

Personal Statement
Megan Christina Davis

Introduction

From neutrinos to galaxies and almost everything in between, I have had a research experience in it all. My research experiences as an undergraduate at Michigan State University have prepared me for taking the next step towards a lifelong research career. The many lessons I learned, including ones learned as a first-generation college student and LGBTQIA+ person in academia, will be useful in my courses, research, and beyond. The two greatest lessons I learned were: 1) how to fail then pull myself and my research projects back together again, and 2) that I want to pursue research for the rest of my life. The next step in continuing my research career is **getting my PhD in Astronomy and Astrophysics with a focus on observational astronomy.**

Intellectual Merit

I entered college ready and sure that astrophysics was exactly what I wanted to study for the rest of my life. I was under the impression that it would be easy to solve the mysteries of the universe. By the end of my first year, I was prepared to not only turn away from astrophysics as a viable field of study, but also leave school, permanently. **As a first-generation college student, college was a difficult adjustment.** I did not have anyone in my family that I could share my college experience with or ask questions when I got stuck. I could not afford many of my textbooks until I got a job that helped pay for them. I did not know how to recover from failing because I could not afford to fail in the first place due to no support. I had to seek out opportunities and pursue research, by myself.

My work ethic and attention-to-detail, gained from watching my parents work tirelessly to keep a roof above our heads, led me to my first research experience: **a Research Experience for Undergraduate (REU) with the IceCube collaboration** the summer after my freshman year. I was lucky, excited, and terrified before going, as I was too afraid to fail and ruin the rest of my career. However, it ended up being the absolute best experience that I could have ever asked for. I was challenged and grew as both a researcher and a person. I learned how to communicate as a scientist, how to ask questions when I do not understand something, and how to power through the Imposter Syndrome I had developed (in addition to becoming an expert using optical fibers to do particle astrophysics). The experience had changed everything for me and, even though it was not exactly what I wanted to research for the rest of my life, I was thankful for it. It was the first thing that assured me that I could not only survive in this field, but actually thrive as well. Because of my hard work and dedication to the project, the PIs of the program wanted me to go to Antarctica to see the IceCube facilities firsthand. Unfortunately, I had a significant time commitment as a Resident Assistant back at Michigan State, so I was chosen as the alternate student to go. Even though I did not go to the South Pole, they did send me to Belgium, instead, for an **International Research Experience for Student (IRES)**, where I studied muon detectors and learned more

about programming in Python than any class could have taught me. I was lucky and privileged to have those experiences so early on in my academic career.

I learned how to fail and make mistakes in research, gracefully. Without making mistakes, there is no way to learn and grow. My **internship at the Jet Propulsion Laboratory**, where I studied future techniques in direct exoplanet imaging, allowed me to dig deeper into research. **It led to my first co-authored paper** (Bottom et al. 2019), but not without getting stalled for a week during the project and re-learning how to ask for help when it scares you. **My senior thesis in computational galactic chemical evolution** gave me opportunities to explain my work outside of my immediate research group, and I won the **first prize for my poster presentation at the University Undergraduate Research and Art Forum** held at Michigan State every spring. That experience showed me that I really enjoy data reduction and analysis, meaning that I am likely more of an observer than a theorist. My **three years of being an observer at our Campus Observatory** forced me to think on my feet, problem solve, and also communicate my science at our monthly outreach events, and it reinforced the idea of pursuing observational astronomy.

My breadth of research experiences has helped decide what I want to do in the future: by showing me what I did not want to do. I know now that I will become an observational astronomer and go to graduate school to further my career as a researcher. Specifically, I would love to observe X-ray binary star systems containing a compact object, such as a neutron star or black hole, as I have been doing **during my Post-Baccalaureate gap year at Michigan State**. I learned that as long as I am motivated and excited to be challenged in unlocking the mysteries of the universe, I can succeed. For a good portion of my undergraduate career, I was dealing with depression and burnout. Being a first-generation college student and a LGBTQIA+ individual with lack of support, lent to those difficulties. My grades are solid (not always stellar), but I was able to pick myself back up following my second year when I found the resources I needed to get me pointed in the right direction. My undergraduate career was an experience in which I would not change a thing. It defines the scientist I am already and will become.

Broader Impacts

I want to not only be a role model for other first-generation and LGBTQIA+ individuals, but also use the privilege and knowledge I have to uplift and support underrepresented minority students in the field of astronomy and beyond. This includes doing community outreach, assisting with teaching undergraduate coursework, and mentoring undergraduates. Working as a **Teaching and Resident Assistant** for several years and as **a mentor to undergraduates in the Stellar Mentorship Program that I helped develop at Michigan State**, I know how important it is to make information as accessible as one possibly can. Connecting people to resources and mentors and creating a supportive environment in which students do not have to be afraid of failing are also vital to creating a thriving community of diverse researchers.

I also plan to work on my science communication skills and explain my research, and other astronomy topics, in accessible language to contribute to the science literacy of the community around me, both in-person and online. A privilege of being at a university is that it may have an

observatory or planetarium at which there are already some efforts for Public Outreach or may have a gap in which I can step-up and create Public Outreach programs using my knowledge from being the current **Public Outreach Coordinator for the MSU Observatory**. I know from my own identities that there can be an extreme lack of support and resources for students from diverse backgrounds within academia. I will have a lot of meaningful work I can do, by propagating university resources and creating our own mentorship programs within my future Astronomy Department. I am excited to remind everyone of the humanity behind the science, and to be a role model, champion other role models, and create the opportunities like I wish I could have had growing up and in college. The NSF Graduate Research Fellowship Program is a way for me to not only do fundamental and novel research, but to achieve further goals for making sure that astronomy is accessible to all and to be my authentic self doing so.

References

M. Bottom, S. Martin, E. Cady, **M. C. Davis**, et al., 2019, *Starshade formation flying I: optical sensing*, submitted to **Journal for Astronomical Telescopes, Instruments, and Systems** (JATIS) on 28 May 2019.