



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	Physics in Action: Engaging with Cloud Chamber Experiments
Name of School	Grand Valley State University
SPS Chapter Number	2529
Total Amount Requested	\$460.00

Abstract

Radiation is often perceived as exotic, unrelated to our everyday life, and intimidating. Grand Valley State University's SPS proposes a hands-on project to demystify radiation among middle school and high school students, by creating cloud chambers. By making physics accessible, we aim to inspire curiosity in traditionally underexplored fields.

Proposal Statement

Overview of Proposed Project/Activity/Event

The members of our SPS chapter will create a presentation on radiation, exploring the sources of natural background radiation, such as cosmic rays and the alpha decay of radon. The volunteers will guide the students through the creation of the cloud chambers, providing step-by-step explanations and assistance for making a successful cloud chamber. A visual aid pdf file from CERN will also be provided as a guide to identify the particles inside the cloud chamber based on the observed tracks. The project includes the use of Geiger Muller counters, provided by the department of physics, to detect background radiation. The principle of operation of the Geiger Muller counters will also be explained. A few alpha sources, also provided by the department of physics, will be incorporated into select cloud chambers, enabling students to observe the distinctive tracks of alpha particles.

Our chapter will visit local schools for these demonstrations, in an effort to rebuild and expand the chapter's outreach activities following the COVID pandemic. The primary goal of this project is to demystify radiation, a subject that commonly brings intimidation to people, understand the sources of radiation, how to detect it, and observe what the eyes cannot normally see. Given the disparities in physics education across different schools, we believe that his project is an opportunity to reach middle school and high school students who may not have otherwise access to physics-related fields. We anticipate visiting classes consisting of at least 20 students per session. While specific days and schools are pending, we envision to visit at least one school (and multiple classes in that school) during the Winter semester of 2024.

The project draws inspiration from a previous engagement of physics majors at GVSU with cloud chambers, during a summer camp organized at GVSU, where physics majors participated in the building of a cloud chamber. Building on this recent experience and expanding, we believe that the SPS chapter is well-positioned for organizing a project focused on radiation. The project also aligns with the chapter's focus on science outreach and re-establishing its presence in local schools, contributing to the community, and inspiring a new generation of physicists.

How Proposed Activity Promotes Interest in Physics

The project is a hands-on experience that immerses participants in the fascinating world of radiation, transforming the abstract concept of radiation into observable phenomena, either by seeing radiation in the cloud chambers or listening to the radiation in the pulses of the Geiger Muller counter. This will be an engaging experience that will foster genuine interest and enthusiasm for physics.

Our chapter recognizes the disparities in physics education across different schools. The project targets middle and high school students who have had little to no exposure to physics-related fields. Our intention to bring the project directly to local schools addresses accessibility barriers and ensures that a diverse range of students can participate, recognizing that not all students have the opportunity to be present in outreach events taking place outside of school hours.

The March W. White Award offers a unique opportunity to our chapter to re-establish our science outreach in local schools and bring enthusiasm for physics inside the classroom, making physics accessible to all the students.

Plan for Carrying Out Proposed Project/Activity/Event

At least five dedicated SPS members and volunteers from the physics club will actively participate in planning and conducting the cloud chamber activities. Experienced SPS members, specifically those who have previously engaged in cloud chamber projects and Geiger Muller counter experiments in modern physics will take on leadership roles. They will be responsible for creating the presentation and providing training and guidance to other fellow volunteers. Progress will be monitored through the weekly SPS meetings, ensuring tasks are on schedule. We will utilize the list of local schools from previous outreach activities and reach out to these schools, emphasizing the hands-on and educational aspects of building a cloud chamber and detecting radiation.

Project/Activity/Event Timeline

Upon submission of the March W. White award, we will begin contacting local schools from the outreach list to gauge availability. Schools have always been excited about having GVSU students come to the classroom. We will start developing the presentation slides that go alongside the cloud chamber experiments we are building. The presentation will be piloted at our weekly SPS meetings where SPS members and physics club members participate. We will also develop a pre-event survey to gauge the perceptions of students on radiation. Upon receipt of the award we will purchase the necessary materials and we will learn to build cloud chambers. The volunteers will undergo a radiation safety training for the handling of the alpha particle sources, and in communication with the radiation safety committee of GVSU, we will learn about the processes in place to transfer alpha particle sources to local schools. The presentation and the development of cloud chambers building skills will be complete by the end of January. Around that time, we will also finalize logistical details, such as transportation of members to local schools. The visits to local schools will take place between February and March, depending on the availability of educators and the volunteers. After the completion of the activity, we will gather feedback from the participating schools and students if we met our goals of making radiation more accessible and engaging students in physics. We will also gauge changes in the perception of students on radiation. We will share the project outcomes and experiences at the weekly SPS meeting, and we will draft and submit the final report in April.

Activity Evaluation Plan

The evaluation of the success of the project will come from the pre- and post-event surveys that gauge changes in the perceptions of students on radiation, and from the feedback we will receive from the students regarding whether the activity was engaging to them and how their level of interest in physics changed before and after the participation in the activity. We will also seek feedback from the educators and school administrators attending the event to receive suggestions for improvements to the activity. The volunteers will gauge the interest of students in the classroom during the activity and determine if and which components need improvements.

Budget Justification

The requested funds from the Marsh W. White award will be allocated to supplies for the project. These supplies include heavy duty aluminum pans, providing a sturdy base when set on top of the dry ice and glass containers that allow students to observe what that takes place inside the cloud chamber. The high purity isopropyl alcohol will make the visualization of particle tracks possible, while the silicone sealant will keep the cloud chamber airtight. Goggles are necessary for safety reasons when handling dry ice. In addition to the supplies listed on the budget, additional items needed, such as dry ice for our training to build cloud chambers, black stretch wrap for the aluminum pans if they are not coated with black color, and additional pairs of goggles, will all be provided by the physics department as needed. The Geiger Muller counters and the alpha particle sources will also be supplied by the physics department. These materials are essential to create a successful cloud chamber project and to facilitate a hands-on activity that promotes curiosity and interest in physics among students.