**Determining the Rate of Rotation of Asteroid 875 Nymphe.** R. Halvorsen[1] and C. Lacy[2]. [1]Texas Tech Univ. student of Physics and Mathematics, Lubbock, Texas 79406 robert.halvorsen@ttu.edu and Arkansas-Oklahoma Center for Space and Planetary Sciences, Univ. of Arkansas, Fayetteville Arkansas 72701. [2]Arkansas-Oklahoma Center for Space and Planetary Sciences and Dept. of Physics, Univ. of Arkansas, Fayetteville Arkansas 72701.

**Introduction:** With recent advances in equipment and observational techniques, the total number of asteroids with known orbital characteristics has topped 10,000. Of these, only 700 have known rotational periods. The large number of asteroids makes possible a statistical approach their study if a large enough database of their characteristics can be compiled. Furthermore, the relative ease of finding the rotational period of asteroids allows dedicated amateur astronomers as well as professionals to contribute in a meaningful way to the study of planetary science.

**The URSA Telescope:** All observations were taken using the Undergraduate Research Studies in Astronomy (URSA) telescope at the University of Arkansas in Fayetteville, AR. The URSA telescope is a Meade LX200 10-inch f/6.3 telescope equipped with a SBIG ST8EN camera with UBVRI filters. The telescope is run through a web interface and is maintained by Dr. Claud Lacy of the University of Arkansas.

**Choosing a Suitable Asteroid:** A dynamic asteroid database, called AstDys, is available online at the link provided in the reference listing. This database provides current and future observability predictions for all numbered asteroids and was used to find an asteroid for this project.

Asteroids were chosen based on several criteria. Firstly, the asteroid must be in a high position in the sky for the length of the observations. This helps to not only maximize observing time each night, but also allows for the observation of dimmer objects since light pollution and atmospheric effects tend to obscure objects near the horizon. Second, it is favorable to observe an asteroid that is near opposition with the Earth. This will ensure that the asteroid will be as bright as possible at night as well as placing it high in the sky at midnight—a favorable position for the long observations needed to determine its rotational period.

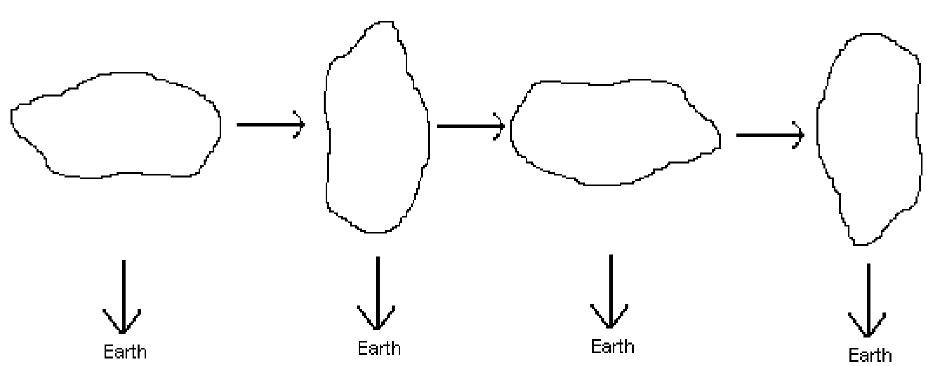
The most important consideration for this project was limitations of the equipment used. Since I was using a 10 inch telescope, the limiting apparent magnitude for any object was around 15. Any asteroids with a current apparent magnitude greater than this would be extremely difficult, if not impossible, to image reliably with the URSA telescope.

The asteroid finally selected for this study was 875 Nymphe, which had an approximate apparent magnitude of 14.4 at the time of observation.

**The Asteroid Light Curve:** Consider an average asteroid. Most know asteroids are not massive enough to compact in to spheres under their own gravity, so they have the appearance of a lumpy, potato-like object. As they travel through space, they rotate due to their own angular momentum of formation and any momentum given to them during collisions. Now, the amount of light reflected by an asteroid is dependant on the surface area available for rotation.

So, as these spinning potatoes pass by Earth, they alternately present faces with large and small reflective surface areas toward us, thus reflecting more and less light towards waiting telescopes (see Figure 1). Then an observation

Figure 1: A Rotating Asteroid presenting a variable profile toward Earth



of the asteroid's apparent magnitude over an extended period of time will oscillate as the asteroid turns. Furthermore, one complete rotation of the asteroid (approximately a bright-dark-bright-dark pattern) can be recorded or estimated to find the rotational period.

Note that if the asteroid is nearly spherical or if the axis of rotation faces the Earth, it will be impossible to find the period of rotation through observational means.

**Processing the Data:** After obtaining multiple images with the URSA telescope, image processing was achieved using the CCDOPS software. To eliminate atmospheric effects, the apparent magnitude of the asteroid was observed only in relation to several nearby stars in the same image. More than one star was used to eliminate the possibility of accidentally comparing the asteroid to a variable star or binary. Using CCDOPS, the differential magnitude could be measured with an accuracy of ±.03. The resulting light curve was then plotted with Microsoft Excel.

**Results:** The plot of the light curve (shown below) with a trend line approximating the apparent shape of the curve gives a period no less than 7 hours. Unfortunately, due to weather and equipment difficulty, only one night of data was collected, so this estimate cannot be narrowed down any further. If future measurements can be obtained, a comparison of several consecutive nights can be used to find a more accurate estimate of the period.

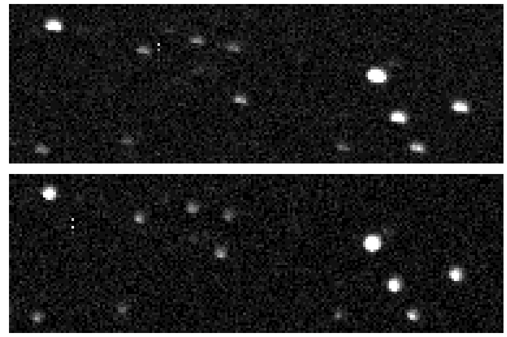


Figure 2: Asteroid 875 Nymphe, Images taken 65 minutes apart

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**References:**

- John E. Hoot - *Photometric Determination Of The Rotational Period of Asteroids* - http://68.5.152.104:800/observatory/asteroid/rotation.html
- AstDys website - http://hamilton.dm.unipi.it/cgi-bin/astdys/astibo