



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	Let the Cat out of the Box: Charlottesville High School Outreach
Name of School	The University of Virginia
SPS Chapter Number	7751
Total Amount Requested	\$259

Abstract

The Society of Physics Students at the University of Virginia is planning three trips to local middle and high schools and collaborating with UVA physics faculty on a National Physics Day show. These events will feature fun physics demos to get a general audience, especially ~~12~~ students, excited about physics.

Proposal Statement

Overview of Proposed Project/Activity/Event

In December 2022 and twice during the spring semester (dates TBD), six to eight SPS volunteers will travel to local middle and high schools to do cool and fun physics demonstrations with students. We estimate that approximately 20 students would be impacted at each outreach event (60 overall). Past demos presented at elementary/middle/high schools have included oobleck (cornstarch and water), marshmallow towers, magnet experiments, density and pressure experiments with eggs, etc. The outreach event at Charlottesville High School planned for December 2022 will include kinematics demonstrations. SPS exec will collaborate with teachers to determine the best demonstrations when closer to the time of the events. UVA's chapter of SPS has been doing outreach programs to local schools since 2016.

In April 2023, on National Physics Day, UVA's chapter of SPS will collaborate with UVA Department of Physics faculty to put on their annual National Physics Day show. The theme of the event is still to be chosen. Cryptography is one possibility. Past themes have included communication, "World of Atoms," "Fire and Ice," and waves. This event is designed for the general public, especially students and families. We estimate that approximately 100 people will come to see the show. The demonstrations will use equipment borrowed from the Physics Demos Lab. The National Physics Day show has been an annual event at UVA since 2013.

How Proposed Activity Promotes Interest in Physics

Fun hands-on demonstrations at local schools will allow students to interact with physics concepts on a tangible level, show these students how physics concepts are accessible and at work in their everyday lives, and get students curious and interested about physics. Volunteers will be wearing physics T-shirts featuring Schroedinger's cat in a box. This design may pique students' curiosity and inspire them to ask more questions about physics. At the National Physics Day show, the demonstrations use professional equipment and are often very exciting to look at and hear. These would get students and their families excited about physics. In all events, presenters explain the demonstrations to help students understand how physics is in their everyday lives. These events are appropriate for a Marsh W. White Award because they will allow students to interact with physics in a visible or tangible manner. Our hope is that seeing physics work in ways they may not expect will inspire student excitement and curiosity about the field.

Plan for Carrying Out Proposed Project/Activity/Event

- Our outreach coordinators Bejoy Sen and Shrinidhi Nadgouda are in charge of planning local school events alongside participating teachers. The Physics Day show is spearheaded by UVA faculty. SPS exec recruits volunteers and helps prepare and present the events.
- Progress updates regarding these events are given at most SPS meetings.
- The Physics Day show will be marketed via listserv emails, the UVA SPS Instagram account, and flyers around campus. Demonstrations at local schools will most likely be held during class times.

- Approximately 6-8 SPS volunteers will participate in each outreach event to local schools, and approximately 10 SPS volunteers will participate in the Physics Day show.
- Many SPS members have experience as teaching assistants, which will help them in explaining physics concepts to students. Most SPS members have lab experience, which will help them successfully perform the demonstrations.

Project/Activity/Event Timeline

Timeline:

Week of December 5th:

Carry out the outreach activities on Dec 7th:

- 9 am: Drive to Charlottesville highschool
- 10 am: Set up the demonstrations
- 11 am: Perform first set of demonstrations: gravitational potential energy
- 12 pm: Lunch break
- 1-3 pm: Perform the second set of demonstrations: Thermodynamics
- 4 pm: Pack up the demonstrations and leave back for UVA

Week of November 28th:

Coordinate the transportation among the students that have vehicles. Also gather the materials needed for the demonstrations.

Week of November 21th:

Start announcing the outreach event to the UVA students involved in SPS. This will be done using both virtual elements such as email as well as physical devices such as flyers. At this time we will also order the t-shirts

Month of October:

Reach out to local middle and high schools to ask if they would be interested in having the UVA SPS chapter for a class period during one day in December and/ or in the spring.

Activity Evaluation Plan

To evaluate how well it succeeded in sparking students' interest in physics, the chapter will keep records of how many students participated in the local school outreach events and how many people attended the Physics Day show, document how individual demonstrations were received by students, and get feedback from teachers about each event. We will also survey students from different age ranges to see their satisfaction with this event compared to our prior outreach events.

Budget Justification

- Volunteer T-shirts: Volunteers will be wearing physics-themed T-shirts featuring Schroedinger's cat in a box. This design may pique students' curiosity and inspire them to ask more questions about physics. It will also serve to increase cohesion among the outreach participants.
- Gas: Volunteers doing demos will require transportation to and from the host schools.
- Mechanics demo supplies: brachistochrone curve apparatus, gyroscopes, wheels, weights
- Thermodynamics demo supplies: cotton balls, tweezers, piston and cylinder, insulated water bottle, Stirling engine
- The National Physics Day show will also use equipment for the University of Virginia's Physics Demo Lab.

For our December outreach event, we will be doing two mechanics demos and two thermodynamics demos. The brachistochrone curve apparatus demonstrates the path-independence of potential energy: two balls will roll on different paths to the end of the curve and exit with the same kinetic energy. We will use weights on the gyroscopes to demonstrate torque-induced precession. We will then press a piston into a cylinder to ignite a cotton ball to demonstrate adiabatic compression. Lastly, we will place the Stirling engine above hot water to convert heat energy into mechanical work.