



# SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

## Marsh White Award Report Template

<b>Project Proposal Title</b>	Observatory Outreach
<b>Name of School</b>	Tarleton State University
<b>SPS Chapter Number</b>	7080
<b>Project Lead (name then email address)</b>	Stephen Bardowell stephenbardowell@outlook.com
<b>Total Amount Received from SPS</b>	\$250.00
<b>Total Amount Expended from SPS</b>	\$0.00

## Summary of Award Activities

The Tarleton State University SPS chapter hosted an Observatory event for students from 4<sup>th</sup> through 12<sup>th</sup> grade, coordinating with the Tarleton Rocket Club (TAR) and the Physics Education class to provide activities for 120 students. The students had the opportunity to try their hands at using the pull of a black hole for a gravitational assist, making balloon rockets hit a target, and using a Coronado solar telescope to see solar flares and anomalies on the surface of the sun. Events culminated with a tour of the research observatory hosted by Dr. Shaukat Goderya.

## Statement of Activity

### **Overview of Award Activity**

Events kicked off bright and early November 30<sup>th</sup> at the Tarleton Observatory, with volunteers arriving at 8:00 to start setting up activities and prepare for the students to arrive. By the time the first buses arrived, 5 stations had been set up and manned, heaters were roaring, and volunteers were waiting to guide each group from event to event in a wild round robin of physics fun!

The first group was 60 students from 7<sup>th</sup> through 12<sup>th</sup> grade. This group was broken into 5 groups of 15, and festivities commenced. Of particular interest to this group was the observatory tour, the rocket clubs design activity, and the heaters! In the brisk winter air students huddled close to the warmth while waiting their turn to build structures from toothpicks and marshmallows, or get a walkthrough of Tarleton's 32 inch Ritchey-Chretien research telescope.

By mid-morning, temperatures had risen enough that focus had begun straying more towards the black hole simulators, and students were enjoying competing to see who could achieve the largest gravity assist. By attaching a neodymium magnet to the reverse side of a canvas painted like space, students were able to roll ball bearings along the surface of the canvas to discover the location of the invisible "black hole." Once discovered, by carefully matching incoming velocity to bearing mass, students were able to slingshot their "ships" around the event horizon for a massive boost in speed.

When the groups left just before noon, volunteers broke for lunch and prepared for the second shift. 5<sup>th</sup> to 6<sup>th</sup> grade students arrived at 1:00 and began exploring the activities. The groups were led round robin style through each station, but this group found much more enjoyment from the balloon rocket activity and using the sun spotters and Coronado.

Students used nested straws with a balloon attached to fire "rockets" toward a target. By controlling the pressure in the balloon and using tape to create wings and airfoils, participants competed to see who could hit the targets from farthest away. Meanwhile, the Coronado received a lot of attention as the sun started to put on a display, showing a sudden uptick in prominences, stellar snakes, and even a solar flare. One student got so good at the black hole activity, he managed to slingshot his bearing around the black hole for two whole rotations before it rocketed off the canvas and got lost in the grass!

The observatory event went so well, another was planned for March 9<sup>th</sup>, when another group of students were invited from neighboring school, Three Way. Unfortunately, the weather did not cooperate, and the event had to be canceled last minute, but another is being considered for the near future!

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

The observatory event had several goals. Primary among these was to raise awareness of the Tarleton Research Observatory. Tarleton State University has one of the foremost research telescopes in Texas, completely capable of remote operation, and very few people know about it. Research at the observatory is being performed on binary stars, exoplanets, near earth asteroids, and spectral classification, and yet

few people know about it, even among the students that actually attend Tarleton State University. Through this event, Tarleton SPS wanted to provide a proof-of-concept of a repeatable outreach event that would allow increased awareness of the Tarleton Observatory, and connection with the future faces of physics.

The second main purpose of the event was, of course, student outreach. Schools around the area were contacted and informed of the event, and a school was selected as the “lucky participant.” The schools selected responded so enthusiastically that grades had to be cutoff to avoid exceeding the capacity of the observatory. The participants themselves enjoyed seeing the inverse square law of gravitational attraction in action, learning about astronomy in the actual laboratory setting, and primarily being able to ask all the physics questions that plague young minds.

Since the event, the schools selected have contacted us to express their gratitude and inquire about future events, and participants have come to visit the Tarleton Science Building for other events. One student participant even exclaimed his intention to go into physics.

The metric of success for this event was how much awareness was raised for the Tarleton Observatory and how many students were exposed to concepts of physics as a result of this event. By both metrics the event was a success.

## Key Metrics and Reflection

Who was the target audience of your project?	Students 1 <sup>st</sup> to 12 <sup>th</sup> grade
How many attendees/participants were directly impacted by your project? Please describe them (for example "50 third grade students" or "25 families").	120 students from 4 <sup>th</sup> to 12 <sup>th</sup> grade
How many students from your SPS chapter were involved in the activity, and in what capacity?	4 SPS members participated in leading activities
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?	Yes, additional funding was received from Tarleton College of Science and Mathematics that allowed us to duplicate the event
Do you anticipate repeating this project/activity/event in the future, or having a follow-up project/activity/event? If yes, please describe.	Yes, weather permitting
What new relationships did you build through this project?	Networked with local school and event coordinator
If you were to do your project again, what would you do differently?	Personally contact local news sources to ensure media coverage

## Expenditures

We rented a Porta-Potty to provide participants a latrine, as the Observatory lavatory wasn't capable of supporting these numbers. We purchased two large propane heaters that can be used for any such events in the future. We also purchased stretched canvas, frames, and ball bearings for the black hole activity. The neodymium magnets, epoxy, and paint was sourced from personal contributions. Finally, we purchased standard straws, wide straws, and balloons for the balloon rocket activity. Funding was able to be acquired through the University for the event, so all purchases for the first event was made under that account. The second event planned for March had a similar bill of materials utilizing the SPS funding, as the event was expanded for the participation of the Triple-Beta biology society, the Tarleton Chemistry society, and the Tarleton Geological society. However, after the event cancellation, the materials were able to be returned for no net loss.

### Expenditure Table

Item	Please explain how this expense relates to your project as outlined in your proposal.	Cost
Porta-Potty Rental	Toilet for participants	\$149.00
Propane Heaters	Outdoor heaters for participants	\$222.48
8" x 10" Canvas	Part of black hole activity	\$19.90
Standard Straws	Part of balloon rocket activity	\$7.99
Ball Bearings	Part of black hole activity	\$10.99
Wide Straws	Part of balloon rocket activity	\$14.98
Floater Frames	Part of black hole activity	\$58.56
Balloons	Part of balloon rocket activity	\$17.98
<b>Total of Expenses</b>		<b>\$501.88</b>

## Activity Photos



Students participating in the TAR structural design activity  
Photo taken by Stephen Bardowell



Stephen demonstrating the black hole simulator



Students playing with the black hole simulator



Student designs in the TAR structural design activity.



Jayce Thedford representing TAR and the College of Engineering



Coronado Solar Telescope setup



Dr. Shaukat Goderya providing observatory  
tour

Unless otherwise indicated, photographs taken by Jordan Prigmore of Visuals JCP.



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