

# Mission Gravity: UNCERTAINTY

60  
MINUTES

PHYSICS YRS 11-12

## MATERIALS:

Pens, Data Lab Manual\*, Mission Guide\*, Mission Gravity Slides\*,  
Lenovo Mirage Solo with remote\*\*

## VCE Physics Curriculum Links:

Unit 2, Area of Study 2, Outcome 2.1 incl. Data analysis  
Uncertainty and Approximation (within Maths Subjects and Physics assessment)

## LESSON OBJECTIVES

- Framing the experimental question;
- Observations of stellar properties over time;
- Derive a trigonometric relationship for angular diameter
- Examine use of small angle approximation
- Graphical analysis of non-linear data
- Develop a model for the acceptable range of a small angle approximation
- Understanding that stars can become different remnants at the end of their lives

## DIFFERENTIATION STRATEGIES TO MEET DIVERSE LEARNER NEEDS:

Differentiation will be based on year level and student comfort with the technology. Teacher does an informal assessment of knowledge at the start of the lesson to determine how much content the degree to which the students require more direction.

## ENGAGEMENT

The purpose of these questions is to allow the students to share their understanding with their peers and leader and to subsequently think about what learning could be new to them.

- Why is it important to understand stars?
- How can we measure the size of something in the sky? Can right angle trigonometry assist us?
- How are the size of an object, its distance, and its apparent size in the sky related?

\* These resources are available in digital form for download

\*\* In lieu of VR, the Mission Gravity program can be accessed through a browser based version

## EXPLORATION

In this portion of the lesson, students will have the opportunity to make observations of stars at various ages and collect data on their physical properties.

- How can we investigate a star's size? What do we measure? And how do we measure it?
- What type of relation would we expect between the apparent size and the true size of the star?
- Show students how to travel to stars in the VR and review how to make observations
- Allow students directed time to use the VR realm to make observations. This time will require the teacher to provide cues for maneuvering and observing in VR.

## EXPLANATION

- Allow students to use their observations to make general statements about their star's lifetime and fate
- Allow students to graphically express their data relating angle, distance, and size
- Allow students to calculate the size using trig model and small angle approximation model
- Allow students to mathematically model the data and study the point at which the approximation fails
- Guide students about the relevance of their fit parameters.
- What happened at the end of the star's life? What did it become?
- Teachers will assist students in the graphing and analysis of their data is needed

## ELABORATION

- After developing group models, groups will share their models
- Introduce key words: Angular Diameter; Small Angle Approximation
- Relate this approximation to the known system of a pendulum
- This knowledge allows students to comprehend the difficulties associated with studying stars. Understanding them helps understand our sun. Also allows for progression of technology in society by development of technologies to support difficult detections.

## EVALUATION

- Students will now use their model to test a star of 'unknown' size and will have to determine which method of calculation is more valid
- The engaged teacher will rotate around to student groups to ask questions about their work during the entire process.
- If time allows, a pre- and post-incursion set of content questions can be provided to evaluate content gains
- If time allows, a pre- and post-incursion set of attitude questions can be provided to evaluate attitude toward scientific process and experimentation