COLLEGE OF SCIENCE
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Research Horizons Day & Research Week April 11-14, 2017

Research Horizons Day

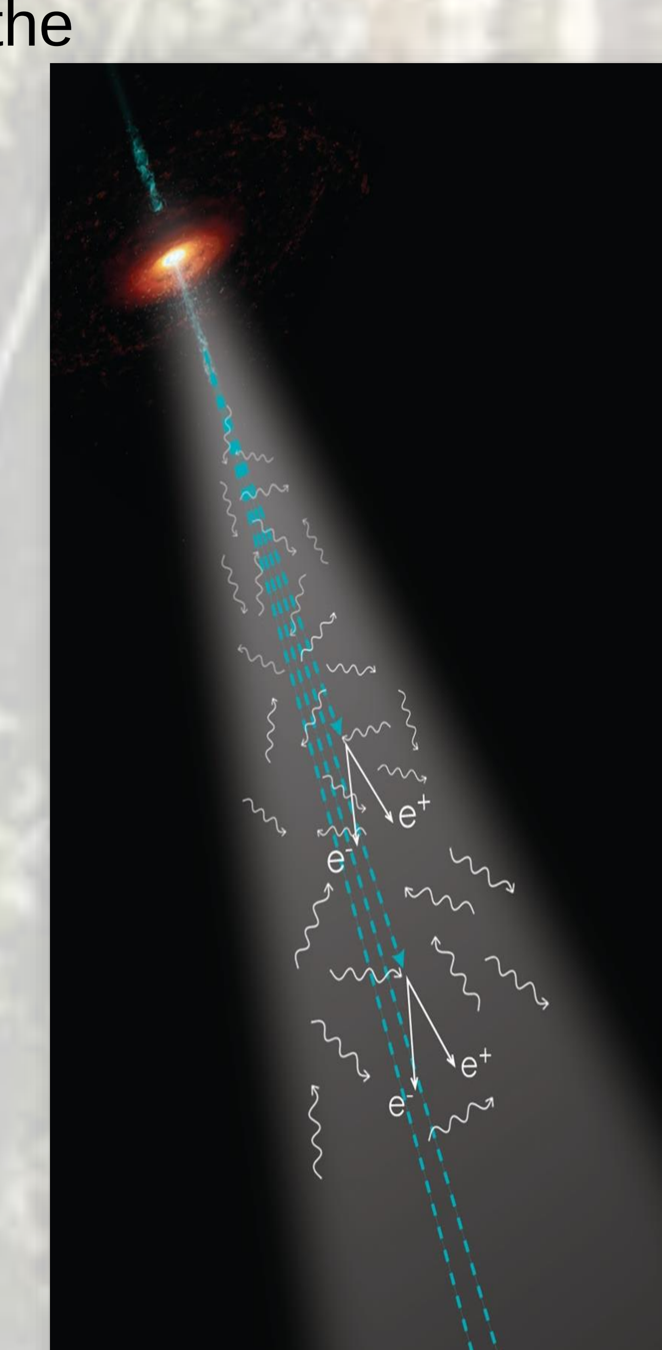
Physoon High Altitude Radiation Detection

E. Cavanaugh, C. Helmerich, T. Jemison, J. Kim, J. Miller, E. Pradhan, S. Widmier, C. Wolfe, Dr. F. Wessling

Department of Physics and Astronomy, College of Engineering

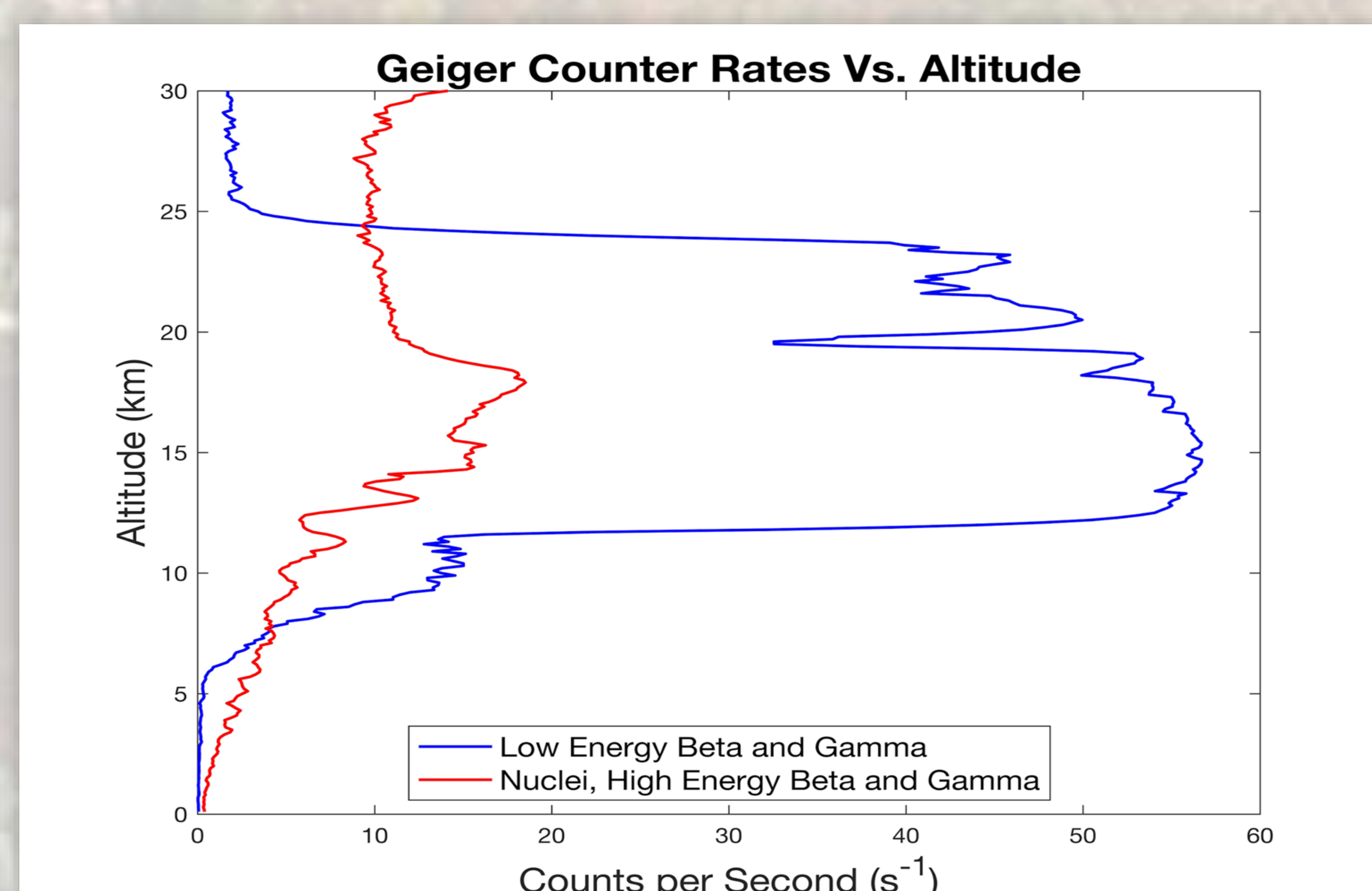
Overview

The Earth is constantly being bombarded with high energy particles known as cosmic rays. Most of these particles, composed of protons and atomic nuclei, never make it to the surface of the Earth thanks to the atmosphere. The purpose of Physoon is to ascend to high altitudes to detect both cosmic ray particles and their secondary particle showers, mostly beta and gamma particles that are created when the cosmic rays interact with the gases in the atmosphere. The method of detection consists of three Geiger counters, each designed to detect energy particles. Ionized gases in the Geiger counter tubes cause a cascade of electrons, which is observed as an electric current. Each of these ionization events, or counts, signifies the detection of a particle. The number of these counts per second is stored in an SD card in the payload.



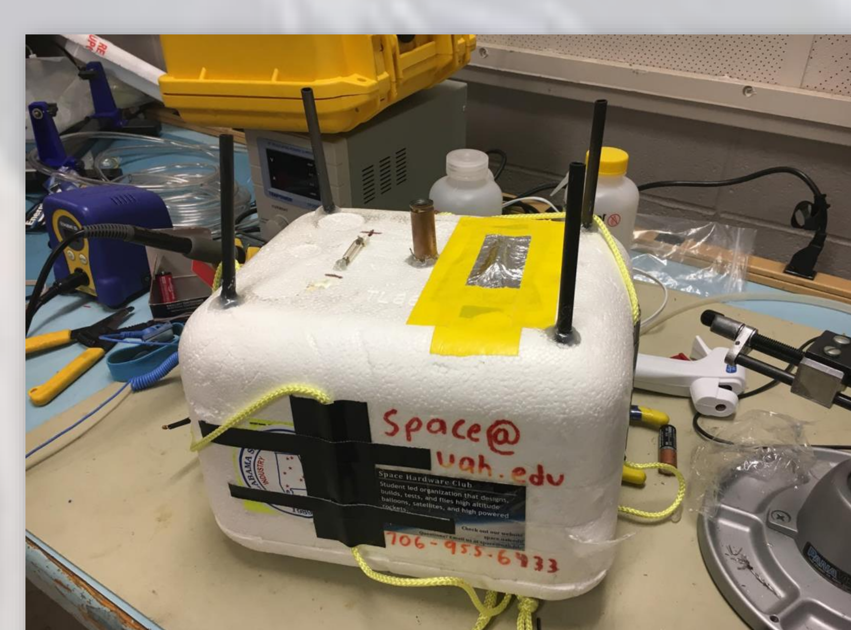
Current Findings and Impact

The graph below displays the recorded radiation values from our flight. Lower energy beta particles and gamma rays, shown in blue, are mainly composed of secondary particles from cosmic ray interactions. Their count rate is a balance of atmospheric density and exposure to cosmic rays from space. The rates are also effected by composition of the gases throughout the atmosphere. Counts of cosmic rays themselves and some higher-energy secondary particles, shown in red, increase with increasing altitude. We compared our results to other similar experiments, and we found that we share the same anomaly in low energy at ~15-20km. The data gathered with Physoon can be used to determine the properties of different layers of the atmosphere under different conditions.



Implementation

In order to protect the Geiger counter electronics from the sub-zero temperatures at high altitudes, a Styrofoam box was used to retain heat. Since the Geiger counter tubes have to be exposed to the outside to detect particles, carbon fiber rods were attached to the outside corners to protect the Geiger counter tubes from breaking or taking damage upon landing.



Future Goals

Physoon will be sent on several more flights in the coming months in varying conditions, including the Great American solar eclipse. With more flights, more information can be gathered and compared from different times of day, different seasons, and different durations of flight. Additional flights also give the opportunity to verify the data collected and to improve detection methods. The payload will be upgraded with more efficient Geiger counters to decrease weight and increase count accuracy. More intensive data analysis will also be implemented to handle the improved data.

Acknowledgements

Dr. J. Miller, Physics Dept. Chair
Dr. T. Chronis, Physics
Dr. Wessling, Engineering

[1]Brouwer, L., et al. (2012, July). "Cosmic Ray Detection with Three Geiger Detectors."

SPACE HARDWARE CLUB
THE UNIVERSITY OF ALABAMA HUNTSVILLE

COLLEGE OF SCIENCE
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE