



# SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

## Marsh White Award Report Template

*Instructions: Please complete each section after reading the purple text describing what should be in that section. Then delete the purple text.*

Project Proposal Title	Shooting for Clouds: The New Mexico State University Cloud Chamber and Outreach Development Project
Name of School	New Mexico State University
SPS Chapter Number	4749
Project Lead (name then email address)	Khadijih Mitchell Eleven11@nmsu.edu
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SPS Chapter Advisor	Michaela Burkardt
Total Amount Received from SPS	\$300.00
Total Amount Expended from SPS	\$204.05

## Summary of Award Activities

The title of our project this past year was Shooting for the Clouds: The New Mexico State University Cloud Chamber and Outreach Development Project. We are very interested in expanding our outreach programs and constantly looking for new ways to reach out to those around us. Our project consisted of the design and fabrication of a cloud chamber and the production of two to four posters to be hung in the physics department. In final reporting we have printed three posters. Our first poster (which we printed two of) is a Society of Physics advertisement poster. It advertises who we are, what we do, and when we meet. We hope that we will be able to bring more people into our meeting by having posters such as this hanging in the hallway. This poster lets incoming students who are unfamiliar to our department know about our organization thus giving them a place to go to become comfortable. The second poster we made (which we printed one of) was our Physics Fun Poster. This poster is one that corrects common misconceptions about science. Again this poster will hang

freely in our department halls and hopefully help people who are just passing through to begin to ponder the world around them and wonder what else they may have a misconception about. Who knows they may take a physics class. Our third and final poster is our energy poster. This poster helps to show how fundamental energy is in our existence. This is the only poster we were unable to print.

This project was a great way to unite us as a group, we all had to work together to make sure the projects were finished correctly and on time. Our main goal was to have two posters completed and the cloud chamber finished. Which is exactly what we accomplished. We are grateful for the Marsh White award for it is only because of this award that we were able to successfully finish this project.

## Statement of Activity

The entire Statement of Activities should be no more than 3 pages, and organized as follows.

### Overview of Award Activity

In the production of our project there were about 5 individuals who worked very hard to make sure the cloud chamber was properly assembled and in working order. We had 3 individuals work diligently on the posters and the whole of SPS worked together to offer recommendations and advice. We would like to extend a very gracious Thank You! to Joni Clark and Chaz Hammond for going above and beyond to help create the posters.

Roughly every other week at our weekly meetings progress on the posters was shown. There was always constructive recommendations given out and a lot of progress was made because of these sessions.

The target audience of our project is anyone and everyone. The cloud chamber targets students at outreaches and the posters target anyone who will encounter them in our hallways. We hope that our posters will help to not only be informative to the students who pass through our halls but also to the general public and anyone with a curious eye.

This project fits very well into our weekly meeting schedule. We have an undergraduate speaker series that we do every year but we feel it is important to try to make the most of our time and increase what we do as an on campus organization that represents those with a love for physics.

As the Project Lead I would like to say there is something magical about looking back on this last year and this experience. Members of this group worked very hard and were very dedicated in making this project a success. We do indeed have a small group, I mean we have maybe 7 people who attend meetings regularly but then we have these big booming meetings where we have 17 people (where did they all come from where did they all go) But at any meeting when the posters were being addressed and people were dishing our suggestions everyone was very elegant in their way with words. I have to bring this up because I feel this was a real bonding experience for our group.

## Impact Assessment: How the Project/Activity/Event Promoted Interest in Physics

The proposed project "Shooting for the Clouds" was organized with the sole purpose of educating others of the amazing wonders of science. The Cloud Chamber should make its debut performance in the fall of 2014 when we do our first Outreach Program. The posters will be hung in the Physics department very shortly and we are sure we will see some effect from them in the fall. We hope that the SPS poster will promote our organization and bring in more students to our meetings. The Physics fun poster should be addition to our department and will help to inform other others of some of the daily misconceptions on this earth.

We feel that this project was highly successful. It brought us closer as a group and proved our ability to work together as a team. We were able to create something useful to take to with us on outreach as well as a way to promote our SPS group.

We set out with a goal in mind at the beginning of the fall 2013 semester we knew that we wanted to have a successful project and in order to do that we needed to have a good idea of how we were going to achieve such a thing. The Society of physics students officers at NMSU worked together to come up with a realistic plan for our time over the school year. We worked as a team to produce the cloud chamber and in doing so produced a pretty amazing final project. Our only concern about the cloud chamber is being able make it cold enough for the alpha and beta particles to be produced. The posters were a lot of work and a few select individuals worked very hard to create them and everyone at the meetings took part in the review of the posters. They will make a great addition to the department and we are grateful that we had the opportunity to take on this project.

The poster project will be continued in the following year. Our Third Poster on energy was a much more difficult poster to create in order to live up to our standards. We hope to have this poster finished by the end of summer. This was an extra poster that we wanted to do if we had time. However, our main goal was being able to print two SPS advertisements and one physics fun poster. Even though it was extra the energy poster will be finished, It's best not to leave any part of a project undone.. We hope to be able to print this poster in the 2014-2015 school year.

The Cloud Chamber will need to have constant maintenance. The sealant to hold the chamber together seems to degrade quickly due to the alcohol used to produce the vapor. Also the dry ice to keep the chamber in production has to be refilled after some time. In order to make sure our project remains a success we will want to find a better sealant.

## Key Metrics and Reflection

Please answer the questions below. Please indicate if a question is not applicable to your project.

Who was the target audience of your project?	<b>New Mexico State University Physics Department Students and visitors, as well as students at local outreach.</b>
How many attendees/participants were directly impacted by your project? Please describe them (for example “50 third grade students” or “25 families”).	<b>So far those only a part of SPS however once the posters are on the walls many more people will see them. We have hundreds of people go in and out of our building in any given week of a semester. The cloud chamber will make its first appearance at an outreach program in the fall semester.</b>
How many students from your SPS chapter were involved in the activity, and in what capacity?	<b>There were about 5-10 participants in the production of our posters and cloud chamber. There were 3 people who worked very hard to make sure the posters were completed and 5 people who worked hard on the cloud chamber</b>
Was the amount of money you received from SPS sufficient to carry out the activities outlined in your proposal? Could you have used additional funding? If yes, how much would you have liked and how would the additional funding have augmented your activity?	<b>300.00 No we did not need additional funding. We feel that the amount received was quite adequate in the completion of our project.</b>
Do you anticipate repeating this project/activity/event in the future, or having a follow-up project/activity/event? If yes, please describe.	<b>We will not necessarily repeat the project so much as maintain it. As stated previously we need to find a different sealant for the cloud chamber. The poster project will also remain ongoing. You can never have too many posters about science 😊.</b>
What new relationships did you build through this project?	<b>We all became much closer as a group. Some people worked very hard to make</b>

	<p>sure the posters were finished and whenever drafts were shown at Wednesday meetings we were always able to have constructive suggestions of improvement.</p>
<p>If you were to do your project again, what would you do differently?</p>	<p>I think we did this project very well however I believe that if we were to recreate the cloud chamber we would first off want a better sealant and secondly we would want a mechanism to keep the chamber cold without the use of dry ice.</p>

**Press Coverage (if applicable)**

Our Project did not have any press coverage.

## Expenditures

Please provide a brief explanation of your expenses. Include a written description of your expenditures below, those covered by your SPS funding and by other funding sources, and then fill in the table with the name and cost of each item purchased with your SPS funding. Add rows as needed.

For this project we printed three posters at a Fed-ex Kinkos all three of the posters were laminated. We were able to receive a \$50 discount by printing at Kinkos because we belong to the University. We were lucky to not have to purchase very many supplies for the cloud chamber because we were able to have most of them donated to us. We mainly have had to buy dry ice and we still need to find a better sealant to purchase. The funding for this project directly came from the March W. White award.

### Expenditure Table

Item	Cost
Society of Physics Students Advertisement poster with lamination (Qty-2 size 2'x3')	98.40
Society of Physics- Physics fun Poster with lamination (Qty-1 size 3'x4')	98.40
Dry Ice (2 lbs)	7.25
<b>Total of Expenses</b>	<b>204.05</b>



## Activity Photos

Please include captions and credits for each photo. By including photos below, you are giving SPS and the American Institute of Physics permission to use these photos in their online and printed publications.



Vice President Fred Smalley works with Patty Corcoran and other students to create the cloud chamber





Looking for the formation of clouds



From left to right: Doug Brown, Dennis Trujillo, Fred Smalley, Wendy Garcia. They ponder how to best set up the cloud chamber at a weekly meeting.



Cloud chamber: Slight formation of clouds



# The Society of Physics Students

## History

The Society of Physics Students was formed in 1968 with a constitution that combined its two "parent" organizations, The AIP Student Sections and the Sigma Pi Sigma honor society. SPS now has over 700 chapters on campuses across the country. About 5,000 students take part in chapter activities each year, making SPS the fourth largest physics society in the country. The associated honor society, Sigma Pi Sigma, now exists in about 450 of those chapters with over 75,000 inductees throughout its history.

## What Physicists Do

A physicist is defined as anyone who has a physics degree. Why is this the definition? Because these people have a common set of experiences. Because other disciplines define their constituents in this manner. Because these people are a critical group for academics and future research. And, most importantly, because these are the only people that laugh at jokes involving a priest, a rabbi, and a quantum mechanic.

Hidden physicists are people with a physics background, but without a typical physics job. Nearly 90% of all physicists are hidden physicists. The testimonials here are taken from Radiations, the physics honor society magazine. They are prime examples of the wide variety of careers available to physics majors – careers you might have never even imagined! They include a businesswoman, a speech writer, a priest, a consultant, an anesthesiologist, a minister, a fighter pilot, a video game developer, and many many more!

## Get Involved

The Society of Physics Students (SPS) is a professional association explicitly designed for students. Membership, through collegiate chapters, is open to anyone interested in physics. The only requirement for membership is that you be interested in physics. Besides physics majors, our members include majors in chemistry, computer science, engineering, geology, mathematics, medicine, and other fields.

## Professional Preparation

SPS exists to help students transform themselves into contributing members of the professional community. Course work develops only one range of skills. Other skills needed to flourish professionally include effective communication and personal interactions, leadership experience, establishing a personal network of contacts, presenting scholarly work in professional meetings and journals, and outreach services to the campus and local communities.

Locally, regionally, nationally, and internationally, the SPS offers the opportunity for these important enrichments to the student's experience.

Undergraduate and Faculty Speaker Series



Outreach On Campus and To Local Communities



Share Opportunities

Imagine Innovate Inspire

**Come join us for science and fun!  
All Majors Welcome!**



Poster to advertise SPS at New Mexico State University. The space to the right is left empty and will hold contact information of the local SPS Chapter



# Physics of the Earth



## Reason for the Seasons

The Earth orbits on its axis with a 23.5° tilt. This tilt causes the northern hemisphere to be tilted toward the sun in summer and away from the sun in winter. The seasons are caused by this axial tilt which causes the sun to be at a higher altitude during a hemisphere's summer, and the sun to be at a lower altitude during a hemisphere's winter.

The Earth's magnetic north pole is not the North Pole at all, the South Pole in Antarctica is actually the magnetic north pole.



## Sun

Because we know the Earth to Sun distance is about 150 billion meters, and the speed of light as a constant  $3 \times 10^8 \frac{m}{s}$  we can determine how long light takes to reach Earth from the Sun.

$$velocity = \frac{distance (m)}{Time (s)}$$

Light from the Sun takes roughly 8 minutes to reach Earth.

After Apollo astronauts placed reflectors on the Moon, a high powered laser could be pointed at these mirrors and then reflected back to Earth. The time it takes for the laser to return to Earth and the known speed of light can then be used to determine the distance to the Moon with great accuracy. On average that distance is 384,400 km.



## Moon

The dark side of the Moon refers to the side of the Earth that permanently faces away from the Earth, but it is not always dark. When the side we see in a New Moon (fully dark) the other side is fully illuminated.

We never see the other side of the Moon because it takes the same amount of time to complete one revolution as it does to complete one orbit of Earth.

Like a hammer thrower spinning on his axis facing the hammer, both the athlete and the hammer face each other but they are both rotating.



## Tides

Gravitational interactions between the Earth, Sun and the Moon cause our ocean tides.

$$F_g = -\frac{GmM}{R^2}$$

Where G is the gravitational constant ( $6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$ ), M is the mass of the first object, in our case Earth, m is the mass of the second object, Moon, R is the distance between them and  $\hat{r}$  the unit vector between them.

When the Earth, Sun, and Moon are in line, as shown (while the Moon is moving from the new phase to first quarter), the Earth experiences Spring Tides. The forces in this orientation add (red arrow), thus Spring Tides are high tides.

When the Moon is on the other side of the Earth and the Earth is between the Moon and the Sun the force vectors from the moon and sun do not add (orange vectors). This orientation causes Neap (low) tides.



## Aurora Borealis

Earth's rapid rotation and liquid interior causes a magnetic field that protects our planet from solar wind and coronal mass ejections. This solar activity launches charged particles toward Earth that get trapped in our magnetic field and collide with particles in our atmosphere. These collisions cause the sky to glow in different colors, often called the Northern Lights. This light show is also seen on the south pole of Earth.



## Coriolis Effect

The Coriolis Effect is caused by the Earth's rotation. The Earth rotates from west to east which causes the deflection of objects to the right in the northern hemisphere, and toward the left in the southern hemisphere. This deflection can affect bodies of water, wind currents, and storm systems. This effect is most pronounced at the poles, and less near the equator.



Though the Coriolis Effect is real, it does not cause toilets in the Southern hemisphere to drain in the opposite direction. The direction a toilet drains is dependent on how it is manufactured.

## Satellites

Astronauts aboard the international space station seem to be weightless, despite the fact that the gravity is only slightly reduced as compared to on Earth. Satellites (and any astronauts within) experience the gravitational pull of Earth a perpetual fall towards it.

It can only stay in orbit when, due to it's speed, the curvature of it's path is the exact same as the curvature of Earth. Depending on its distance from the Earth there is exactly one speed that will keep a satellite in orbit. The closer the satellite is to the surface of the Earth, the faster it must go to stay in orbit.

## Asteroid Belt

Many television shows and movies show the asteroid belt as a crowded area that spaceships need to swerve to avoid collisions. This is not the case, there is a great amount of distance between asteroids, and spaceships can navigate through them with little problems.

Some asteroids have come gravitationally bound to one another, like our Earth and Moon, meaning some asteroids have moons of their own.



Society of Physics Students "Physics of the Earth" Poster. It contains some processes and misconceptions that we can understand and remove using the basic laws of physics.



If you have any questions, please contact the SPS National Office Staff  
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