The flashpoint of my scientific interest was sparked in the shadow of an astronomy dome in Peacham, Vermont. As my eyes adjusted to the velvety darkness of a February night, the sky began to reveal many of the scientific phenomena that refined my previously scattered work ethic towards studying the cosmos. Since that moment, I have relentlessly pursued knowledge of the mechanisms that govern unknown realms of the universe. With my fervor now uncovered, I not only follow my passion but strive to share it with different minds - starting with my family. My father is a high school educated immigrant in his late seventies who continues to work over forty hours a week at a blue-collar job, while my mother with advanced degrees set aside her career to raise my sister with autism.

The early opportunity to experience the universe fueled my passion to study its complexity and share its beauty with others. My parents' sacrifices to ensure a quality education for my sister and me emphasized the importance of community-driven leadership. Earning my Ph.D. at Syracuse is the next opportunity to contribute to the frontiers of physics while reinforcing my core values to the scientific and broader community. I have experience developing computational models, maintaining observatory infrastructure, developing observational data pipelines and analysis routines, and assembling and integrating astronomical instrumentation. I am eager to extend my expertise from previous research to solve problems in gravitational-wave physics and cosmology.

After several experiences working in solid-state physics developing mid-infrared lasers, I shifted my focus towards astronomy during my sophomore year at Wheaton College. I sought out the only astronomy expert at Wheaton, **Prof. Dipankar Maitra**. Prof. Maitra connected me with software engineer James Synge of Google and another Wheaton student to begin working on a citizen-science exoplanet telescope called project PANOPTES. PANOPTES uses a network of smaller, cost-effective telescopes to detect exoplanets using transit photometry. We installed PANOPTES inside an observatory dome at Wheaton and used it as a test case for a new dome-compatible design in the PANOPTES network. I integrated pre-existing Python code for observatory control into the PANOPTES instrument, enabling the telescope to operate autonomously at Wheaton. Our modified design was presented at the 2018 meeting of the Northeast Astronomy Forum in Suffern, NY.

In the summer following my sophomore year at Wheaton College, I earned a position in the National Science Foundation Research Experiences for Undergraduates program at Rutgers University-New Brunswick. I was paired with **Prof. Carlton Pryor** to study dwarf satellite galaxies of the Milky Way using astrometry from the second data release of the Gaia space observatory. Developing a data pipeline to select member stars using photometric and kinematic filters served as my first experience working with data analysis tools in Python. After comparing discrepant Gaia and ground-based proper motions in the Bootes dwarf satellite, I confirmed a previous result of a tidal tail in the dwarf satellite Carina. I showcased these results in oral presentations to faculty and students at Rutgers University and Wheaton College, along with poster presentations to faculty and students at Rutgers University, Wheaton College, and attendees of the 234th meeting of the American Astronomical Society.

I studied at University College London (UCL) in early 2019 and spearheaded a project with Prof. Thanh Nguyen, other UCL students, and research staff at the Royal Institute of London. We determined the limit of detection for diagnostic devices doped with different types of magnetic nanoparticles. I seized this opportunity to test my intellectual flexibility and project management skills in an unfamiliar environment. It culminated in lead-authoring a report and presenting our results at a poster session that received the highest marks from UCL and Royal Institute faculty.

The broader goal of studying at UCL was to seek a deeper exposure to astrophysics than Wheaton could provide. I enrolled in challenging graduate courses at UCL in Interstellar Physics and Cosmology. This immersion led to an honors thesis with Prof. Amélie Saintonge of UCL and Prof. Maitra at Wheaton. I investigated cold-gas and dust scaling relationships in star-forming galaxies, starting with building a data pipeline to use with galaxy morphology measurements from several different galaxy surveys. I developed a Markov-chain Monte-Carlo sampler to constrain the relationship between interstellar medium composition and the Balmer emission of star-forming galaxies. When the full effects of the COVID-19 pandemic began to impact the world, I adjusted to working from home to complete the project within the modified school year. I applied the smaller survey calibration to a wider set of galaxies to discover a bias due to galactic inclination. I presented these results in a virtual thesis defense to faculty and peers at Wheaton College and UCL and submitted a final report that earned the highest distinction from the faculty of both colleges. Following this presentation, I generalized the calibration to include the effects of galactic inclination to better constrain the galactic contents.

I earned the opportunity to further my technical repertoire when I joined the Astronomical Instrumentation Team (AIT) at the Massachusetts Institute of Technology in November 2020, under principal investigator Gábor Fûresz and faculty lead **Prof. Rob Simcoe**. AIT is building the LLAMAS spectrograph for the Magellan Telescopes at Las Campanas Observatory in Chile, scheduled to be installed in July 2022. I assembled optical mounts and ground support equipment, designed optical mounting fixtures, and tested diffraction gratings to ensure they met optical-design requirements. My principal responsibility was integrating the fiber run of the spectrograph. I found that my early attempt to bond fibers with the required precision was too slow to meet our project deadlines. To remedy this, I wrote LabView code to allow for simple DC motor control through a computer interface, removing a critical project bottleneck. These adjustments enabled exceptional accuracy in the fiber run when compared to the design requirements (100% fiber yield vs. 99.5% requirement). I presented the science and engineering status of the LLAMAS instrument to an astronomy class at Wheaton College in November 2021.

In parallel to LLAMAS, I am developing software tools to support a research proposal for AIT, concentrating on using solar spectrophotometry to extend photosphere and chromosphere events on the sun to activity on exoplanet host stars. AIT has installed a multi-channel solar spectrometer at Lowell Observatory in Flagstaff Arizona to perform a preliminary ground-based study. I created analysis tools for this spectrometer and organized meetings between AIT members and collaborators at other institutions. Early in the project, I struggled with developing a data pipeline that maintained compatibility with all of the observations, as their file structure was constantly being modified to accommodate the high data volume. After iteration, I constructed a robust and flexible data pipeline with the capability to accurately represent all solar observations. This pipeline enabled a detailed analysis of several solar events in the second half of 2021 and served as supporting evidence in several forthcoming publications that describe the project scope.

I possess a unique combination of experimental, computational, and analytical skills to make immediate contributions to gravitational-wave physics and cosmology projects. I am very interested in the development of the next generation of gravitational wave detectors with aLIGO, Cosmic Explorer, and LISA. I have optomechanics and precise instrumentation skills from my experience with AIT at MIT that would translate quickly to active gravitational-wave detector research. However, I am cognizant of the long time-scales of these projects and am committed to supporting the development of advanced gravitational-wave detectors for both the near and distant future. I am also interested in the interface of theoretical and observational cosmology. My previous experience working with various astrophysical data sets has prepared me to glean new findings from current surveys of the cosmic microwave background and use these analyses to inform the development of future cosmic microwave background studies, particularly CMB-S4. I am broadly interested in gravitational-wave physics and cosmology but am particularly interested in the research of Prof. Ballmer, Prof. Watson, Prof. Brown, and Prof. Coughlin.

Gaining experience through a doctoral program will prepare me for a postdoctoral position, and ultimately a faculty position at a university. With this opportunity, I will contribute to astrophysics research at the cutting edge and communicate complex topics to the next generation of STEM leaders using teaching methods that reach every student, regardless of their intellectual approach. I will not limit my studies to the cosmos and train undergraduates to solve problems outside of pure research. I will build upon my previous experience in education and public outreach to create a healthy culture that increases participation in STEM by historically under-represented groups. The foundation of my future contributions to science and beyond is earning my Ph.D. at Syracuse.