

April 15, 2006

**Blake Lilly Prize Application  
University of Michigan  
Society of Physics Students**

**Society of Physics Students  
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Physics Department  
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Blake Lilly Prize Report

It all began with evaluations at the end of the last SPS school year. As in many years before, students suggested we expand our outreach, and others suggested we add an activity to build something nifty. From these suggestions and the hope of the Physics Department to reconnect with the Ann Arbor Hands-On Museum, Physics Palooza was born.

Our goal was to present physics to a diverse group of community members in a non-threatening setting. To begin the planning, we met with the Ann Arbor Hands-On Museum and decided to create an annual weekend of physics fun, using 15-20 hands on activity tables and a Super Science Show to showcase the best, most interesting demonstrations around. The demonstrations would then become a part of the Ann Arbor Hands-On Museum's exhibit collection, able to be used throughout the year for physics education.

We began looking for funding and drawing up plans for possible demonstrations over the summer of 2005. We approached the FOCUS (Frontiers in Optical Coherent Ultrafast Science) center at the University of Michigan for possible financial assistance. After many meetings and presentations, UM's FOCUS group signed on to help by assisting SPS with a generous \$15,000 grant and the help of researchers and professors in planning and execution of Physics Palooza.

Over 25 SPS members volunteered their help, so we got to work. We split up into four groups—Electricity and Magnetism, Household Physics, Vibrations & Sound, and Optics. Each group met weekly and was responsible for designing 4 or more hands-on activities, 1 large demonstration, and coming up with a list of supplies to be ordered. SPS leadership met with the staff of the Ann Arbor Hands-On Museum to discuss logistics, supplies, and how to reach the audience of the Museum (1-100 year olds). We invited the Museum's Public Program Director, Erin Mattimoe, to speak at one of our meetings and instruct us on how best to develop informal hands-on activities. We also invited physics demonstrator extraordinaire, Warren Smith, of the University of Michigan demo lab. He helped us refine our ideas and discussed the various issues we needed to consider when designing demonstrations. Through this work, we decided on a final list of activities and demos, and got to work.

We met on weekends to purchase supplies, work on write-ups for the museum staff, and start building. After a few crazy months and a handful of frenzied nights, the day came to show our work to the public.

On April 1<sup>st</sup> and 2<sup>nd</sup>, we filled the Ann Arbor Hands on Museum with enthusiastic physics undergrads looking to excite people about the fantastic applications and manifestations of physics. Physics Palooza ran from 10am-4pm on Saturday, and 12pm-4pm on Sunday, filling a wonderful weekend with demonstrations.

The Electricity and Magnetism group provided hands-on activities which included: the amazing Levitating Ring, to demonstrate how changing electric currents can induce magnetic fields, and vice versa; a Van de Graff Generator, which allowed participants to feel the hair-raising power of electricity; Shake n' Shine Faraday Flashlights, to demonstrate the principle of electromagnetic induction and how it can be used to generate power; the Ring-Launching Killer Capacitor, to demonstrate how electrical energy can be stored to launch projectiles and even vaporize tin foil.

The Household Physics group provided hands on activities which included: How to Make a Comet, to show that comets are made of familiar, every-day materials; the Lycra Space-time Universe Model, to demonstrate the basic principles of general relativity; Radiation and the Radioactivity of Household Items, using a Geiger counter to demonstrate how some every-day objects are highly radioactive; Levitating Friends, in which participants used the air pressure in their own lungs, along with an ordinary garbage bag, to lift their friends off the ground; the incredible Cloud in a Jar, to demonstrate how changes in pressure can cause phase changes in matter; and Musical Goblets, to demonstrate the principles of resonance and damping.

The Optics group provided the astonishing Disappearing Pyrex, to demonstrate the principle of refraction; inversion goggles, which challenged the participants to see the world upside-down; the Refraction Tank, to show how light bends as it travels through various media; the Sky Tank, to help explain scattering and why the sky is blue; and Custom Rainbows, in which participants used dispersion prisms and spatial filters to create their own rainbows.

The Waves & Vibrations group provided Sympathetic Tuning Forks, to explain beats and resonance; the Ripple Tank, to demonstrate constructive and destructive interference of waves; an oscilloscope and microphone to illustrate the shapes of different sound waves; the Dancing Plate, in which a speaker and an ordinary plastic plate were used to demonstrate standing waves; and provided a take-home project of slide whistles to explain the concepts of frequency and wavelength.

The Super Science Show consisted of 4 demos that consistently wowed the audience. We started with Star Fingerprints, in which audience members were provided with diffraction gratings that they used to observe the spectra of various elements found in stars, such as hydrogen and helium. We then moved on to the SPS-built Tesla Coil, which generated fantastic displays of electrical discharge and was even able to light up a fluorescent light bulb. The appropriately named Wavy Tube of Fire was used to demonstrate the wave nature of sound, as tones of different frequencies and even some classic Beatles tunes made flames dance and leap. The Super Science Show concluded with a liquid nitrogen extravaganza which involved frozen marshmallows, shrinking balloons, breaking racquetballs, shattering roses, and a superconductor.



April 14<sup>th</sup>, 2006

To Whom It May Concern:

I am writing regarding the extreme success of The Ann Arbor Hands-On Museum's physics Sciencepalooza event held on April 1<sup>st</sup> and 2<sup>nd</sup>, 2006. The activities developed by the University of Michigan's Society of Physics Students, and funded by FOCUS, were extremely popular and engaging for our guests.

We had over 1200 visitors in the building between Saturday and Sunday! Comments such as "Whoa!" "That is sooo cool!" and "Physics really *is* fun!" were stated over and over again by our guests. The Tesla coil, the "wavy tube of fire" (Ruben Flame Tube) and the musical goblets were just a few of the favorite activities that caused wonderment and hands-on discovery that weekend.

The FUNtastic Physics Sciencepalooza reached all ages, from adults to preschoolers. The SPS members were enthusiastic, knowledgeable and made a sometimes challenging science accessible to individuals of diverse science backgrounds.

The Ann Arbor Hands-On Museum cannot thank Society of Physics Students and FOCUS enough for their unending hard work and dedication to this project and science literacy in our community. I look forward to what we will accomplish together in the future!

Sincerely,

A handwritten signature in black ink, appearing to read "E. Mattimoe". The signature is fluid and cursive, written over a horizontal line.

Erin S. Mattimoe  
Public Programs Manager  
Ann Arbor Hands-On Museum



SPS members working on their activities in the SPS office.



Tim and Aaron working together to construct the Tesla Coil.



SPS President Maeredith Danowski working to get everything ready in time.



April 14, 2006

Ms. Meredith Danowski  
Society of Physics Students  
University of Michigan  
Ann Arbor, Michigan

Dear Meredith:

On behalf of everyone at the Ann Arbor Hands-On Museum, please accept a heartfelt thank you for the Physicspalooza weekend. The program was an unparalleled success and it completely exceeded our expectations. We are grateful to you and the Society of Physics Students for developing, researching and delivering an exceptional informal learning experience. We also wish to express our appreciation for the support of the University of Michigan Physics Department.

The comments from guests and members of our community have been exceptional. I received calls over the weekend congratulating the Museum on such a content-rich, exciting and motivating special event. As I have mentioned before, our desire to elevate the level of our programming has been a high priority for us. Your program impressed everyone, including a number of sincerely hard to impress people immersed in advanced research and academia. Many of our guests expect nothing less than excellence and they were impressed.

You may not immediately understand the magnitude of your gift to the Museum. It is difficult to measure beyond the bright eyes, the fascination of impressionable young minds and the resounding Ooohs and Ahhs from everyone. Trust us when we say this project will impact our programming for many years ahead. The passion, enthusiasm and commitment provided by the Society of Physics Students is an invaluable gift to us and to thousands of guests yet to visit.

The Ann Arbor Hands-On Museum is a community treasure. Your efforts support our community-based tradition of providing unique informal educational activities for the children, families, and adults of the region. We cannot thank you enough for your generous support that included your time, resources and passion for physics. These things were evident in every activity over the weekend. Our staff and guests were amazed by the experiments, by the enthusiasm of the students providing the demonstrations and, most of all, everyone enjoyed the bright-eyed responses from our guests. Your year-long effort will continue to strengthen our museum, improve our programming, and will benefit thousands of visitors each year, for years to come.

Thank you!

A handwritten signature in cursive script that reads "Mel".

Mel J. Drumm  
Director,  
Ann Arbor Hands-On Museum



SPS members setting up for Physics Palooza day one at the Ann Arbor Hands-On Museum.



Overhead view of part of Physics Palooza day two.



Participants break roses using liquid nitrogen during the Super Science Show.



SPS member Kimmy explains how the ring levitates due to induced currents.



SPS members Aaron, Mike, and Paige explain gravitation with our model universe.



SPS member Mike uses the Tesla Coil to power a fluorescent light during the Super Science Show.