

CosmicEye

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A Gamma Ray and Cosmic Ray Detector for Outreach

Abstract

While astrophysical gamma rays and cosmic rays do not reach the ground, they generate a shower of particles when they interact in the atmosphere. This shower then generates a brief, but bright, flash of Cherenkov light. The detection of this Cherenkov light is often performed with imaging atmospheric Cherenkov telescopes (IACTs) which are incredibly large and sensitive instruments. I am developing a small-scale implementation of the IACT technique which can be used for outreach called CosmicEye. This inexpensive (expected to be ~\$500) device will be usable on clear dark nights to detect the signatures of gamma rays and cosmic rays. It will consist of two silicon photomultiplier pixels each at the focal point of a parabolic mirror. With proper setup, the device will trigger on Cherenkov light from gamma rays and cosmic rays. While focused for outreach, this device is designed for real astrophysics observations. I present the concept for this project and ideas for its use engaging with local students and amateur astronomers.

Materials

Electronics:

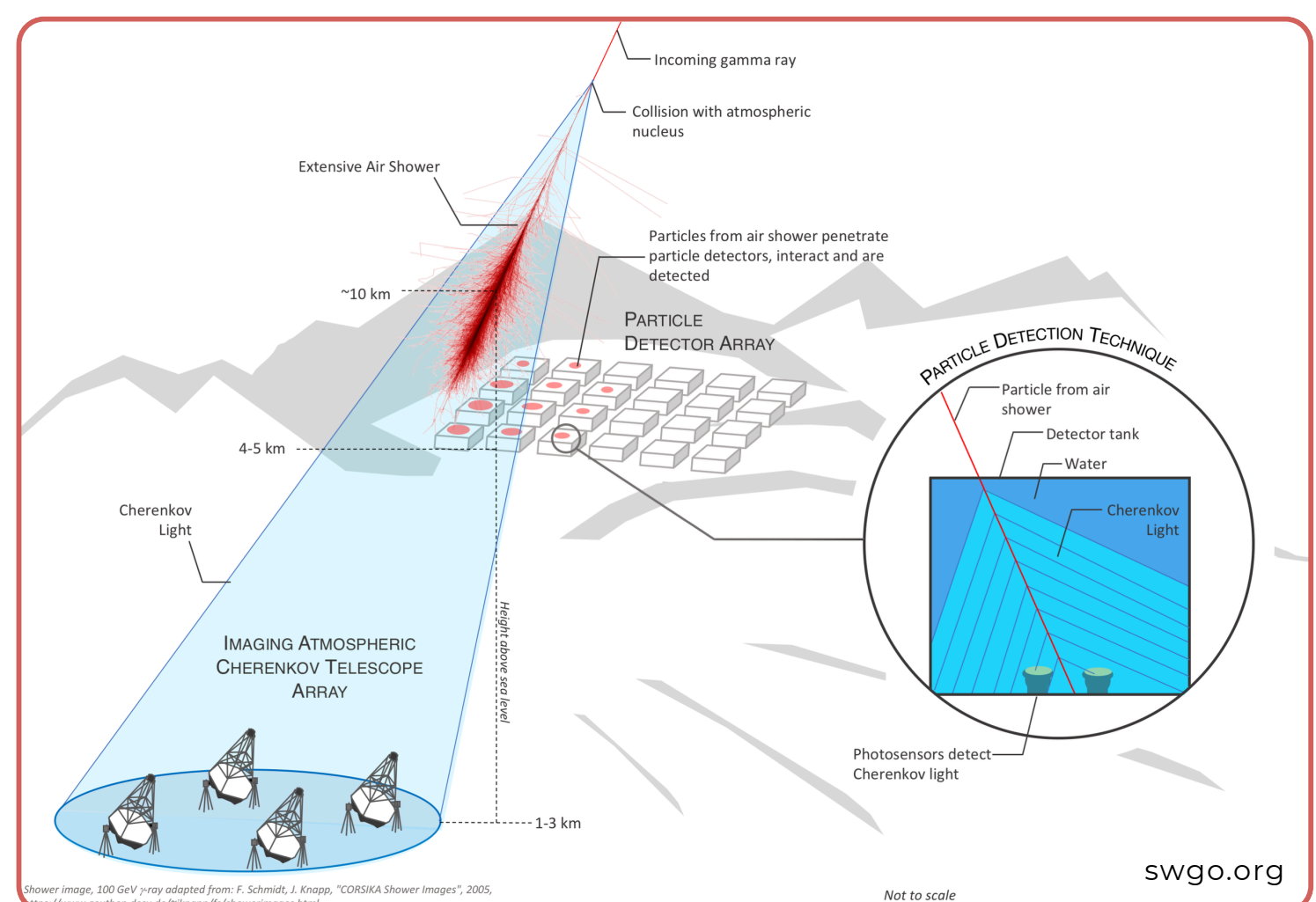
2x modified CosmicWatches [1], 2-channel oscilloscope, 2+ channel coincidence trigger, BNC cables

Optics

2x acrylic parabolic mirrors

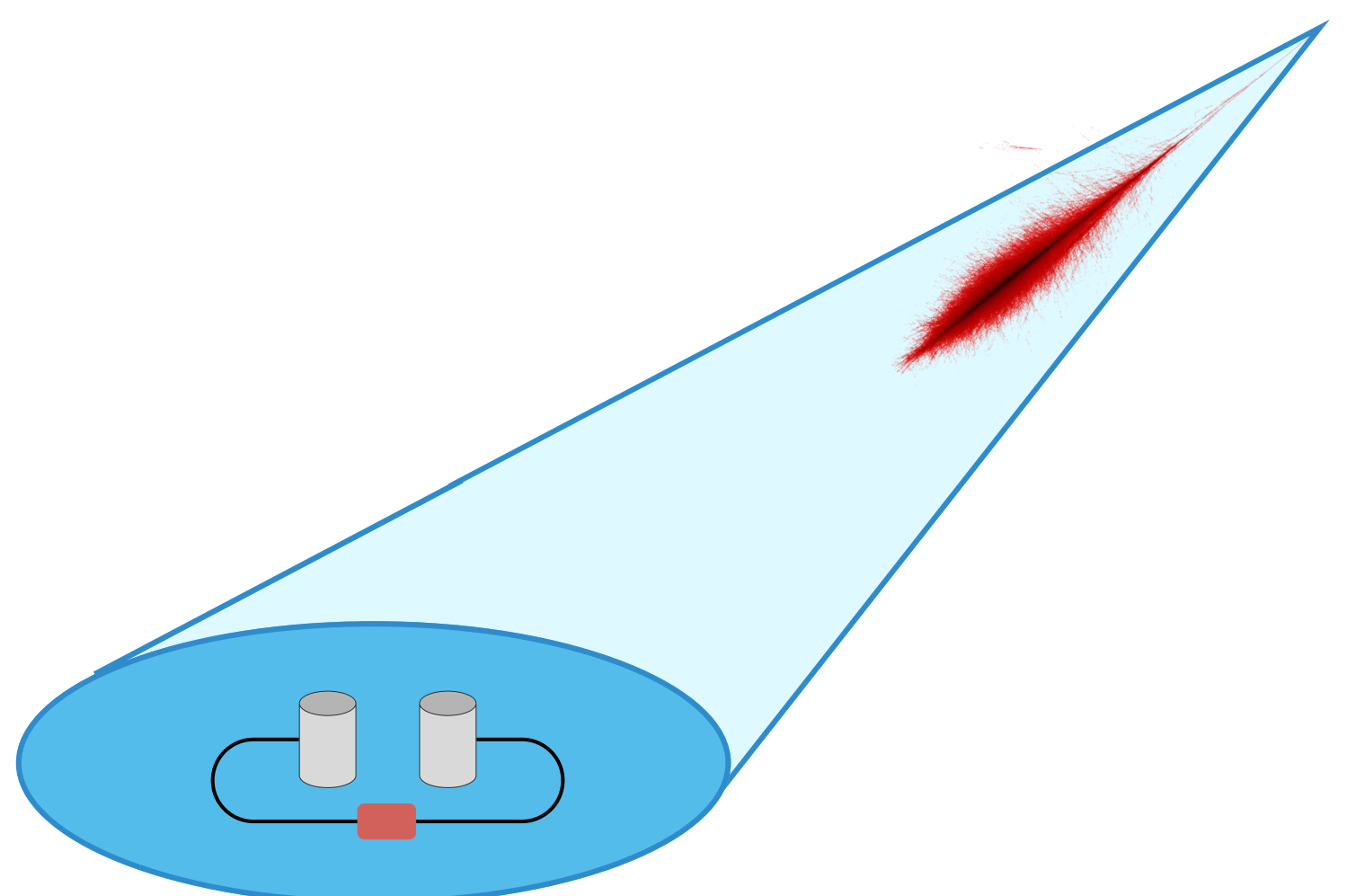
Support:

Rope, wood, PVC pipe, fasteners, 2x small garbage cans as containers/baffles, paint



Development

- Development of educational material with standard CosmicWatches during the 2026 PEOPLE PSU4 program
- Construction of 2x modified CosmicWatches
- Assembly of mirrors and CosmicWatches inside structure (optimization in progress)
- Verification of coincidence trigger with oscilloscope (in-progress)



Outreach Opportunities & Projects

PEOPLE high school program, Astronomy Club Star Parties, Madison Astronomical Society, WIPAC outreach events...

Projects:

- SiPM gain calibration
- Coincidence trigger window optimization
- Custom coincidence trigger circuit
- Dark rate measurement
- Alt-Az mount construction and elevation dependent rate measurement
- Coincident LED flasher design and construction

Acknowledgments

[1] Spencer N. Axani et al 2025 JINST 20 P10040

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