PLANET	OBSERVER & APERTURE (cm)	OBSERVING PERIOD (2014)	NO. OBS.
1995 CR	Harvey, 73	Feb 21	6
2006 DP16	Harvey, 73	Feb 16	6
2013 WT67	Faure and Rayon, 40	Aug 23	23C
	Harvey, 73	Aug 19	6
2014 SC324	Harvey, 73	Oct 23	6
2014 WZ120	Harvey, 73	Nov 28	6

LIGHTCURVE ANALYSIS OF THE HUNAGARIA ASTEROID 30935 DAVASOBEL

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After a single night of observations at the Sopot Astronomical Observatory on 2014 Dec 31, there were possible indications of an attenuation that would indicate that the asteroid was binary. A collaboration was formed by the authors to obtain data from well-separated locations in case the potential satellite had an orbital period commensurate with an Earth day. The final data set contained no significant secondary period and led to a single period solution of $P = 3.9769 \pm 0.0005$ h, $A = 0.60 \pm 0.03$ mag.

Observations of the Hungaria asteroid 30935 Davesobel were started on 2014 Dec 31 by Benishek at the Sopot Astronomical Observatory (SAO). A preliminary analysis appeared to show an attenuation and the possibility of something other than a single period solution. Benishek contacted Warner to obtain additional data while continuing his observations. The advantage would be two stations well-separated in longitude, which could help resolve ambiguities should a secondary period be commensurate with an Earth day. Also, if conditions allowed, observations ending in Serbia would almost overlap those starting in California, thus providing a very long set of nearly continuous observations. Unfortunately, the moon and weather did not cooperate in this regard.

OBS	Telescope	Camera
Warner	0.35-m *f*/9.1 Schmidt-Cass	STL-1001E
Benishek	0.35-m *f*/10 Schmidt-Cass	ST-8XME

Table I. List of observers and equipment.

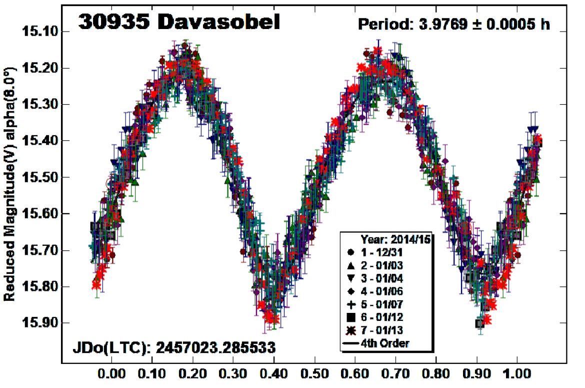
Obs	Dates (2014/2015)	Sessions
Warner (CS3-PDS)	12/31 01/12 13	1 6 7
Benishek (SAO)	01/03 04 06 07	2-5

Table II. Dates of observation for each observer. The Sessions column gives the session numbers shown in the lightcurve legend.

Tables I and II give the equipment used and the dates of observations for each observer. Over the range of observations, the asteroid's phase angle started at $\alpha = 8.0°$, dropped to 6.8°, and increased back to 9.1°. The phase angle bisector longitude was nearly constant at $L_{PAB} = 103°$ while the latitude went from $B_{PAB} = 10°$ to 6° (see Harris *et al.*, 1984, for the derivation of the phase angle bisector).

Both observers used *MPO Canopus* to measure the images. The Comp Star Selector utility found up to five solar-colored stars for each session. The magnitudes for the comparisons were taken from the MPOSC3 catalog, which is based on the 2MASS catalog converted to the BVRcIc system using formulae developed by Warner (2007). Benishek sent his *MPO Canopus* export data sets to Warner for period analysis, which was also done in *MPO Canopus,* which incorporates the FALC Fourier analysis algorithm developed by Harris (Harris *et al.*, 1989) and modified by Warner to allow subtracting a Fourier model lightcurve from a data set to search for a secondary period.

The search for a second period found nothing that rose above the noise in the period spectrum covering 5 to 30 hours. Instead, a unique single period solution was found with $P = 3.9769 \pm 0.0005$ h, $A = 0.60 \pm 0.03$ mag. It should be noted that the observations on 2014 Dec 31 were hampered by moonlight and weather conditions. It's possible that the deviation was the result of a systematic error.



Acknowledgements

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LIGHTCURVE ANALYSIS OF THE NEAR-EARTH ASTEROID 2015 CN13

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The near-Earth asteroid 2015 CN13 made a fly-by of Earth in late 2015 February. We observed the asteroid on Feb 25, 26, and 28. Analysis of the data set found two possible periods, the most likely being $P = 22.7 \pm 0.3$ h. Given the estimated diameter of 70 meters and long period, this puts 2015 CN13 in a small group of NEAs with $D \leq 140$ meters and periods well below the spin barrier, *i.e.*, approximately $P \geq 2.2$ hours.

The near-Earth asteroid (NEA) 2015 CN13 made a fly-by of Earth in late 2015 February. It was V < 18.0 from about Feb 22- March 5, reaching a minimum of V ~ 16.9 on Feb 28. Given its sky motion and the size of telescopes available and, combined with a waxing moon beyond first quarter, there was only a small window of opportunity for making CCD photometry observations. With an estimated size of about 70 meters, the chances that the asteroid was a super-fast rotator, $P \ll 1$ hour, were high and so exposures had to be kept short in order to avoid *rotational smearing*, which is when exposures are a significant portion of the rotation period and so details about features within the lightcurve are lost (see Pravec *et al.*, 2000).

Tables I and II give the equipment used and the dates of observations for each observer. Exposures were 60 sec on Feb 25-26 and 30 sec on Feb 28. To keep the signal-to-noise as high as possible, no filters were used.

OBS	Telescope	Camera
Warner	0.30-m *f*/9.6 Schmidt-Cass	FLI ML-1001E
Oey	0.61-m *f*/6.8 CDK	Apogee U42

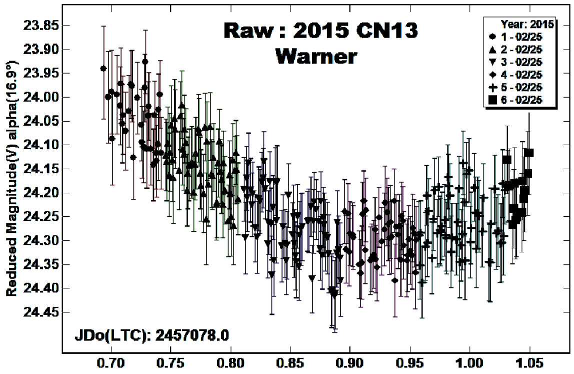
Table I. List of observers and equipment.

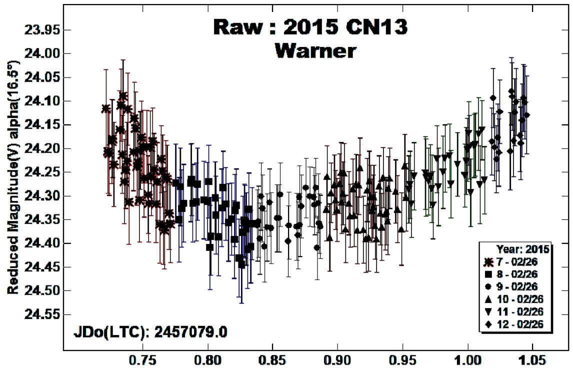
Obs	2015 mm/dd	Sess	α	L_{PAB}	B_{PAB}
Warner	02/25 26	1-12	17.1,16.4	160,163	8,6
Oey	02/28	13-15	20.2	170	1

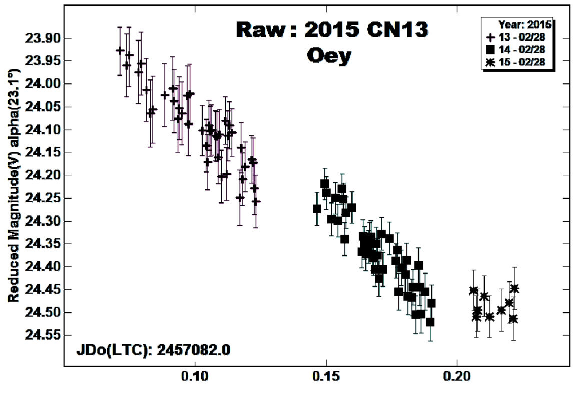
Table II. Dates of observation for each observer. a is the solar phase angle. The last two columns are the phase angle bisector longitude and latitude (see Harris *et al.*, 1984).

Both observers used *MPO Canopus* to measure the images. The Comp Star Selector utility in *MPO Canopus* found up to five solar-colored stars for each session. The magnitudes for the comparisons were taken from the MPOSC3 catalog, which is based on the 2MASS catalog converted to the BVRcIc system using formulae developed by Warner (2007). Oey sent his data to Warner for period analysis using *MPO Canopus,* which incorporates the FALC Fourier analysis algorithm developed by Harris (Harris *et al.,* 1989).

The raw plots for Feb 25 and 26 each show an apparent minimum in the lightcurve. Since the Feb 26 shifted the minimum to the left, a first estimate for the period was that it was a little less than being exactly commensurate with an Earth day, *e.g.*, between 11-12 or 23-24 hours. Given the shape of the raw curves, shorter periods near 6 and 8 hours were considered unlikely, but leaving the possibility for a period near 16 hours. Since the asteroid was within range for only a short period, there was no chance for a single station to get sufficient coverage of the total lightcurve to find a reasonably accurate period. This is where the observations from Oey, located about 110 degrees in longitude to the west of Warner's location, became critical.







The data from Oey were obtained when the asteroid had an even larger sky motion and the moon was 3 days past first quarter, therefore there was some uncertainty about how well they would fit in with the other data. Fortunately, when combined with the data from the two previous sessions, they led to solutions that, as