CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S1811

Project Title

A Mathematical Study of the Effects of Magnetic Fields on Cosmic Radiation

Abstract

Objectives/Goals

The goal of this study was to understand and develop a mathematical and computational model of a typical cosmic radiation particle as it travels through time changing magnetic and electric fields.

Methods/Materials

Using Maxwell's equations and the Lorentz Force Law, equations for a particle path in three different fields situations (Uniform Magnetic Field & Zero Electric Field, Uniform Magnetic and Electric Field, Non-Uniform Magnetic Field & Induced Electric Field) were derived. A MATLAB program was developed to create a visual 3D model. The model was tested both by hand and computationally using random data sets.

Results

While there is a slight numerical error due to the use of approximation in anti-differentiation, the program was successful in modeling the path of a proton through a magnetic and electric field.

Conclusions/Discussion

In conclusion, I was able to develop a mathematical and computation model of a cosmic radiation particle through magnetic and electric field. This effectively set up a method to test different magnetic field shapes to find optimal shielding from cosmic radiation particles, which would be the ultimate goal in future projects.

Summary Statement

I was able to derive/create a mathematical and computational model of a cosmic radiation particle path as it travels through magnetic and electric fields.

Help Received

I was fortunate to have Dr. Ameesh Pandya (Professor at UCLA) check my MATLAB code for logical errors.