



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

SPS Chapter Research Award Proposal

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| Project Proposal Title | Introductory Astronomy Research |
| Name of School | Old Dominion University |
| SPS Chapter Number | 5311 |
| Total Amount Requested | \$2,000 |

Abstract

The Old Dominion University chapter of the Society of Physics Students is conducting celestial observations, outreach events, and research through astrophotography using a department-sponsored telescope and other imaging equipment. The ODU SPS telescope project will contribute to senior thesis project requirements and the development of future undergraduate astrophysics opportunities.

Proposal Statement

Overview of Proposed Project

The Chair of the Physics Department provided a telescope to the local SPS Chapter to engage in their research of the night sky. Over the next year, we will use the telescope to study, photograph, and document variable stars (stars with varying intensity. Additionally, we will attempt to study and photograph exoplanets (planets outside of our local solar system) by traveling to areas of low light pollution over the summer. However, a more modern camera lens is needed to effectively document and observe these celestial bodies. The Starlight Xpress Pro-35 lens camera lens will allow us to continue our passion for astronomy and enable both current and future Undergraduate students here in SPS to conduct their own astronomical research. The telescope will also be available for Astrophysics Undergraduates to conduct hands-on research for their senior thesis if they choose to do so.

For our school, this will be one of the most ambitious projects attempted to be conducted in the field of astrophysics. This has been strongly supported by the school's faculty and shown through their creation of a new Astrophysics Undergraduate and Graduate program last year (2021). In addition, because the research team is composed entirely of Undergraduate SPS members, this will inspire other ODU students and SPS chapters to become involved with research early and to explore Astrophysics as a career path.

The telescope will also be used at local recruitment events for our SPS chapter to inspire non-STEM majors to consider a career path in science, look at SPS as a potential opportunity on campus, and appreciate the science of Astronomy.

Background for Proposed Project

Astrophotography is not solely conducted by massive observatories with millions of dollars in funding. A large understanding of what we know today is from amateur astrophotographers and private studies (Woodhouse, 2017). Studies funded by NASA and similar large organizations simply cannot scan the entire sky at one time. For this reason, the more eyes pointed toward the night sky, the more data can be collected, and the more we can learn about Astronomy and Astrophysics as a whole (Woodhouse, 2017).

Larger and brighter planets, along with stars, require short exposure times due to their intensity (Woodhouse, 2017). This allows for more room for technical and operational errors. We will focus our photography on these objects while still learning how to use the equipment.

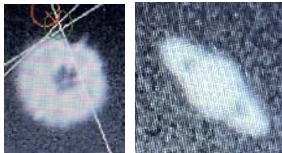
Variable stars and smaller planets, however, require a longer exposure time, resulting in more blur from vibration and errors (Woodhouse, 2017). Exoplanets are an even greater challenge. Once we become acquainted with the equipment, we will begin to photograph and identify these objects with more advanced understanding and techniques.

Expected Results

We expect to be able to find increased clarity and magnitude of photographs of various celestial bodies. We will compare the photographs of the proposed lens to that of our current, older model. Emphasis will be placed upon variable stars and exoplanets as stated above.

Additionally, we will compare photography from campus, an area of high light pollution, to other local locations with a low light population.

Description of Proposed Research - Methods, Design, and Procedures



The two photos provided to the left are the result of our current astronomical photography. On the left, we have an unidentified variable star. On the right is Saturn. We will continue using our current telescope, lens, and software to take photos of celestial bodies and identify them. We have, however, not completely mastered the usage of the telescope and its software. Due to this, our first goal is to become more familiar with the equipment. Once we are familiar with the equipment and its usage, we will next begin to compare the photographs of identified celestial objects from the current lens and the more modern lens (if available) to ensure improved quality.

During the summer semester, we plan to host a camping trip for the local SPS chapter in the Appalachian Mountains to take the telescope for low-light level pollution photography. We will photograph objects we previously identified for comparison and photograph objects that were not visible in the high-light pollution area of the ODU campus for identification.

The photographs will then be used for Undergraduate Senior Thesis, and local SPS outreach and recruitment events. The long-term goal is to enable current and future SPS members at ODU to engage in their own astronomical research.

Plan for Carrying Out Proposed Project

The main personnel who will be conducting this research is as follows:

- Jonathan Rose, Undergraduate and Local SPS Chapter Vice-President
- Brandon Velasco, Undergraduate and Local SPS Chapter Outreach Officer
- Wyatt Elliot, Undergraduate and Local SPS Astronomy Officer

In addition, all activities involved with the telescope will be open to all students on Campus and will receive significant support from other members of SPS and the student body. Normally, our activities involve 3-8 additional students who volunteer to help assist with the research. These students are mostly local SPS members.

The faculty members that bring expertise and guidance to the project are as follows:

- Justin Mason
 - He holds a Master of Science degree in Physics, and a Master of Arts degree in Astronomy. He also has valuable experience as the current ODU Planetarium director for the past 7 years. Justin has been instrumental in assisting SPS members with assistance in starting Astrophysics research at ODU.
- Dr. Matthew “Perry” Nerem
 - Dr. Nerem holds a Doctor of Philosophy degree in Physics and is the faculty sponsor for our local SPS Chapter. He is also the head of the new Astrophysics degree programs offered here at ODU. He has been a strong supporter of Undergraduate research in general and is now offering his expertise in mentoring us in Astronomical studies both inside and outside of the classroom.

As for locations, the local campus has a field outside of our library away from the tall buildings on campus that allow us to gain a large view of the night sky. Additionally, several nearby parks in local cities can be used with lower levels of light pollution.

As mentioned above, we plan to use the local Appalachian Mountains as a large part of the summer research for the project.

Project Timeline

- Fall 2022
 - Understand the usage, limitations, and capabilities of the telescope. We plan to fully understand how to use the telescope optimally along with the software designed to run it by the end of this fall semester.
- Spring 2023
 - Once we have a firm grasp of the equipment, we will begin focusing on using that understanding to photograph and identify celestial objects to use for comparison with areas of lower light pollution. If we are ahead of schedule, we will also attempt photography of local parks in Chesapeake and Suffolk to compare. These cities have a lower population density than ODU’s (Norfolk), and as a result, have lower light pollution. This will all be reported in May’s Interim report.
- Summer 2023
 - During the Summer, we will continue taking photography on Campus. However, our focus will be on the camping trip to the mountains. We need to complete this before the Fall semester, as we will not have the availability during the main school year.
- Fall 2024
 - Like before, we will continue photographing for comparison and practicing year-round on campus. However, we will take the Fall semester to analyze our progress over the year. We will be comparing our photographs and continuing to identify celestial objects. We will also be analyzing things we did well, and things we need to improve on. This includes but is not limited to locations, equipment, logistics, and personnel support. These will all be documented in the Final Report submitted before the end of the semester.

Budget Justification

The proposed lens is the Starlight Xpress Pro-35 lens. It is specifically designed for Astroimaging, with a 4034 x 2688 maximum resolution. It will be a significant improvement in quality from the current lens being used. Its total price is \$4,725.00, which is far too high for our local SPS chapter's budget. However, our Physics Department has agreed to match whatever funds we can procure for our projects, including funding received from grants. The combination of the department and this award would allow our local chapter to fund the final \$360 to afford the new lens.

| Source | Amount |
|---|-----------|
| SPS National Research Award | \$2,000 |
| Local SPS Chapter | \$362.5 |
| Total before Physics Department Subsidization | \$2,362.5 |
| Final After Funds are Matched by Physics Department | \$4,725 |

Estimated values not accounting for economic changes, taxes, etc. The added increase due to taxes will also be affordable by our finances.

Bibliography

Woodhouse, C. (2017). The astrophotography manual [e-book] a practical and scientific approach to deep sky imaging. New York, NY : Routledge.