5. Spinning Space Rocks

Investigation

Developed by HOU Leader, Thomas Morin

Rotation Period Of An "AsterSpud"

Objects rotate differently in space. Planets being spherical (like a ball) for the most part spin on an axis with simple symmetry.

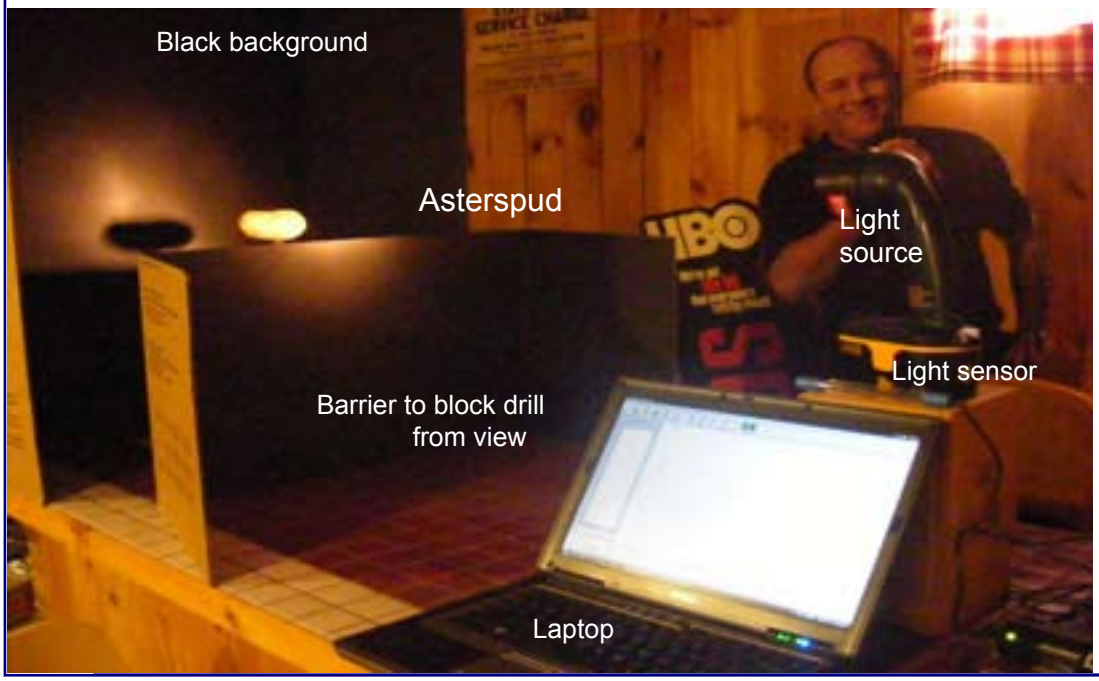
Other objects such as asteroids similarly have axes of rotation but because of their shape can be widely different than spherical such elongated like a potato, ...or a chunk of rock....

In this investigation you use a potato and light sensor to collect data that can help you to determine the time it takes a potato (acting as an asteroid) to rotate around its axis.

This image shows the potato and drill setup. Note the black background. The drill is mounted with the spin axis vertical.

SETUP—this is what you will need:

- A single light source to shine on the potato.
- A light probe and interface connected to a computer to be used as the instrument to collect the data while the potato is rotating.
- A back drop that is dark helps the potato to stand out during the investigation.



This image shows the rest of the setup using the light probe, light source and computer interface.

When you have constructed your “Astro-spud” setup, it is now time to collect data and determine the period of rotation.

Procedure:

Part I:

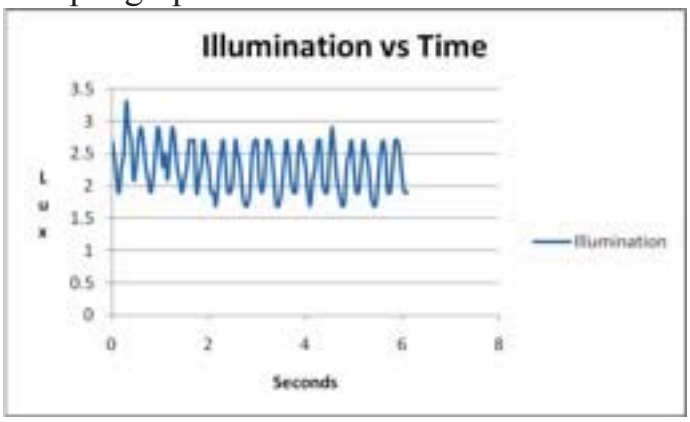
Plot brightness of a rotating object to determine its period of rotation.

1. With the surrounding lights off or low turn on your single light source on to the “Astro-spud”.
2. Make sure that the computer and light probe are connected and the probe is pointing directly at the “Astro-spud” and the correct software (such as Vernier’s Logger Pro or Logger Lite or similar software) is activated.
3. Turn on the drill to a slow rate of rotation so as not to launch the “Astro-spud” from the drill.
4. Keeping the drill turning at a constant rate (that’s where a clamp placed on trigger works well)
5. Start to record the light fluctuations produced as the “Astro-spud” rotates. This should be done for at least 5-6 seconds to collect a fair sized sample. Longer times can work as well.
6. Your data and graph might look like the samples shown here.

SAMPLE OF THE DATA

Time	Illumination
0	2.7
0.05	2.5
0.1	2.1
0.15	1.9
0.2	2.3
0.25	2.5
0.3	3.3
0.35	2.9
0.4	2.7
0.45	2.1
0.5	2.3

Sample graph



7. From your data and constructed graph, you now will be able to determine the period of the “Astro-spud”. The graph is now a signature of what a particular orientation of a rotating object and it can be used to determine other objects that rotate on a similar axis.
8. Questions:
   a. What do you think a graph would look like for the “Astro-spud” if it was spun at a faster rate?
   b. What do you think a graph would look like for the “Astro-spud” when it is spun at a slower rate?
9. Now that you have collected data, and made graphs of a least two different rotational rates, share your results with another team and see if they have similar wave forms as yours.

Part II:

Make a record of different rotational positions.

1. Take your “Astro-spud” attached to the drill and now change the position in which it will spin.

   Example: Turn it towards the probe so it looks like a propeller and collect data at different speeds.
2. After collecting the data and constructing graphs of each different speed, compare these graphs with your first set of graphs and see if you can identify unique the signatures of each.
3. Using your finished graphs, see if other teams can determine the orientation of your “astro-spud”.