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LIGHTCURVE OF NEA 1993 RA

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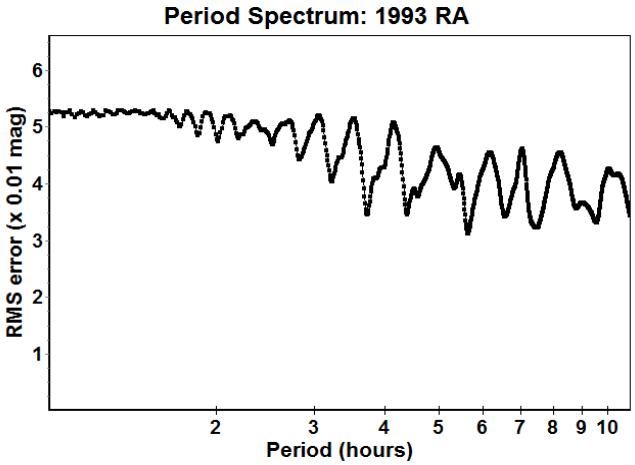
The near-Earth asteroid (NEA) 1993 RA was observed with the 2.5-m Isaac Newton Telescope (INT) in full Moon conditions for 8h total during three successive nights (2017 Oct 3-6). The composite lightcurve could be fit by a 3-order period P = 5.64 ± 0.01 h with amplitude of 0.13 mag; other solutions are possible.

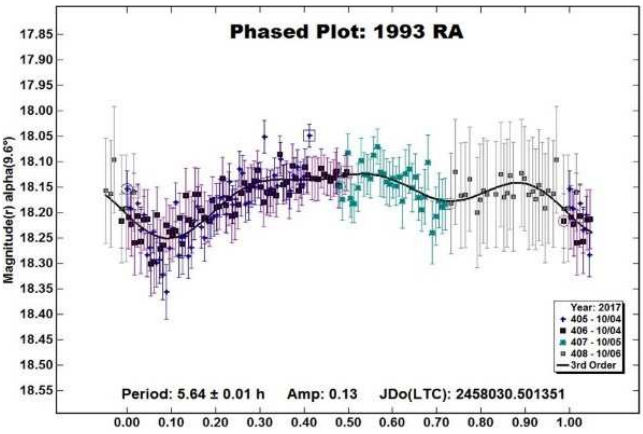
In 2014, the European Near-Earth Asteroids Research (EURONEAR; *www.euronear.org*) started its NEA Lightcurve Survey. Our first set of results for about 150 NEAs were published by Aznar Macias et al. (2017), Vaduvescu et al. (2017), and in a paper in progress. Following this work in 2017, we resumed observations during "free time" on the telescopes available to the EURONEAR network. This included the nights of 2017 Oct 3-5 that were used for student training at the Isaac Newton Telescope (INT). Using the EURONEAR long planning tool, we searched for NEAs brighter than V = 18, having no lightcurve data, and targeted 1993 RA, which had no previously reported periods.

1993 RA was discovered by Spacewatch at Kitt Peak on 1993 Sep 9 (MPC 22555). It was recovered in 2001 and the followed for another four other oppositions through 2017. During this time, it remained fainter than V = 18. It has an Amor-type orbit with a = 1.91 A.U., e = 0.42, and i = 5.6°. Its absolute magnitude is H = 19.2 and diameter of 500 meters if the albedo is 0.15. We used the Wide Field Camera (WFC) which can be windowed to 10′x10′ and read in fast mode (10s). Exposures were 1 min and tracked at half the asteroid sky motion. We used a Sloan *r* filter to minimize scattered light from a very close full Moon. The seeing was around 1.2″ during all three nights.

Bias and flat-fields were applied using IRAF. We used *MPO Canopus* for photometric measurement, choosing up to five reference stars with magnitudes taken from the SDSS12 catalog. This assured precise (~0.01 mag) night-to-night linkage. The RMS errors of the measurements were 0.02 mag during the first night, 0.03-0.04 mag during the second, and 0.07 mag during the third night when the Moon was only 6° away.

As show in the period spectrum, a 3-order Fourier fit results in P = 5.64 ± 0.01 h with other solutions between 4–8 h. Unfortunately, none of these could be covered completely during the available time any night since our longest run was 4 hours.





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Number	Name	2017 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.
	1993 RA	10/03-10/06	384	9.6,8.8	17	-5	5.64	0.01	0.13	0.04

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).

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