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LIGHTCURVES OF THREE HILDAS

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I present lightcurves for three Hilda population objects. For 1748 Mauderli, I find a period of 6.003 h, in agreement with some but not all published values. For two other objects, 1439 Vogtia and 2246 Bowell, I find good agreement with previous periods. The observations for these two objects were made in 2013, so they can be useful for providing additional time baselines for shape models.

All CCD images were reduced and measured using custom scripts using the IRAF software package. Reduction steps included subtraction of background images to reduce the effects of contaminating stars and galaxies, and pairwise comparison of seeing and transparency monitoring stars to look for stellar variations during the night.

1748 Mauderli is a member of the Hilda group discovered on 1966 Sep 7 by P. Wild at Zimmerwald. Period values around 6.00 h have been published by Gonano et al. (1991), Dahlgren et al. (1998) and Romanishin (2020). Warner and Stephens (2018) present a preferred period of 5.320 h and alternate periods of 5.552 and 5.981 h. In Romanishin (2020), I suggest that Mauderli may be a contact or close binary due to sharp V-shaped minima.

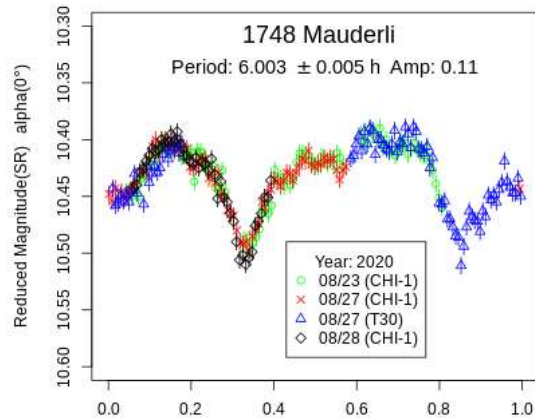
I remotely observed Mauderli near its opposition in August 2020 using the 0.6-m telescope (CHI-1) of the Telescope Live system located at El Sauce Observatory in Chile and a 0.5-m telescope (T30) at the iTelescope observatory in Australia. Exposures on both telescopes were 120 s long. Using CHI-1, I obtained observations on three nights through a Sloan r filter. On 2020 Aug 23, I obtained 93 exposures, spanning about 4.6 h, on 2020 Aug 27, 78 exposures spanning 3.5 h and on 2020 Aug 28, 45 exposures spanning 2.0 h. Using T30 and the available red filter, I obtained 87 exposures on 2020 Aug 27, spanning 3.6 h. Due to weather and telescope scheduling constraints, I was unable to obtain a complete lightcurve on any single night. However, as the two telescopes are about 9 hours apart in longitude (~1.5 times the period), I was able to observe the entire lightcurve at low airmass, roughly half from Chile and half from Australia.

For this object, photometric calibration was made with reference to Pan-STARRS catalog r magnitudes of stars in each field. Magnitudes were reduced to absolute Sloan r band system using the Bowell et al. (1989) H,G formalism, with $G = 0.15$. Small magnitude corrections were required to superimpose the light curves.

Number	Name	yyyy mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.
1439	Vogtia	2013 05/05-05/08	2.4, 1.5	233	-1	12.927	0.01	0.34	0.02
1748	Mauderli	2020 08/23-08/28	2.1, 3.8	325	-1	6.003	0.005	0.11	0.01
2246	Bowell	2013 05/04-05/04	3.7	233	7	4.985	0.01	0.26	0.02

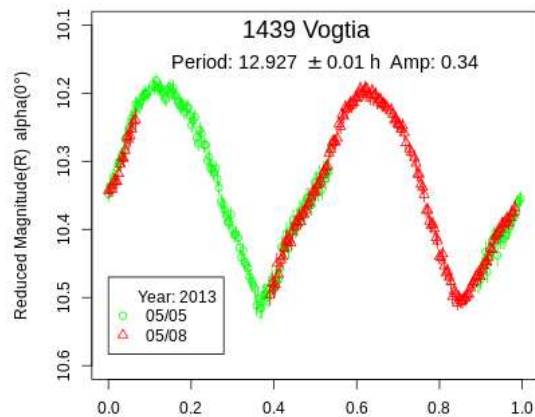
Table I. Observing circumstances and results. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984).

Phased lightcurves for all published period values were calculated and examined, and lightcurves with finer period spacing around the best of these were produced and examined. The best overall fit is for a period of 6.003 h. Periods of 5.32, 5.55 or 5.98 h do not give acceptable phased lightcurves. The magnitude plotted for Mauderli is the reduced magnitude in the Sloan r band.



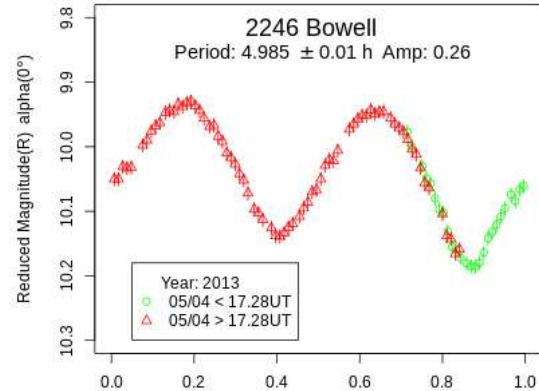
1439 Vogtia is a Hilda group object discovered on 1937 Oct 11 by K. Reinmuth at Heidelberg.

I observed Vogtia with the 0.9-m SMARTS telescope at Cerro Tololo Observatory in Chile on two night in May of 2013, using 150-s long exposures. On 2013 May 5, I obtained 157 exposures spanning 8.3 h, and on 2013 May 8, 162 exposures spanning 8.8 h. I find a period of 12.927 h, in reasonable agreement with the 12.95 h period of Dahlgren et al. (1998) and good agreement with the 12.933 h period of Warner and Stephens (2020).



2246 Bowell is a Hilda discovered 1979 Dec 14 by E. Bowell at Lowell Observatory. Using the SMARTS telescope, I obtained 99 exposures, each 150-s, spanning 5.6 h on 2013 May 4. I find a period of 4.985 h, which is in reasonable agreement with the published periods of 4.992 h (Dahlgren et al. 1998) and 4.997 h (Warner and Stephens 2019).

For both Vogtia and Bowell, photometric calibration in the Landolt R magnitude system was made using observations of several Landolt standard fields each night (Clem and Landolt, 2013). The reduced Landolt R band magnitude is plotted for Vogtia and Bowell.



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