2003-04 WINTER OBSERVING CAMPAIGN AT ROSE-HULMAN INSTITUTE. RESULTS FOR 797 MONTANA, 3227 HASEGAWA, 3512 ERIEPA, 4159 FREEMAN, 5234 SECHENOV, AND (5892) 1981 YS1.

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CCD images recorded in November and December 2003 and January 2004 using the Tenagra 81-cm telescope yielded rotation period and lightcurve amplitude results for six asteroids: 797 Montana 4.55 ± 0.01 hr, 0.28 mag; 3227 Hasegawa 6.536 ± 0.001 hr, 0.29 mag; 3512 Eriepa 6.7824 ± 0.0008 hr, 0.20 mag; 4159 Freeman 4.4021 ± 0.0008 hr, 0.35 mag; 5234 Sechenov 12.067 ± 0.006 hr, 0.22 mag; (5892) 1981 YS1 11.905 ± 0.005 hr, 0.33 mag. We give information on eleven other asteroids that may have long periods or low amplitudes.

Introduction and Procedures

During the winter of 2003-04 seven Rose-Hulman students (Hirsch, Kramb, Kropf, Meehl, Stanfield, Tollefson, and Twarek) and two professors (Ditteon and Kirkpatrick) obtained images with the 81-cm Ritchey-Chretien telescope at Tenagra Observatory in Arizona. The Tenagra telescope operates at f/7 with a CCD camera using a 1024x1024x24u SITe chip (Schwartz, 2004). Exposure times were generally 90 seconds and our images were binned 2 by 2.

Asteroids were selected for observation by using *TheSky* published by Software Bisque to locate asteroids that were at an elevation angle of between 20° and 30° one hour after local sunset. In addition, *TheSky* was set to show only asteroids between 14 and 16 mag. Bright asteroids were avoided because we pay for a minimum 60 second exposure while using this telescope. The asteroids were cross checked with Alan Harris' list of lightcurve parameters (Harris, 2003). We tried to observe only asteroids that did not have previously reported measurements or had very uncertain published results.

Observation requests for the asteroids and Landolt reference stars were submitted by Ditteon using ASCII text files formatted for the TAO scheduling program (Schwartz, 2004). The resulting images were downloaded via ftp along with flat field, dark and bias frames. Standard image processing was done using *MaxImDL* published by Diffraction Limited. Photometric measurements and lightcurves were prepared using *MPO Canopus* published by BDW Publishing.

Observations and Results

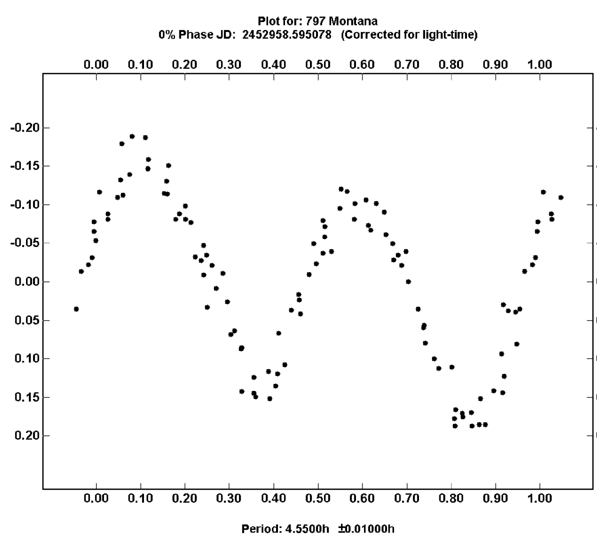
A total of 19 asteroids were observed during this campaign, but lightcurves were not found for all of these asteroids. If an asteroid had a very small variation in brightness or appeared to have a period longer than about twelve hours during the first night it was observed, that asteroid was dropped from further observation. This allowed the maximum number of quality observations with limited funds. The variation in the data for 2235 Vittore and 830 Petropolitana was below 0.1 mag and 0.05 mag respectively, making these difficult targets. Asteroids 580 Selene, 673 Edda, and 1351 Uzbekistania all had variations about 0.1 mag and appeared to have periods near 32 hours or more. Asteroids 5378 Ellyett, 5392 Parker, and 6827 Wombat also had long periods (32+hours). Finally, the data on three asteroids (4618 Shakhovskoj, 21282 1996 TD15, and 5426 Sharp) turned out to be little more than noise. We encourage follow-up observations on these 11 asteroids whose solutions are necessary so as to not bias the total statistical sample of asteroids in favor of only those having short periods or large lightcurve amplitudes.

In addition to the successful results for 6 asteroids reported below, we also successfully observed 1742 Schaifers and 2953 Vysheslavia. These asteroids were observed for Stephen Slivan at MIT for pole position studies and the data have been sent to him for future publication.

All of our data are available upon request.

797 Montana

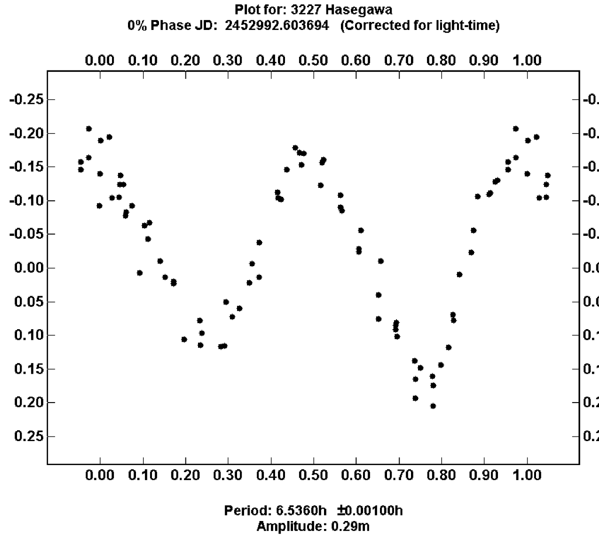
Asteroid 797 Montana was discovered on 17 November 1914 by H. Thiele at Bergedorf. It was named after the Latin word for 'mountain village' in honor of Bergedorf (Schmadel, 1999). We used a total of 110 images taken over three nights: 2003 November 15, 16, and 21. The data reveal a lightcurve with a 4.55 ± 0.01 hr period and 0.28 mag amplitude.



3227 Hasegawa

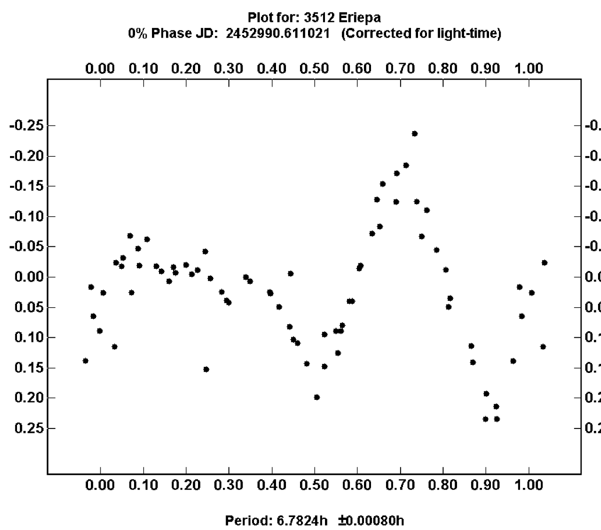
Asteroid 3227 Hasegawa was discovered on 24 February 1928 by Karl Wilhelm Reinmuth at Heidelberg. It was named in honor of Ichiro Hasewaga, editor of the Yamomoto Circulars (Schmadel, 1999). A total of 86 images were taken over five nights: 2003

December 19, 22, 25, 27, and 28. The data reveal a lightcurve with a 6.536 ± 0.001 hr period and 0.29 mag amplitude.



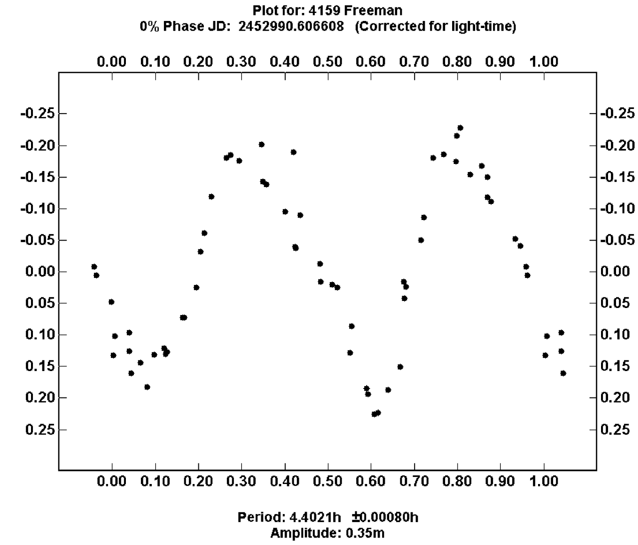
3512 Eriepa

The asteroid 3512 Eriepa was discovered 8 January 1984 by J. F. Wagner at Anderson Mesa who named the asteroid after his hometown, Erie, Pennsylvania (Schmadel, 1999). For this asteroid, 71 images were taken over 4 nights: 2003 December 17, 18, 22, and 2004 January 9. The apparent period of 3512 Eriepa was found to be 6.7824 ± 0.0008 hr with 0.20 mag amplitude.



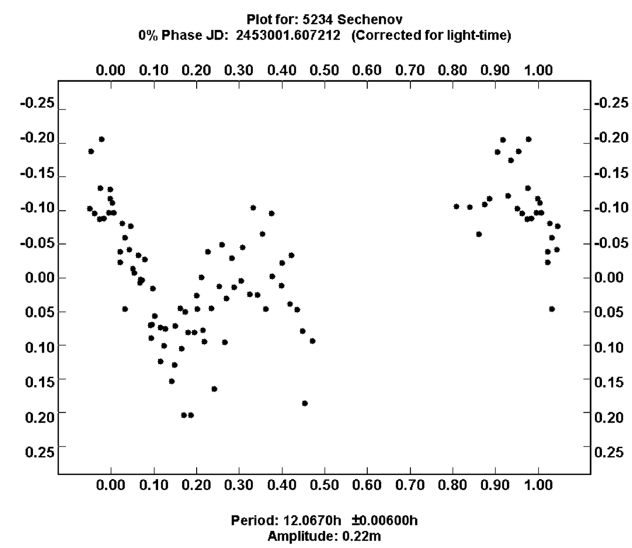
4159 Freeman

The asteroid 4159 Freeman was discovered 5 April 1989 by E. F. Helin at Palomar who named the asteroid in honor of her friend Ann Freeman for her birthday (Schmadel, 1999). For this asteroid 67 images were taken over 3 nights: 2003 December 17, 18, and 23. The apparent period of 4159 Freeman was found to be 4.4021 ± 0.0008 hr with 0.35 mag amplitude.



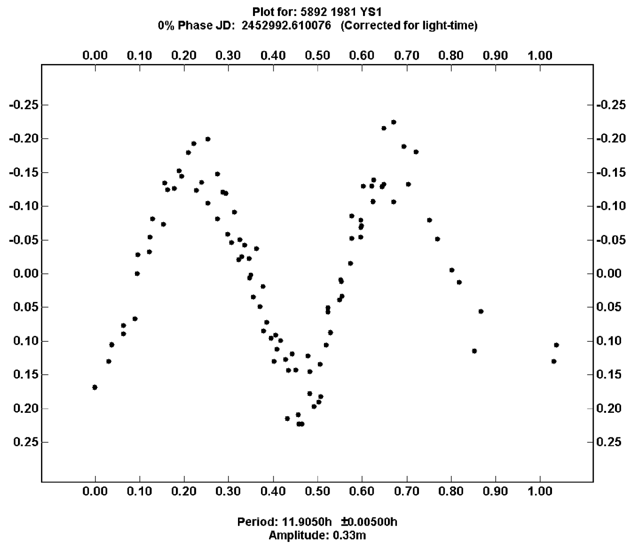
5234 Sechenov

Asteroid 5234 Sechenov was discovered 4 November 1989 by L.G. Karachkina at Nauchnyj. It was named in honor of the outstanding Russian naturalist Ivan Mikhailovich Sechenov (1829-1905) (Schmadel, 1999). There were a total of 92 images collected over five nights: 2003 December 28, 29, 2004 January 9, 10, and 12. The apparent period of 5234 Sechenov was found to be 12.067 ± 0.006 hr with 0.22 mag amplitude. However, the lightcurve is incomplete and we are not very confident of this result.



5892 1981 YS1

The asteroid (5892) 1981 YS1 was discovered on 23 December 1981 at Purple Mountain Observatory in Nanking, China (Schmadel, 1999). We used a total of 101 images collected over six nights: 2003 December 19, 21, 25, 27, 2004 January 10, and 11 in this lightcurve. The period was found to be 11.905 ± 0.005 h with 0.45 mag amplitude. Here again, because the period is close to 12 hours, we are not as confident of the result as our formal uncertainty would suggest.



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Schmadel, L. D. (1999) *Dictionary of Minor Planer Names.* Springer: Berlin, Germany. 4th Edition.

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CCD PHOTOMETRY OF ASTEROID 12753 POVENMIRE

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Main-belt asteroid 12753 Povenmire was observed to have a lightcurve period of 12.85 hours and a brightness variation of 0.50 magnitude during its 2003 opposition. The lightcurve was symmetrical throughout the 3-month observing period, consistent with a simple shape. BVRI photometry measurements yield the following color indices: V–R = 1.34 ± 0.18 (redder than the sun) and R–I = 0.33 ± 0.10 (solar-like), implying a typically red, then flattening spectral curve. The asteroid was 0.3 magnitudes fainter than predicted, suggesting H=12.8 as a revised absolute magnitude.

Introduction

Asteroid 12753 Povenmire is a faint main-belt object discovered in 1993 by Eugene and Carolyn Shoemaker and named to honor Hal and Katie Povenmire. Pre-discovery positions have been established as far back as 1949, which enabled an accurate orbit to be determined. The closest approach to the sun is 2.238 a.u., which will happen during the upcoming 2006 opposition. The farthest distance to the sun is 3.01 a.u., which is the approximate geometry for the 2003 opposition. The asteroid is estimated to have a diameter of 16 km based on its brightness and an assumed albedo. The absolute magnitude is given as H = 12.5 in the JPL Ephemeris, which would yield a brightest V-magnitude of 17.0 during the 2003 opposition. No information is available for brightness variation with viewing geometry since a standard value for G = 0.15 is adopted in the Ephemeris. No color information is available.

Observations

Asteroid 12753 was 2.0 a.u. from Earth at closest approach in October, 2003. At that time its average V-magnitude was 17.6. An asteroid this challenging is close to the limit of amateurs using modest equipment. It was a major learning experience for me since it was my first attempt at asteroid observing.

Nine observing sessions totaling 40 hours were conducted over a 3-month period. A Celestron 14-inch Cassegrain telescope on a German equatorial mount was used with a JMI Smart Focuser, a SBIG AO-7 tip/tilt image stabilizer, SBIG CFW-8 color filter wheel and SBIG ST-8XE CCD. Telescope control was accomplished using MaxIm DL/CCD and MaxPoint. Image analysis was done using MaxIm DL. The telescope was controlled from my office using 100-foot cables in buried conduit that go to a sliding roof observatory. The observing location is at an altitude of 4650 feet, located in southern Arizona.

Because this asteroid is faint it was necessary to perform background subtraction using the star field from images taken before, or after, the asteroid passed through a crowded star field. All sky photometry was used to establish a magnitude scale for V, R and I filter observations. Additional data analysis was performed using QuickBASIC programs written specifically for this project. Quattro Pro and Excel spreadsheet programs were also used.

Near opposition, when rotation-averaged brightness is unlikely to change from one observing date to the next, all-sky measurements were made of nearby standard stars from the Landolt list. Extinction plots were constructed so that small brightness corrections could be applied based on differences in the asteroid's air mass and that for the Landolt stars. CCD transformation equation corrections were not applied, but they are known to be small for this telescope/CCD configuration based on other measurement programs for which transformation coefficients were determined.