



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh W. White Award Proposal

Project Proposal Title	Lunchtime Physics Club for True Inquirers
Name of School	Cleveland State University
SPS Chapter Number	1247
Total Amount Requested	\$500

Abstract

Campus International School (CIS) is a K-8 public school operating in partnership with Cleveland State University (CSU). For the 2018 school year, CSU's Outreach team will provide in-school, interactive lessons that expand upon CIS's Programme of Inquiry, "How the World Works," as a lunchtime physics club for K-5 students.

Proposal Statement

Overview of Proposed Project/Activity/Event

Cleveland State University's Outreach team has worked with Campus International's YMCA Afterschool program for seven years now, through our highly successful Physics Fridays Outreach program. The 2017 school year saw the opening of CIS's brand-new building, and with it, several new student programs. CSU's SPS has been asked to help with the International Baccalaureate (IB) Programme of Inquiry, a K-5 grade educational structure focusing on globally-minded, investigation-based lessons and learning. The science portion of the Programme of Inquiry has a unit titled "How the World Works," and aims to live up to its title while emphasizing humanity's effect on the world. This unit for each grade level features its own central idea and lesson themes, including how an object's properties effect its behavior, mechanics, states of matter, environmental sciences, and optics. Each grade is designated a month of the school year to cover its "How the World Works" unit.

The goal of the CSU SPS Outreach team is to bring interactive lessons to each grade during the corresponding months of the unit. These lessons will be based on "How the World Works" unit, and will show how common place phenomena in students' lives illustrate the grade-specific learned concepts of the unit. For example, to cover the topic of states of matter the SPS team will show how certain edible materials, notably chocolate, gradually transition between phases through melting (after all, everyone like chocolate). Similarly, other commonplace demos will explore the topics of center of mass and density, simple machines, Newton's laws, environmental physics, and light phenomena. These visits will occur once a month at CIS during lunch, and will involve all students within a specific grade level. The scheduling of the visits will be coordinated with the CIS's Instructional Leader, Mrs. Bechtel.

Traditional Physics Fridays outreach to afterschool students at CIS will also continue and will use lessons created and updated via this award. We expect to have 2-3 Friday afternoon visits to CIS per semester.

How Proposed Activity Promotes Interest in Physics

CIS's Programme of Inquiry seeks to explain how humans use the scientific principles to understand the natural world, and how scientific and technological advances impact our societies and environments. The interactive lessons we will conduct will enable the students to directly engage with the phenomena they are studying in their classes through everyday applications. This augmentation of the traditional classroom setting takes into account the different learning styles of students and brings "textbook theory" into the real world both for CIS kids and CSU students. By showing the physics in the world around us, CSU students will come to more fully appreciate and value the sciences, while also encouraging individual exploration beyond academic classrooms and halls. As the CSU Outreach program will be part of the school day, we will be able to reach a fuller range of students than just those seen during a standard afterschool session.

Plan for Carrying Out Proposed Project/Activity/Event

- **Key Personnel**

- Samantha Tietjen, Physics Major; Outreach Coordinator
- Aubrey Lokey, Computer Engineering/Physics Major; SPS Secretary
- Ngozi Williams, Civil Engineering/Physics Major; Chief LN₂ Ice Cream Maker
- James Ellis, Physics/Mathematics Major
- Dan Terrano, Chemistry/Physics Major; SPS President
- Ilona Tsuper, Chemistry/Physics Major; SPS Vice President

- Tony Dobrila, Physics/Mathematics Major
- Dr. Kiril Strelitzky, Cleveland State University SPS Advisor
- Mrs. Dora Bechtel, CIS Instructional Leader, CIS/CSU liaison
- **Marketing** – CSU’s Outreach team will coordinate our lesson plan with CIS’s schedule per grade level, prior to the program’s start to ensure lessons align with the school’s curriculum and have maximum impact. Staff will notify parents of the lesson plan accordingly. Also, CSU students will be notified of volunteer spots via email and at meetings.
- **SPS Member Participation** – Key personnel will work with 3-5 other volunteers (other STEM majors) to carry out each lesson. These students are recruited during SPS meetings and are thus usually either national SPS members or Choose Ohio First (COF) students.
- **Expertise** – past members of CSU’s outreach team will also aid in various aspects of this program:
 - Jim Pitchford, 2011 Math Alum, Science Writer, past SPS Outreach Coordinator and co-founder
 - Krista Freeman, PhD (Carnegie Mellon), 2011 Physics Alum, past president, Outreach co-founder
 - Janna Mino, 2015 Physics Alum, past Vice President, currently working on teaching certification

Project/Activity/Event Timeline

One individualized lesson will be conducted per age group based on the curriculum outlined in CIS’s “How the World Works” Programme of Inquiry. These will occur during the school day at CIS to allow full-grade participation.

- I. **Kindergarten – Density and Center of Mass (January 2018):** Why do things balance? What is friction? How does center of mass affect the world around us?
- II. **1st Grade – Intro to Force and Phase Change (Early February 2018):** Simple machines and their applications. What are the phases of matter?
- III. **2nd Grade – Newton’s Laws (Late February 2018):** How do Newton’s Laws dictate the physical world? What is rotational motion and why is it important? More advanced simple machines.
- IV. **3rd Grade – Phase Change (March 2018):** How do phase changes effect everyday life? Are there more than three phases (non-Newtonian fluids). Dry ice versus “wet ice”.
- V. **4th Grade – The Water Cycle and Rainbows (April 2018):** What is the water cycle? Creating a basic cycle (clouds and rain inside). What really is a rainbow and how are they formed? Atmospheric pressure.
- VI. **5th Grade – Light and Waves (May 2018):** An introduction to optics. Colors, reflection and refraction.

A rehearsal will occur prior to each visit based upon a detailed lesson plan to ensure presentations are both accurate and engaging for students.

Activity Evaluation Plan

Outreach events will be documented for future reference and reporting purposes primarily via detailed outlines of each lesson (including a lesson plan, summary of activities, materials, and overall student response). Photos will also be taken at each event. A record for each grade level will be kept; including age range, number of students, and Programme of Inquiry Topic. Lastly, surveys will be given to CIS faculty, parents, and students as well as CSU outreach volunteers. The surveys to the CIS kids will be to assess and document the lesson’s effectiveness and student response to the activities, while the volunteers’ survey will inquire about the impact the outreach program has on CSU students and our SPS chapter.

Budget Justification

The SPS Outreach team already has well-developed demos and lessons regarding Newtonian mechanics and simple machines from previous Physics Fridays events. The team works closely with the CSU Physics Department, which will be able to provide hotplates and Magdeburg spheres for the 4th grade’s investigation into environmental physics. “Wet” and dry ice will be supplied by the Biological, Geological, and Environmental Science (BGES) department for the 3rd grade phase change lesson. However, the wide range of topics covered by the Programme of Inquiry boasts a new challenge for

the CSU Outreach team, and thus require funds to support these new lessons. Items that will help the Programme of Inquiry while also building on the catalog of demos available to the long-standing Physics Fridays program include:

- I. **Kindergarten – Density & Center of Mass (January 2018):** Helium tank, 2.5-gallon glass aquarium (\$55)
 - II. **3rd Grade – Phase Change (March 2018):** Cooler (for safe transportation and storage of dry ice; \$25)
 - III. **4th Grade – The Water Cycle and Rainbows (April 2018):** Vacuum pump and chamber (\$220)
 - IV. **5th Grade – Light and Waves (May 2018):** Laser Classroom™ Light, Lasers and Optics Outreach Kit (\$200)
- Each year we design and develop new lessons and activities, and refine old ones to engage CIS students, new and old. The Marsh White Award funds will enable us to cover topics we have not addressed before and perform new demonstrations the students, and possibly some outreach volunteers have yet to see.

It is our interest and passion to pass on what we have learned and experienced in our physics classes and all science courses. This is why the CSU SPS Outreach program began, why it continues to this day, and why it will remain a part of our SPS Chapter and CIS-students' academic opportunities into the future.