

ROTATION PERIOD FOR (138847) 2000 VE62

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Photometric observations of the Amor class asteroid (138847) 2000 VE62 were performed by the author over five nights from 2018 April 22 to May 10. The rotation period was found to be 7.601 ± 0.001 h with an amplitude of 0.30 ± 0.03 mag.

(138847) 2000 VE62 is an Amor class Near-Earth Object (NEO) discovered at Socorro on 2000 November 3 by LINEAR. Photometric observations were performed by the author over five nights between 2018 April 22 and May 10. More than 21.6 hours of observations produced 1677 data points for analysis. The rotation period was found to be 7.601 ± 0.001 h with an amplitude of 0.30 ± 0.03 mag.

A search of the asteroid lightcurve database (LCDB, Warner et al., 2009) indicated one previously reported lightcurve: Monteiro et al. (2017; $P = 6.469$ h, $A = 0.36$ mag). Their observations included about 200 data points obtained in 12 hours of observation spread over 5 nights during a 3-month period in 2016 (March into May). The observations and data analysis reported here resulted in a longer rotation period and a less-regular sinusoidal lightcurve shape. The new phased plot reveals a plateau in the lightcurve that was not evident in the previous research. The data were checked against the period of 6.469 h found by Monteiro et al. (2017); this produced an unconvincing fit. One possible solution at 6.563 ± 0.001 h did present itself. However, it was less convincing than the 7.601 h fit.

All observations were performed at The Studios Observatory (Z52) using a Meade 0.36-m LX200 ACF OTA operating at $f/7$. The OTA was mounted on a Paramount MEII robotic mount and equipped with Moonlite CSL motorized focuser, Astro Physics AP CCDT67 focal reducer, and a QSI 683 cooled CCD camera (binned 2x2). An Astrodon Clear (UV blocking only) filter was used for all observations. The CCD is based on an 8.3 Mp (3326x2504) Kodak KAF-8300 sensor with 5.4 μ m square pixels. The image scale after 2x2 binning was 0.86 arcsecs/pixel.

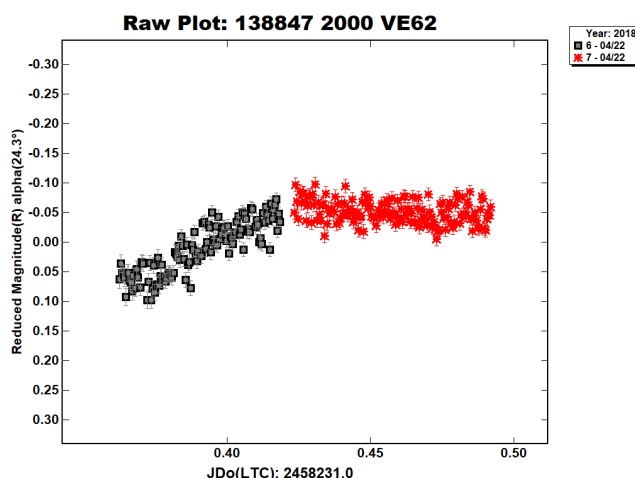
TheSkyX Professional software by Software Bisque (2018) was used for all telescope, focuser, and camera control. This software was also later used to calibrate all science images using dark, dark-for-flat, and flat field frames. All flat field images were taken at the end of the observing sessions using a wall-mounted whiteboard illuminated by an A4-size electroluminescent (EL) panel. A library of dark and dark-for-flat frames was used in the calibration process, no scaling of dark frames was necessary.

All data processing of the calibrated images and subsequent period analysis was performed using *MPO Canopus* (Warner, 2018a).

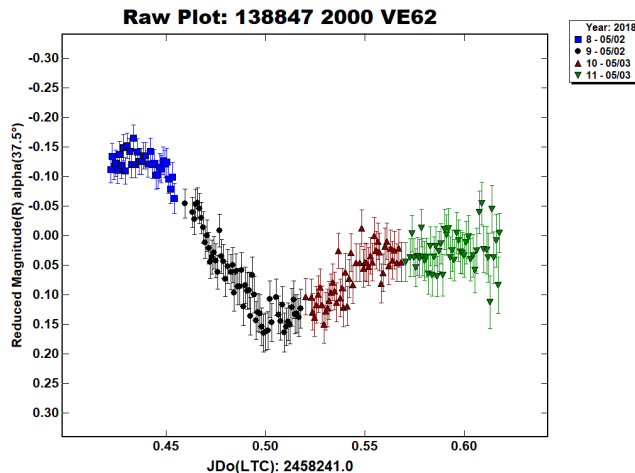
Differential photometry measurements were performed using the Comp Star Selector (CSS) and Star-B-Gone procedures of *MPO Canopus*. The asteroid and four or five solar-like stars were used for all photometric comparisons.

On three (possibly four) nights of observation, the raw data plots showed a plateau in the lightcurve. This plateau was not evident in the Monteiro et al. (2017) data, which may explain why a different rotational period was determined.

Table I provides an overview of the observed results. The observing schedule and calibrated data are summarized below.



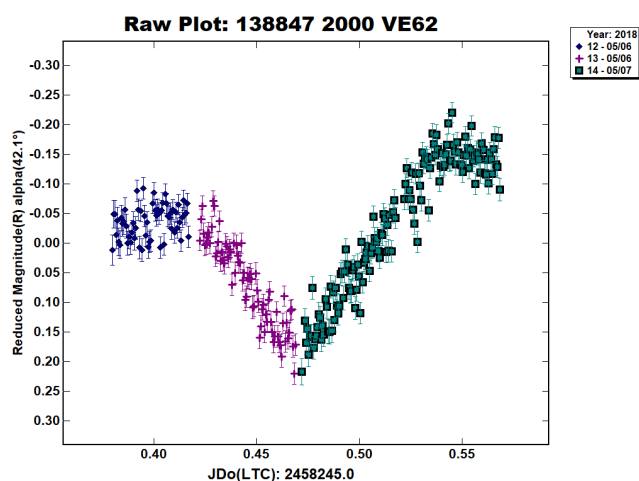
2018 April 22 (Phase 24.3, L_{PAB} 196.3, B_{PAB} 2.0). A total of 207 data points (30 s exposures) was acquired over a 3 h 4 min period.



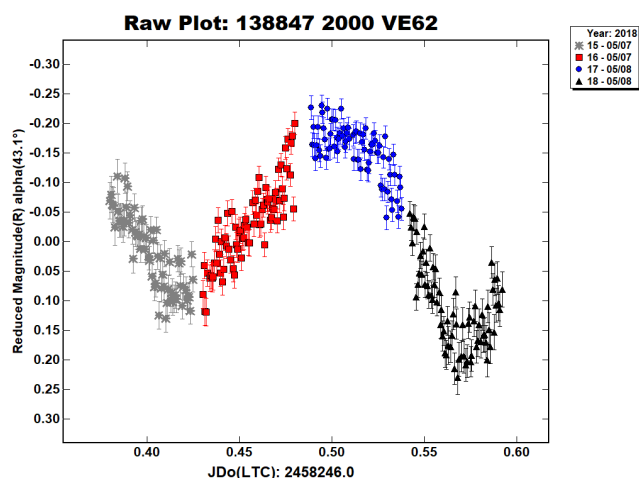
2018 May 2 (Phase 37.6, L_{PAB} 201.0, B_{PAB} 14.5). A total of 400 data points (30 s exposures) was acquired over a 4 h 29 min period.

Number	Name	2018 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
138847	2000 VE62	04/22-05/10	1677	24.3, 45.9	201.2	12.2	7.601	0.001	0.30	0.03	NEA

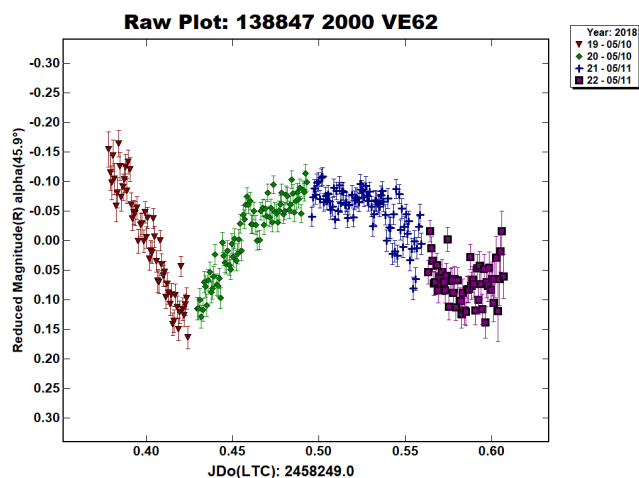
Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner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



2018 May 6 (Phase 42.1, L_{PAB} 203.4, B_{PAB} 18.6). A total of 285 data points (45 s exposures) was acquired over a 4 h 20 min period.

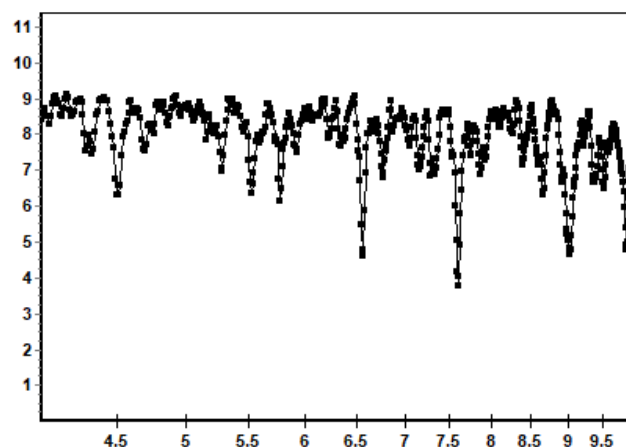


2018 May 7 (Phase 43.2, L_{PAB} 204.1, B_{PAB} 19.6). A total of 312 data points (45 s exposures) was acquired over a 4 h 39 min period.

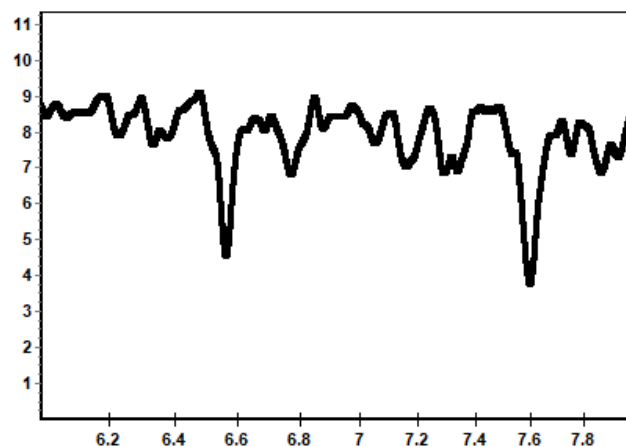


2018 May 10 (Phase 46.0, L_{PAB} 206.2, B_{PAB} 22.3). A total of 473 data points (60 s exposures) was acquired over a 5 h 10 min period.

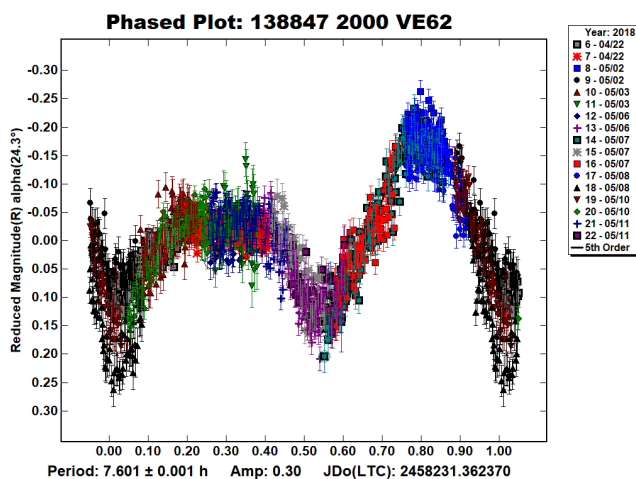
Two example period spectrums for (138847) 2000 VE62 are shown below. A range of periods was checked, first ranging from 4 to 10 hours, and then from 6 to 8 hours. In all cases, a period of 7.601 h proved to be the optimum rotation period.



Period Spectrum for (138847) 2000 VE62, Period 4 to 10 Hours



Period Spectrum for (138847) 2000 VE62, Period 6 to 8 Hours



The final phased plot for (138847) 2000 VE62 showing the matched 7.601 h rotation period.

All new data were uploaded to the ALCDEF database (Warner, 2018b).

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References

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

Monteiro, F., Silva, J.S., Lazzaro, D., Arcoverde, P., Medeiros, H., Souza, R., Rodrigues, T. (2017). "Lightcurve Analysis for Ten Near-Earth Asteroids." *Minor Planet Bull.* **44**, 20-22.

Software Bisque (2018). *TheSkyX Professional* software. <http://www.bisque.com/sc/pages/TheSkyX-Professional-Edition.aspx>

Warner, B.D. (2006). *A Practical Guide to Lightcurve Photometry and Analysis* (2nd edition). pp 268. Springer, New York.

Warner, B.D., Harris, A.W., Pravec, P. (2009). "The Asteroid Lightcurve Database." *Icarus* **202**, 134-146. Updated 2018 July. <http://www.minorplanet.info/lightcurvedatabase.html>

Warner, B.D. (2018a). MPO Software, *MPO Canopus* v10.7.11.1. <http://www.bdwpublishing.com>

Warner, B.D. (2018b) Asteroid Lightcurve Photometry Database (ALCDEF) website. <http://www.minorplanet.info/alcdef.html>

PHOTOMETRIC OBSERVATIONS OF NEAR-EARTH ASTEROID 2018 GE3

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On 2018 April 14, we observed as a target of opportunity the near-Earth asteroid (NEA) 2018 GE3 from the Astronomical Institute of the Romanian Academy (IAU code 073). Analysis of our data found a synodic period of 0.304 ± 0.001 h based on data obtained over one hour prior to the asteroid's closest approach to Earth.

The near-Earth asteroid (NEA) 2018 GE3 was discovered 2018 April 11 (JPL, 2018). It made its closest approach to Earth (193.000 km) on Apr 15 at 06:41 UT (Tichy et al., 2018). Unfiltered CCD images were taken at the Astronomical Institute of the Romanian Academy, Bucharest, Romania, on the night of 2018 April 14 between 22:44–23:43 UT. The observations were made with a 0.38-m *f*/8 Ritchey-Chretien telescope and SBIG STL-11000M CCD camera (Sonka et al., 2017).

The asteroid was observed when it was at 0.005 AU from Earth. In order to keep a point-like source for 2018 GE3, we tracked it at half of its differential sky motion. Exposures were 10 sec. The raw science images were calibrated with bias, flats, and darks using the standard procedures of *Maxim DL* (2016) software. Data processing and period analysis were made using *MPO Canopus* software (Warner, 2015). Differential photometric measurements were performed using the Comp Star Selector (CSS) procedure in *MPO Canopus*, which allows selecting up to five comparison stars with a near-solar color. The comp star magnitudes were taken from the CMC-15 catalog (Munos, 2017).

Our data fit a period of 0.304 ± 0.001 h. The lightcurve amplitude is 0.93 ± 0.05 mag. A fourth-order fit showed an asymmetric bimodal lightcurve. A period spectrum between 0.1 h and 1.2 h indicated that the most probable solution was 0.3 h. The folded lightcurve points are slightly shifted; this could be due to a slightly

Number	Name	2018 mm/dd	Pts	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
2018	GE3	04/14	138	28.4, 30.1	216	8	0.304	0.001	0.93	0.05	NEA

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).