



Colorado Science and Engineering Fair

2024 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: An Analysis of the Coronal Temperature Spike using Solar Spectroscopy

Finalist's Name: Alexander Diener

School and City: Fairview Highschool, Boulder

Sponsor's Name: Sarah Bruce

Category: Physics & Astronomy (PHYS)

Division: Senior (9th - 12th grades)

Abstract (250 words or less):

What is the cause of the coronal temperature spike? We know that the layers in the sun start with the Core at 15 million Kelvin(MK). The temperature then continuously cools down until the Photosphere at 6,000 Kelvin. From the Photosphere, Chromosphere, Transition Region, and out to the Corona, the temperature spikes up to 4MK. Identifying the mechanism(s) that drive this pattern has been a goal of solar physicists for decades, thus, my goal is to find a pattern in the spectral plots gathered that could indicate a reason for the spike. Researchers collected the sun's spectra and color image data in Australia during the April 20th, 2023, solar eclipse. I took these data and condensed each spectral line in the spectra into a single pixel with the average brightness value of the line. Using Python I then graphed the brightness intensity on the y-axis (unitless) against the wavelength the spectral line was at on the x-axis (\AA). Next, I made a random value generator based on the normal distribution and plotted the points it generated on the spectral plot to simulate the noise other celestial objects might emit. The overall layout of the graph is expected and the general variations are a function of the corona's spectra. However, I noticed that the higher the temperature, the more deterministic the graph becomes. This observation is a possible pattern that I will explore in the spectral plot of the April 8, 2024, solar eclipse. If the cause of the coronal temperature spike is found, it could lead to a better understanding of coronal mass ejections which can damage electronics unprotected by the earth's magnetic field.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Alexander Diener

Date:

2/28/2024

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.