SOCIETY OF PHYSICS STUDENTS
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Marsh W. White Award Proposal

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Project Proposal Title	Outreach Totality: Eclipse based Outreach-Teaching Experience
Name of School	Cleveland State University (CSU)
SPS Chapter Number	1247
Total Amount Requested	$600.00

Abstract

The 2024 total solar eclipse in Cleveland has provided CSU's SPS the opportunity to partner with Hathaway Brown, a local K-12 all-girls school, for a unique outreach-teaching experience. 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 their outreach to younger HB students and general public. In phase 1, called "First Sighting", we propose a day trip to HB in January to introduce eclipse outreach activities to HB students and teach them how to perform outreach for themselves. The HB outreach team will then use their new knowledge to help CSU's SPS perform eclipse demos to the younger students (K-8) at HB on the same day. This effort should benefit the girls of all ages at HB in particular the HB outreach team as the best way to learn and understand a subject is to teach it to others. In phase 2, called "Outreach Totality", HB outreach team together with the CSU's SPS will reach out to Cleveland inner city kids via several 2024 eclipse related outreach sessions through after-school care programs at 5 locations of the Cleveland Public Library. This project will not only educate and prepare Cleveland students on the upcoming eclipse but will also provide the girls at Hathaway Brown the skills to perform their own outreach so we can further spread the fun of science to schools in northeast Ohio.

Proposal Statement

Overview of Proposed Project/Activity/Event

The historical model of CSU's SPS Outreach has had undergraduate CSU physics students leading engaging STEM activities in various local schools to spark interest in science. However, this year, we are proposing a unique innovation to this model that we believe will maximize impact to more children in our community and empower the next generation of scientists and science educators. The CSU outreach team has been in contact with Janna Mino, former CSU's SPS outreach coordinator and current Director of Fellowships in Science Research and Engineering at Hathaway Brown, 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 (HB) is an all-girls K-12 school that serves over 900 students, 41 percent of whom are students of color, and 44 percent are enrolled in their flexible tuition program.

In phase 1 of the project, called "First Sighting", CSU's SPS plans to travel to HB in early January to show 7 volunteers how our demonstrations work and give them the knowledge to teach others using the same methods. All of our demonstrations will be based on the 23-24 SPS SOCK and will include an Earth/Sun/moon moving diagram, with explanations on why the eclipse occurs as well as the interaction between the three celestial bodies, planet deformation, where students will use basic materials to construct a diagram of a planet and learn how angular momentum and spin cause planets to change shape, and straw rockets, where students will make paper rockets to learn how different forces acting on an object causes motion. After training the HB outreach team, CSU's SPS will then invite them to do the demonstrations together for the younger HB students (~30 students) in a large class setting, so that the HB volunteers can get accustomed to presenting and doing demonstrations for the eclipse.

In phase 2, called "Outreach Totality", CSU's SPS will use the opportunity to partner with Cleveland Public Libraries to perform outreach together with the HB outreach team at 5+ different locations during the spring semester. Bernadette Lemak, Project Coordinator with Outreach and Programming Services at Cleveland Public Libraries (CPL), reached out to CSU earlier in the Fall 23 to set up outreach efforts with the after-school support program at CPL. We currently have plans to go to 5 different locations with the same interactive demonstrations we will be teaching the girls at HB. We also plan to hand out eclipse glasses for safe viewing of the eclipse in April. Current dates span from the beginning of February to late March of 2024. The trained volunteers from HB will participate with the CSU outreach team in the outreach efforts which will help further their understanding of the science and hopefully help to ignite their passion for careers in science and engineering.

Doing outreach across 5 different CPL locations in one semester would have been difficult for CSU's to do alone. We have not done outreach more than twice in a semester since the COVID pandemic. However, the partnership with HB will allow CSU's SPS to perform more outreach than it has in the previous two years combined and maximize our influence and share the joy of physics with as many Cleveland students as possible. The 2024 eclipse has sparked interest amongst the local community, and this is the perfect way to use this opportunity to show how amazing and important physics is in our daily lives as well as during special events like the eclipse.

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 Cleveland Public Libraries (CPL) over the last month or so to set up our 5 visits that will allow us to interact and educate over 120 local K-8 students on the eclipse as well as on safe viewing practices for them and their families in April.

How Proposed Activity Promotes Interest in Physics

The 2024 eclipse is a rare phenomenon that is a critical opportunity to get our community interested in physics and astronomy, as the next total solar eclipse will not pass through Cleveland until 2444, and Ohio until 2099. The target members of our community in our outreach efforts may not have the privilege to travel to see another total solar eclipse in their lifetime, making this a once-in-a-lifetime event. However, most households might not know safe viewing practices or the science behind the eclipse. With the heightened interest, there isn't a better time to help students learn and have a deeper understanding of why the eclipse occurs and how awe-inspiring and scientifically important eclipses are. 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 eclipse. In addition, teaching driven high school HB students how to perform outreach activities could have effects that reach outside the scope of what CSU's SPS outreach alone can accomplish. Not only will the HB students share their knowledge with others (like HB elementary and middle school kids) and will get a real community service opportunity with outreach at CPL branches, but they will also have a deeper understanding of science behind the eclipse 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 Herron, physics major, SPS President and Outreach Coordinator
  - Jordan Miller, physics major, SPS vice-president
  - Collin Douglas, physics major, SPS secretary
  - Grace Miller, physics and mathematics major, SPS math club liaison
  - Dr. Kiril Streletzky, SPS advisor and Outreach Supervisor
- Marketing
  - Cleveland Public Libraries (CPL) will advertise weeks before our planned outreach dates at each location to ensure as much exposure and participation as possible. We currently plan for 120+ students across the five CPL locations. Hathaway Brown already has 7 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 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 six trips are currently planned for the CSU outreach team:

I. **Visit by CSU SPS Outreach team to Hathaway Brown in Shaker Heights, OH (mid January):** The day long visit by the CSU students will begin by meeting the 7 Hathaway Brown volunteers (HB outreach team) and going over the planned demonstrations that will be used at both HB school and Cleveland Public Libraries. The activities are based 2023-24 SPS SOCK and will include an introductory demonstration to be determined at a later time (it will involve the Sun, Earth, and Moon model demo) and no less than three stations with different interactive demonstrations that will include the following:

   a. Moving planetary diagram
      Students will learn why the eclipse happens as well as the intricate interactions between the Earth, Sun, and moon. This will include orbital planes, the alignment of our system, and how the distance between the three celestial bodies contributes to the eclipse.
   b. Planet Deformation
      Students will use paper, scissors, and glue to build their planet. Students will learn how the planets in the solar system were created and how angular momentum affects the shape of planets.
   c. Paper Rockets
      Students will use basic materials to create a rocket propelled by a plastic straw. Students will learn how a propulsion force pushes the rocket and how gravity and air resistance slow the rocket as it is moving. Students will also have a conversation with the presenter about the scientific method and how it can be used in our daily life.

   The outreach will also include a discussion afterward with a Q&A about the eclipse and what they have learned. Students will also be given eclipse glasses for safe viewing of the upcoming eclipse.
   These outreach activities will be practiced with the HB volunteers first and then we will perform the demonstrations together with HB volunteers for the younger students at HB (30 students anticipated).

II. **Five trips to local Cleveland Public Libraries (February 9 – March 22):** Together with the volunteers from HB, members of CSU SPS outreach team will travel to five different locations on Fridays from 4:30pm-5:30pm throughout the spring semester to perform the same/similar outreach with the CPL after-school support program. Given the large scope of the proposed involvement we plan to have two large presentations at the CPL with the entire team of CSU SPS Outreach and HB volunteers and three smaller sessions attended by rotating CSU SPS and HB volunteers. Planned dates and locations are listed below with the date for the large presentations to chosen from this list by CPL later:

   a. February 9, 2024, South branch, Cleveland, OH.
   b. February 16, 2024, Sterling branch, Cleveland, OH.
   c. February 23, 2024, Collinwood branch, Cleveland, OH.
   d. March 1, 2024, Rice branch, Cleveland, OH.
   e. March 22, 2024, Rockport 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 Libraries; 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

We request the following amount: ~$600. It will cover most of the supplies needed to expand the Eclipse SOCK demos (especially the part a. Moving Planetary Diagram) to 30 students at HB and 120 students in CPL. We estimate that the Marsh White will fund 120 beach balls, 120 tennis balls and 120 ping pong balls. CSU Physics Dept and HB will help to fund the rest of the supplies including the paper, straws, glue sticks, instruction printing and so on. We also request funds (~$145) for one good Sun, Earth, and Moon model for the introductory demonstrations. Additional copies of models will be borrowed from the CSU Physics Dept if needed. Finally, we request funds for the SPS team T-shirts of the outreach event. A special SPS design will be used for the eclipse-themed T-shirts. HB will pay for the identical t-shirts of 7 HB outreach volunteers. The volunteer t-shirts are needed to be able to clearly identify the members of the outreach volunteering team during the eclipse outreach events in the branches of the Cleveland Public Library. These T-shirts will also highlight the 2024 Eclipse and will promote both the SPS national and CSU chapter of SPS.