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

Marsh W. White Award Proposal

Project Proposal Title	SPS Super Sound Science Show
Name of School	Rhodes College
SPS Chapter Number	5940
Total Amount Requested	$496.78

Abstract

Rhodes College SPS will cultivate interest in physics for k-12 students by creating a musical science show we will perform at local schools. The show focuses on creating music in unorthodox ways, and explaining the science of sound, vibrations, and waves in a highly engaging format that embraces Memphis culture.

Proposal Statement

Overview of Proposed Project/Activity/Event

Our goal is to create a physics of sound science show that we will take to different schools to perform. The purpose of the show is to cultivate interest in physics and explain the science of sound, vibrations, and waves by creating music in unorthodox ways. While doing demonstrations at schools is relatively common for our chapter, this project is an effort to increase our impact by bring in a level of showmanship we have mostly been lacking up to now, as well as expanding our demo roster, and embracing Memphis culture.

The show will last about 45 minutes and alternate between scripted lecture style presentation of demos with heavy audience participation, and concert style sections featuring those demos creating music. Our featured instruments will include a tesla coil, Theremin, wine glasses, boom whackers, Stroh violin, and as the finale a fire organ (an instrument we've been designing that consists of an array of singing tubes and creates notes by superheating the air inside the pipes). Several of these instruments our chapter already owns, such as the Tesla coil and Theremin, others will need to be bought, or constructed in our physics department's machine shop. These instruments were chosen for the variety of ways in which they make sound, as well as their general showmanship. They will be supported by a small band made up of SPS members during the concert sections of the performance.

Our goal with the project is to emulate the style of touring science shows to present an important aspect of physics in a way that is far more engaging, fun, and memorable than normal science classes or our standard presentation methods. The show will focus on the science of vibrations, waves, and how we perceive sound. Many of our featured instruments create sound in a drastically different way than what most people are used to. In the case of the fire organ and Stroh violin, they take familiar instruments and alter the method of sound production (heat rather than air pressure for the fire organ, and the vibration of a metal rod rather than a wooden body for Stroh violin) while still sounding relatively the same. These instruments will allow us to explain basic concepts such as sound waves and standing waves to younger kids, as well as more complicated concepts such as wave interference, timbre, resonant frequency, and translating between electrical and audible frequencies to older audiences.

Our chapter has a good working relationship with the surrounding K-12 schools, and our goal is to perform at least five of these schools over the course of spring semester, plus a performance here at Rhodes. While the specific explanations of the instruments and science involved will change between presentations depending on the audiences age range, the basic show format will be able to stay largely the same.

The idea for a musical physics performance originated last year when we realized that a significant portion of the students currently in our chapter have some type of musical or performance skill that we could use. The original plan was to form a physics band made up of SPS members, this was later combined with several sound based demos that had been proposed and restructured with a focus on outreach.

How Proposed Activity Promotes Interest in Physics

The goal of this project is to maximize the impact of our outreach by creating an event that is educational while also being memorable and entertaining. While our outreach events are generally well received, our events that have a greater element of showmanship and flare, such as pumpkin drop, generally tend to elicit a much more engaged audience response. We're hoping to use the performance talents in our chapter to bring this element of showmanship to our outreach events. Putting our physics explanations in a show format with the inclusion of music will create an element of wonder and novelty that would otherwise be absent. Several of our members remember attending these kinds of science shows as kids, and while most of them were silly, they taught us actual science, and have stuck with us far more than any kind of class presentation. The reasons for this are clear, they took everyday science, and put it in a context that most people never would have considered, while at the same time making us laugh and teaching us. These are the elements that we hope to emulate in this project.

Plan for Carrying Out Proposed Project/Activity/Event

- Personnel
  - Josh Ortega: Project head, will head writing of the show and design of new demos
  - Anna Murphy: Will assist in design and lead construction of new instruments/ demos
  - Evan Main: Will Coordinate with local schools to market and schedule shows
  - Spring Smith: Will keep the project on schedule and handle logistics (tables, speakers, etc.)

    - Alden Raymond: Will handle budget, and help write
- Marketing
    - Rhodes SPS is fortunate to have a very good working relationship with local k-12 schools, we are regularly invited to present and do demonstrations, and host events that are well attended by local students. Many of these schools we interact with will be more than willing to let us come a put on a show of this nature. In addition, in the spring semester Rhodes puts on a music festival, in which student bands can perform, participation in this would be a good way to engage in our local Rhodes community.
- SPS member participation
    - The show is relatively light in terms of manpower, with most of the work being put in ahead of time by the project leads. Six dedicated members will need to put in time for rehearsal and performance (five to play instruments and explain demos, one to run sound equipment). Several of these members are already set, they include Josh Ortega, Alden Raymond, and Anna Murphy. There has been a significant amount of interest in this project in our chapter, so filling the rest of the slots will not be an issue
- Expertise
    - Much of the inspiration for this project came from the level of musical and performance talent currently present in our SPS chapter. Many of our officers are musically talented, and the project lead, Josh Ortega, is uniquely suited for this as he is a physics/ theater double major, as well as a musician.
    - We've started conversations with community members to help maximize the impact of the show. These include Nick Tombs, a local magician who has a science show he performs for kids, who will help us with the showmanship and entertainment aspects of the show. We've also talked Lawrence Blackwell, the director of programs at Hattiloo theater, about the best way to approach and market ourselves to schools.
    - The Rhodes Physics Department has a staffed machine shop that will help provide the proper tools and expertise to ensure that the construction of the Fire Organ goes according to plan, and the final product is safe for everyone involved.
    - Notable student skill sets
        - Josh Ortega: Physics/Theater major with a focus on directing, plays piano and sings
        - Anna Murphree: Design/construction experience, plays drums, band performance experience
        - Alden Raymond: plays drums, can run sound equipment
        - Madeline Allen: plays cello
        - Several theater and music majors have expressed interest in joining the project as well

Project/Activity/Event Timeline

Jan. 1st	All new instrument/demo designs completed
Jan. 14th -First Monday after start of spring semester	Show script finalized
Jan. 14th	New demo construction begun
Feb. 15th	All new instruments completed or bought
Feb. 16th	Rehearsal start
Mar. 15-Apr. 20th	Range for performances and visiting schools
Mar. 22-24	Rites of Spring, the on-campus music festival

Activity Evaluation Plan

Most of the feedback for this event will be through our contacts at the schools we visit. We will ask these teachers about the reception to our event, as well and feedback for future performances. Once all the equipment for the show is acquired

it will likely be a recurring outreach event, so their feedback will be vitally important for its continued success and improvement of the show.
There is also a significant informal feedback source which is the audience itself. Anyone who has presented or preformed knows that audience energy is relatively easy to gauge, and we will be able to edit and improve our show based on what our audience is receptive to and what they aren't.

Budget Justification

Budget items:

1. Wine glasses: These glasses will be one of the featured demonstrations in our performance, they are a good way of explaining resonant frequency, and are an example of applying physics to everyday objects.
2. Boom whackers: These are useful tools for explaining how different objects vibrate at different frequencies, and they will primary source of audience participation during the show. They are cheap, easy to use, and hard to break, and we will be able to pull several audience members on stage to participate in songs.
3. Whirly tube: Will be used in conjunction with the boom whacker presentation to demonstrate that no matter how a vibration is produced, the resonant frequency of an object remains the same.

4-8. Fire organ supplies: The rest of the Items on the list will go toward materials for the fire organ. The steel tubing, mica, and nichrome wire will be used to build a large array of singing tubes, while the Arduino will be used to remotely cover and uncover the pipes in order to control what notes are being played. We already have most of the materials for the larger structure of the organ on hand, the misc. category will cover smaller building supplies such as screws, brackets, wire, etc. The ability to construct this demo is vitally important to the show, creating sound through heat will let us explain and connect different areas of physics, in a truly novel and compelling way.

Other funding

- The only demo that will not be purchased with the Marsh White award or that we do not already own is the Stroh violin, this will more than likely be bought with money from our chapter budget.
- Sound equipment for the show will be borrowed from the Rhodes library and theater department.