# Mission Gravity: GRAVITATION

60 – 90 MINUTES

PHYSICS YRS 11-12

LESSON PLAN: MISSION GRAVITY

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
Unit 3, Area of Study 1, Outcome 1

## LESSON OBJECTIVES

- Framing the experimental question;
- Observations of stellar properties over time;
- Develop a relationship between mass, orbital acceleration, and orbital distance for orbital motion
- Observe the curvature of objects moving near a star
- Graphical analysis of non-linear data
- Develop a model for the mass of a star based on orbital motion
- 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?
- What do you know about Jupiter and its moons?
- What are some properties of the gravitational field?
- How can we investigate the gravitational field of a massive body?
- What are the characteristics of objects in orbital motion (forces, acceleration, velocity)?

* These resources are available in digital form for download
** In lieu of VR, the Mission Gravity program can be access through a browser based version

# LESSON PLAN: MISSION GRAVITY

## 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 mass? What do we measure? And how do we measure it?
- What type of relation would we expect between the stellar mass and the orbital acceleration? Mass and orbital distance?
- 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 orbital distance and acceleration
- Allow students to mathematically model the data using inverse square relations
- 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 linearization of their data if needed

## ELABORATION

- After developing group models, groups will share their models
- Introduce key words: Newton's Law of Gravitation
- 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' mass and compare to a 'known' answer
- 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