Goldwater application short answer questions

In one or two sentences, describe your career goals and professional aspirations (see example below). This statement will be used in publications if you are selected as a scholar or honorable mention. *(Example: Ph.D. in Molecular Biology. Conduct research in biomedical science and teach at the university level.) (200 character limit including spaces.)*

Ph.D. in Astronomy. Conduct research in observational astronomy concentrating in extrasolar planetary systems and planetary system formation.

What are your career goals and professional aspirations? Indicate which area(s) of mathematics, science or engineering you are considering pursuing in your research career and specify how your current academic program and your overall educational plans will assist you in achieving your career goals and professional aspirations. *This is an expansion of the brief description of the career goals and professional aspriations you provided above(3000 character limit including spaces)*

I intend to pursue a career as an observational astronomer with a focus on extrasolar planets and planetary system formation. My current academic program and educational experiences are essential components towards this goal. The University of Texas is a powerful research institution for astronomy, with access to top facilities and research grants, faculty and scientists involved in some of the biggest projects in astronomy, and faculty members at the top of their fields. I have presented my work at several conferences, which enables me to showcase my work to professionals in the field, and opened the potential for future collaboration. Additionally, Dr. Kraus has mentored me in exoplanet research, providing guidance on best practices and potential pitfalls specific to the unique qualities of exoplanet research. He has suggested numerous scholarships, awards, and conferences, and supported me in pursuing them. His mentorship, as well as the assistance of other exoplanetary researchers at UT, has been invaluable in shaping my career for the future.

My immediate education goals are to complete my current research project through the publication of results, while maintaining a high GPA in math, physics, and astronomy courses. In summer of 2016, I participated in a Research Experience for Undergraduates (REU) at Northern Arizona University. In 2017, I devoted the summer to my exoplanet research at UT. For the summer of 2018, I intend to participate in a summer research experience, either at the University of Texas or another institution, through a program such an REU. Having an extended and dedicated time period to devote solely to research was educational, exciting, and fueled my desire to commit to a career in astronomy research. The support of grants and awards has been essential to my research endeavors in the past, and further support of awards such as this one will continue to drive my success in the future.

Immediately upon completing my degree at UT in spring of 2018, I will attend graduate school for astronomy.

Describe an activity or experience that has been important in helping shape or reinforce your desire to pursue a research career in science, mathematics or engineering. *(1500 character limit including spaces)*

I recently attended a panel discussion on astronomy research careers. One of the panelists remarked that you know you're in the right place if, when you go home at the end of the day, you find yourself thinking about a problem in your work and driven to tackle it until it's solved, even on a Friday night, not because you have to, but because you want to. That comment struck me because I had spent that very preceding Friday night trying to find a bug in my code that just wouldn't let me leave it alone. I know exoplanet research is the right place for me.
In the course of my exoplanet research project, I have been challenged in every aspect of my professional skill set. I have built my own statistical modeling algorithms from the ground up, and used them as tools to analyze a critical question in the field of exoplanets. I have presented my work to the professional astronomy community and been recognized for it. I have traveled to Hawai'i to use the world's premier ground-based telescope, the W.M. Keck Observatory, for my own research project. I have met and gotten to know numerous highly accomplished astronomers in my field. I participated in the Women in Astronomy IV conference. I have found the astronomy community welcoming and encouraging and actively working to make the community a better place for students and researchers. The astronomy community suits me like no career path has before. My experience in exoplanet research as an undergraduate has shown that a research career in astronomy is the career track for me.

Goldwater Scholars will be representative of the diverse economic, ethnic and occupational backgrounds of families in the United States. Describe any social and/or economic impacts you have encountered that influenced your education - either positively or negatively - and how you have dealt with them. *(1500 character limit including spaces)*

After completing my first undergraduate degree in chemistry at Purdue University in 2003, I was commissioned as an officer in the US Navy serving aboard the *USS Samuel B. Roberts* (FFG-58). In 2005, I attended US Naval Nuclear Power school, after which I served aboard the aircraft carrier *USS John C. Stennis* (CVN-74) for 2 years.
Nuclear reactor operations for the Navy has done the most to shape me as an individual. Reactor plant operations in wartime require continual training, drills, inspections, and maintenance. My level of knowledge, leadership skills, and physical endurance were pushed to the limits, and I learned quickly what I was capable of. I learned to make important decisions quickly, I achieved proficiency in reactor plant design and operations, and I learned how to lead my sailors well. I am proud of my service.

All of this has born itself out in my subsequent career as a middle school science teacher, and now here at UT Austin. Compared to the first time I was an undergraduate, I know better who I am, what I can do, and what I want. I know myself well enough now to have no doubt that astronomy research is the only career I want to pursue. I am focused, pursuing only experiences or opportunities that will help me in graduate school, and I pursue them eagerly. This is in a very large part due to my experience in the Navy. It was very difficult, but I am very glad to have done it. It is an essential part of who I am today.

Describe research projects:

Orbits of Long Period Exoplanets:
This project is to characterize the orbits of several long period exoplanets around their hosts stars, to analyze the orbital characteristics for clues as to their mechanisms of formation. I am doing this by utilizing several epochs of image data (as much as 10 years' worth in some cases) obtained from the NIRC2 camera on the Keck Telescope in Hawai'i. For each image, I developed a Markov Chain Monte Carlo algorithm to precisely measure the location of star and planet in the image. I then obtain a mean separation and position angle for the planet (at sub-milliarcsecond precision) to determine the tangential motion. I then use a rejection sampling algorithm I built to fit orbital parameters to observations. Under the guidance of Dr. Adam Kraus, I developed all of the analysis tools and performed the analysis. I am currently preparing a paper for publication of the results.
This project taught me the invaluable skills of the methodology of MCMC and rejection sampling, the mechanisms of coding them in python and running them on the TACC supercomputer, how an infrared camera works, using the Keck telescope for observations, and professional science communication skills.

Behavior of lakes on Titan:
During this project, conducted at Northern Arizona University and Lowell Observatory, I investigated the physical behaviors of chemical mixtures which could exist on the surface of Titan. Mixtures behave differently in terms of freezing and boiling points than do pure chemical species, so the composition of the lakes on Titan will impact when and how they might freeze, which impacts the lakes' interaction with the atmosphere and climate modeling. My role was to measure the freezing point of various compositions of methane, ethane, and nitrogen mixtures in the laboratory. The lab had previously found that mixing methane and ethane together caused the mixture's freezing point to drop below temperatures found on Titan. My contribution to the project was to explore the effect of adding nitrogen to those mixtures. I found that the addition of nitrogen increased the freezing point, but it still remained below Titan temperatures, meaning it is unlikely that ice is able to form on Titan in lakes with this potential composition. My participation in the project was funded through an NSF REU.
I learned professional science communication skills and lab astrophysics skills, and was introduced to python through this project.