

**PHOTOMETRY AND LIGHTCURVE ANALYSIS OF
TWO MARS-CROSSING ASTEROIDS:
(106848) 2000 YP16 AND (133090) 2003 MS9**

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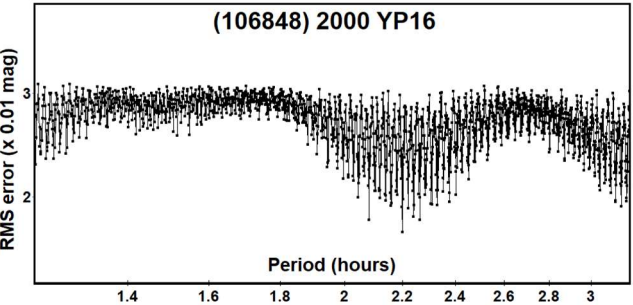
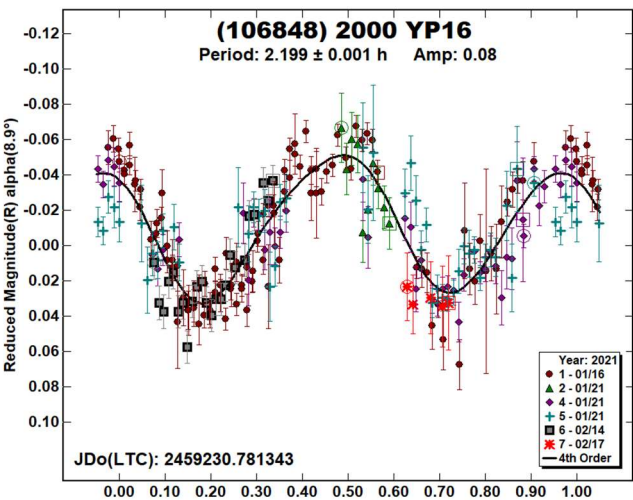
Lightcurves and rotational periods for Mars-Crossing asteroids (106848) 2000 YP16 and (133090) 2003 MS9 were obtained at the Observatório Astronômico do Sertão de Itaparica (MPC code Y28, OASI) in 2021 January-February and October-December, respectively.

CCD photometric observations of two Mars-crossers (MCs) were made at the Observatório Astronômico do Sertão de Itaparica (MPC Y28) between 2021 January-February and October-December. Images were obtained with the 1.0m f/8 telescope of the IMPACTON project and an FLI PL424 CCD camera (2048×2048 pixels) set to 2×2 binning (Rondón et al., 2020) and Johnson-Cousins R filter. The reduction process included calibration of raw images with dark and flat frames via IRAF. MPO Canopus (Warner, 2017) was used for brightness measurements, Fourier analysis (Harris et al., 1989) and to produce the final lightcurves.

Table I shows the date of the observations for each object, as well as the derived rotation period and amplitude of the lightcurve. Individual results are discussed below. The phased rotational lightcurve and the periodogram are shown for each object.

(106848) 2000 YP16. A search in the Asteroid Lightcurve Database (LCDB; Warner et al., 2009) did not find any previously reported period for this MC. This object was observed over several nights in 2021 January and February. Our photometric analysis allowed us to derive a rotational period of 2.199 ± 0.002 h. The lightcurve shows a well-defined bimodal shape and a low maximum amplitude of 0.08 mag.

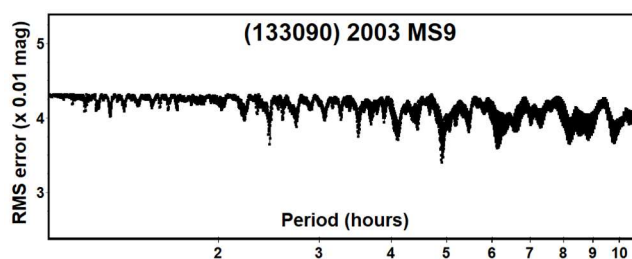
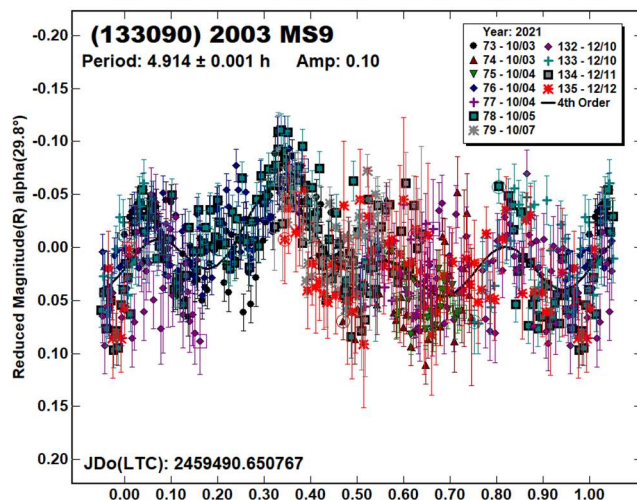
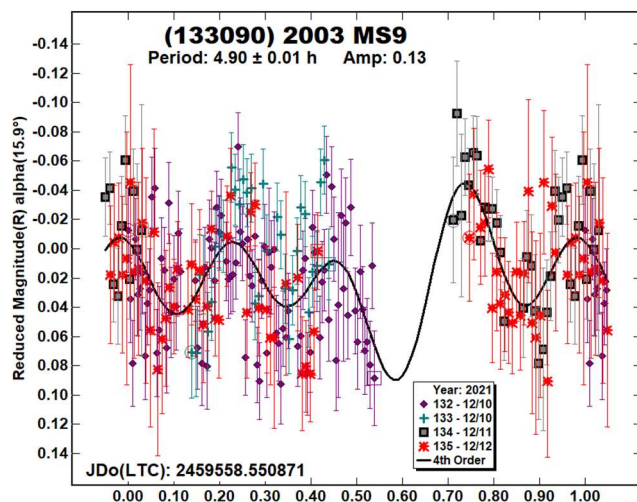
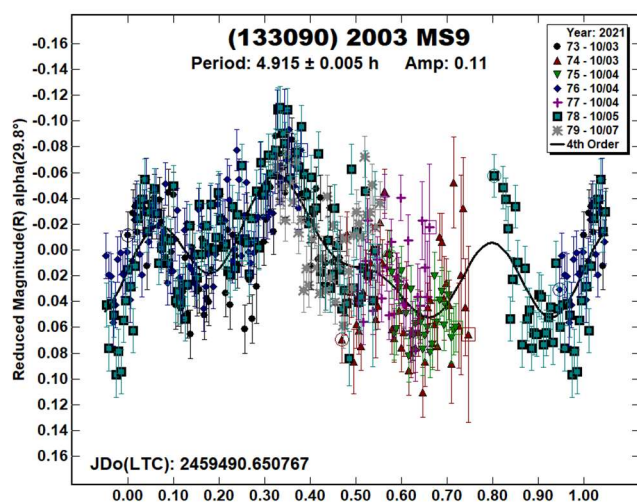
The period found places the asteroid just above the so-called “spin barrier,” of about $P = 2.2$ h (Pravec and Harris 2000), which might have implications of the cohesive forces of the object (gravitationally-bound or strength-bound). In order to clarify the nature of the object, we believe this MC is an interesting target for future observations.



(133090) 2003 MS9. No rotational period has been found in the LCDB (Warner et al., 2009) for this object. In order to get the best possible fit, we grouped the observations into two sets. First, we adjusted a period based on the data obtained over four nights in October 2021. This data showed a period of 4.915 ± 0.005 h and an amplitude of 0.11 mag. Next, we fit the data acquired over three nights in December of the same year and found a period of 4.90 ± 0.01 h with an amplitude of 0.13 mag. Given the small variation in amplitude between the lightcurves with data in October and December, we then performed a new fit including all the data. The period found and the one adopted for this paper is 4.914 ± 0.001 h and an amplitude of 0.10 mag. We present the three fits below.

Number	Name	2021 mm/dd	Phase	L _{PAB}	B _{PAB}	Period(h)	P.E.	Amp	A.E.	U
106848	2000 YP16	01/16–02/17	* 8.4, 18.4	131	–2	2.199	0.002	0.08	0.01	2+
133090	2003 MS9	10/03–12/12	*29.4, 17.3	48	0	4.914	0.001	0.10	0.02	2

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).



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