SOCIETY OF PHYSICS STUDENTS
An organization of the American Institute of Physics

# Marsh W. White Award Proposal

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| **Project Proposal Title** | Physics Fridays Light Waves Outreach in Downtown Cleveland: Campus International School and Cleveland Public Library |
| **Name of School** | Cleveland State University (CSU) |
| **SPS Chapter Number** | 1247 |
| **Total Amount Requested** | $600.00 |


## Abstract

Since 2024 Cleveland State University' SPS chapter partnered with Hathaway Brown, a local K-12 all-girls private school, for a unique outreach-teaching experience. We will be continuing this partnership for our upcoming outreach events. CSU's SPS, which has a multi-year record of physics outreach in local schools (a.k.a "*Physics Fridays*") will work with former CSU's SPS outreach coordinator, Ms. Janna Mino, currently the Director of Fellowships in Science Research and Engineering at Hathaway Brown (HB), to train a team of HB's 9-12 grade students how to perform outreach themselves and facilitate SPS outreach to the general public at several branches of the Cleveland Public Library (CPL). First, we propose a day trip to Campus International School (CIS) inner city public school in downtown Cleveland in January. The HB outreach team will be invited to join SPS in learning how to do outreach before the trip to CIS. The HB outreach team will then use their new knowledge to help CSU's SPS perform light demos to the younger students (K-8) at CIS on the same day. Later in the spring, HB outreach team together with the CSU's SPS will deliver fun filled interactive light wave outreach sessions to general public at 4 prescheduled events at various branches of the CPL. This project will not only educate and engage Cleveland kids and general public in physics but will also provide the girls at Hathaway Brown a better understanding of science, hands-on engagement, and, hopefully, a burning desire to perform their own science outreach. This could help the underlying goal of the project to further spread the excitement and appreciation of science in northeast Ohio.

# Proposal Statement

## Overview of Proposed Project/Activity/Event

The historical model of CSU's SPS Outreach (a.k.a "*Physics Fridays*") has had undergraduate CSU physics students leading engaging STEM activities in various local schools. However, following previous years' example, we propose to continue our recently developed collaboration with Hathaway Brown (HB) school in which SPS outreach team trains high schoolers from HB in science outreach and then together with them delivers outreach lessons in an inner city Cleveland public school to general public at the Cleveland Public Library branches. We believe that this unique model of outreach maximizes the outreach impact on our community and further empowers the next generation of scientists and science educators. The CSU outreach team will be working with Janna Mino, former CSU's SPS outreach coordinator and current Director of Fellowships in Science Research and Engineering at HB, to teach some of the high-school students how to perform scientific outreach in their school to younger students and facilitate their own outreach to the local communities. Hathaway Brown is an all-girls K-12 private school that serves over 900 students, 41 percent of whom are students of color, and 44 percent are enrolled in their flexible tuition program.

At the start of the project (in January), CSU's SPS plans to travel with approximately ten volunteer students from HB to Cleveland's Campus International School (CIS) – the inner-city public school, where the Physics Fridays program began 14 years ago. The HB students will be shown how our demonstrations work and how to perform them. All of our demonstrations will be based on light waves. The various activities will explore how light waves travel and change direction through different mediums, how polarization works and its effects, the dispersion and diffraction of light and their applications, and review of basic optical devices. These activities will serve as an opportunity to teach about frequency, wavelength, dispersion, refraction, reflection, diffraction, polarization, and more. After training the HB outreach team, CSU's SPS will invite them to do the demonstrations together for the elementary and middle school students of CIS's afterschool program. This will give the HB students a chance to cement their new knowledge and practice the demonstrations in a real outreach context. We also plan to send the CIS kids home with small activities that will reflect what they learned during our demonstrations.

In the next phase of the project (February-April), CSU's SPS will partner again with the Cleveland Public Library (CPL) to perform outreach together with the HB outreach team at 4 different locations. We have been in contact with Bernadette Lemak, Project Coordinator with Outreach and Programming Services at the CPL, to set up outreach efforts with the after-school support program at CPL. We have plans to go to 4 different locations with the same interactive demonstrations we will be using at CIS. The trained volunteers from HB will participate with the CSU' SPS outreach team in the outreach efforts to general public in CPL branches. This outreach will help HB students to further their understanding of science and hopefully help to ignite their passion for careers in science and engineering.

Doing outreach across multiple different locations in one semester would have been difficult for CSU's SPS to do alone. The partnership with HB allows CSU's SPS to perform more outreach sessions than it has in the previous years and therefore maximize our influence and share the joy of physics with as many Cleveland students and residents as possible. Light waves is an engaging topic that students can relate to their everyday life.

We are fortunate at CSU to have a strong community bond as well as dedicate to outreach alumni. Our previous Marsh White supported outreach effort at BioMed Science Academy, Ms. Janna Mino's previous place of work, helped to rebuild our relationship and lead to this new opportunity at HB. Also, Physics lab manager, Ms. Tara

Peppard, has been in contact with the Cleveland Public Library over the last several years. She will help us to set up 4 visits to CPL branches.

## How Proposed Activity Promotes Interest in Physics

The proposed outreach plan will allow CSU's SPS to reach out to many members of the local community in an effort to get them engaged and excited about learning physics. With the wide variety of students in our CPL outreach in previous years, it is clear performing outreach through CPL attracts students that generally show little interest in science or physics outside of school. This could be the first real exposure to pure physics that the students get and could open their minds to even more physics outside of the demonstrations we show. In addition, teaching driven HB high school students how to perform outreach activities could allow us to reach outside the scope of what CSU's SPS outreach alone can accomplish. First, HB students will get a chance to share their knowledge with inner-city elementary and middle school kids. Second, they will get a real community service opportunity with outreach at CPL branches. Third, they will also acquire a deeper understanding of the physics behind light through their own outreach work which could help to interest them in possibilities of physics-related careers in college and/or job.

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

- Key Personnel
  - Patrick Barrett, physics major, SPS President
  - Jaxon Riley, physics major, SPS Treasurer
  - James Taton, physics major, SPS member
  - Maharshi Patel, biology major, Outreach Member
  - Josh Hoeflich, physics major, SPS member
  - Dr. Kiril Streletzky, SPS advisor and Outreach Supervisor
- Marketing
  - Cleveland Public Library (CPL) will advertise our outreach sessions weeks before our planned dates at each location to ensure as much exposure and participation as possible. We currently plan to reach about 120+ students across the four CPL locations. Hathaway Brown has already several volunteers signed up to learn from our outreach group and assist at each location.
- SPS Member Participation
  - In addition to the key personnel, 3-6 other SPS students, alumni, and possibly CSU graduate students will assist our efforts. Most are current/former SPS members, as our chapter rewards a yearlong outreach with a paid SPS scholarship.
- Expertise
  - Ms. Janna Mino, 2015 CSU alum, *Physics Fridays* outreach coordinator 2013-2014, Director of Fellowships in Science Research and Engineering at Hathaway Brown
  - Mr. Jim Pitchford, 2011 CSU alum, *Physics Fridays* co-creator and participant
  - Tara Peppard, CSU Lab Manager
  - Bernadette Lemak, Project Coordinator for Outreach and Programming Services at Cleveland Public Libraries

## Project/Activity/Event Timeline

A total of five trips are currently planned for the CSU outreach team:

I. **Campus International School (Late January):** The visit begins by meeting the Hathaway Brown volunteers (HB outreach team) and going over the planned demonstrations that will be used at both Campus International School and Cleveland Public Library branches. The activities are based on SPS outreach previous experiences and will include a set of introductory demonstrations (a wave ripple tank, big lenses/mirrors, etc) and five stations with different interactive demonstrations that will include the following:

a. Refraction and Reflection: Lenses, Mirrors, and Fiber Optics
Students will be shown a variety of different lenses and shown how images are altered as the light passes through the glass and plastic. They will be able to experiment with convex vs concave lenses and mirrors as well looking at different combinations of thin and thick lenses. In addition to the lenses, we will have fiber-optic cables which students can use to bend and redirect light.

b. Dispersion: Prisms and Spectrometers
At this station, students will be given the chance to see how "white" light can be broken into all the colors of the rainbow using prisms and spectrometers. By seeing how light can be broken up, the students will better be able to understand how color and dispersion are both related to the light's wavelength.

c. Polarization
This station will use linear polarizing filters to exemplify to students how polarizing natural light impacts its intensity and color. We will talk about optical activity and birefringence. We also plan to use a demonstration using sugar water to display the barber pole effect and circular polarization. The students will then be given the materials and instruction necessary to recreate a similar demonstration at home.

d. Optics Instruments (Telescopes, Microscopes, and more) and Diffraction
Using what students learned in station a., they will be shown how specific combinations of specific lenses can yield very interesting results, such as telescopes, microscopes, cameras, copiers, etc. We will show them what makes optical devices different from one another. We will also consider the phenomena of diffraction and its effect on optical instruments.

e. Sending the excitement home
This station will be where students receive gift bags with simple do-at-home light wave demos and learn how to perform their own physics tricks at home. We will also highlight potential career paths, areas of research, or even just interesting topics that students can continue to wonder about, hopefully encouraging the next generation of scientific minds.

The joint CSU SPS and HB outreach team will perform outreach at CIS on the same day. This will give the HB students a chance to reenforce what they just learned about performing outreach as well as their own knowledge of light. Additionally, students of CIS will get a chance to engage in our demonstrations and learn about light waves. It will also include a Q&A session where students will be encouraged to continue seeking answers.

II. **Four trips to local Cleveland Public Libraries (February 6 – April 10):** Together with the volunteers from HB, members of CSU SPS outreach team will travel to four different locations on Fridays at varying times throughout the spring semester to perform the same/similar outreach with the CPL after-

school support program. The events will be attended by rotating members of our SPS chapter and the group of volunteers from HB. Planned dates and locations are listed below with the date for the large presentations to chosen from this list by CPL later:

a. February 6, 2026, Glenville branch, Cleveland, OH.
b. February 20, 2026, Mt. Pleasant branch, Cleveland, OH.
c. March 6, 2025, Jefferson branch, Cleveland, OH.
d. April 10, 2025, Brooklyn branch, Cleveland, OH.

## Activity Evaluation Plan

The outreach events will be carefully documented via: 1) lesson plan outlined and detailed for every event; 2) photo-reports of the activities at Hathaway Brown and Cleveland Public Library; 3) archiving of each of the activity's equipment; 4) recorded number of kids and their respective grades for each activity; 5) surveys will be handed out to Hathaway Brown volunteers and younger students to assess the overall effectiveness of our efforts. Outreach members will also be given a quick survey to assess the impact of the activities on themselves.

## Budget Justification

The majority of our request it to construct 150 take-home packages for the kids to further explore the concepts we demonstrated. This will include polarizing filters, diffraction glasses, and magnifiers. Smaller supplies like straws, string, and any needed printing will be provided by the physics department. Additionally, we request funds for the SPS team T-shirts of the outreach event. A special SPS design will be used for the 2026 T-shirts. The volunteer t-shirts are needed to be able to clearly identify the members of the outreach volunteering team during the outreach events in the branches of the Cleveland Public Library.