ASTEROID LIGHTCURVE ANALYSIS AT THE OAKLEY OBSERVATORY – SEPTEMBER 2007

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(Received: 31 January)

Data were collected for 17 asteroids over eight nights of observation during the month of September 2007 at the Oakley Observatory. The asteroids were 256 Walpurga, 294 Felicia, 408 Fama, 789 Lena, 892 Seeligeria, 983 Gunila, 1033 Simona, 1411 Brauna, 2173 Maresjev, 2976 Lautaro, 3722 Urata, 3907 Kilmartin, 3915 Fukushima, 3971 Voronikhin, 5615 Iskander, (8085) 1989 CD8, and (9120) 1998 DR8.

A total of 17 asteroids were observed during the nights of 1-4, 13-15, and 17 September 2007. The observations were made at the Oakley Observatory at Rose-Hulman Institute of Technology in Terre Haute, Indiana. The data that were collected enabled us to find lightcurves for 14 asteroids. Out of those 14 lightcurves, 12 were previously unrecorded while the remaining two did not agree with previously published results.

Three telescopes were used throughout the eight days of observation. Each telescope was a 14-inch Celestron optical tube assembly mounted on a Paramount ME. The telescopes were set up with an STL-1001E CCD camera from Santa Barbara Instrument Group. Each CCD had a clear filter and an image scale of 1.94 arcseconds per pixel. All of the exposure times were four minutes. Images were calibrated with CCDSoft using master twilight flats, darks, and bias frames. Processed images were measured using MPO Canopus. Asteroids were selected based on their sky position approximately one hour after sunset. Priority was given to asteroids without previously published lightcurves. Asteroids with uncertain periods were also selected in order to potentially validate previous results.

To our knowledge, no previous observations have been reported for 256 Walpurga, 789 Lena, 892 Seeligeria, 1033 Simona, 1411 Brauna, 2173 Maresjev, 2976 Lautaro, 3722 Urata, 3971 Voronikhin, 5615 Iskander, (8085) 1989 CD8, or (9120) 1998 DR8. No repeatable pattern could be found for 294 Felicia, 983 Gunila, or 3907 Kilmartin. This was due to noisy data and equipment problems. The table below contains all of the results. Comments have been added as necessary.

408 Fama. The period was reported as "long" by Behrend (2006) and by Stephens (2008) as 202.1 h. Our results gave a period of about 12 hours, but with very low amplitude. We do not have enough data to rule out a longer period.

3915 Fukushima. Our results disagree with the period of 8.4 h reported by Warner (2004). We could not make our data fit the 8.4 h period.

Acknowledgement

This research was supported in part by NASA through the American Astronomical Society's Small Research Grant Program

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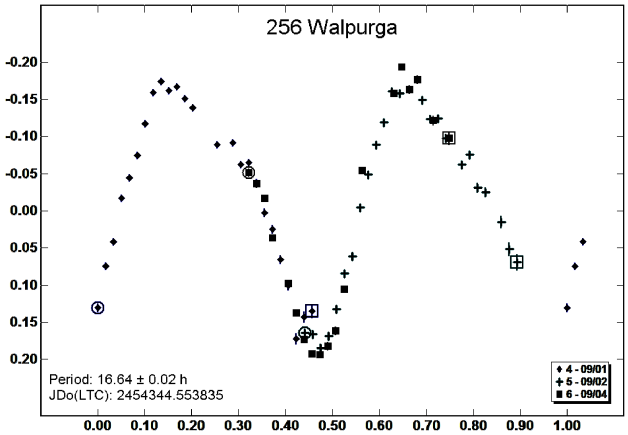
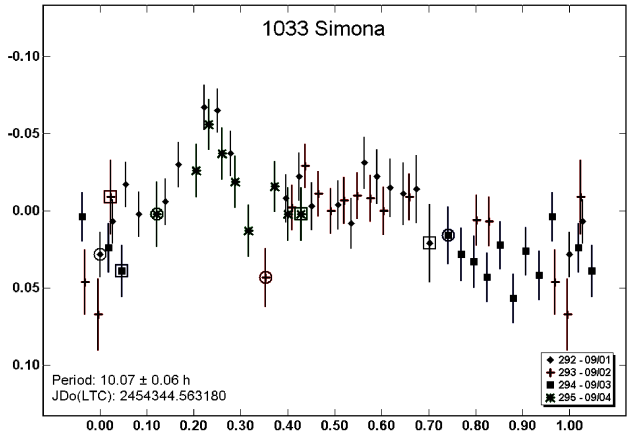
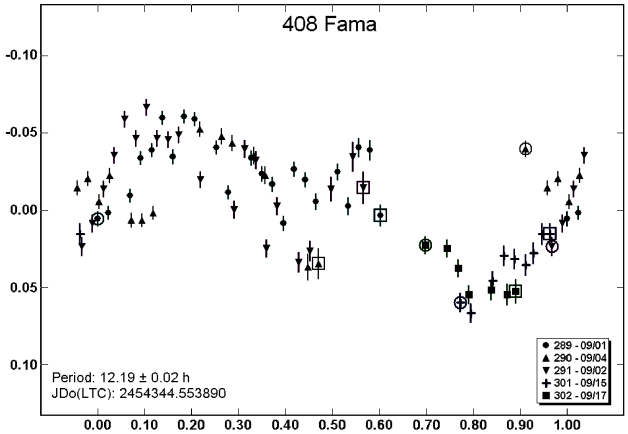
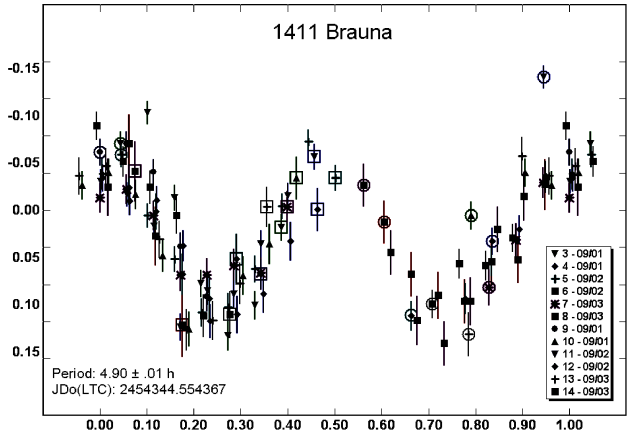
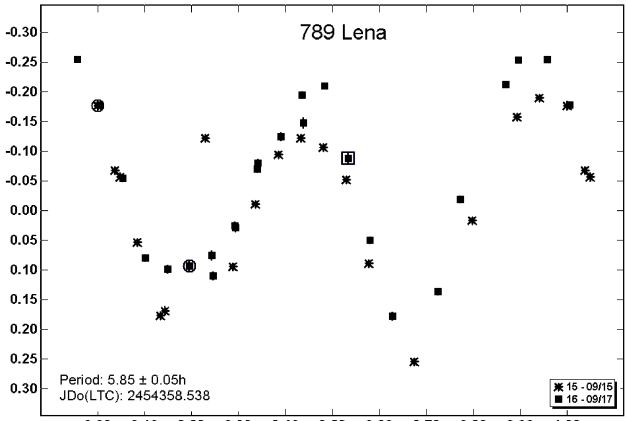
Number	Name	Dates (2007) mm/dd	Data Points	Period (h)	P.E. (h)	Amp. (mag)	A.E. (mag)
256	Walpurga	9/1, 9/2, 9/4	68	16.64	0.02	0.38	0.02
294	Felicia	9/13, 9/15, 9/17	23	-	-	0.35	0.07
408	Fama	9/1, 9/2, 9/4, 9/15, 9/17	75	12.19	0.02	0.15	0.03
789	Lena	9/15, 9/17	42	5.85	0.05	0.5	0.01
892	Seeligeria	9/13, 9/14, 9/15, 9/17	55	15.78	0.04	0.35	0.07
983	Gunila	9/17	11	-	-	0.25	0.05
1033	Simona	9/1, 9/2, 9/3, 9/4	56	10.07	0.06	0.15	0.05
1411	Brauna	9/1, 9/2, 9/3	116	4.90	0.01	0.15	0.05
2173	Maresjev	9/1, 9/2, 9/3	57	11.6	0.1	0.5	0.05
2976	Lautaro	9/1, 9/2, 9/3	49	17.41	0.08	0.16	0.01
3722	Urata	9/2, 9/4	47	5.565	0.005	0.58	0.05
3907	Kilmartin	9/13, 9/14, 9/17	25	-	-	0.45	0.1
3915	Fukushima	9/1, 9/2, 9/3, 9/4	49	9.41	0.01	0.52	0.02
3971	Voronikhin	9/3	20	5.41	0.14	0.21	0.05
5615	Iskander	9/1, 9/2	76	5.415	0.011	1.05	0.1
8085	1989 CD8	9/1, 9/2, 9/3, 9/4	40	7.75	0.05	0.45	0.05
9120	1998 DR8	9/1, 9/2, 9/3	51	14.76	0.09	0.16	0.02

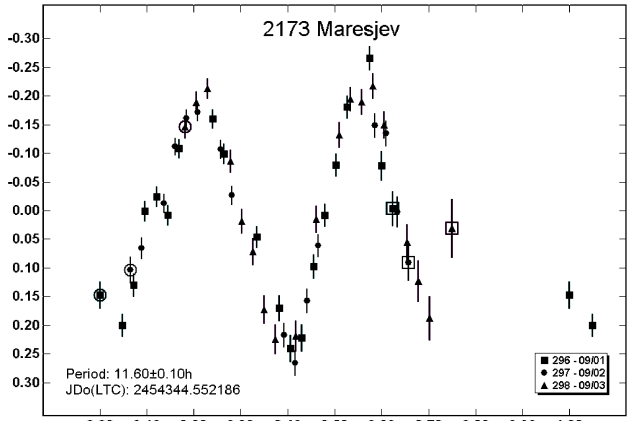


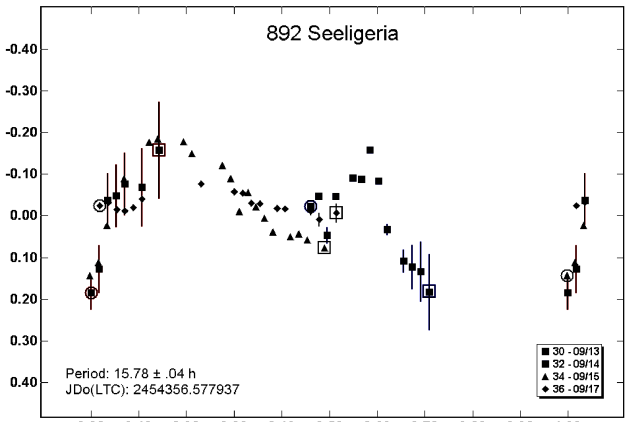


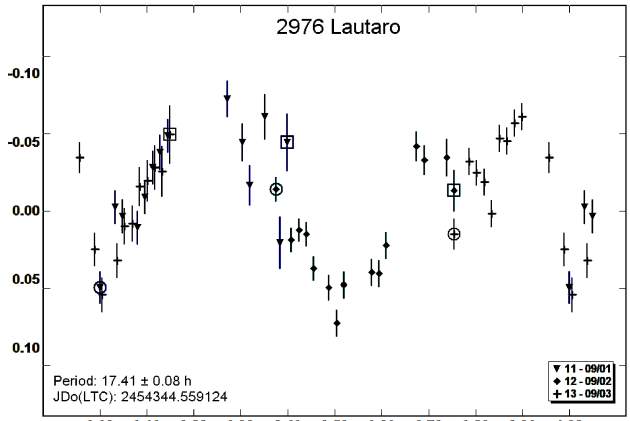


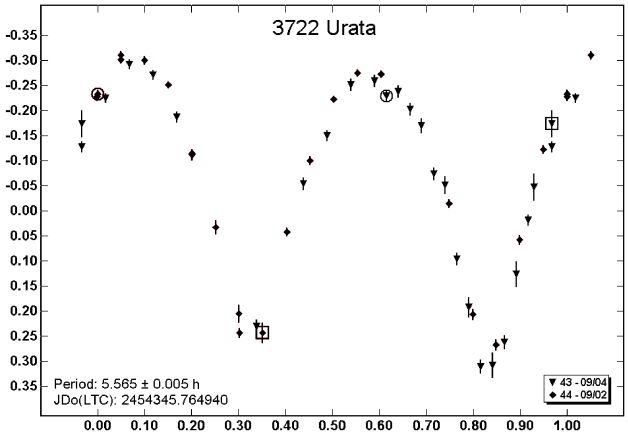


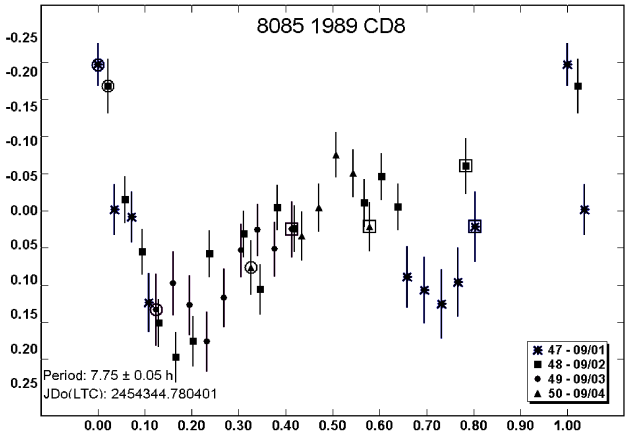


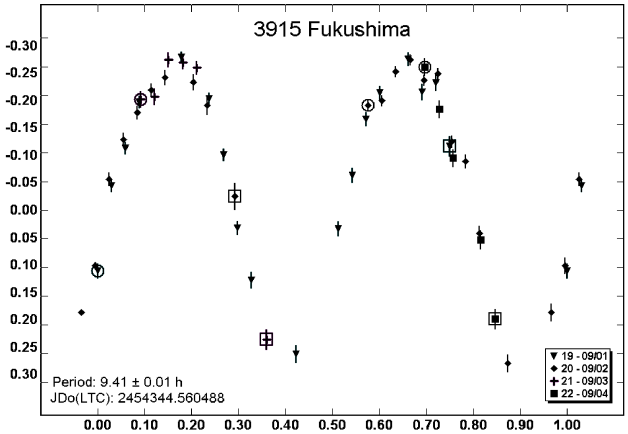


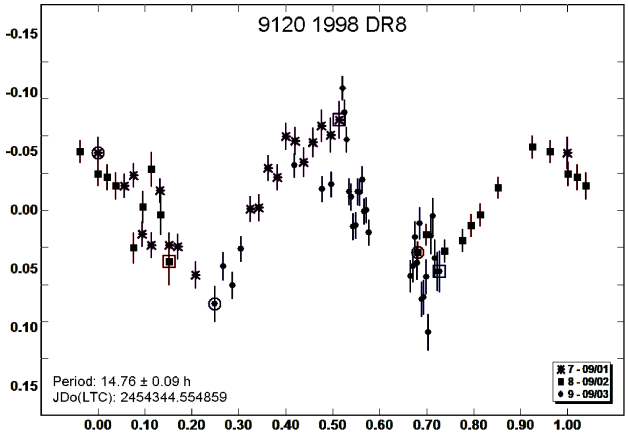


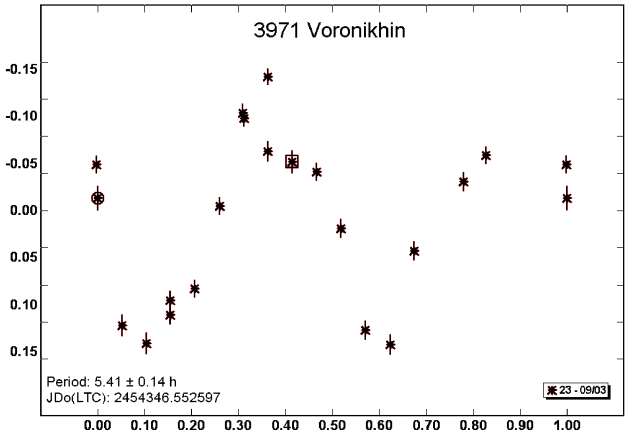


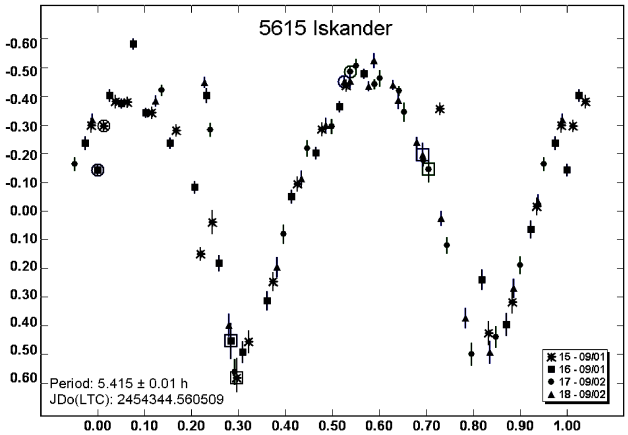












PHOTOMETRIC OBSERVATIONS OF THE NEAR EARTH ASTEROIDS 1989 UR AND 2007 XH16

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The NEAs 1989 UR and 2007 XH16 were observed in November and December from Salvador, Bahia, Brazil. The synodic period of 2007 XH16 is estimated to be 3.75 ± 0.03 h, with amplitude of 0.54 ± 0.09 mag. For 1989 UR, V-R = 0.42 ± 0.05 and for 2007 XH16 V-R = 0.513 ± 0.006.

Apollo group asteroids 1989 UR and 2007 XH16 have been listed by the Minor Planet Center as Potentially Hazardous Asteroids (PHA). Observations of the two were made by Arecibo and Goldstone in November and December 2007. At that time optical photometry was requested to compliment the radar data. In response, we obtained observations of the two asteroids in December 2007 using a Meade LX-200 GPS 0.3m /f3.3 telescope and SBIG ST-7XME CCD camera. Observations were made with V and R filters to investigate the synodic period, the V-R color index, and the amplitude-phase dependency.

All images were bias, dark, and flat-field corrected. MPO Canopus v9.3.1.0 was used for photometric reductions and period searches via Fourier analysis. In order to increase the SNR of target and stars when finding the V-R values, the images were aligned using the "rregister" and "trans2" routines and then added with the "add2" routine of IRIS v5.52 (Buil, 2008). The b and r magnitudes of USNO A2 field stars were used for photometric calibration (Kidger, 2003; Gary, 2006). We found only a limited number that met our requirements of 0.3 < V-R < 0.6, as suggested by Binzel (2005), V magnitudes similar to the object, and a near-solar B-V colour index (B-V = 0.654, Holmberg et al, 2006). Presumably, the cause for finding so few reference stars is the uncertainty of the b and r magnitudes, i.e., around 0.3 mag for the USNO B catalogue (Monet et al., 2003).

1989 UR. Observations of this asteroid were made on 16 Nov 2007. Forty images of 20 s exposure in V and R were obtained. These were used to find a colour index of V-R = 0.42 ± 0.05. Due to poor weather conditions, we were not able to obtain sufficient data to find the period of the asteroid. Binzel et al. (2004) reported finding a period of 73.0 ± 0.5 h and a taxonomic class of S.

2007 XH16. This asteroid was observed on three nights, 21-23 December, 2007. Short exposures, 20 s, were required in order to keep the profile of the fast-moving asteroid somewhat stellar. Using 486 observations obtained on 21-22 December (Fig. 1), we found a synodic period of 3.75 ± 0.03 h. Casulli (2007) preliminarily reported a period of 4.1 h based on observations on 22 December 2007. However his data are incomplete, covering only two hours, or about one-half the estimated period. Due to large errors on 21 December, it was not possible to find a definitive relation of the amplitude versus ecliptic longitude. The amplitude on 22 December was 0.54 ± 0.09 (Fig. 2). From this, the S taxonomic classification, and applying the correction for the amplitude at zero phase angle (Zappalá et al., 1990; Pravec et al., 2000), the a/b axis ratio of the asteroid is estimated to be ≥ 1.2. In addition, eighteen observations from 23 December were used to find V-R = 0.513 ± 0.006.

Acknowledgments

Thanks to The Vitae Foundation, MCT (Ministry of Science and technology) and the Institute of Physics of UFBA (IF-UFBA) for supporting the "Discovering the Sky" Project.

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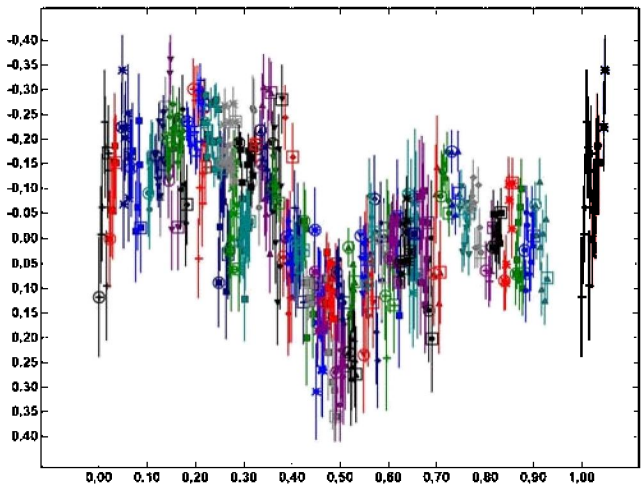

Fig. 1. Differential lightcurve of 2007 XH16. 0% phase corresponds to JD 2454456.490051, corrected for light-time

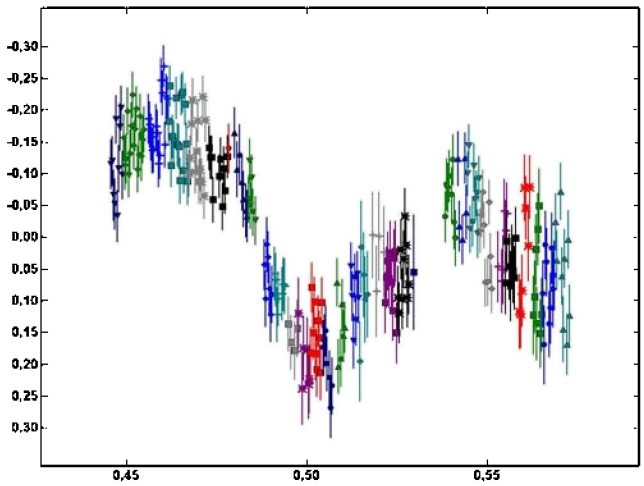

Fig. 2. Differential lightcurve of 2007 XH16 on 22 Dec 2007. The X-axis is + JD 2454457.0, corrected for light-time.