BROAD-BAND PHOTOMETRIC MONITORING OF 1226 GOLIA AND 6349 ACAPULCO

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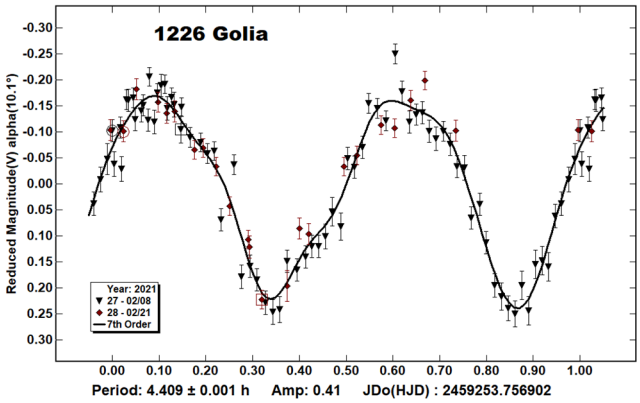
Broad-band photometric monitoring of 1226 Golia and 6349 Acapulco was carried out in 2021 February-March. For 1226 Golia, we report a rotation period of 4.46 ± 0.05 h and a V-band variability amplitude of 0.41 ± 0.02 mag, which are in agreement with the range of previously reported measurements. For 6349 Acapulco, we find typical colors for a C-type asteroid of B-V = 0.7 ± 0.1 mag and V-R = 0.3 ± 0.1 mag and little evidence for color changes as a function of time. We report a rotation period of 4.48 ± 0.05 h that is in good agreement with a previous measurement, and a variability amplitude of 0.55 ± 0.02 mag that is three times larger than previously reported.

Asteroids 1226 Golia and 6349 Acapulco were monitored through broad-band filters over the course of a few nights in 2021 February and March. Observations were obtained as part of the course work for the Georgia State University class *Astronomical Techniques and Instrumentation* at GSU's Hard Labor Creek Observatory. Monitoring was carried out with the 24-inch Miller Telescope, an *f*/6.5 Planewave Corrected Dall-Kirkham Astrograph, equipped with an Apogee Alta CCD with 2048×2048 pixels, giving a field of view of 26.3 arcmin × 26.3 arcmin and a pixel scale of 0.77 arcsec.

All images were reduced in *IRAF* following standard procedures, which included bias and overscan subtraction, dark subtraction, and flat fielding. Aperture photometry of the asteroids and field stars was carried out in *IRAF*. APASS *B*- and *V*-band photometry of field stars (Henden et al., 2009) was used to convert instrumental magnitudes to calibrated magnitudes, while the transformation equations of Jordi et al. (2006) for Population I stars were used to determine the effective *R* magnitudes for field stars using the Sloan *r′* magnitudes and the *g′*-*r′* colors from APASS.

Rotation periods and variability amplitudes of the asteroids were determined using *MPO Canopus*, which implements the Fourier Analysis of Light Curves (FALC) algorithm of Harris et al. (1989). Below, we discuss our analysis and findings for each asteroid separately.

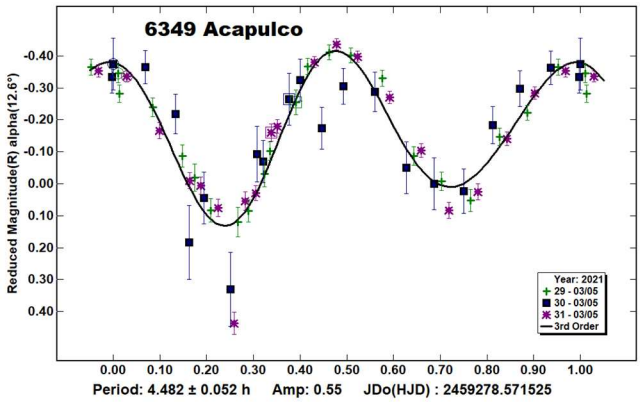
1226 Golia was discovered on 1930 April 22 by Dutch astronomer Hendrik Van Gent at Leiden Southern Station, Johannesburg (JPL, 2022). 1226 Golia is an S-type (stony) asteroid in the inner main belt (family 9104; Warner et al., 2009). Observations were collected through the Johnson *V* filter on UT dates Feb 8 and Feb 21. A total of 74 images with exposure time 90 s were collected on Feb 8, while wind and cloud conditions on Feb 21 only allowed for 23 images with exposure times of 210 s to be collected. The amplitude of variability in *V* was found to be 0.41 ± 0.02 mag, while the final determination of the rotation period is sensitive to the choice of order in *MPO Canopus*: the adoption of order = 5,7,8 all give a best-fit period of 4.409 ± 0.001 h while order = 6 gives a best-fit period of 4.472 ± 0.001 h. If the period finder is restricted to the observations collected on Feb 8, then periods of 4.48-4.52 h are found. We therefore adopt a best-fit period of 4.46 ± 0.05 h. Previous determinations of the rotation period have found values that range between 4.10 h (di Martino et al., 1994; Waszczak et al., 2015) and 4.47 h (Behrend, 2021web; Ďurech et al., 2018) and include variability amplitudes of 0.24-0.40 mag. Our measurements agree well with the upper ends of these ranges.



6349 Acapulco was discovered on 1995 February 8 by Japanese astronomer Masahiro Koishikawa at the Ayashi Station of the Sendai Astronomical Observatory (JPL, 2022). It is a member of the Adeona family of carbonaceous (C-type) main-belt asteroids, which are believed to have formed when the parent body, 145 Adeona, underwent a massive collision about 600 million years ago (Carruba et al., 2003). Observations through the Johnson-Cousins *B*, *V*, and *R* filters were collected on UT date 2021 March 5 with typical exposure times of 240 s for each of the 63 good frames. Exploration of the asteroid color shows little evidence for color changes as a function of time, with B-V = 0.7 ± 0.1 mag and V-R = 0.3 ± 0.1 mag. These colors are typical for other C-type asteroids (Dandy et al., 2003). A rotation period of 4.48 ± 0.05 h and variability amplitude of 0.55 ± 0.02 mag was determined by adjusting the *B*- and *R*-band light curves to match the *V* band and then fitting all three bands simultaneously. Given the low signal-to-noise of the *B*-band measurements (blue boxes in the figure below), we also fit each band separately:

Number	Name	2021 mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
1226	Golia	02/08-02/21	10.12,5.42	156	9	4.46	0.05	0.41	0.02	9104
6349	Acapulco	03/05	12.62	138	1	4.48	0.05	0.55	0.02	505

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).



B: rotation period = 4.50 ± 0.06 h, amplitude = 0.57 ± 0.02 mag
V: rotation period = 4.49 ± 0.04 h, amplitude = 0.54 ± 0.02 mag
R: rotation period = 4.38 ± 0.09 h, amplitude = 0.62 ± 0.02 mag

The results of analyzing each band separately agree with the results derived from fitting all bands simultaneously, although the scatter in variability amplitude is a bit larger than the formal uncertainties and appears to be driven by the low sampling rate in each band and a few discrepant measurements. The only previously reported period is 4.376 ± 0.002 h with a variability amplitude of 0.18 mag, determined from 64 observations collected over 51 days through the Mould *R* filter as part of the Palomar Transient Factory survey (Waszczak et al., 2015). The rotation period we find from observations collected in a single night is just slightly longer than this previous measurement, but we find a variability amplitude that is three times larger and does not seem to be strongly dependent on the filter choice.

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