Radiation Detection in Various High Altitude Environments

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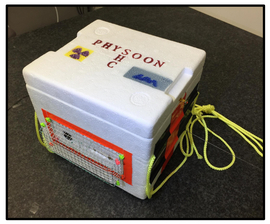
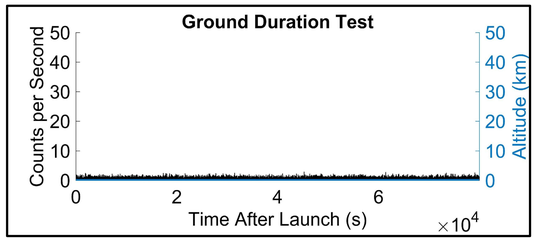
Overview

Physoon, a high altitude ballooning payload, was designed and built by students to investigate cosmic and terrestrial sources of high-energy radiation. Of particular interest are events called terrestrial gamma-ray flashes (TGFs) and gamma-ray glow, both of which occur in thunderstorms.



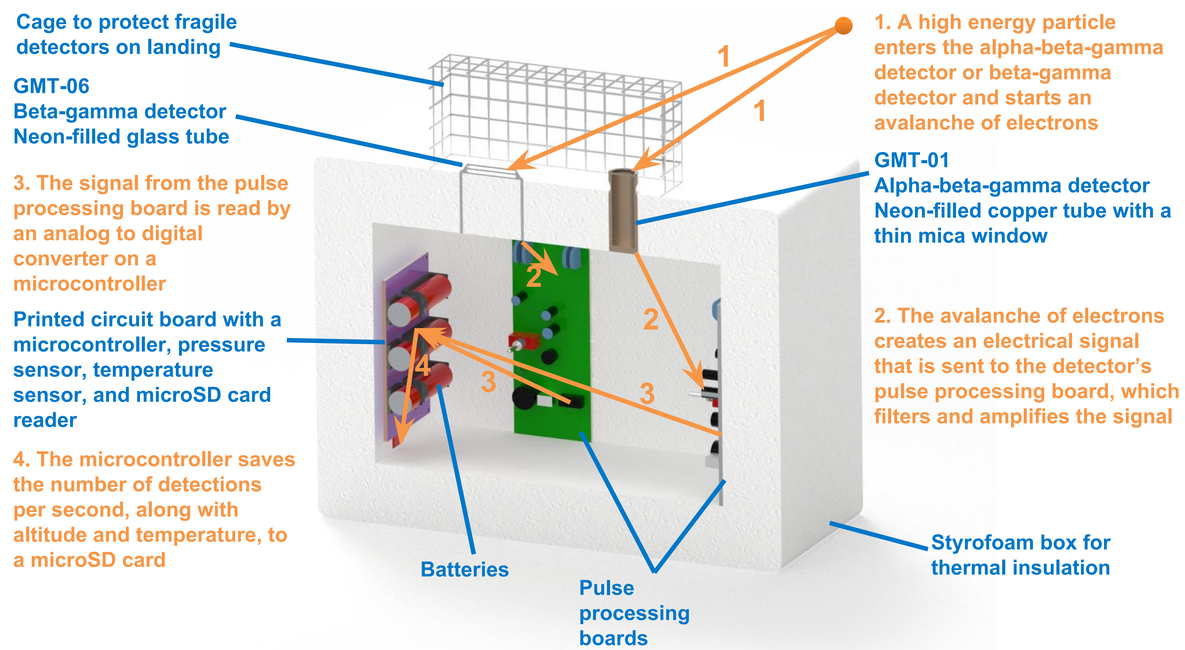
Physoon has flown above thunderstorms, through thunderstorms, in the totality of The Great American Solar Eclipse, and during sunny daytime conditions as a control. These flights can help advance the understanding of the different physical processes that lead to increased radiation from thunderstorms.

Testing of Instrument



In addition to drop tests and rain tests, we performed a 24 hour duration test to verify the operation of the instrument. The instrument was left running on the ground in a low radiation environment.

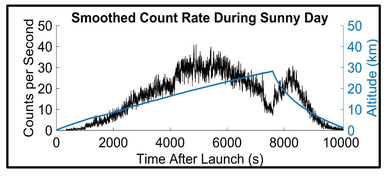
Instrumentation



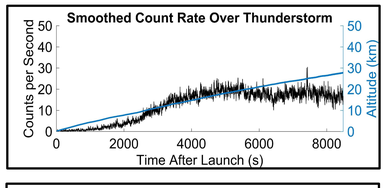
Radiation Data

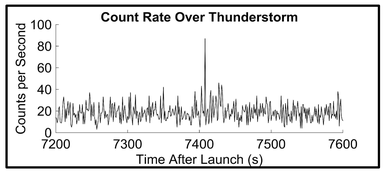
Alpha-Beta-Gamma

Flight 1

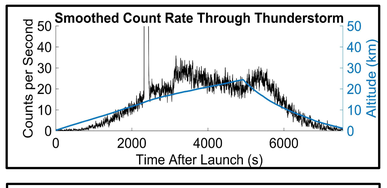


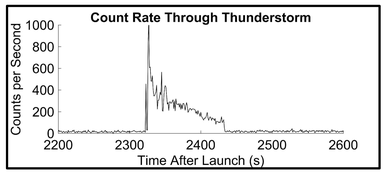
Flight 2





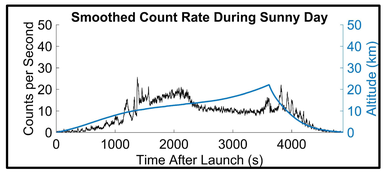
Flight 3



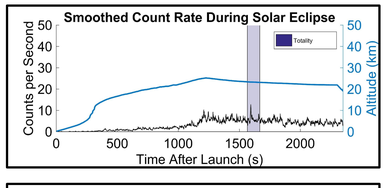


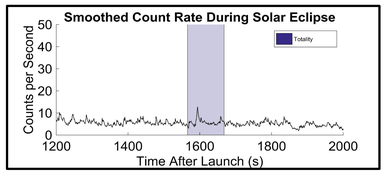
Beta-Gamma

Flight 4



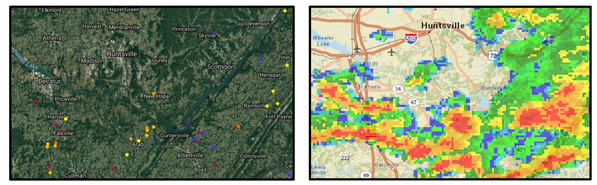
Flight 5





Verification of Data

Radiation events were cross checked with satellite data from SWIFT and FERMI to confirm the events were not of extraterrestrial origin. Event time stamps were correlated with nearby lightning strikes and radar maps. When comparing with control data taken during the sunny day flights, this suggests the high energy radiation events are due to thunderstorm activity.



Conclusions

Due to the promising results from several Physoon flights, a new project named "HELEN" has been formed. HELEN will consist of three payloads with onboard scintillation material and accurate timing to gather spectra, neutron rates, and location information of these events in thunderstorms.

Acknowledgements

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