

Michael Foley

**Graduation Year:** Sophomore

**College:** Science

**Major(s):** Physics, Honors Math

**Minors(s):** Glynn Family Honors Program

**Scholar Group Membership:** Glynn Family Honors Program

**Did you received other funding for this project?:** Yes

**Could you have completed this project without CUSE funding? Yes**

**More details on CUSE funding assistance?**

**Project Title:** iLocater Software Development

**Project Location:** University of Notre Dame, Crepp Laboratory

**ND Faculty Mentor:** Justin Crepp

**Project Type:** Research Assistantship

**Why did you undertake this project/experience?** Deepen your knowledge of a topic or issue, Prepare for graduate school (MA or PhD), Prepare for national fellowships, Career discernment and/or preparation

**Did your funded experience help you:**

**[Deepen your understanding of your coursework or field of study]:** Yes

**[Discern your interests and post-bac goals]:** Very Much

**[Become confident in your ability to set and achieve your goals]:** Very Much

**[Gain a more nuanced view of local, national, or global communities]:** A Little

**[Improve your written and verbal communications skills]:** Yes

**Tell us about your experience.**

Over the past summer, I worked as a research assistant to Dr. Justin Crepp on his iLocater project. In particular, I was responsible for the creation of software allowing users to communicate with various pieces of hardware. Through this work, I gained valuable insights into optics, computer science, and electronics.

My main project involved developing software for a 5-axis (X, Y, Z, tip, and tilt) stage that serves as a mount for a 1-micron diameter optical fiber. This fiber will be fed starlight acquired the Large Binocular Telescope (LBT) in Arizona. A fiber of this size significantly reduces modal noise compared to larger fibers, meaning more precise measurements can be made from the light collected. On a large scale, this precision will enable us to discover significantly more exoplanets than our radial-velocity instrument predecessors. Consequently, this software serves an imperative role in the project, ensuring the fiber is properly coupled and fed the maximum possible amount of starlight.

This project enabled me to gain insights about laboratory work and general research practice in physics. Additionally, I achieved proficiency in MATLAB and knowledge of hardware/software

interfacing. Furthermore, I established a valuable skill set that will aid me significantly in future research endeavors.

**Describe the impact this project had, both on you as a student-scholar and on the people you worked with.**

For me, this project was a wonderful introduction into the world of research and professional academia. I learned a plethora of valuable skills, made strong connections with leaders in the field of astronomy, and expanded my academic horizons. As such, it has given me strong preparation for grad school and individual research. Furthermore, it serves as a stepping stone for other undergraduate research endeavors, such as those in the theoretical or computational realms of astrophysics.

This project also enabled me to make a significant contribution to the iLocater project. The development of this software significantly expedited testing, and it is vital to the implementation of a proof-of-concept system this fall. Without it, this demonstration system would not be usable, since the hardware will only be able to be accessed remotely. I am very grateful to CUSE, FYS, COS, and my mentors for allowing me to work on a project so influential to me and the overall system.

**Describe how this experience is connected to your plans as a student or future professional.**

As a physics and math double major, I hope to pursue a Ph.D. in astrophysics. Along the way to graduate school, I plan to write a senior thesis and apply for various national fellowships. In regards to my senior thesis, this project has solidified important bases of computational knowledge. Since so much modern research is dependent upon computers, this extensive foundation will permit me to pursue more sophisticated topics for my thesis and beyond.

This work will also prove very helpful in applications for national fellowships. In addition to the experience of applying for a grant through CUSE, the connections I have developed will certainly aid in the application process. Additionally, this integral work done as part of Dr. Crepp's groundbreaking project will undoubtedly prove influential in any selection process.

**What advice would you give other students who are planning to pursue similar projects?**

Do not be afraid to approach professors or other leaders to ask questions. The most important part of securing a research or professional position is demonstrating initiative. Especially at the undergraduate level, it is understood that most students will not have substantial knowledge of, or expertise in, the cutting-edge research of any academic field. Consequently, do not be discouraged from investigating potential projects or mentors due to a perceived lack of knowledge on a project. For example, I knew relatively little about optics before I began work with Dr. Crepp, but he presented me with a task on which I could make progress. Thus, I was still able to make an important contribution to the project.

In terms of subject material, I have found that a solid knowledge of computers - coding, in particular - provides a huge advantage in any scientific or mathematical field. Often, there is significant computational work to be done, and it provides a wonderful foray into the complexities of any project. As a result, I would recommend familiarizing one's self with virtually any programming language in order to take advantage of the benefits of computational work.

Most importantly, find a project that truly interests you. While certain projects may have more influence, the experience will only be as strong as your interest in the subject. A project that you enjoy will prove significantly more beneficial to you than one pursued only because it is believed to be attractive to graduate schools or national fellowships.

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