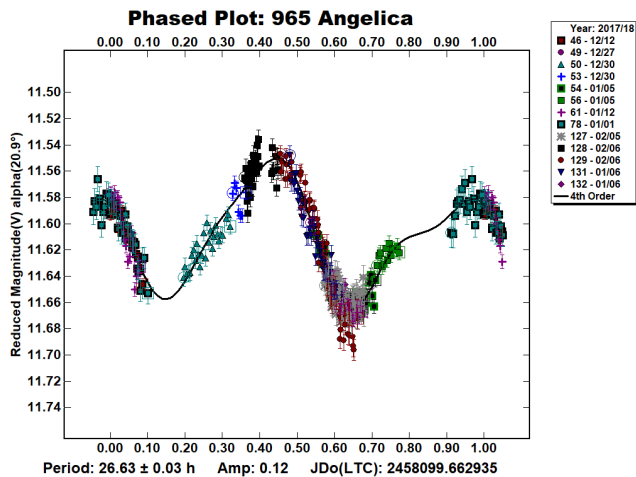russdurkee1@gmail.com

CCD observations of five asteroids were made between 2017 November and 2018 April. Analysis of the data found the period and lightcurve amplitudes for 965 Agnelica ($P = 26.63 \pm 0.03$ h, $A = 0.12$ mag), 1266 Tone ($P = 15.55 \pm 0.03$ h, $A = 0.19 \pm 0.05$ mag), 3210 Lupishko ($P = 14.255 \pm 0.03$ h, $A = 0.74 \pm 0.05$ mag), 4435 Holt ($P = 2.867 \pm 0.002$ h, $A = 0.18 \pm 0.05$ mag), and 5133 Phillipadams ($P = 6.665 \pm 0.005$ h, $A = 0.43$ mag).

CCD Photometry observations of five asteroids took place from the Shed of Science Observatory between 2017 November and 2018 April in partnership with Minnetonka High School in Minnetonka, Minnesota.
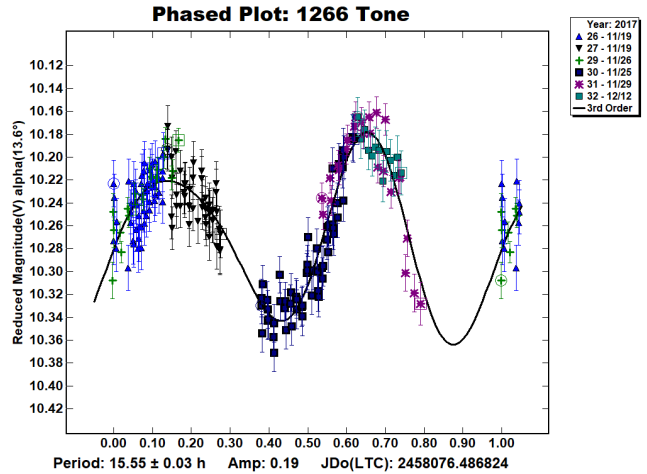
The observations used a 0.5-m Planewave corrected Dall-Kirkham telescope using a focal reducer, which resulted in a focal ratio of $f/5.3$ and a plate scale of 1.24 arcsec/pixel. An SBIG ST-10XME CCD camera was used and all exposures were made through a Celestron UHC LPR filter.

All images were dark and flat-field corrected. Images were measured using *MPO Canopus* (Bdw Publishing) with a differential photometric technique. The *MPO Canopus* Comp Star Selector was used to link sessions. The data were light-time corrected. Period analysis was also done with *MPO Canopus*, which incorporates the Fourier analysis algorithm developed by Harris (Harris et al., 1989).
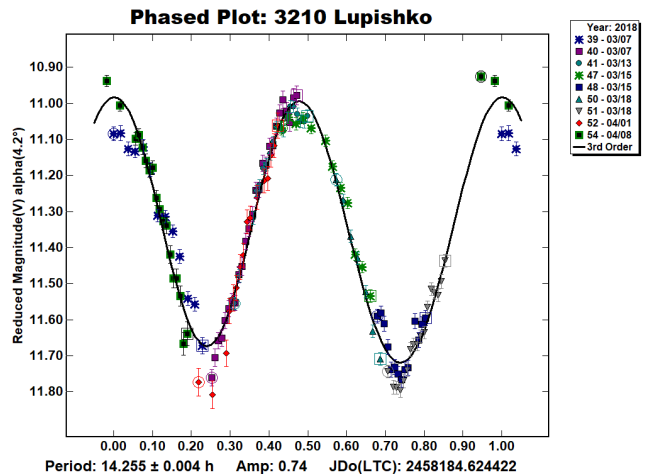
965 Angelica. Observations were made over nine nights between 2017 Dec 12 and 2018 Feb 6. Data analysis indicates a synodic period of $P = 26.63 \pm 0.03$ h, $A = 0.12$ mag. This is in agreement with earlier observations by Polakis (2018).

1266 Tone. Analysis of observations over five nights between 2017 Nov 18 and Dec 29 indicates a synodic period of $P = 15.55 \pm 0.03$ h, $A = 0.19 \pm 0.05$ mag. Earlier observations indicated a period of $P = 11.38 \pm 0.05$ h based on data over two nights (Warner, 2003).
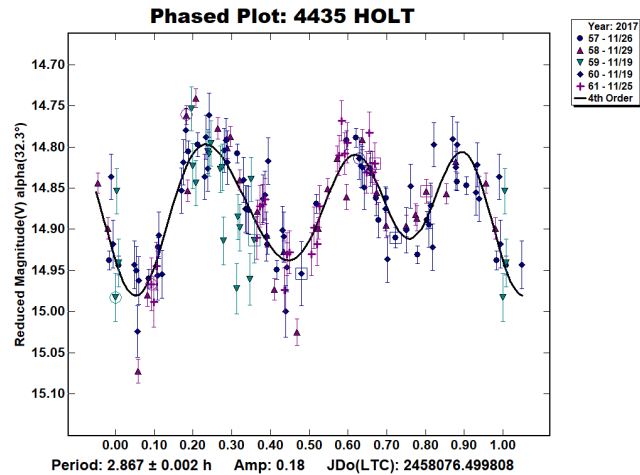

3210 Lupishko. Observations were made over six nights between 2018 Mar 7 and April 8. Our analysis indicates a synodic period of $P = 14.25 \pm 0.03$ h, $A = 0.74 \pm 0.05$ mag.
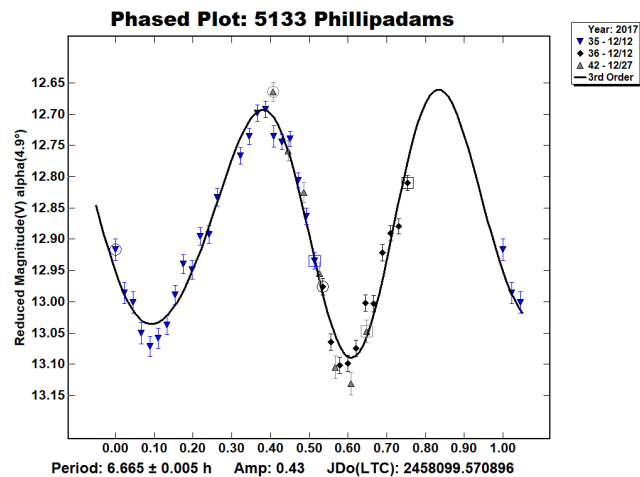

4435 Holt. Observations made over four nights between 2017 Nov 19-27 led to a synodic period of $P = 2.867 \pm 0.002$ h, $A = 0.18 \pm 0.05$ mag. Earlier work by J. Ruthroff indicated a period of 2.71 h ± 0.002 h based on data over two nights (Ruthroff, 2017). Additional work on this object was completed in 2018 January by the Ondrojev Asteroid Photometry Project, which identified it to be a binary and possibly ternary system (Stephens, et. al., 2018). Our data supports the primary period found. However, our data set was not sufficient to confirm their findings of a binary or ternary system.

Number	Name	20yy/mm/dd	Phase	L$_{PAB}$	B$_{PAB}$	Period(h)	P.E.	Amp	A.E.	Grp
965	Angelica	17/12/12-18/02/06	15.3,13.1,19.0	100	24	26.63	0.03	0.12	0.02	MB-O
1266	Tone	17/11/19-17/12/12	13.5,16.3	12	16	15.55	0.03	0.19	0.05	MB-O
3210	Lupishko	18/03/07-18/04/08	4.1,12.8	164	10	14.255	0.004	0.74	0.05	MB-O
4435	Holt	17/11/19-17/11/29	30.3,32.9	29	31	2.867	0.002	0.18	0.05	MC
5133	Phillipadams	17/12/12-17/12/27	4.7,11.4	72	−3	6.665	0.005	0.43	0.05	MB-O

Table II. Observing circumstances and results. The phase angle (α) is given at the start and end of each date range. L$_{PAB}$ and B$_{PAB}$ are, respectively, the average phase angle bisector longitude and latitude (see Harris *et al*., 1984). The Group column gives the orbital group to which the asteroid belongs. The definitions are those used in the LCDB (Warner et al., 2009). MB-O: Main-belt outer, MC: Mars-crosser.

Phased Plot: 4435 HOLT

Period: 2.867 ± 0.002 h   Amp: 0.18   JDo(LTC): 2458076.499808

<u>5133 Phillipadams.</u> Analysis of observations over two nights between 2017 Dec 12-27 indicates a period of $P = 6.665 \pm 0.005$ h, $A = 0.40$ mag. Our results do not have sufficient coverage for a unique solution. However, our result does agree with earlier work (Carbo et. al, 2009; Behrend, 2009).

Phased Plot: 5133 Phillipadams

Period: 6.665 ± 0.005 h   Amp: 0.43   JDo(LTC): 2458099.570896

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[Editor's Note: Congratulations to high school students Montminy and McDonald on their work and a salute to their mentor Durkee for guiding them.]