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

Marsh W. White Award Proposal

Project Proposal Title	Demonstrating the "Phun" side of Physics through hands-on projects
Name of School	New Mexico State University
SPS Chapter Number	SPS Chapters: New Mexico St University-ZONE16-SPSChapter4749
Total Amount Requested	$200.00

Abstract

The Society of Physics Students at New Mexico State University is applying for the Marsh W. White Award for funds to expand demonstrations for outreaches. The major demonstrations include a marshmallow trebuchet, water crystal beads, and a Faraday radio.

Proposal Statement

The SPS Chapter at NMSU will have these demonstrations to present for younger generations to get their interest in physics and will need the money for demonstrations that go above and beyond normal demonstrations.

Overview of Proposed Project/Activity/Event

The major projects that the chapter will do are three demonstrations as stated earlier: a marshmallow trebuchet, water crystal beads, and a Faraday radio.

Marshmallow Trebuchet

This will be a small trebuchet with the dimensions of 35 cm x 35 cm x 15 cm (height width depth) and will be made with ¾" softwood, braces, string, duct tape, and nails. The purpose of the size is meant to be portable and safe indoors. It will be modeled using the blueprints of the Hila Trebuchet found at http://hila.webcentre.ca/projects/trebuchet/index.htm . The project would be to calculate the trajectory of a marshmallow to teach students about projectile motion. The target audience would be students in elementary to students entering college. The physics behind the demonstrations will be changed to get students to understand, but it would be applicable for all wishing to learn about projectile motion. Every year, NMSU's chapter tries to expand their demonstrations, the demonstrations are fun and can be interactive. While trying to think of new projects, we have to keep in mind that we have to talk about the physics behind it. We thought about subjects that the students would be learning at the time, and while we have many physics demonstrations, they mostly apply to lights, this project would dive more into the mathematics that can be found in every day life and show the different results with different variables. The chapter would experiment and get the physics down to where the marshmallow would land and be able to show the math that went into the result.

Water Crystal Beads

For this experiment, the chapter will have to prepare the beads a couple of days in advance. The experiment will show the refractive properties of different solutions. There will be three liquids as of right now: regular water, sugar water, and Splenda water. The beads will be soaked in these three solutions; multiple beads for each solution. At the time of the experiment, each bead will be in their "original" solution, we will demonstrate that it seems as if there is nothing but the type of solution in there. We will then switch the beads and put them in different solutions, when this happens, the students will see the beads in different solutions are visible because the solution is not the same throughout the cup. The target audience will again be students from elementary school to students entering college. This was a concept that students had learned in college and we think that it will very much put into perspective of what the refractive index is early on. The idea of this experiment comes from the recent PhysCon workshop and the chapter thought it would be a very simple demonstration for this concept.

Faraday Radio

This demonstration also came from the recent PhysCon workshop; it would teach students about Faraday's Law. In this demonstration, we would have the radio on and show that it is indeed a functioning radio. After we show that there is nothing wrong with the radio, we will put the radio in a Faraday cage. The radio will not be able to receive the waves. This would be a fairly simple project that could be done in multiple ways; there could be different versions of the cage to show that the shape does not matter, as long as it is closed it will work. The materials needed will be a stainless steel wire mesh and a radio. The chapter would do multiple versions that also include aluminum foil and a box to show that the concept can be a DIY project and try it out at home. The target audience is students ranging from elementary school to college and would show Faraday's Law and some of the principles in E&M. While we want out demonstrations to be unique, we want to show students that they too can do physics in their

own home. Many of our demonstrations require instruments that students would not be able to access, so this project would give them the chance to take the idea home to their families with little equipment needed.

How Proposed Activity Promotes Interest in Physics

The ideas and concepts that the chapter wants to present are the kind that is pretty simple to wrap ones' mind around. These projects allow students to not only watch, but participate in. Getting students interested in a subject requires that great "Aha!" moment; students will not be so inclined to study physics if they feel that they will not have fun because they do not know what is going on. The marshmallow trebuchet for instance would demonstrate how the results would change based on the variables. For younger students, the chapter would ask questions like "If we cut a marshmallow in half, would it go further?" while students in high school would have to go through the equations. This project would be applicable for any age and could even be used in early physics classes.

When doing outreaches, the main goal is to get students interested in physics. It is common for students to be afraid of physics, doing outreaches we want to show that physics is not all scary equations and laws; every thing we do happens because of physics and it can be really fun and interesting to know why things happen. Every year, the chapter will go out to local schools on their own time and show the students how interesting physics can be. Unfortunately, some of the students might have seen the demonstrations from earlier, which is why we try to expand our collection. Having these projects, students we be able to understand the physics behind them because they are not just watching, they are interacting with the projects and having fun doing it. We know that very young students would not be able to entirely understand a concept, but introducing them to the topic and giving them a hands-on example would stay with them throughout their lives; when the subject is brought up again they will have introductory knowledge of the concept.

Plan for Carrying Out Proposed Project/Activity/Event

- The projects will be monitored by the leader of the group. The group leader will be in charge of keeping in contact with the president and will have to give bi-monthly reports of progress made to ensure it will be ready for outreaches.
    - There are a total of three groups:
        - Revamp – Fix up old demonstrations
        - Long-Term – Semester long projects
        - Short-Term – Two to three projects a semester
    - Long-Term:
        - Marshmallow Trebuchet
    - Short-Term:
        - Water Crystal Beads
        - Faraday Radio
    - Leaders will have meetings outside of regularly scheduled chapter meeting to complete projects.
    - Leaders will be in charge of supplies and talk to officers if in need of supplies.
- When the projects are ready to demonstrate at outreach events, the chapter will have a feel if they are getting through to the students. With this, the chapter could have a simple survey that could be given out at the end of the presentation or have a follow-up with the teacher the day after the presentation.
    - The chapter will also talk about the demonstrations with the department head to allow professors teaching introductory level classes access and instructions for demonstration.
- All of the SPS members will participate in the projects because they will all be in a group. When a new member joins, they will learn about the projects and decide which they find most interesting and would be able to give advice on.
    - Currently, SPS is trying to team up with SEPh, Society of Engineering Physics. Leader can talk to the officers and then the officers can have a joint meeting with SEPh to try and work on helping each other from outreaches to equations and even manpower for making the demonstrations.
- There are resources for the groups to use. The groups can ask advice on concepts as well as design from veteran members and officers. The members could also go to professors during office hours for ideas on what to improve on. As far as the building of experiments, there will be blueprints to follow. SPS members are often in labs or classes that require them to be able to problem solve and build.

Project/Activity/Event Timeline

Marshmallow Trebuchet

This project is to be completed by May 1st, 2017. The completion of this project will mean that the demonstration is ready for outreach use. April 3rd, 2017 will be the date of the finished trebuchet while

May 1st will have the write-up complete. The chapter will meet for the first time in the semester on January 25th, 2017 and leaders will be in charge of delegating what needs to happen.

Water Crystal Beads

This project is to be completed by February 25th, 2017. The groups will have to find the ideal amount of days before to start growing beads in solutions. Will have write-up of the substance as well as what the refractive index is. This includes having "key-words" for each grade to show what is going on while staying as close to the concept.

Faraday Radio

This project is to be completed by April 28th, 2017. The group will have to have made one cage by February 25th and the second cage made by March 15th. The write-up will be due on April 28th but the goal is to have the demonstrations finished earlier than the write-ups so that the demonstrations could be used for outreaches for each of the projects.

Activity Evaluation Plan

NMSU's SPS chapter is responsible for outreaches and it is purely volunteers. The volunteers are usually members of SPS and the president is in charge of having demonstration days and write-ups made so that people helping with the outreaches know what to say to which grade level. Since it is volunteers from SPS, the volunteers have to work around with their school schedule. At every presentation, the chapter tries to have three to four members, but can work with two members at the minimum. When outreaches happen, it is usually a full day of three to four presentations. Based on the results or the survey, the chapter will be able to know if they should incorporate more hands-on projects. Students will also be able to provide which concepts they think would be interesting as well, which can lead to more demonstrations. With more demonstrations, it would be possible to have more than one outreach for the specific class as the demonstrations would be different and the feedback would give the reason for students to be excited for learning physics.

The physics faculty would also be presented to so SPS can show the department what they are doing and get feedback on what to improve on and what else to teach the students when doing outreaches.

Budget Justification

The budget proposal has all of the materials needed to make the demonstrations. The wood, braces, marshmallows, and nails are for the trebuchet. The tools can be supplemented by the SPS members. The Water Gel Crystals and clear plastic cups would be used for the refractive index demonstration. The stainless steel mesh, aluminum foil, wood, and nails would be used for the Faraday Radio. The radio and box can be supplied by the chapter or the department.

The total cost would $166.84, but for the sake of the proposal, the SPS chapter from New Mexico State University is asking for a round $200.00 in case of mistakes or underpricing of materials.

The SPS chapter from New Mexico State University thanks you for the opportunity to provide funds for demonstrations that would help influence younger generations have an interest in physics. SPS members have to make time for theses events and want to get the best demonstrations for these outreaches, they provide the hard-work and are very dedicated to outreaches. If needed, the chapter will find a way to manage getting the materials needed, but it would be a great help to have most of the materials covered through the March W. White Award.

Thank you once again.