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Calculation of the rotational period of the 'Mars Crosser' asteroid (32910) 1994TE15.

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Abstract: We present the lightcurves and the derived rotational period of the inner main belt asteroid (32910) 1994TE15. The asteroid was selected because it seems to have close encounters with the orbit of Mars (Mars crosser). The observations were undertaken during August 2010 at Skinakas Observatory, Crete, using the 1.3m Telescope with an Andor DZ436 CCD camera and a Johnson-Cousins R filter. The magnitude of the target was 15.3 during the observations and the amplitude of the lightcurve was 0.13 mag.

1 Target selection

The inner belt ($a \leq 2.5AU$) is mostly chaotic. This chaos is caused by mean motion resonances with Mars and three-body resonances Mars-Jupiter-asteroid. Because of the chaoticity of the belt, asteroids tend to slowly migrate in eccentricity. This chaotic diffusion leads many bodies in the inner belt to become Mars-crossers [1]. Asteroid (32910) 1994TE15 is located in the inner main belt of asteroids, which is the main source of Near Earth Asteroids (NEAs). It was discovered on 13/10/1994 and belongs to Mars Crossers. Also does not belong to any of the five big asteroid families (Vesta, Flora, Massalia, Nysa-Polana and Erigone). This fact means that it is an inner main belt background asteroid. Another contributive factor was its rate and its position on the sky.

1994TE15 Orbital info	
Absolute Magnitude	14.8 Mag
Perihelion	1.6265 AU
Aphelion	2.7373 AU
Orbital Period	1177.18 days
Eccentricity	0.254545

Table 1: Orbital Info

2 Observations at Skinakas Observatory

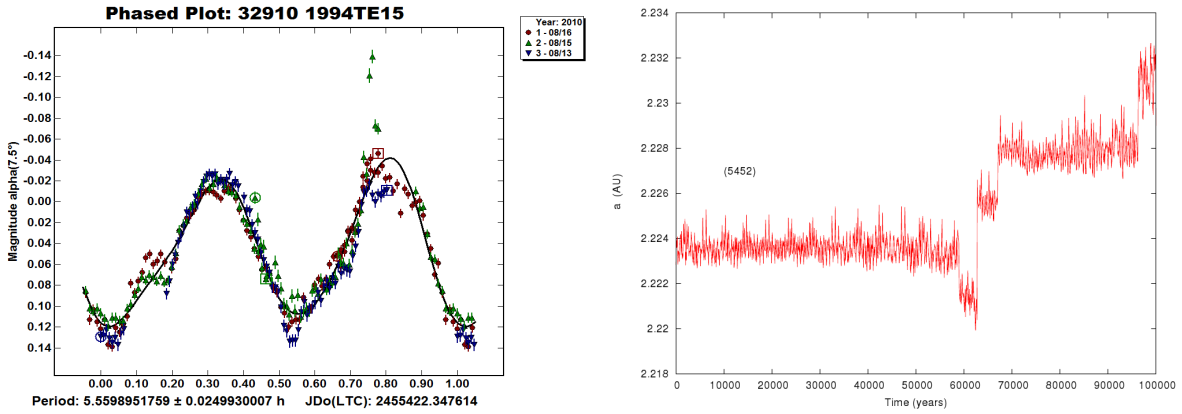
The asteroid was observed on 13, 15 and 16 of August, 2010 during moonless nights. Wind speed and humidity were below the limits in which the Observatory operates. We observed the asteroid during specific dates in which it had the maximum solar elongation combined with the absence of moonlight. The exposure time was calculated separately every night in order to achieve the best signal to noise ratio but also to avoid trails of the target. Totally we acquired 308 light frames, which we analysed photometricaly using the MPO CANOPUS software (The Minor Planet Observer and Palmer Divide Observatory).

Observational info				
Date	Magnitude	Solar Elongation(^{o})	Rate(arcmin/min)	Exposure Time(sec)
13 08 2010	15.3	168.1	0.5	150
15 08 2010	15.3	168.0	0.5	150
16 08 2010	15.3	167.8	0.5	200

Table 2: Observational Info

3 The final results and future work

During the 3^{rd} night we observed the full period of the asteroid. The observations of the first two nights did not cover the full period. However, the observed part matched the light curve extremely well (Fig.1a). The small differences in the three light curves are due to the different comparison stars. Moreover we used the analysis-software embedded MPOSC3 catalogue which has an error of $\pm$ 0.03 mag for the R filter. In the future we plan to re-observe (32910) 1994TE15 in a different solar elongation in order to extract the details of its shape. We also plan to observe in the near future asteroid (5452) 1937NN (Fig.1b). Generally it has the same characteristics with (32910) i.e. it does not belong to any of the 5 big asteroid families and is a Mars Crosser too.



(a) (b)

Figure 1: (a) The Composite Lightcurve of (32910) 1994TE15 and (b) The evolution of the great axis of the (5452) 1937NN.

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References

Morbidelli A. and Nesvorny D., 1998, *Chaotic Structure of the Asteroid belt and Origin of Mars-crossers*, Bulletin of the American Astronomical Society, 30, 1029.