SOCIETY OF PHYSICS STUDENTS
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# SPS Chapter Research Award Interim Report

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| **Project Title** | Naked Eye Observatory |
| **Name of School** | Ithaca College |
| **SPS Chapter Number** | 3183 |
| **Total Amount Awarded** | [Enter the amount awarded for the proposal.] |
| **Project Leader** | Adam Rabayda |

## Abstract

Ithaca College has been trying to create a naked eye observatory on campus for years. The structure would drastically improve campus involvement in physics and astronomy. Our SPS chapter aims to provide the research and models necessary to begin this project.

## Statement of Activity

The project began its planning phase by breaking up the tasks into four teams: Theory, Modelling, Printing, Full-Scale. Each team has a leader who is responsible and accountable for the operation and management of that group. The activity of each team will be listed below.

**The Theory Team:**

The job of the Theory group is to come up with theoretical models for each instrument that will be added to our model of the Naked Eye Observatory. They are tasked with knowing exactly what proportions the models need to be in as well as exactly where to place them in the grand design so that they may function properly.

The Theory team is still working but has created the base models for the instruments. We call these the “obelisks.” These obelisks were sent to the 3D Modelling team for further development. Now, the Theory team is focusing on creating the few, more intricate instruments left before assisting the Full-Scale Model team on design.

**The Modelling Team:**

The job of the modelling team is to take the results from the Theory team and create working 3D models of them. The 3D models are made in Google Sketchup, but do not need to be print ready yet. The models need to be able to be scaled so that we may create a full-scale model as well as a scaled model.

The Modelling Team has finished production of the "obelisk" models and is now moving toward modelling the more intricate designs that the theory team are currently working on. The models already created have been sent to the Print team.

**The Print Team:**

The job of the Print team is to prepare the models for 3D printing, test the "printability" of the models, and then print them in their scaled and full size.

The Print team has successfully printed the "obelisks" mentioned before and is awaiting more models to continue printing. The have passed the prints to the Full-scale team for an initial test.

**The Full-Scale Team:**

The job of the full-scale team is to take all printed materials and test their functionality. In the end of the project, this team will make a full-scale model of the Naked Eye Observatory for testing, as well as a scaled model to showcase at the college.

This team is still testing the initial prints, and should complete initial tests by mid-July, allowing for full tests by September.

## Interim Assessment

In this project, our "research" question (which is almost an engineering question) is: How can we most effectively create a Naked Eye Observatory on the Ithaca College Campus? In this project, we will construct various models to test the theories that answer this question. A Naked Eye Observatory is a collection of instruments that can be used to do astronomy with the naked eye (an example of this is Stonehenge). The observatory consists of eight main pillars with obelisks on most of them and some more delicate instruments on a few. These will align with things such as the sun, moon, stars and galaxies so that any person walking through it can be an astronomer!

In our endeavors thus far, we have completed most of the theory required to progress through this project and have modelled the most important pieces. We continue to print the objects to test our printing capabilities and limits and are soon to have our initial tests that will set the stage for the full-scale showcase.

The majority of the people working on this project are SPS members. We have a few non-SPS members such as our 3D printing lab advisor, but otherwise we are all SPS members. The personnel age range goes from Freshman to Senior. No one is excluded due to age, and our age range distribution is about even across. We have mainly Astronomy research students working on the theory of the project since that aligns very well with their academics. For Modelling and printing we have our students who are interested in engineering, modelling, and experimental science. These students get first hand experience with a project that is very similar to that of a real-world project in these fields. Finally, we have our SPS leadership in the full-scale model team, as they will be communicating the results directly to administrative staff after completion of the project.

Through working on this project, we further the SPS mission in enlightening our members in the world of physics. This project does an extraordinary job of simulating a real-world project in physics. In addition, we get to create something that will expand into the community and involve everyone on our campus with the creating of a Naked Eye Observatory.

## Updated Background for Proposed Project

Naked eye observatories have existed for a very long time. Stonehenge is most likely one of the first naked eye observatories followed by structures by the Aztecs, Mayans, and Mississippi river valley civilizations. A naked eye observatory today is a set of obelisks aligned with celestial bodies so that certain simple measurements can be made during various times of day, in different months and years. Measurements such as time of day, moon cycle, day of the year, season, tide pattern, planetary alignment etc. can be made with these instruments. Each obelisk also has a plaque on it detailing how to use the instrument on top of it. Before the full structure can be built, someone needs to make the necessary measurements and design the layout of the naked eye observatory. This is where our research comes in. We will be the ones to create the foundation for a college-wide effort to build this observatory.

## Description of Research - Methods, Design, and Procedures

We want to figure out what instruments we can build and how to arrange them. We will do this by creating a model of the area that the observatory will be built, and simulating the sun, moon, and other celestial bodies so we can appropriately align each instrument. We also want to experiment with different alignments of the observatory to make sure that the final product will work for years to come. Many of our models will be 3D printed using our extensive 3D printing lab (we have over 15 3D printers at our disposal), and our full-size demo will be built using our woodshop on campus. Each confirmed and completed instrument will be added to the overall model, which will be eventually printed out and put on display

## Initial Results

Although the process is long, it proves effective to have people working specifically on a given area. The level of detail received by each team is much higher since people have a focus group, rather than having to be a jack-of-all-trades for the project. The obelisks we have printed so far are excellent quality and are expected to perform well in initial tests. We run into a challenge when one group has to wait for another group to continue working. For example, if the theory group have not yet finished their net model, but the modelling group are done with their last assignment, then the modelling group is waiting for the Theory group to be done before continuing. This is a barrier we have yet to overcome and ae currently working on solutions, but overall, the project shows promising results.

# Statement of Next Steps

## Plan for Carrying Out Remainder of Project (including Timeline)

1. Finish Modelling all instruments – Finish by end of July 2018
2. Finish 3D printing instruments and continue researching alignment.
3. Begin printing aligned overall model. – Finish by end Aug 2018
4. Finish printing overall model, begin compiling materials for demo - Finish before demo
5. Run demo for the Office of the President, and hand over completed overall model to college proposal team – Finish by end Sept 2019

# Bibliography

Ithaca College Department of Physics and Astronomy