

DETERMINING THE ROTATIONAL PERIODS AND LIGHTCURVES OF THREE MAIN-BELT ASTEROIDS

Roberto Bonamico
BSA Osservatorio (K76)
Strada Collarelle 53
12038 Savigliano, Cuneo, ITALY
info@osservatorioastronomicobsa.it
website: <http://www.osservatorioastronomicobsa.it>

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CCD photometric observations of three main-belt asteroids were made from 2020 March to May. We report the results of lightcurve analysis for 1784 Benguella: $P = 41.035 \pm 0.008$ h, $A = 0.87$ mag; 4582 Hank: $P = 6.446 \pm 0.001$ h, $A = 0.58$ mag; and 5947 Bonnie: $P = 13.414 \pm 0.003$ h, $A = 0.10$ mag.

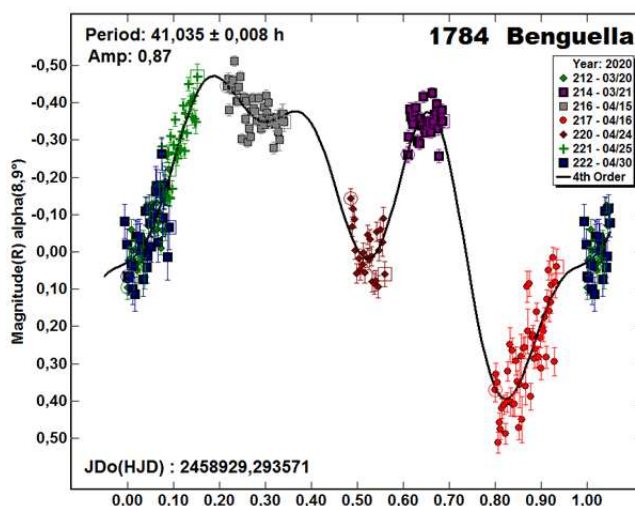
During the period from 2020 March to May, the Astronomical Observatory BSA studied the rotation period of three asteroids in the main belt. These asteroids were chosen from the website at <http://minorplanet.info/call.html>.

Observations were made with a Marcon 0.30-m $f/5$ Newtonian telescope with an Atik 314L+ CCD camera using a Sony ICX285AL sensor (1360×1024, 6.5-microns). The observatory used *MaximDL* (<http://diffractionlimited.com/product/maxim-dl/>) for camera control, *The Sky 6 Pro* (<http://www.bisque.com>) for mount control, and *Voyager* (<http://software.starkeeper.it>) to automate the entire observatory.

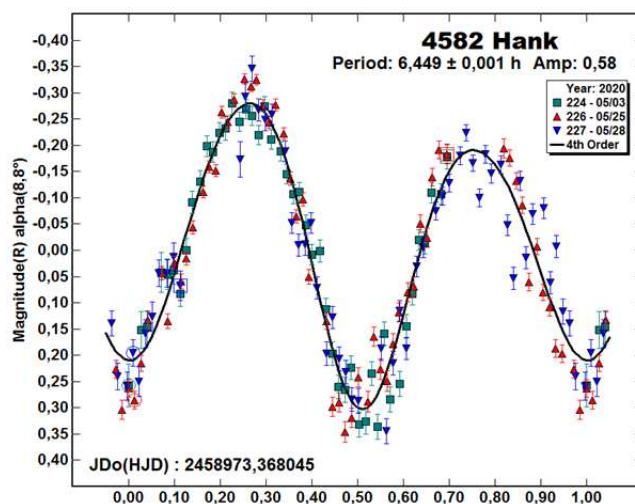
All photometric reductions were done with *MPO Canopus* v10.7.12.9 (<http://bdwpublishing.com>). Precise night-to-night zero-point calibration was obtained using the Comparison Star Selector utility in *MPO Canopus*. Whenever possible, five solar-colored comparison stars from the MPOSC3 catalog supplied with *MPO Canopus* were used.

1784 Benguella. In the spring of 2020, the particularly difficult weather conditions did not facilitate photometric research.

The seven observational nights scattered for over a month were not enough to precisely complete the calculation of the rotation period of this asteroid. The decreasing magnitude eventually reached the limit of the instrument and observations were stopped. The data analysis led to $P = 41.035 \pm 0.008$ h and lightcurve amplitude $A = 0.87$ mag. Future observations are encouraged to get better results.



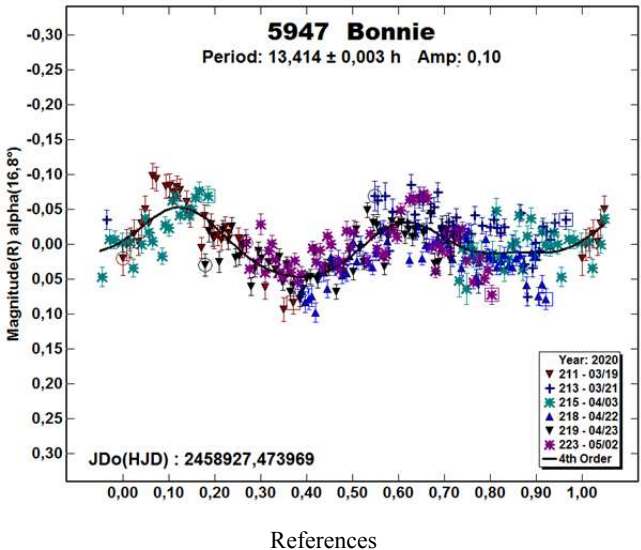
4582 Hank. Due to the short period and large amplitude ($P = 6.446 \pm 0.001$ h, $A = 0.58$ mag), three observation nights were enough to calculate the rotation period precisely.



5947 Bonnie. Six observational evenings took place on this asteroid. The bright magnitude, which gradually increased during the observation period, compensated for the small lightcurve amplitude, allowing the result of $P = 13.414 \pm 0.003$ h and $A = 0.10$ mag. Given the good number of hours available for each observational night, no further investigations were made.

Number	Name	yyyy mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
1784	Benguella	2020 03/20-04/30	8.5, 22.0	163.1	22.0	41.035	0.008	0.87	0.03	MB
4582	Hank	2020 05/03-05/27	8.9, 11.9	228.2	14.9	6.446	0.001	0.58	0.01	MB
5947	Bonnie	2020 03/18-04/23	17.0, 10.0	209.1	18.7	13.414	0.003	0.10	0.01	MB

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 extreme 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). Grp is the asteroid family/group (Warner et al., 2009).



Harris, A.W.; Young, J.W.; Scaltriti, F.; Zappala, V. (1984). "Lightcurves and phase relations of the asteroids 82 Alkmene and 444 Gyptis." *Icarus* **57**, 251-258.

Warner, B.D.; Harris, A.W.; Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2020 Feb. <http://www.minorplanet.info/lightcurvedatabase.html>

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LIGHTCURVE BASED ROTATIONAL PERIOD DETERMINATION FOR ASTEROIDS 1579 HERRICK AND 2171 KIEV

Pablo Loera-González, Lorenzo Olguín & Julio Saucedo-Morales
Departamento de Investigación en Física
Universidad de Sonora
Hermosillo, Sonora, México
pabloloerag@gmail.com

Ramona Nuñez-López
Departamento de Física, Matemáticas e Ingeniería
Universidad de Sonora, Unidad Regional Norte
Caborca, Sonora, México

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We present results for rotational period determination using lightcurves for two asteroids observed during the first half of 2020. For 1579 Herrick we obtained $P = 9.196 \pm 0.002$ h and amplitude $A = 0.12 \pm 0.03$ mag, for 2171 Kiev we obtained $P = 3.1714 \pm 0.0002$ h and amplitude $A = 0.14 \pm 0.08$ mag. We also found evidence for the presence of a secondary period $P_2 = 23.38 \pm 0.03$ h.

The Mexican Asteroid Photometry Campaign (CMFA in Spanish) began in 2015 as an effort to study asteroids and to establish a collaborative network among researchers from different Mexican institutions (Sada et al., 2016) and has been regularly reporting results on asteroid period determination. As part of the results for 2020 we present lightcurves and periods for two asteroids. Images were taken during January, February, April and May 2020 using the observatory’s 16" SCT telescope and SBIG-10XME CCD camera. No filters were used to attain the highest possible S/N ratio. The images were reduced using bias, dark and flat images following standard procedures and the photometric analysis was made with *MPO Canopus* (Warner, 2017). Data on asteroid visibility and information on previous results, was obtained from *The Asteroid Lightcurve Database* (Warner et al., 2009) and the *JPL Small-Body Database* website.

1579 Herrick. Initially named 1948 SB, this body was discovered on 1948 Sept 30 by S. Arend at Uccle and subsequently named in honor of Samuel Herrick (1911-1974) who is well-known for his contributions to celestial mechanics and astrodynamics (Schmadel, 2003). This asteroid was observed at the Universidad de Sonora Observatory on 2020 Jan 28, 29 and Feb 1 and 5, collecting over 21 h of data. Exposure time was set to a 100 s; data from Feb 5 was split into two sessions due to guiding problems. With the total of 603 points, a Fourier fit was obtained with order 6 resulting in a period $P = 9.196 \pm 0.002$ h and amplitude $A = 0.12 \pm 0.03$ mag. At the time of writing no other results for period or amplitude were found for this asteroid.

Number	Name	yyyy mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
1579	Herrick	2020 01/28-02/05	*3.5, 3.8	130.0	-8.7	9.196	0.002	0.12	0.03	MB-O
2171	Kiev	2020 04/26-05/20	*12.6, 6.3	234.2	8.7	3.1714	0.0002	0.14	0.08	MB

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). Grp is the asteroid family/group (Warner et al., 2009).