

CCD PHOTOMETRY OF THREE SHORT-PERIOD ASTEROIDS FROM THE UNIVERSIDAD DE MONTERREY OBSERVATORY

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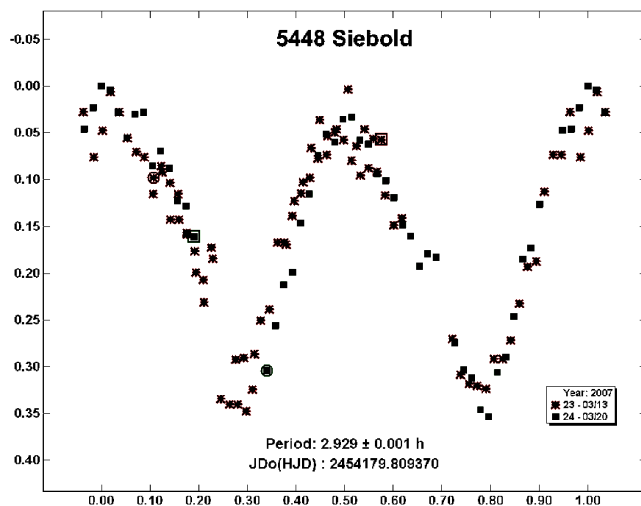
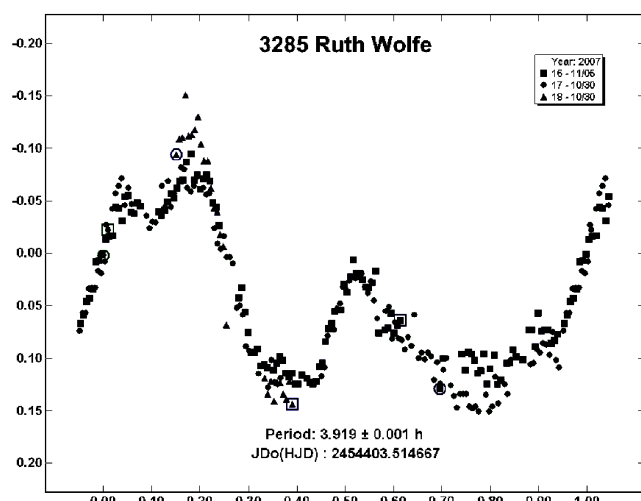
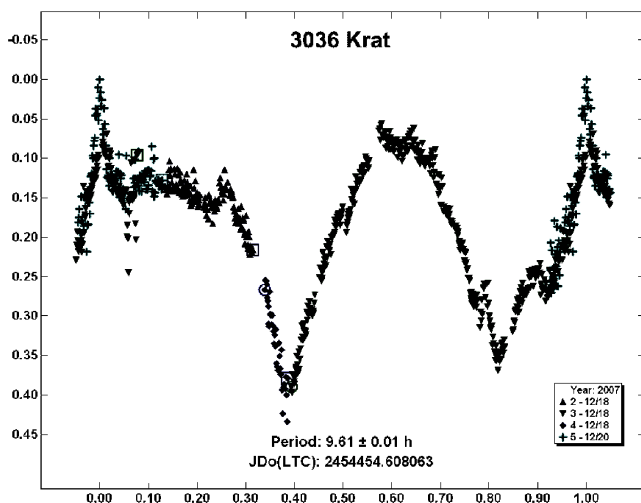
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CCD photometry of three asteroids was obtained at the Universidad de Monterrey Observatory during 2007 April and 2008 March. These asteroids were observed on only one or two nights, but complete lightcurves were obtained due to relatively short rotation periods. The resulting synodic rotation periods and amplitudes are as follows: 811 Nauheima, 4.011 ± 0.006 h, 0.11 ± 0.03 mag; 3787 Aivazovskij, 2.97 ± 0.01 h, 0.18 ± 0.02 mag; and 5474 Gingasen, 3.628 ± 0.005 h, 0.16 ± 0.03 mag.

The observations reported here were made with the Meade 36-cm LX200GPS telescope of the Universidad de Monterrey Observatory (MPC 720). The telescope is permanently mounted in a 6-foot fiberglass automated dome and is operated from a nearby warm room. The CDD used to gather the 811 Nauheima data was an SBIG ST-9E with a $512 \times 512 \times 20 \mu\text{m}$ chip, which yielded an image scale of $\sim 1.7''/\text{pixel}$ and a field-of-view of $\sim 14.6' \times 14.6'$ using an f/6.3 focal reducer. The CCD used to gather the 3783 Aivazovskij and 5474 Gingasen data was an SBIG STL-1301E with a $1280 \times 1024 \times 16 \mu\text{m}$ chip. The field-of-view in this case was $\sim 21.1' \times 16.9'$ with an image scale of nearly $1''/\text{pixel}$.

The targets were selected from the list of asteroid photometry opportunities published by Brian Warner on his Collaborative Asteroid Lightcurve Link (CALL) website (Warner 2008). These asteroids were observed only during one or two nights, but the data for each asteroid suggested that they had short rotation periods. Weather and other considerations prevented additional observations. However, the available lightcurves were complete and had enough overlap to derive rotation periods. In all cases the images were obtained unfiltered, guided, and standard dark-current and flat-field corrections were applied. The 811 Nauheima exposures were 4 min, unbinned, and with a detector temperature of -10°C . The 3783 Aivazovskij and 5474 Gingasen had exposures of 2 min, were binned 2×2 , and the detector temperature varied between -15°C and -20°C on each session, depending on the ambient temperature. Image measurements and period analysis were performed using *MPO Canopus* (Warner 2008).

811 Nauheima This asteroid was observed on two consecutive nights in 2007 April. Initial analysis of the data suggested a rotation period of about 4 h but, since the resulting lightcurve did not exhibit a standard bimodal behavior and had a small amplitude, the results were labeled as suspect and in need of further observations. This was not possible during the 2007 apparition. The data were reanalyzed in early 2008 using *MPO Canopus* software, and the initial result seemed to stand, thus it is presented here, it being a synodic period of 4.011 ± 0.006 h and an amplitude 0.11 ± 0.03 mag. This asteroid is of particular interest because it belongs to the Koronis family. Recently Slivan *et al.*



(2008) reviewed and published a set of lightcurves for 811 Nauheima taken over the past few years that superseded initial observations by Binzel (1987). Their best data set from the 2004 apparition yields a synodic rotation period of 4.0011 ± 0.0005 h and an amplitude of ~ 0.20 mag. Galád (2008) also observed 811 Nauheima on four nights during the 2007 apparition (May 2, 3, 4, and 13) and obtained a rotation period of 4.0011 ± 0.0004 h, identical to Slivan et al. (2008), and an amplitude of ~ 0.13 mag, in agreement with the amplitude reported here.

3787 Aivazovskij This asteroid was observed only on 2008 March 8. The resulting synodic period was 2.97 ± 0.01 h and the amplitude 0.18 ± 0.02 mag. Although it was observed on only the one night, the short rotation period allowed sampling the lightcurve more than twice during the 7-hour observing session. We are confident about the result because of the relatively clean bimodal lightcurve, although at least one more observing session would have substantially decreased the uncertainty in the period. No other reports were found for this asteroid.

5474 Gingasen This asteroid was observed on two consecutive nights during 2008 March. The resulting synodic period was 3.628 ± 0.005 h and the amplitude 0.16 ± 0.03 mag. The asteroid was faint and the resulting low S/N of the individual measurements combined with the small amplitude and irregular shape of the lightcurve make the derived period uncertain, although both observing sessions covered the rotation period more than once. This asteroid is also found on the website maintained by R. Behrend (2008). He reports a provisional rotation period of ~ 2.91 h and an amplitude of 0.10 ± 0.01 mag from three nights of observations in 2006 by L. Bernasconi, and has classified it as difficult and with low amplitude. This object is labeled with a reliability code of “1-” in the Minor Planet Lightcurve Parameter List (Harris et al. 2008), which means that the result may be completely wrong. The result derived from the observations presented here is almost an exact $5/4$ multiple of the Behrend rotation period. However, a fit of our data to the Behrend reported period resulted in a less satisfactory lightcurve than the one presented here.

Acknowledgments

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References

- Behrend, R. (2008). “Asteroids and Comets Rotation Curves, CdR.” Observatoire de Geneve web site : http://obswww.unige.ch/~behrend/page_cou.html
- Binzel, R.P. (1987). “A Photoelectric Survey of 130 Asteroids.” *Icarus* **72**, 135-208.
- Galád, A. (2008). “Several Byproduct Targets of Photometric Observations at Modra.” *The Minor Planet Bulletin* **35**, 17-21.

Harris, A.W, Warner, B.D, and Pravec, P. (2008). “Collaborative Asteroid Lightcurve Link: Lightcurve Parameters List.” (March 18, 2007 update). <http://www.minorplanetobserver.com/astlc/LightcurveParameters.htm>

Slivan, S.M., Binzel, R.P., Boroumand, S.C., Pan, M.W., Simpson, C.M., Tanabe, J.T., Villastrigo, R.M., Yen, L.L., Ditteon, R.P., Pray, D.P., and Stephens, R.D. (2008). “Rotation Rates in the Koronis Family, complete to $H \approx 11.2$.” *Icarus* **195**, 226-276.

Warner, B.D. (2007). “Collaborative Asteroid Lightcurve Link.” <http://www.minorplanetobserver.com/astlc/default.htm>

Warner, B.D. (2008). MPO Software, *MPO Canopus*, v9.4.0.3, Bdw Publishing, Colorado Springs, CO.

