PHOTOMETRIC OBSERVATIONS OF 1856 RUZENA

Melissa N. Hayes-Gehrke, Brandon Stoeckel, Suteerth Vishnu, Dallas Rhoades, Daniel Yang, Alex Pham, Andrew Gingerich, Gi Yoon Woo
Department of Astronomy
University of Maryland
College Park, MD 20742
mhayesge@umd.edu

Stephen M. Brincat
Flarestar Observatory (MPC 171)
FL5/B, George Tayar Street
San Gwann SGM 3160, MALTA
stephenbrincat@gmail.com

Charles Galdies
Znith Observatory
Armonie, E. Bradford Street
Naxxar NXR 2217, MALTA
charles.galdies@um.edu.mt

Winston Grech
Antares Observatory
76/3, Kent Street
Fgura FGR 1555, MALTA
win.grech@gmail.com

(Received: 2018 May 25)

CCD photometric observations of asteroid 1856 Růžena were taken over a span of 10 nights in April 2018, yielding a lightcurve with a rotation period of 5.960 ± 0.003h and an amplitude of 0.65 mag.

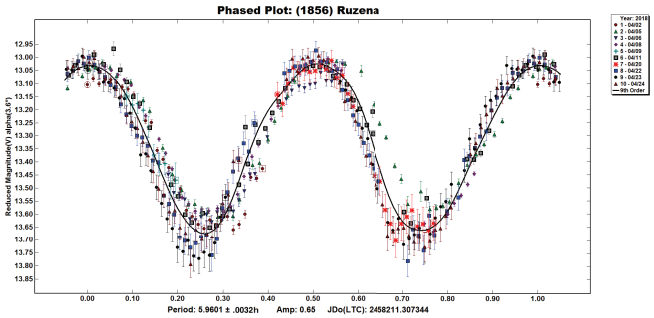
The main-belt asteroid 1856 Růžena was discovered on 1969 Oct 8 by the Russian astronomer Lyudmila Chernykh at the Crimean Astrophysical Observatory in Nauchnyj on the Crimean Peninsula. The asteroid was named in honor of Růžena Petrovičová who was a staff member of the Klet Observatory who observed comets and minor planets. The name was proposed by the discoverer of Růžena, Lyudmila Chernykh. Růžena has an orbital period of 3.35 years and an absolute magnitude of 12.8 (The International Astronomical Union Minor Planet Center. 2018). The geometric albedo of Růžena is 0.335 and SMASSII spectral classification is S-type (JPL, 2018).

One set of observations was obtained from iTelescope's New Mexico observatory (MPC code H06), located in Mayhill, New Mexico (32° 54'N, 105° 31'W). These observations took place on 2018 Apr 5, Apr 8, and Apr 11. We utilized the T21 telescope, a 0.43-m f/6.8 Corrected Dall-Kirkham (CDK) telescope with a FLI-PL6303E CCD (iTelescope, 2018). The CCD has an array of 3062 x 2048 pixels. Images were obtained with a clear filter and an exposure time of 300 seconds. All images were mid-exposure time light-time corrected using MPO Canopus 10.7.11.3 (Warner, 2017).

We took 175 images and discarded 36 images. A total of 139 images were used in the analysis, while the remaining images were discarded due to bad weather and the presence of a cloud cover. We performed differential photometry using MPO Canopus. We selected five comparison stars and used the lightcurve analysis feature to calculate the period. In addition, we also used the "Lightcurve Analysis" tool that uses the Fourier analysis calculation developed by Harris (Harris *et al.* 1989).

Following registration of preliminary periodic information of Růžena asteroid on MPO's CALL website by the US team, additional support came from the Malta team by means of additional observations of this asteroid. This resulted in a set of observations obtained from Flarestar Observatory - MPC Code: 171 (14° 28m 12.4s E, 35° 54' 37.2" N) through a 0.25-m f/6.3 Schmidt-Cassegrain (SCT) equipped with a Moravian G2-1600 CCD camera, and from Antares Observatory (14° 30m 46.7s E, 35° 52' 13.0" N) through a 0.28- m SCT coupled to a SBIG ST-11000 CCD Camera. All images were taken through a clear filter and auto-guided for the duration of the exposure. Flarestar Observatory used the camera in 1x1 binning mode with a resultant pixel scale of 0.99 arcsec per pixel while Antares Observatory used its camera in 2x2 binning mode with a resultant pixel scale of 1.32 arcsec per pixel. Both cameras were operated at sensor temperature of –15°C and images were calibrated with dark and flat-field frames. Both telescopes and cameras were controlled remotely from a nearby location via Sequence Generator Pro (Main Sequence Software). Photometric reduction, lightcurve construction, and period analyses were done using MPO Canopus software (Warner, 2017). Differential aperture photometry was used, and photometric measurements were based on the use of comparison stars of near solar color that were selected by the Comparison Star Selector (CSS) utility available through MPO Canopus. Asteroid magnitudes were based on MPOSC3 catalog supplied with MPO Canopus.

We consolidated all of our nights of data to get a single phased lightcurve with period 5.960 ± 0.003h. The lightcurve has typical peaks and troughs with a magnitude spanning 0.65 mag. We adjusted the order and the number of steps to ensure the data were fitted correctly.



Number	Name	2018 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
1856	Ruzena	04/02-04/24	445	3.0,14.5	187	0.3	5.960	0.003	0.65		MBA

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).

Acknowledgements

We would like to thank the University of Maryland Astronomy Department and the College of Computer, Mathematical, and Natural Sciences for their support. We would also like to thank iTelescope.net for their telescope services.

References

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.

Harris, A.W., Young, J.W., Bowell, E., Martin, L.J., Millis, R.L., Poutanen, M., Scaltriti, F., Zappala, V., Schober, H.J., Debehogne, H., Zeigler, K.W. (1989). "Photoelectric Observations of Asteroids 3, 24, 60, 261, and 863." *Icarus* **77**, 171-186.

The International Astronomical Union Minor Planet Center. (n.d.). *https://www.minorplanetcenter.net/db_search/show_object?object_id=1856*

iTelescope (2018) iTelescope.Net - Remote Internet Telescope Network - Online Image & Telescope Hosting Services. *http://www.itelescope.net/*

JPL (2018). Small-Body Database Browser - JPL Solar System Dynamics web site. *http://ssd.jpl.nasa.gov/sbdb.cgi*

Warner, B.D. (2017). MPO Software, MPO Canopus version 10.7.11.3, Bdw Publishing. *http://www.minorplanetobserver.com/*

Warner, B.D., Harris, A.W., Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2016 Sep. *http://www.minorplanet.info/lightcurvedatabase.html*

ROTATION PERIOD DETERMINATION FOR 418 ALEMANNIA AND 4911 ROSENZWEIG

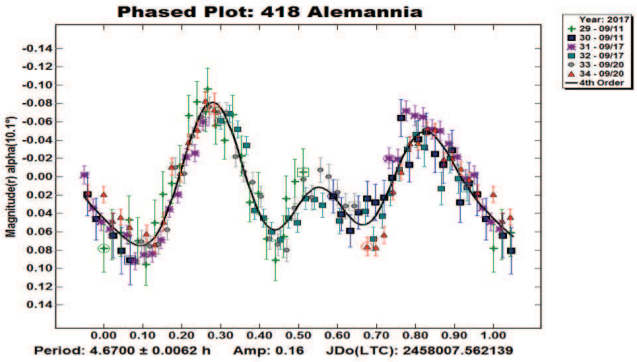
Richard D. Gorby, Adam W. Rengstorf, Jacob Pavel
Northwest Indiana Robotic Observatory
Purdue University Northwest
Department of Chemistry and Physics
2200 169th St.
Hammond, IN 46323
adamwr@pnw.edu

(Received: 2018 May 29)

Fourier analysis of data taken of asteroid 418 Alemannia determined a rotational period of 4.670 ± 0.006 h with an amplitude of 0.16 ± 0.02 mag. 4911 Rosenzweig's analysis shows a period of 9.75 ± 0.01 h with an amplitude of 0.08 ± 0.02 mag.

418 Alemannia was observed over 6 nights between 2017 Sep 11 and Sep 20. 4911 Rosenzweig was observed over 6 nights between 2017 Sep 25 and Oct 20. All data were taken at Purdue University Northwest's Northwestern Indiana Robotic Observatory (NIRo, MPC W11) in Lowell, Indiana. The two asteroids were selected from the MPC quarterly bulletin as good observation candidates. Data were collected using a 0.5-m f/8.1 Ritchey-Chretien telescope equipped with an *FLI ProLine PLO9000* camera housing a KAF-09000 CCD image sensor. Images were corrected for bias, dark current, and flat-field artifacts using accepted data reduction practices. Rotation periods for both asteroids were determined via Fourier analysis using *MPO Canopus* (Warner, 2017).

418 Alemannia is an M-class main-belt asteroid discovered on 1896 Sep 7 by Max Wolf at the Heidelberg Observatory. Originally designated as 1896 CV, the German astronomer Adolf Berberich named this asteroid after the fraternity Alemannia in Heidelberg, Germany. The JPL Small-Bodies Database lists the orbital period as 4.18 yrs along with an albedo of 0.201, a diameter of 40.330 km, and an absolute magnitude of H = 9.77 mag (JPL, 2017).



The first published period for 418 Alemannia was 5.82 h (Lagerkvist et al., 1987). Wetterer et al. (1999) published a period

Number	Name	2016 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
418	Alemannia	09/11-09/20	153	7.5,17.0	332	9	4.760	0.006	0.16	0.02	MB-I
4911	Rosenzweig	09/25-10/20	162	7.5,8.8	355	10	9.75	0.01	0.08	0.03	EUN

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).