Astrophysics For All

An in-depth investigation on how advanced theories on gravitational behaviour can be taught in the grade school classroom.

The purpose of this project is to show how astronomy and astrophysics can be integrated into the grade school curriculum through the development of easy-to-understand and fun experiments that are appealing to grade school students.

Due to the extraordinary breadth of the subjects of astronomy and astrophysics, I have decided to focus my investigation on one particular topic: gravity. I have developed the following problem to answer in my investigation:

What are the theories of gravity, their applications to the universe that we live in, and how can we integrate these theories into the grade school curriculum.

Stemming from this problem, I first did my preliminary research using a variety of resources including scientific periodicals, astronomy and physics textbooks, library books, and interviews with university students. From this research, I developed a comprehensive understanding of the following topics and equations which have been summarized below:

- Newton's Gravity Equations
  - $F_g = mg$, $F_g = G(m_1m_2/r^2)$
  - Describes the force that gravity applies on objects
- $a = 2\Delta d/(\Delta t)^2$
  - Describes the acceleration of freefalling objects
- Einstein's General Theory of Relativity
  - Describes how gravity affects the curvature of space
- Black Holes
  - $R_{sch}=2Gm/c^2$
  - Incredibly dense masses where gravity is extraordinarily strong

From this newly acquired knowledge, I developed the following easy-to-understand and fun experiments for grade school students:

- Water Balloon Experiment
  - Students would take turns dropping water balloons out of a window to measure how gravity accelerates the balloons towards the ground
- Table Cloth Experiment
  - Students would hold a table cloth above the ground and use it to simulate how space curves around objects by placing objects onto the cloth and seeing how the curvatures of the cloth changes.
- Black Hole Experiment
  - Students would use the Schwarzchild formula to discover how massive black holes would be at different radii and would compare them to the density of everyday household objects.

I have found that teaching advanced astronomical concepts can be made very simple with creativity. With these experiments, I hope to take the first step in exposing students to the exciting world of astronomy and astrophysics so that they too may begin enjoying these subjects.