Photometry of asteroid 2006 RH120 during its short visit to a geocentric orbit

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On 14 September 2006 a new near-Earth asteroid was found by the Catalina Sky Survey. During the next two weeks new astrometric observations were obtained by several stations which allowed determination of orbital elements. It appeared this several meters in diameter object was moving on a geocentric orbit which suggested it was a space debris. As a result it was given a designation 6R10DB9 and classified as a Distant Artificial Satellite (DSO).

In December 2006 new astrometric observations allowed to compute a more accurate orbit of 6R10DB9. It appeared one of the parameters of the orbital fit, the area to mas ratio (ARM), was found to be much smaller than typical values for artificial satellites (Bill Grey, personal communication). This rose suspection 6R10DB9 could actually be a natural body and not some burned-out rocket booster.

Recently the natural origin of 6R10DB9 has been confirmed (mainly thanks to radar observations by Lance Benner et al.) and its official designation is now 2006 RH120. The object has left the geocentric orbit and is unavailable for further studies.

On the suggestion of Carl Hergenrother we observed 2006 RH120 on five nights in March 2007 with a new 10 m Southern African Large Telescope (SALT). This instrument is still in a commissioning phase and its performance is not optimal. It is an Arecibo-type telescope which does not move during the observation and can only track objects at the altitudes from 49 to 58 degrees.

The geometry of observations was very specific with the asteroid moving along the declination circle, starting at Decl=-29 deg on 11 March and ending at Decl=+3 deg on 18 March. During that time the large solar phase angle of 74 deg didn't change by more than 0.5 deg, making it easier to compare the photometric data.

At the time of observations the V=20 mag asteroid was moving by 15 arcsec every minute so we used 7 sec exposures and a clear filter. After the standard reduction of the data we found out only the 15, 16 and 17 March measuments could be used for further analysis.

Original lightcurves did not resamble a quasi-sinusoid light variations–a clear sign our sampling frequency (about two points per minute) was close to the rotation frequency of the target. Searching for the rotation period we fit the 4th order Fourier series to the data,

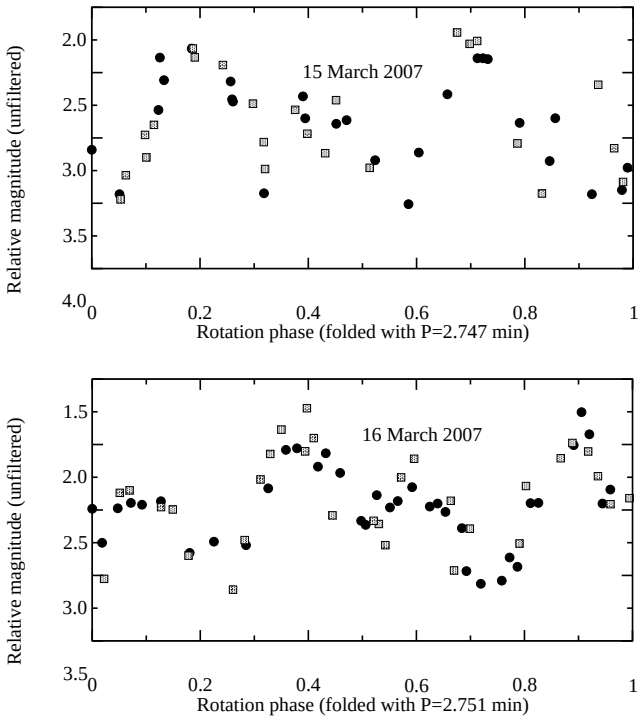

Figure 1: Lightcurves of 2006 RH120 from 15, 16 March 2007. Each plot shows a composite of two lightcurves (marked by circles and squares), which were adjusted in magnitude. Between the observations the asteroid moved by 5 deg in declination (RA remained the same) and the solar phase angle was constant at 74.2 degrees.

which gave us two possible solutions: $P_1 = 1.85$ and $P_2 = 2.75$ minutes, with the second one having lower χ^2. This result was obtained independently for each of the three nights. Unfortunately, due to a low accuracy of the period (about 0.03 minutes), we could not link the nights together in one global fit. Two composite lighcurves from 15 and 16 March are presented in Fig. 1. A complex shape of both curves is typical at such large phase angles. The average amplitude of 1.2 mag, when reduced to a zero solar phase angle, translates to the a/b elongation of 1.4-1.8 (assuming the 90 degrees aspect angle).