CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
S1708

Project Title
Predicting and Analyzing Coronal Mass Ejections

Abstract

Objectives/Goals
My objective was to predict and measure Coronal Mass Ejections (CMEs). I plan to develop and implement an algorithm generated from an Excel graph, that spans an entire solar cycle, which will enable us to better predict and analyze images of CMEs. I will also utilize the engineering program MATLAB in order to analyze images of CMEs taken by the SOHO satellite and determine the amount of ionized gas ejected by the CME, analyzing patterns in the cycle to make predictions.

Methods/Materials
Materials:
1. Microsoft Excel
2. MATLAB (Student Simulink Toolbox)
3. Laptop
4. SOHO/LASCO CME Catalog
5. Various CME images

Procedures: Part 1 - More than 10 tests, to input data, determine correct graph and algorithm. 1. First log all dates (from SOHO/LASCO CME catalog) , including missing ones, number them and label the amount of occurrences next to that numbered date. 2. Generate and add a trend line to the graph. Part 2 - Tested 5 different times to refine the program and the image. 1. Open up MATLAB Simulink Toolbox 2. Make the white-pixel program. 3. Run the image through the program. 4. Find the average amount of gas ejected per pixel.

Results
From the analysis of the data provided, I determined the presence of a pattern in CME occurrences. The trend shows the sun to be more active during the middle of the 11 year cycle. The sun became less active as it exited the solar cycle, with some days having no occurrences at all. Though the program I developed is far from complete, it handles the basic task of calculating white pixels in analyzing a photo of a coronal mass ejection. This makes the amount of ionized gas ejected into space much easier for astronomers and astrophysicists to analyze.

Conclusions/Discussion
In conclusion, my hypothesis proved to be correct.The data I was able to generate showed a pattern and a rough equation, estimating the amount of occurrences in one day. I was also able to successfully create a rudimentary program that will enable scientists to calculate things even faster than before.

Summary Statement
In this project, I attempt to predict the occurences of CMEs using an algorithm based on the data from an entire solar cycle, as well as analyze an image of a Coronal Mass Ejection with MATLAB.

Help Received
Thank you to my parents for helping me to edit and go over my report. Thank you to Dr. Cozean for aiding me in my project design.