



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Future Faces of Physics Award Proposal

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| Project Proposal Title | What's so hot with physics? |
| Name of School | University of The Sciences |
| SPS Chapter Number | 5619 |
| Total Amount Requested | \$500 |

Abstract

The University of the Science's SPS Chapter plans to engage with young students from minority groups from the Philadelphia South Jersey region virtually through Zoom. We will engage the young students by displaying exciting experiments interactively that help understand the physics concepts of heat and thermodynamics, while doing DIY experiments that they can recreate themselves.

Proposal Statement

Overview of Proposed Project/Activity/Event

The Future Faces of Physics outreach will be directed to a group of at least 30 high school students and middle school students consisting of women and mostly underrepresented minorities from the Philadelphia and South Jersey region. The group will come from three groups: high school students from the Franklin Institute's STEM Scholars Program, graduates of the Ed Snyder Hockey Foundation, and graduates of the Physics Wonder Middle School Girls Program.

Many of the participants from the first two groups are considered financially needy and are from underserved Philadelphia School District schools, while the third group are all women interested in physics. SPS has already established connections with the first two groups through our SPS Advisor, Dr. Roberto Ramos. Through the collaboration with Franklin Institute, our SPS chapter is exploring possibilities of eventually doing outreach to a broad and diverse patrons of Philadelphia's largest science museum. Dr. Ramos is the Physics Wonder Girls program and will reach out not just to middle school girls but to campers who have now moved on to high school.

The SPS Chapter plans to mail out some safe experiments to get the attendees to get more involved beforehand. This will not only gain their interest and attention but boost their curiosity first hand. It will also be that the students are able to try these experiments themselves instead of being stuck watching through the screen.

The event will start with a segment mainly involving the SPS members displaying many ways the concepts of physics can be demonstrated in real life via do yourself experiments with common household items. In recent outreach, we implemented this small idea which the audience loved and engaged with. These experiments not only show how physics can be shown even at your own home, but also shows how enticing it is to study further into the physics. Then we will get into the segment of the demonstration earlier, to which we will also demonstrate on the screen while giving instructions on how to do so together with the students. This is going to be a big section of engaging with them and sparking their curiosity more.

Throughout the event, the members of the SPS chapter will be doing these demonstrations shown virtually towards the audience. We will also engage with the audience by engaging with them, asking questions "what would happen if?" and trying to spark interest in their brains turning and wondering what and why the phenomenon just occurred.

After the DIY demonstrations, the event will then transition into much more complicated and exciting experiments that you cannot exactly find at home. These experiments include the physics concepts of heat and thermodynamics such as a hand boiler which displays heat and vapor pressure, and a Stirling engine to help the audience into wondering how the engine is operating without electricity. This section of the event further attempt to awaken curiosity from the younger audience and hope inspires them to further engage with physics for knowledge.

How Proposed Activity Promotes Physics Across Cultures

Throughout the past years, many students nowadays consider furthering their education to study in the STEM fields such as physics. However, the number of students from not just underrepresented schools, but also from underrepresented backgrounds. These underrepresented areas do not truly get the experience to fully explore the STEM fields especially physics like other areas do. This is due to the fact that higher education in these fields are costly, nor they aren't greatly exposed to these sciences in grade- high school.

The University of the Science's SPS chapter's goals are to expose these STEM fields more towards those groups to shed light towards how great these fields, especially physics, can be. This is done by proposing the chance to promote events/ activities like these to help minority groups learn and engage with concepts in physics, like heat and thermodynamics. Hoping that our chapter can inspire these young scientists to further their education in the science fields and see it as an opportunity that they can take in the future.

Plan for Carrying Out Proposed Project/Activity/Event

Personnel: There will be a total of 5 members of the SPS chapter involved in the activities. The project will be led by Dan Fauni, the SPS chapter president with the help of the SPS chapter secretary, Ryan Hess, who will also participate throughout the event and help make sure the event is a success. The SPS chapter members also participate in the event by assisting in the demonstrations of the experiments and engage with the audience to help them understand the concepts displayed at hand, asking questions, getting their predictions, etc. Before the event, there will be trial runs and lessons so every member participating is knowledgeable of the concepts and can assist the audience. Our chapter advisor, Dr. Roberto Ramos, will be present to help answer questions and other means.

Marketing: The project event will be marketed through advertisements that contain "previews" of the experiments and who is involved in the event via social media. This is through the SPS Chapter Facebook page and the SPS Facebook page. It will also be displayed through emails sent by the SPS members involved, even inviting the general public to stop by and watch the show.

Expertise: The SPS chapter members participating will include mostly experienced members who have done outreach either via Zoom or in person before. As well as many of the members were involved in past outreach events by the University of the Sciences which will help make the event a success.

Activities: The event will consist of a section dedicated to DIY experiments that involve physics fundamentals and other concepts. These DIY experiments will include many household items and other items that can easily be found in a grocery store. Another segment will contain the experiments that SPS will ship out to the students before the event. This will be a hands-on experience for the students and a moment to engage with the members. They can try it after the event and experiment with what else they could do with it. There will be an interactive segment where SPS members will demonstrate different experiments regarding heat and thermodynamics, getting the audience intrigued and engaged.

A few of the experiments are listed below:

- (1) **Hand Boilers-** A glass bulb that contains colored liquid. It demonstrates vapor pressure and the forces the gases exert. This is done by placing your whole hand under/over the side that has the liquid in it, the

exchanged from the hand causes the vapor pressure to increase and flow to the other side, if your hands are cold however, it will flow towards the hand.

- (2) **Pressure Globe** Displays the properties of air pressure. This is done by inflating the balloon with either water or air and attaching a stopper to the hole. This keeps the balloon inflated but once the stopper is removed, it releases everything inside.
- (3) **Bottle & Egg** - A piece of burning paper/ a match/ a candle inside a bottle is placed in a glass bottle, then a boiled egg is then placed over the opening, "magically", the egg is sucked inside after the flame is extinguished. This displays how pressure in the bottle increased and once the egg is placed, the air in the bottle contracts because of the extinguished flame, causing the egg to be sucked in.
- (4) **Pressure Pumper** A pumper that can be tightened over a soda bottle. The soda bottle is filled with an object like marshmallows, and as we pump the air in the marshmallows shrink. This displays what happens with pressure and temperature and adiabatic expansion.
- (5) **Energy Transfer Balls** Two steel balls collide with one another. This causes enough heat to form through friction being transformed into thermal energy, to cause a small burn in a piece of paper between the balls. This concept shows how energy can be transferred between objects.
- (6) **Stirling Engine** - The biggest experiment of them all. This displays cyclic compression but also expansion and contraction of air at certain temperatures. It displays how the energy of heat can be converted into work in machines such as the Stirling engine.
- (7) **Ice Melting Blocks** - One block feels cooler than the other, and once you place an ice cube, one melts faster. It displays concepts of heat transfer, and thermal conductivity.
- (8) **Nitinol Wire** - A mysterious wire that can be bent into shape then heated, once we place it in cool water, it will deform back into its original shape. Placing it in hot water again will reform it to the shape bent previously. This is a demo that will be sent to students.
- (9) **Liquid Crystal Sheet** - A liquid crystal sheet that changes color of the shape placed on it due to the change in temperature. This will display thermal sensitivity. This will also be a demonstration sent to students.

Project/Activity/Event Timeline

January 2021 - By the end of this month, we will finalize the specific date that the event will run in. This will accommodate so that the event will get the most amount of people in the audience.

February 2021 - Order all of the experiments/ required items by the beginning of the month in order to make certain that all equipment is prepped and ready to go, functioning properly, and we have it present. By the end of the month we should have if not all, most of the items arrived at designated locations and inspected.

March 2021 - Throughout March, we will run a couple of training sessions for the members involved. They will be taught how to use the demonstrations, clarify what they do/ how they involve heat and thermodynamics. They will also be trained to know how to engage with the audience and make sure everyone is involved and intrigued.

April 2021 - In the beginning of the month, we will run a final training session and a professional talk to make sure the whole event runs smoothly. Soon after we will have a final training session, we will launch the project and run the event virtually via Zoom.

May 31, 2021- Submit the final reports and any other duties by this date.

Activity Evaluation Plan

The way of determining the success of the event will be based on the responses we receive from the audience and after the event. We will first observe how many participants came, whether they are from a high school or just from the general public. At the end of the event, we will then encourage the participants to fill out a quick assessment. This assessment will contain questions such as: "were you familiar with these demonstrations beforehand?" and "which of the demonstrations did you find interesting?" then it'll have a quick survey on whether they were interested in going into higher education, their interest in the STEM field, mainly in physics the event, then after. We will also have the SPS members speak with the participants about their experiences in physics and what they are interested in, want to pursue in the future. They will keep a record of responses.

Budget Justification

The proposed budget will be used to fund the experiments/ required items needed for the list of demonstrations the SPS Chapter will perform. The budget will also go into estimated shipping costs including the cost of mail for small demonstrations to registered participants. It will engage the students visually and provide them with a sense of interaction that physics, especially heat and thermodynamics that this project explores, is for everyone regardless of status. Even though this event is done virtually, these fascinating experiments will undoubtedly get the whole audience to engage with the SPS members. All of the items in the budget are for the demonstrations and shipping costs. Any other sources of money that this project receives will be from the University of the Sciences SPS Chapter, if needed.