



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Future Faces of Physics Award Proposal

Project Proposal Title	Falling For Physics!
Name of School	University of the Sciences in Philadelphia
SPS Chapter Number	5619
Total Amount Requested	\$500.00

Abstract

The University of the Science's SPS Chapter plans to engage with students from the underrepresented minority group from the Philly-South Jersey region in person for the first time since the COVID-19 pandemic. We will engage the students through a variety of interactive demonstrations to help understand the concepts of kinematics and elasticity.

Proposal Statement

Overview of Proposed Project/Activity/Event

The Future Faces outreach will be demonstrated to a group of at least 30 high school and middle school students from the underrepresented communities. The groups will consist of mainly women and those with underrepresented access to physics in the Philadelphia and South New-Jersey regions. The chapter is considering working with St. Francis de Sales School and other schools in the Philadelphia school district.

There are many public schools that are severely underfunded and underserved in the Philadelphia School District. St. Francis de Sales School has many students that carry the potential to become outstanding in their future. However, these public schools, like St. Frances, are limited with how much their educational program provides. We have worked with St Francis de Sales before with our previous projects building a strong relationship with them. Each time, the students were constantly engaging with our team and we always peaked their interests in the STEM fields. This strong bond is a result of our time during outreaches with them hence our determination to work with other schools in the Philadelphia area. Our SPS Chapter plans to change by engaging them more with different concepts of physics. Exposing the STEM fields to them can greatly increase their potential in being part of the STEM community.

The event will be started with a segment from the SPS members and executive board displaying the way that the concepts of physics can be applied in real life. Throughout the event, the members of the SPS executive board and chapter will be conducting hands-on demonstrations. This will create excitement around physics and introduce the students further into the wonders of physics and achieve the goal of the project.

Before the demonstrations the SPS chapter members will propose questions to the students on what they expect the outcome of the demonstration to be. This will engage the students and build excitement for the demonstration. These demonstrations will exemplify the physics ideas of kinematics and elasticity and once completed the SPS chapter members will explain why the demonstrations occurred the way they did. These demonstrations will include a ballistic cart and a vertical acceleration demonstrator to show how horizontal motion does not affect vertical acceleration. Furthermore, a Hooke's Law apparatus will be used to illuminate the elasticity of springs as well as a Newtons Cradle to show elastic change of potential between collisions.

Overall, this event will further spark the curiosity of the audience and will inspire them to further engage in the wonders of physics and develop a knowledge for physics.

How Proposed Activity Promotes Physics Across Cultures

Throughout the previous years, an education in STEM such as physics has been steadily increasing, however it is not uniform as those from underrepresented schools and underrepresented backgrounds have not seen an increase. This is chiefly due to the fact that higher education in these fields is very costly and there is not nearly enough funding in these underrepresented communities to support these sciences. Without this funding these students do not have the opportunity to experience the wonders of physics which is what our event will provide.

The University of the Science's SPS chapters goal is to expose these underrepresented students to STEM, specifically physics. This is done by promoting these demonstrations to help excite these students for physics while simply explaining the concepts to not confuse the students. Through these demonstrations it will

strengthen these communities as it will fill the void that is missing in their high schools and middle schools and promote the future of physics.

Plan for Carrying Out Proposed Project/Activity/Event

Personnel: There will be a total of three to five members from the SPS chapter involved in the demonstrations. The project will be led by Dan Fauni, the SPS chapter vice-president with the help of SPS chapter treasurer, Ryan Hess. Other SPS chapter members will also participate in the event by assisting in the demonstrations as well as explaining the concepts behind them to ensure the event is a success. We plan to also include non-physics majors that are part of our organization so they can also experience outreach and increase their knowledge on physics. They will also engage the audience by asking questions, getting the predictions from the students and helping push the audience to understand the concepts of kinematics and elasticity. Before the event, there will be trial runs and lessons to ensure that each member of the group has extensive knowledge of the concepts and can assist in any questions the audience should raise. The SPS chapter advisor, Dr. Roberto Ramos, will be present to help answer any further questions that should arise.

Marketing: The project will be marketed through advertisements that will contain a “preview” of the demonstrations to be done. This marketing will be done through social media including the SPS Chapter Facebook page and the SPS Zone 3 Facebook page. Furthermore, emails from the SPS members involved will be sent to reinforce when and where the event will be held.

Expertise: The SPS chapter members who will be participating in this event will be led by those of us who have extensive knowledge on the subject and experience in outreach. Those with outreach experience will run the event, expertise being determined not only through classes, but previous events including in-person and zoom events. In addition to the core experienced members, newer members will be included to ensure that future events can be run smoothly.

Safety: In order to comply with Covid-19 safety procedures, every member will be required to take a Covid-19 test and monitor their health to report any symptoms they might experience. This will be required before the event day. Every team member and student participant will also be required to wear masks properly, practice hygiene, and clean each demonstration after every use; extra masks will be provided to ensure that any student who wants to participate can. The venue will also have a limited capacity, how many attendees can be viewing each team and in the room overall will adhere to the preset amount at any time.

Activities: The event will consist of interactive demonstrations done by the SPS members in which the physics concepts covered will be kinematics and elasticity. These demonstrations will be split with two-three teams where each team will present two-three demonstrations. Each team will equally have a few demonstrations conducted by the team members and one-two that are interactive. The students will then be able to go as groups to each team within a given time limit. Before the demonstrations the members will interact with the audience by asking questions about what they believe will happen. A few of the demonstrations that will be conducted at this event will be listed below:

1. **Shoot The Monkey-** In this apparatus, the “monkey”, which is a disk, hangs from its “tree” which is an electromagnet about 4 feet away from the “hunter” (ball launcher). The launcher is aimed directly at the monkey using the laser sight and shot. At the instant the ball is launched, the power to the electromagnet is interrupted, causing the monkey to fall. The ball will hit the monkey every time provided that the launcher is aimed at the monkey before firing. This demonstrates how projectile motion works as the

ball that is shot will experience projectile motion as well as the monkey falling will experience the same vertical acceleration down.

- 2. Vertical Acceleration Demonstrator-** Two identical balls are placed at the same height while one is dropped with no initial horizontal velocity while the other is shot off the platform with an initial horizontal velocity. This demonstrates how horizontal velocity will not affect vertical acceleration as the two balls will reach the ground at the same time.
- 3. Ballistic Cart-** A ball will be placed in a spring-loaded cylinder and the car in motion on a smooth, level surface. A quick pull on the magnet releases the mechanism to launch the ball into the air. As the car keeps moving, the ball will come back down right into the cylinder. This demonstration will further enforce how with projectile motion the horizontal velocity does not change as the ball lands back in the moving cart.
- 4. Projectile Launcher-** A metal ball and plastic ball are loaded into a spring launcher and shot out of the launcher. This displays in depth the full motion of the balls and how they are subject to projectile motion and can be modeled using classical kinematics.
- 5. Newton Cradle-** The Newton Cradle is a line of metal balls attached to strings in which the beginning ball will collide with the next and will cause the end ball to move. This demonstration illuminates the elasticity of the balls and how momentum and energy transfers throughout the balls.
- 6. Hooke's Law Kit-** This kit comes with a spring that is attached to an aluminum rod with a built in ruler. A mass is attached to the spring and the stretch is measured with the ruler. This demonstration shows the elasticity of the spring and can be used to determine its spring constant. The mass can also be increased to show that the spring has a maximum elasticity and can break the spring which can be used as a question to the students about what they expect when the mass is increased.

Project/Activity/Event Timeline

January 2022 - By the end of the month, we will finalize the date that the event will run in collaboration with the school. This will be announced early in order to maximize the size of the audience.

February 2022 - By the end of the first week of the month, all of the demonstrations/ required items will be ordered to give the products time to be delivered, prepped, and ready to go. After each demonstration is delivered, a team member or project lead will make sure it is functioning properly and have it ready for training.

March 2022 - The whole month will be dedicated to training sessions at least once a week for the members involved. Each member will be responsible for proper use of the equipment, explanation of their concepts, and how it is relevant to the community. The training sessions will also contain lessons on how to engage with the audience and provide a fantastic and fun experience during the outreach.

April 2022 - During the first week, there will be a final training session where the whole program will be run through the allocated amount of time. This ensures the event will run as smoothly as possible. After the final training session, we will then be ready to launch the project and conduct the outreach at said school.

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

Activity Evaluation Plan

Determining the success of the event will be based on the responses we receive from the audience during and after the event. This will first be accomplished by asking their age group (from grade to high school). Throughout the event, team members will be roaming around and asking evaluation questions such as “how is the event?”, “are you having fun?”, etc. to a random selection of participants in the audience. At the end of the event, participants will be able to fill out a short assessment form which will contain similar questions in addition to what they liked the most and any improvements that the team can work on. In the same assessment will be a survey regarding age group, education, interest in STEM, and whether their opinions changed throughout the course of the event. The team will keep a record of responses.

While the audience is of primary importance, involving SPS members who aren't on the Executive Board is also a concern, and will count towards what we consider to be a successful event. Many new members have a lot to gain from outreach events like this.

After the demonstrations, we plan to have a forum with the team members so that the audience can ask any questions regarding their career, inspirations, how physics is involved, and even experiences. The forum's purpose is to inspire others and answer questions that may have caused hesitation with careers in the STEM fields.

Budget Justification

The proposed budget will be used to fund the experiments/ any other required items needed for the variety of demonstrations that the SPS Chapter team members will use to perform. Visual engagement is key in providing a positive learning experience for the audience. Hence, it will also give a sense of interaction in the field of elasticity and kinematics, that is open for everyone to explore regardless of age and status. With the reach of providing an in-person outreach, hands-on demonstrations will engage both the audience and the SPS members to create bonding activities. All of the items in the budget are for the demonstrations and any other sources of money that this project receives will be from the University of the Sciences SPS Chapter, if needed.