COLLEGE OF SCIENCE
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

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Research Horizons Day

High Energy Lightning Emission Network (HELEN)

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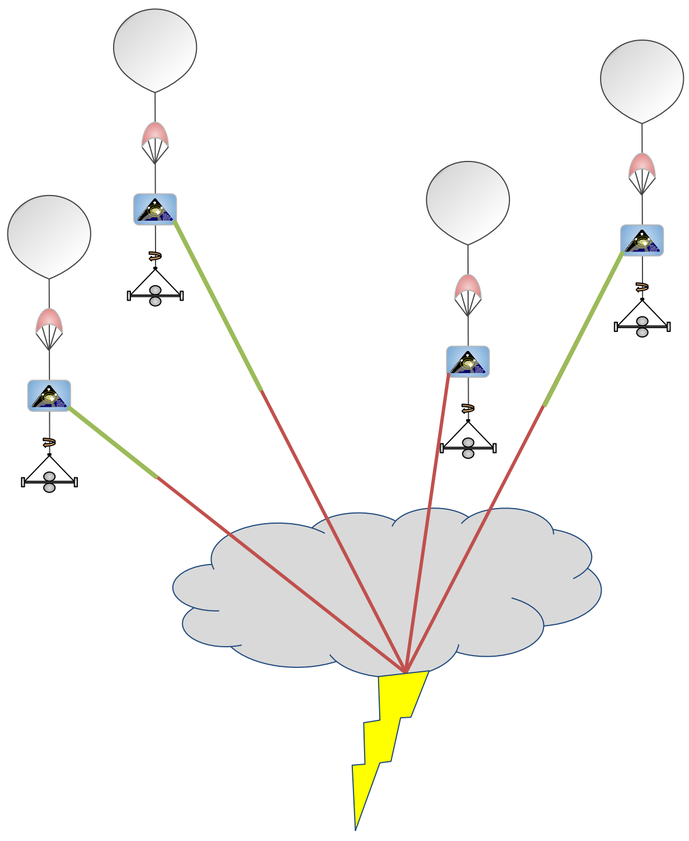
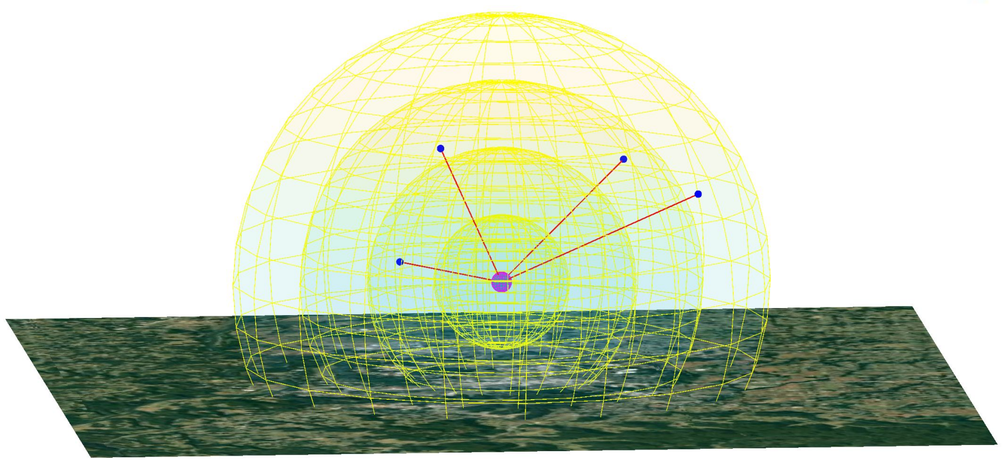
Introduction

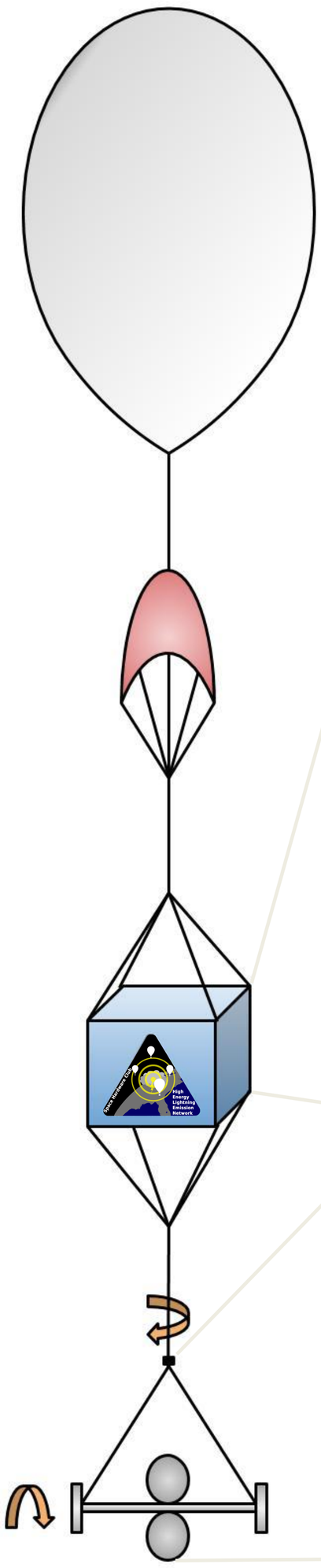
HELEN is a network of high altitude balloon payloads designed to investigate terrestrial gamma-ray flashes (TGFs). TGFs are intense bursts of gamma-rays that have been spatially and temporally correlated with lightning. The exact method of TGF formation is currently uncertain, though there are several models that describe this process. The study of TGFs is a relatively new field of science, and has primarily relied on satellite and ground observations. HELEN is proposed to assist the in the aerial study of TGFs using radiation and electromagnetic field measurement payloads, which will allow detection of any low energy TGF events that usually go unobserved.



Simulations

A simulation of TGF propagation was written in MATLAB to determine the necessary timing resolution to accurately locate a TGF. Location determination will be done through a process called multilateration, which depends on the time difference of arrival of the event at each payload and the payloads' locations. The simulation can compare the location errors for different resolutions of the time differences and for different payload location configurations, allowing system requirements for data acquisition speed to be created.



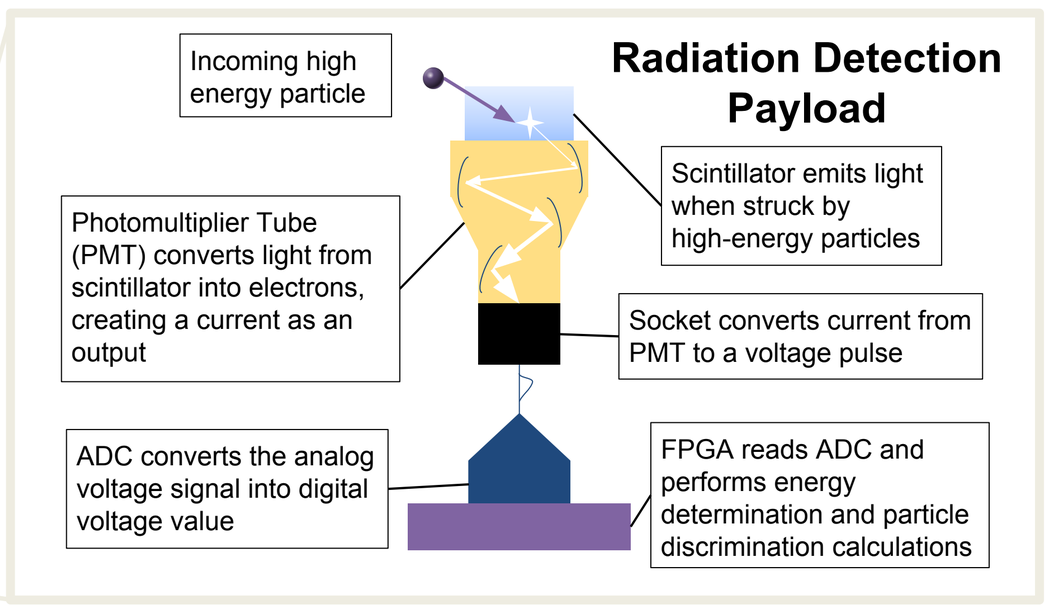


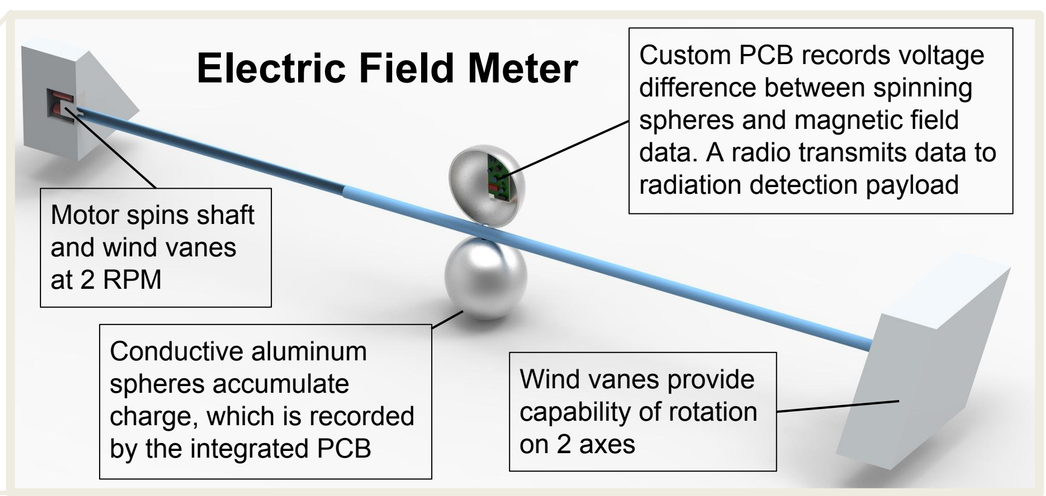
Science Mission

Four balloons will be flown, each carrying a radiation detection payload (RDP) and an electric field meter (EFM). The radiation detection payload will collect a time stamped energy spectrum and neutron flux from a TGF. Additionally, the electric field meter (EFM) will measure the electric field strength of the thunderstorm that produced the TGF. These measurements will fulfill the following science objectives:

- **Verify** pre-existing models of TGF formation
- **Calculate** the location of TGFs
- **Determine** the bounds on the TGF cone of emission
- **Correlate** the photon flux and energy spectrum of the TGF with the measured electric field strength of the thunderstorm
- **Correlate** the location of TGF with the location of lightning
- **Determine** the neutron flux due to TGFs

Instrumentation





Conclusions

HELEN will provide a cutting edge platform for observing TGFs. The prototype payloads are currently being developed and tested. The first prototype radiation detection payload has already been flown on a test launch at an outreach event and gathered valuable data. Along with being a scientific asset, the HELEN project will be used for more College of Science outreach events at local high schools.

Acknowledgements

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