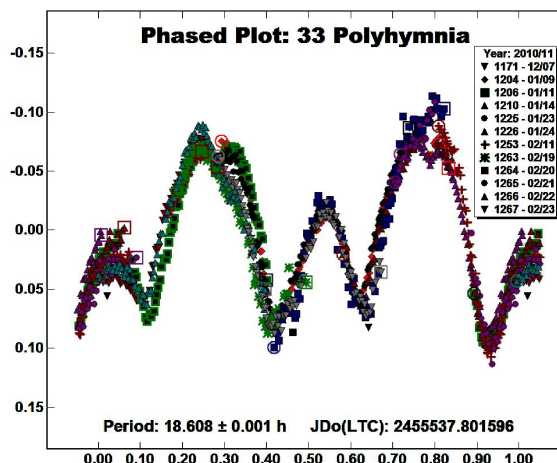
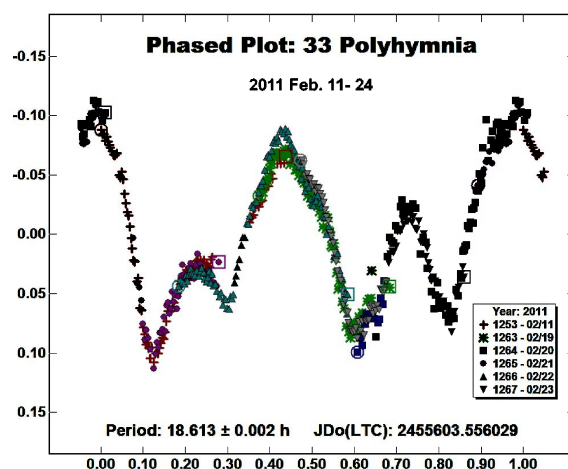
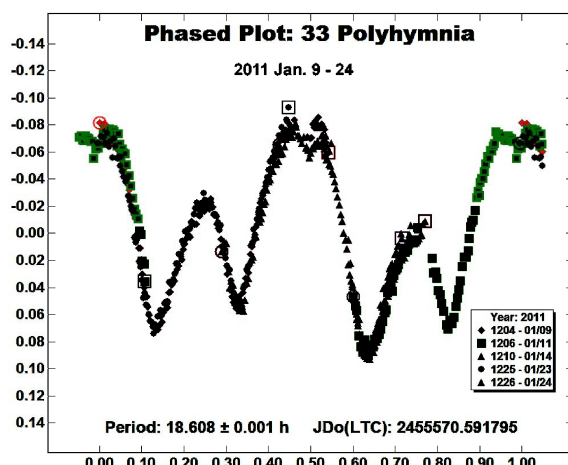


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LIGHTCURVE ANALYSIS OF ASTEROIDS 890 WALTRAUT AND 2010 JL33

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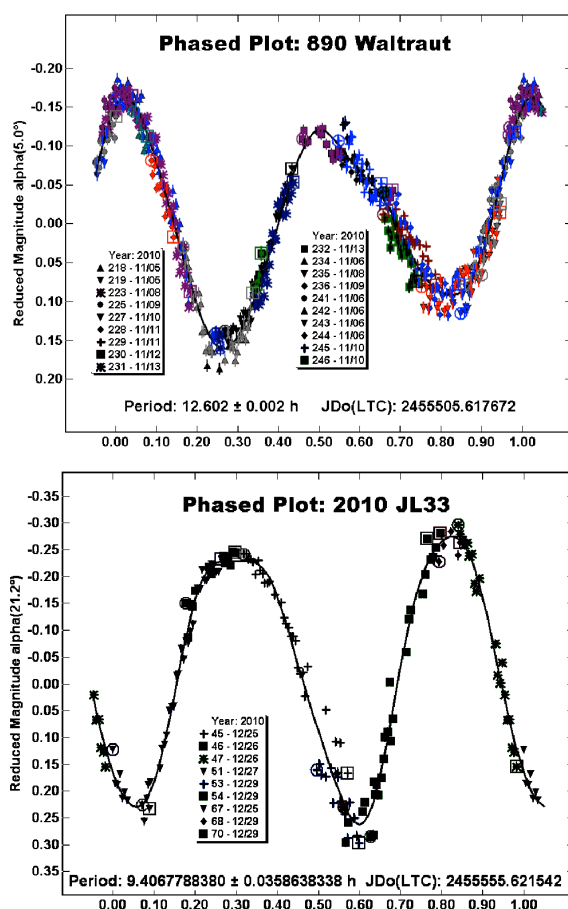
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Lightcurves of asteroids 890 Waltraut and 2010 JL33 were obtained by using observations made in 2010 November and December. We found the synodic rotation period for 890 Waltraut to be $P = 12.602 \pm 0.002$ h with amplitude $A = 0.32 \pm 0.02$ mag. For 2010 JL33 we found $P = 9.41 \pm 0.04$ h, $A = 0.53 \pm 0.03$ mag.

Lightcurves for asteroids 890 Waltraut and 20010 JL33 were derived with images taken with equipment located at New Mexico Skies, USA, and operated remotely from the Marshall Space Flight Center (MSFC). The telescope was an RCOS 0.5-meter f/8.1 Ritchey-Chretien telescope on a German Equatorial Mount. The CCD camera was an Apogee U9000 with a 3056x3056 array of 12-micron pixels. 2x2 binning was applied, creating a 1528x1528 array of 24-micron pixels and image scale of 1.22 arcsec/pixel. Both asteroids were imaged using a Johnson V filter. An infrared pre-flash of the CCD was applied prior to each image begin acquired, including bias, dark, and flat frames. This was done to mitigate the effects of residual bulk images (RBI), which is a serious issue, especially for the Kodak KAF-09000 CCD chips. This technique provides a uniform, repeatable background rather



than the ghost images of bright stars. Images of both asteroids were appropriately dark subtracted and flat fielded using *Maxim DL*.

The asteroids were chosen due to their position, magnitude, and elongation angle. Each frame was inspected; those with stellar apulses were not considered in the analysis. This ensured accurate light measurement of the asteroid. The asteroid parameters were automatically determined using the Minor Planet Center asteroid database. *MPO Canopus* (Warner, 2010) was used to perform photometric and period analysis according to the FALC method developed by Harris (Harris *et al.* 1989).

890 Waltraut. This is a main belt asteroid 27.33 kilometers in diameter (JPL) that was favorably placed to be imaged in 2010 November. Its lightcurve parameters had been previously found (Brinsfield, 2010), therefore it was used to confirm our data processing procedure. 180-second exposures were taken for Waltraut, which exhibited no streaking due to asteroid motion and so circular target apertures were used.

2010 JL33. This is a near-Earth asteroid with an Apollo orbit. The asteroid was imaged after NASA published radar images of it from their Goldstone Solar System Radar on 2010 Dec 11 and 12 (Agle, 2011). The asteroid shape was clearly seen by Goldstone radar; its diameter was measured to be roughly 1.8 kilometers long and the rotation period was estimated to be 9 hours. The asteroid was small and fast-moving, so a 180-second exposure was needed to achieve

a high enough signal-to-noise ratio, which resulted in some streaking. Elliptical target apertures were used for all sessions due to the streaking. Data were taken in 2010 December and 2011 January, although by January the signal-to-noise ratio on the images was below an acceptable level for photometry. The usable data were taken 2010 December 25, 26, 27, and 29, out of which a lightcurve emerged with period 9.41 ± 0.04 h and amplitude of 0.53 ± 0.03 mag.

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LIGHTCURVE PHOTOMETRY AND H-G PARAMETERS FOR 1342 BRABANTIA

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The main-belt asteroid 1342 Brabantia was observed over seven nights in 2010 December and 2011 January-February with filtered and non-filtered systems. The resulting synodic period is $P = 4.1754 \pm 0.0001$ h with an amplitude $AV = 0.19 \pm 0.01$ mag. The color index $V-R = 0.41 \pm 0.02$ mag. The measured absolute visual magnitude, $HV = 11.30 \pm 0.05$ mag, and the slope parameter, $G = 0.23 \pm 0.06$, are consistent with a medium albedo object, e.g., type M or S. The diameter is estimated to be $D = 18 \pm 2$ km.

The main-belt asteroid 1342 Brabantia was reported as a lightcurve photometry opportunity in the *Minor Planet Bulletin* (Warner *et al.*, 2011). All the observations were carried out from Gothers Observatory (J03) in Cornwall (UK) and from A81 Balzareto Observatory in Rome (IT) over the period spanning from 2010 December 18 to 2011 February 04, or a total of 48 days (Table I). The equipment used for observations is described in Table II.