Creating A Light Curve of Asteroid 2000 SO1 Using Original Data

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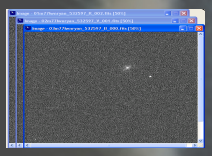
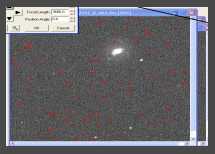
Abstract: Our group of students with the support of educators and astronomers carried out a program to do astrometric and photometric analysis on the asteroid 2000 SO1 with the objective of obtaining a more in depth analysis of this asteroid and publishing light curve data describing the period of the asteroid. We chose our target asteroid using the minor planet center database, choosing an object that would have an acceptable Right Ascension, Declination, magnitude, and air mass for the ARO (Astronomical Research Observatory)-30 inch telescope operated by the SKYNET program. Our journey began with using Astrometrica for the IASC/WISE Program to identify and find new asteroids in the sky and add data to the Minor Planet Center Database. We then used MPO (Minor Planet Observatory) Canopus to form a light curve and conduct a fourier analysis on an example asteroid to familiarize ourselves with the program and used the program again to conduct fourier analysis on asteroid 2000 SO1. The educational goal in mind was to (a) learn the process of collecting and analyzing data using Astrometrica, MPO Canopus, the Minor Planet Center, and SKYNET and (b) create a poster to display the steps used in the process of surveying taken images and the production of a light curve. We collected 300 images a night, while discarding all the corrupted images, until we had enough data to accurately represent the object. Our work was successful due to resources from; Eastern Illinois University's Physics Department, the Astronomical Research Observatory, the University of Chicago's Yerkes Observatory, the SKYNET network, NASA's IASC/WISE (International Astronomical Search Collaboration/ Wide-Field Infrared Survey Explorer), NITARP (NASA/IPAC Teacher Archive Research Program) and Lincoln-Way North High School.

Astrometrica – Defining Location of Asteroids

Three sets of images are loaded. Each "set" represents a group of images that are stacked to produce one picture. The images are taken in a single night and represent a small part of the sky .

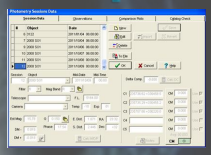




An overlay of all possible asteroids can be reproduced at this point. The images are then placed into a blinker, or a tool that allows the images to be flashed in succession so that asteroid movement may be detected.

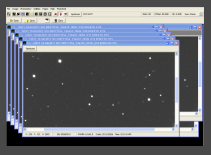
Once blinking, the asteroid that is being observed must be clicked in all three image sets, which will note the click with a red circle around the object. Afterwards, the Right Ascension and Declination of the asteroid is noted and submitted to the Minor Planet Center Database.

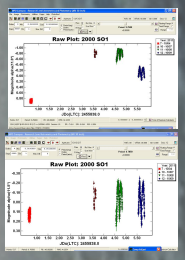
Canopus – Defining Light Curves of Asteroids



For each night of data gathered, there needs to be a new session started. The information entered need to include the name of the asteroid and the date of the photos used for observation.

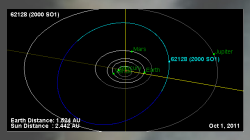
The blinking of images allows the asteroid to be tracked in a way that shows the location of the asteroid, possible reference stars, and conflicts that might occur due to an asteroid passing too close to another star.

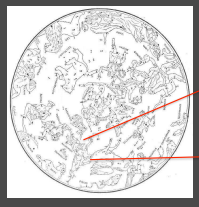




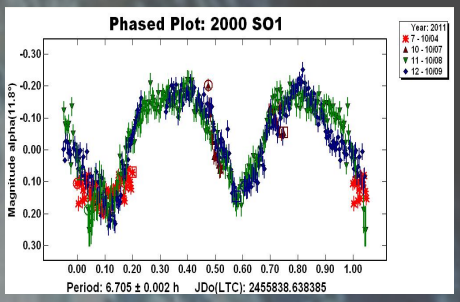
The magnitudes of the asteroids have been plotted on a graph. Using fourier analysis, the data can be adjusted using a variable called the delta composition. The top image shows the graph with raw numbers while the bottom image shows the same data reformatted with the delta composition adjusted.

Asteroid 2000 SO1 October 1-9, 2011 - You are here





Light Curve Data



LWN Pipettes at Work

The Lincoln-Way North Pipettes was formed in September 2010 when science teacher Margaret Piper extended the invitation to explore astronomy possibilities to students who had been in her classes, advisory included. Two students answered the call, and shortly after that, they invited two more friends to join them. As a group, they decided on the group name "Pipettes" , both in homage to their teacher and as a reference to the scientific instrument. The group began work on the Astrometrica program, which used to identify the locations of asteroids, sharing many insightful moments and inside jokes along the way. Towards the end of the 2012-2011 school year, the students(and teacher) began to familiarize their selves with the program MPO Canopus, which focuses on the rotation of asteroids. After a visit to Eastern Illinois University and adjunct professor Bob Holmes, the group dove into the idea of creating a light curve using images that they arranged to gather themselves from remote telescope program SKYNET.

As a result of our research, we discovered that our data supported a rotational period of 6.7 hours for asteroid 2000 SO1. At a point during our research, our research supported a period of 3.35 hours, instead. The difference in periods were related to the numbers used for the orders. The orders used relate directly to the number of peaks and valleys in the graph, with a higher orders leading to more peaks and valleys. The shorter period was supported by data with an order of two, and the longer period was supported by an order of four. By using higher orders that are multiples of both two and four (numbers like eight), the rotational period of 6.7 hours is more heavily supported in the higher orders.

We gratefully acknowledge funding via NITARP