Recording Stellar Heartbeats

Plotting Variable Star Cycles

Classroom Activity

Overview

Age Range:

12-16

Prep. Time:

10 minutes

Lesson Time:

2 hours 15 minutes

Cost per activity:

Low (printer cost)

Includes the use of:

Graph paper, ruler, pencil, print outs

Outline

In this activity students will be asked to estimate data from an image and then convert it into a graph.

Students will then need to read data from the graph and consider what this implies.

Pupils will Learn:

- Not all stars are constant, some vary in brightness
- Brightness of stars is measured in magnitude with 1 being the brightest
- Plotting graphs and making estimates based on visuals

Lesson Plan:

Overview of the time required to complete lesson.

Description	Time	Notes
Introduction to the subject	15 min	Variable Stars video: https://www.youtube.com/watch?v=wKXmxQ8KH0A Use apparent magnitude video: https://www.youtube.com/watch?v=9P8Veb_AlJ0
Activity 1	45 min	Link to activity: use pdf Activity1_variablestar and animation1
Assessment	15 min	
Break	15 min	
Activity 2	30 min	Link to activity: use pdf Activity2_variablestar
Assessment	15 min	

Introduction to the subject:

Some stars are variable, meaning they change in brightness over a period of time. Some stars vary because they are pulsing due to internal forces, while others are actual two stars in a binary system. https://www.youtube.com/watch?v=wKXmxQ8KH0A

We can see stars in the night sky and those we see vary in brightness; we measure this brightness in apparent magnitude (m). The lower the magnitude the brighter the star, therefore those that are the brightest have m=1 while the dimmest that we can see with our eyes are m=6. https://www.youtube.com/watch?v=9P8Veb_AlJ0

Activity 1:

- Hand out the first activity sheets, the images of star X Cyg and show the animation of it changing brightness.

Make sure the students understand what a variable star is and how we measure brightness. Point out that to avoid confusion (it seeming like another star) the decimal point is not shown on the image, therefore 53 on the image would be 5.3m when written out and 101 = 10.1m. Remind students that the method used for dating is 'Julian Days' and this should be reflected in their tables.

1. Students should cut out and order the images based on date, shown in Julian Days

2. Complete a table, filling out the estimated apparent magnitude for the star in each image.
3. Then students plot a graph from their table, of magnitude over time, using it to read the stars cycle

Assessment:

- Does the star have a regular cycle?
- What is the cycle period?
- Compare your answers to others, how have your estimates differed? What is the variation in results? What common features do your graphs have?

Activity 2:

- Hand out the second activity sheets, the images of the star.

The activity is similar to the last one, except the students will need to try and locate the variable star themselves.

1. Give students some time to look over the images and see if they can spot which star is variable.
2. After some time ask the students to circle the star they believe is variable and then show the image with the stars labelled
3. Students should estimate the maximum and minimum magnitude of the variable star and try and estimate the star cycle without plotting the graph
4. Show them the light-curve graph for the variable star and see how accurate their estimates managed to be.

Assessment:

- You will be shown the stars magnitude-time graph, how many cycles are shown?
- Compare your max. and min. magnitudes, how accurate was your estimate?
- How precise were your visual estimates?
- Justify why this is or is not a reasonable method for calculating variable stars cycles

Background Resources:

The expected graph for activity 1 can be seen on the following page, along with the labelled image of the stars in activity 2.

Julian Days - https://keisan.casio.com/exec/system/1227779487
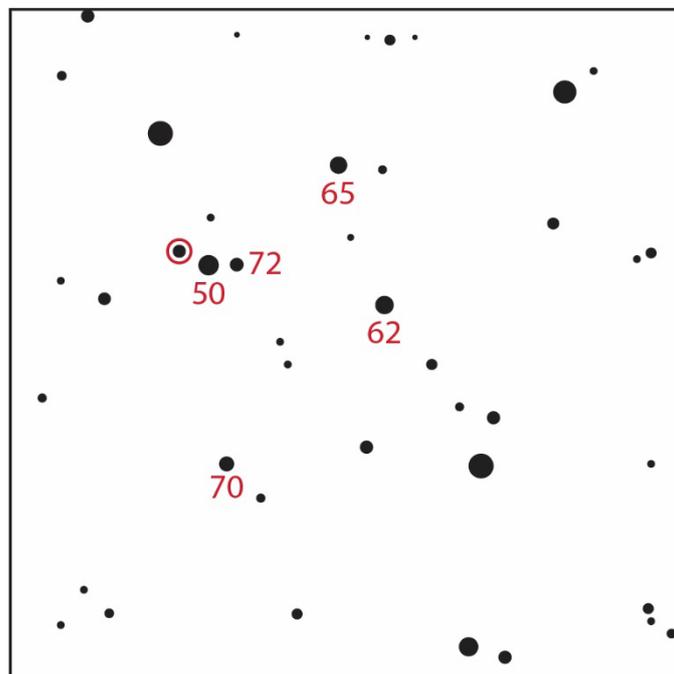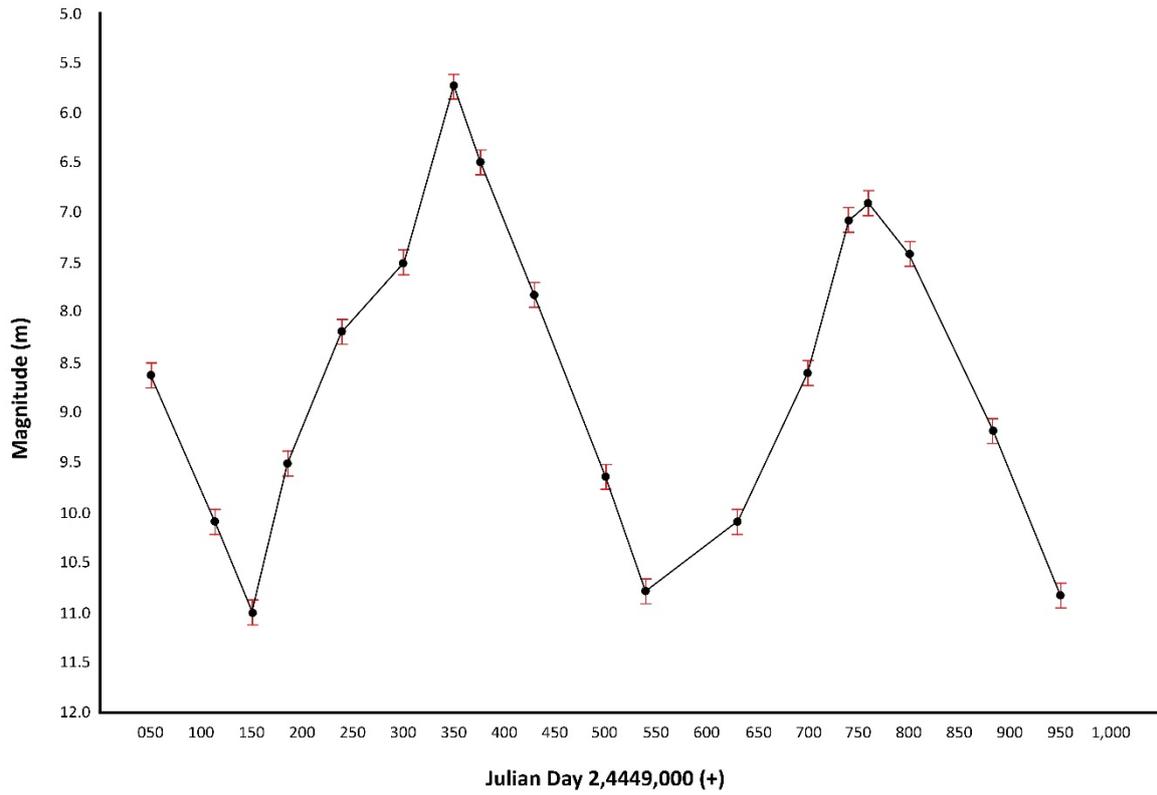
Based on the Chandra activities, available at http://chandra.harvard.edu/edu/formal/variable_stars/

The online observatory collaboration consists of the following partners:
Baldone Observatory, Brorfelde Observatory, Cardiff University, Harestua Solar Observatory, Helsinki Observatory