



# SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

## Marsh W. White Award Proposal

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Project Proposal Title	Engaging High Schoolers in Electromagnetism
Name of School	Stony Brook University
SPS Chapter Number	#6786
Total Amount Requested	\$498.22

### Abstract

Despite its extraordinary importance in our modern lives, electromagnetism remains a difficult and unintuitive subject for beginning learners. To build interest and intuition in electromagnetism, and broaden the scope of high school students' physics experiences, Stony Brook SPS proposes a three day seminar program with hands-on projects in electromagnetism.

# Proposal Statement

## Overview of Proposed Project/Activity/Event

Volunteering members of the Stony Brook SPS general body and executive board will put together three seminars designed to delve deeper into topics briefly mentioned in high school physics classes through lab activities that students can build themselves. In this post-COVID world, many students have been unable to gain substantive experience in physics outside the virtual classroom. Many schools, including Longwood High School, feel underprepared and under-resourced to provide sufficient opportunities for students to explore physics and discover interest they might have in the field. We want to provide students with an opportunity to explore physics and the support they need to pursue physics as a future.

The program will consist of three instructional seminars components, each building off the previous ones. In the first session, students will build an electromagnet and a simple motor to learn the basic principles of electromagnetism and motors. In the second session, students will apply this knowledge to build a generator using a prefabricated motor. In the last session, students will work together in groups to build AM radio receivers. For the final session, the students will have help and guidance from SPS chapter members. Sessions will also include fun demonstrations of relevant physics, such as a Gauss rifle to model a linear accelerator. The program will culminate in a field trip to Stony Brook University, where students will get to see Stony Brook's Van de Graaff generator and the world's first university-based superconducting heavy-ion LINAC and relate the physics principles they've learned to those used by the accelerator and modern physics research. This project is designed to be both challenging and within the scope of what high school students are capable of, with assistance from SPS volunteers. Members of our chapter will be responsible for going to Longwood High School and leading seminars for interested students over the course of three days, providing them with engaging challenges that push students to work together.

With our chapter's focus this year on science communication and several students having STEM education experience through tutoring, TA positions, and Stony Brook's 5-year Master in Teaching Physics program, our chapter strongly believes we have the qualifications, resources, and dedication necessary to carry out this proposal. We have already been in communication with Longwood High School about our plan and the school is incredibly excited to partner with us.

## How Proposed Activity Promotes Interest in Physics

In light of the deficits and disparities in physics education across different schools, our chapter believes that the return of in-person learning is a prime opportunity to reach students whose interest in physics might otherwise go undiscovered and unnurtured. Many schools, including Longwood High School, feel ill-equipped to extracurricularly support students with interests in traditionally less popular fields, such as physics. The educational system unfortunately often fails to provide opportunities to more deeply explore an enthusiasm in physics for many brilliant students who would otherwise thrive in the subject.

The Marsh W. White award offers our chapter an opportunity to provide students with the encouragement and experiences they need to explore their interest and realize that there could be a future in physics for them. Not only will we provide students with the necessary tools to gain experience outside the classroom, we will also give them the opportunity to visit a college with a world-class physics department and show them the many available possibilities for continuing physics beyond high school. Our proposal will give quality opportunities for students in a smaller

school to have a hands-on, engaging experience in a field they would otherwise have little exposure to. We aim to make high school students see physics as an option, not an impossibility.

## Plan for Carrying Out Proposed Project/Activity/Event

After a meeting with the Vice Principal of Longwood High School, the following plan was created:

The program will be conducted over four days. Longwood will advertise the opportunity to the students and the students has already come up with a list of students who might be interested. The first three days will consist of volunteers from our chapter of SPS traveling to Longwood and managing educational seminars. This involves giving instructional lessons on the relevant electromagnetism principles for each day, as well as guiding students through building their projects. The fourth day will be a trip to Stony Brook University, where SPS members will lead students on a tour of Stony Brook's Van de Graaff generator, physics research labs, and the Stony Brook campus.

## Project/Activity/Event Timeline

To date, we have met with Longwood High School to discuss our plan and iron out logistical details regarding timing. Together, we have come up with the following timeline:

We are currently developing lesson plans to go alongside the lab projects. These lesson plans will be piloted at our chapter's weekly Physics Café events with SPS general body members and Stony Brook freshmen, whom we will ask for feedback to improve our plans. We will also remain in communication with educators at Longwood for comments on our lesson plans. Upon disbursement of the award, chapter members will purchase materials for and prepare the lab kits. The lesson plans and lab kits will be fully complete by the end of January. The four days of the project will take place from late February to early March, subject to weather conditions. The three seminar days will take place sometime during a regular school week, at the end of the school day. After completing the three lessons, students will be invited to Stony Brook's campus and physics facilities at a date to be determined by the high school's schedule. At the conclusion of our program, we will send a survey to participants to evaluate if we met our goals of making electromagnetism more approachable and encouraging students' interest in physics.

## Activity Evaluation Plan

The evaluation of the success of our efforts will come from attendance across the three seminar days and the Stony Brook University trip as well as feedback provided by students directly through our survey. We will also discuss the outcome of our program with Longwood educators to get their opinions and suggestions for improvements. In addition, SPS volunteers will be actively working with students during seminars to keep them interested and engaged, so we will be able to identify how engaged students are in different activities to determine if any components need improvement.

## Budget Justification

The budget will entirely be spent on supplies for the projects to be completed by students and demonstrations to be performed by SPS members. The projects will consist of building an electromagnet and simple motor, building a generator using a prefabricated motor, and building an AM radio receiver using an RLC circuit. Demonstrations will include a Gauss rifle to introduce students to the idea of using electromagnetism for a linear accelerator before they visit the Van de Graaff generator and a fully homemade AM radio receiver. These projects and

demonstrations serve the dual purposes of deepening students' learning by engaging them with hands-on applications of the principles they'll learn in our seminars, while also proving *to be fun!*