



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	The Giant Brachistochrone of SCIENCE!
Name of School	University of Central Arkansas
SPS Chapter Number	1059
Total Amount Requested	\$300.00

Abstract

SPS Chapter 1059 at the University of Central Arkansas performs science demonstrations for middle school children. The Chapter will use the funds from the Marsh W. White Award to build a large version of the brachistochrone ramp that is big enough for children of all ages to see the demonstration.

Proposal Statement

Overview of Proposed Project/Activity/Event

The SPS Chapter 1059 at the University of Central Arkansas will use these funds to build a large, yet still mobile, brachistochrone ramp with an adjacent straight ramp. The ramps will be made out of wood and be on a stand with wheels. The ramp will also be equipped with an electronic relay system to ensure that the steel balls are released at the same time. At the end of the tracks, there will be sensors to show which ball arrives first.

The Chapter has three main goals with building this demonstration. Our first goal is to increase our outreach towards other schools. In the previous school year, many elementary schools took field trips to our university where SPS would setup and run 1-hour long demonstration shows in order to create excitement and spark an interest in children at a young age. These shows were an extreme hit yielding nearly 30 shows and over 900 children reached! Since last year, the requests for our shows have dramatically increased and we have already scheduled well over 30 shows for the spring semester and we still expect more requests. Because of this, we want to update our demonstrations. One of our ideas was to build a very large brachistochrone with a simple electronic system to control the release of the balls and track the timing of the balls at the finish line. This allows the system to be interactive for our outreach projects.

The second goal is to increase the size of our organization and increase the enrollment into our science programs at the University of Central Arkansas. This demonstration will be utilized at our “Bear Facts Days,” which is a departmental recruiting day, our Registered Student Organization's fairs which is used for increasing our Chapter's enrollment, and at the school's “Major's Fair” which is used for increasing interest in specific degree majors.

The third goal of the Chapter is to provide a demonstration for the Classical Mechanics class at our university. This class utilizes the Lagrangian to calculate the path that an object needs to take between two points for a minimized time of travel. While the students can easily calculate the time that it takes for the ball to arrive at the end of the ramp, the brachistochrone can be used with existing video analysis software to fully verify the calculations versus real world measurements.

With the goals stated above, our target audience will include everyone at our outreach events to increase an overall excitement for science and ignite the science fire in the gut of our viewers. This audience will also not just be limited to the people who attend our events. We plan on creating videos that explain the physics behind our demonstrations that will be put on our YouTube page and, if approved, this demonstration will be included. Our target audience also includes any student that will be taking the Classical Mechanics class at the University of Central Arkansas.

The motivation behind this project stems from the enthusiasm that all of our SPS members have for improving our presence among our student body and our community. One of the overall goals at our Chapter is to increase an eagerness in the general public for science education and we believe that creating large and exciting demonstrations is one way to do that.

How Proposed Activity Promotes Interest in Physics

The goal of this project is to present a new and exciting interactive demonstration to the attendees of the Chapter's demonstration shows and other events. The Chapter hopes to use this new demonstration to bring enthusiasm in science into the lives of our attendees in hopes of expanding an interest in the subject to improve retainment in the sciences. The Chapter plans on accomplishing this goal by making the demonstration physically large, painting it with noticeable colors, and making it interactive for the public. We feel that having the ability to make the demonstration interactive and large allows the user to physically experience science and gain an appreciation for the physics behind the brachistochrone.

Plan for Carrying Out Proposed Project/Activity/Event

Our department instrumentation technician Allan Roisen will be assisting with the actual carpentry work of the project. He has the equipment and experience necessary to fulfill the attention to detail required for this project. The faculty advisor of our SPS Chapter Dr. William V. Slaton will be overseeing the project through all steps. The Chapter members will be doing all other work on the project including the electronics of the display, collection of materials, mobility of the display, construction of the display, and the overall visual appearance of the display. Marketing is not a major necessity for this project's success due to the fact that our science demonstration shows have already been scheduled for this year. Last academic calendar year we saw approximately nine hundred students. The project will improve our science demonstration shows.

Our Chapter conducts these demos for local students every year. There is usually a group of around twelve SPS students who are very active in assisting at the demonstrations. The RSO fairs at our university usually have a group of around six SPS members who actively participate. In the fall, when the mechanics class is to be held, there will be over twenty students who will be using this demonstration while actually calculating the brachistochrone curve. The success of this project is ensured by our experience with previous science demonstration shows. This is a classical and amazing demonstration that is perfect for any mechanics class. In fact, it is a good demonstration for any level physics class.

Project/Activity/Event Timeline

The project is planned to be completed before the middle of the spring semester, around February. This general deadline is chosen based on the dates of the Texas Section Meeting of the APS, AAPT and Zone 13. Our Chapter would love to present this project at the meeting to maximize its exposure. This deadline is also effective due to the demonstrations of local grade schools beginning around April. Also, April 22nd is The University of Central Arkansas's on campus research poster symposium where the project will be presented. Planning is ongoing from now (November) through December at the end of semester. Work will be started over Christmas break. As soon as our Chapter receives the award, the purchasing of materials will begin. Within the month after the award, the project will be built and tested. Once the project is properly functioning, the details with paint and visual appearance will be worked on. The final stages of the project will be to make it

mobile. Presentations to the professors will begin immediately followed by the zone meeting, school demos, and finally mechanics classes in the fall semester. The project will, of course, continue to be a main demonstration in our future annual events.

Activity Evaluation Plan

The plan for our evaluation of the project includes our department faculty as well as teachers who attend our demonstrations. Typically, during our demonstrations, handouts are given to the students as well as teachers and chaperones that are in charge of the students. These handouts include the different demonstrations, what the ideas behind the demonstrations are, and how the students can do them on their own. These will include a short survey asking the chaperones specifically how they felt our overall presentation was. We will include a specific question asking about the different demonstrations. This will help us to improve our demonstration shows, as well as find out specifically what they liked. Students' participation and feedback during the demonstrations will be a direct way to evaluate our project. Students, especially younger audiences, typically are very honest about what they think about our demonstrations. This demonstration will also be used with video analyzing software in the Classical Mechanics class in order to compare the measured values against what the theory suggests. We will ask these professors to gather feedback from their students who are introduced to the demonstration in classroom settings to show its effectiveness for improving the learning process.

Budget Justification

The funding will be used to purchase the material for building the brachistochrone. Materials will include: enough wood for a large ramp, screws, several steel balls, electronics for instant release of the balls, casters, and other miscellaneous materials for function and visibility of the ramp. The amount of wood to create the large display would make it possible for our Chapter to meet the goals of visibility and astonishment of the display. The steel balls and the electronics would help in making the presentation precise which would help our demonstration to convey that the mysterious behavior is, in fact, governed by physics alone. This will be especially important during the sessions with children to rule out human error, not to mention the kids love

to push buttons. The casters will make it possible for our Chapter to transport the display around campus to the various events we participate in. Having this display at events such as high school recruiting days and RSO fairs would help promote excitement and wonder into our department through our interactions with students, future students, and other RSO groups. The miscellaneous materials are for the display to appeal to our audiences, the ball catch at the end of the ramp, and equipment to mount our electronic circuits and peripherals. All of the materials included are very important in building a functional, visually appealing display that will last for many future generations of students in our Chapter.