



# SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Project Proposal Title	The Starch Difference
Name of School	Drexel University
SPS Chapter Number	1619
Total Amount Requested	\$210

## Abstract

Our chapter would like to hold a non-Newtonian fluid demonstration to introduce the concept of viscosity and sound waves. We will use a speaker to manipulate the fluid and make shapes. In doing so we will compare it to water (a Newtonian fluid) to note differences between non-Newtonian and Newtonian fluids.

# Proposal Statement

## Overview of Proposed Project/Activity/Event

Our chapter would like to hold a non-Newtonian fluid demonstration to introduce the concept of viscosity and sound waves. We will use a speaker to manipulate the fluid and make shapes. In doing so we will compare it to water (a Newtonian fluid) to note differences between non-Newtonian and Newtonian fluids.

The cornstarch and water mixture is safe to touch and biodegradable so participants can feel the effects first hand. Our goal is to prove that physics can be hands on and experimental. The ability to touch and feel leaves lasting impressions that encourage a continued interest in physics.

At the Philadelphia Science Festival the Drexel SPS reaches a wide range of children and adults. Our audience will be focused on children but adults will enjoy the experiment as well. Because of the nature of the material our message can be presented in multiple ways as to fit the knowledge and education level of each participant. Hands on science is for everyone.

Our chapter has had a presence at the Philadelphia Science Festival for many years. Our demonstrations are always fun and educational while providing support for our university and the city of Philadelphia. We use our knowledge and resources to bring science to the public. Our chapter works with anyone they can to foster a growing interest in science.

## How Proposed Activity Promotes Interest in Physics

The Starch Difference is a project with many different aspects of physics to look at. You can choose to focus on the Oobleck fluid and its properties, which range from the relation of strain and viscosity to the impact resistance, or the sound waves and how their frequency and amplitude change the reaction of the fluid. We draw participants in with the cool “dancing” of the Oobleck but once we explain the principles behind the unusual reaction people will ask questions. The ability to touch is a valuable asset as it gives a third sense to our demonstration. Participants can hear the sound the speakers make, see the fluids reaction, and feel the resistance it gives.

This project is worthwhile because it introduces properties of sound as well forces and viscosity. The basic principles are memorable enough to stick with a small child or intriguing enough to encourage an adult to complete further research. Because Oobleck is safe and simple to make it also encourages further experimentation, a part of physics rarely showcased.

## **Plan for Carrying Out Proposed Project/Activity/Event**

The Starch Difference demonstration will be led by the secretary of our chapter, and will take place at the Philadelphia Science Festival. This festival ends in an extremely popular and well attended “Carnival on the Parkway” where interesting, and exciting science events take place. The number of SPS volunteers from our chapter will anywhere from 5 – 12, as members will have to make and re-hydrate the cornstarch/water mixture along with perturbing the mixture to produce the desired outcome. Our Women in Physics Society (WiPS) chapter president and treasurer also offered their assistance. The secretary has sufficient experience in outreach, including student and participant safety as well as previous involvement in the carnival. The other members involved continually perform outreach demonstrations at our physics open house as well as other non-annual SPS sponsored events. The additional WiPS officers share many experiences with SPS members as well as additional planning experience.

## Project/Activity/Event Timeline

### January:

Begin ordering necessary materials. Continue research on speaker quality in relation to applies force to Oobleck.

Begin testing limits of Oobleck.

Test how long it can remain saturated and retain non-Newtonian properties in different heats.

Find most reliable recipe for fluid.

### February

Create procedure for measuring frequency of speakers.

Test best sealant method for speakers.

Test food coloring.

Find best method of disturbing the fluid.

Research interesting facts to preset.

### March:

Begin gathering other volunteers and training them.

Test if handwashing bins will work with large crowds.

Estimate exact amounts of Oobleck based on the Philadelphia Science Festival predicted numbers.

### April:

Review basic information we will be presenting.

Prep sparkers (seal them).

Prep water and corn starch for transportation.

Check weather forecast for May 2<sup>nd</sup> and plan accordingly.

Finalize volunteer shifts.

### May 2<sup>nd</sup>:

Present our work.

## Activity Evaluation Plan

The Drexel University chapter hopes that the audience gains knowledge in physics after participating in the Starch Difference. The attendance is evaluated by comparing the Philadelphia Science Festival official attendance (which we will keep track of by counters we will keep on hand) and their enjoyment in taking part in poking and prodding the Oobleck. As the participants engage in the demonstration, Drexel volunteers will discuss the variety of physics principals involved with the set up. When they finish the volunteers ask questions that involve further thinking. For example, volunteers could ask what they think would happen if they were to run across a pool of Oobleck, or what would happen if they stood still.

## Budget Justification

Cornstarch and water, also known as Oobleck, is a dilatant non-newtonian fluid whose viscosity increases with stress. It is not only a convenient commodity, but also can be produced in large amounts economically.

Food coloring, when mixed with Oobleck, does not interfere with the properties of the non-Newtonian fluid and makes the demonstration more visually interesting for the target audience. Since the demonstration will be conducted at the Philadelphia Science Festival, which has a turnout of almost 120,000 people, it will be a good way of attracting attention towards our demonstration.

Large subwoofer speakers operating at a high volume are the most efficient way to observe interactions of non-newtonian fluids with sound waves. Vibrations from the subwoofers will result in enough stress on Oobleck so as to keep changing its viscosity and make it jump. The speakers will be protected from the Oobleck by the trash bags which is quite efficient yet inexpensive method. Since the event is outdoors, we won't have any sinks around to dilute and dump Oobleck. Therefore, we will require hand wash bins.