CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
J1808

Project Title
The Muon Detective

Abstract

Objectives/Goals
To build a working particle detector and test for baseline particle count flux based on elevation and protected locations such as caves and overpasses with sufficient density to shield levels of particle bombardment. I was inspired by a National Geographic article where scientists were able to identify a hidden chamber at the Great Pyramid in Giza. Using muon detectors they found anomalies in particle count which identified a hidden void in what should have been solid stone. I built a detector using the CosmicWatch website and collected data at specific locations to establish a baseline particle count. Once a baseline was established I tested locations to identify the effects of particle flux with shielding as a factor such as in a cave or under a highway overpass.

Methods/Materials
The components and software to build a working particle detector. Once the detector was built and tested, I monitored particle counts at locations in various conditions and at different elevations. I determined averages for each location and identified any anomalies which did not correlate to the predicted condition/elevation. After learning all of this, I used the detector to do home experiments with different materials (plastic, water, gravel) to model potential shielding options.

Results
Elevation and density of ceiling (inside of a cave or under a highway overpass) did affect the count. Higher elevation equaled higher count and a thicker density of ceiling equaled a lower count. Weather was also a factor. Heavy rainfall equaled a slightly lower count and snow equaled a slightly higher count. There were also specific days that experienced higher counts which seemed to coincide (plus or minus a day) with solar flares. Temperature and time of day were not factors.

Conclusions/Discussion
After monitoring and recording counts at locations, I created a predictable model which helped determine profiles for locations as well as ideas for shielding people from major cosmic ray events. From these results, I eliminated certain variables that I originally thought might affect average count. I also discovered an anomaly in my local area with a higher than expected average count that could be attributed to background radiation from a power plant.

Summary Statement
I built a working particle detector and tested locations based on elevation and conditions to determine average particle bombardment levels as well as investigated particle shielding materials.

Help Received
My parents helped with muon detector build and drove me to the data collection locations. Tyler Hooker at the HSU Physics Dept assisted with software and troubleshooting.