Earning my Ph.D. at Cornell 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, building 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.

Following several research projects in solid-state physics and exoplanet astronomy in my first two years 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 with the goal of studying astrophysics with more depth than Wheaton could provide. I enrolled in challenging graduate courses in Interstellar Physics and Cosmology. This immersion led to an honors thesis with Prof. Amélie Saintonge of UCL and **Prof. Dipankar 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).

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 understanding the nature of gravitational waves through simulation and analysis. My previous experience developing numerical models for constraining galaxy evolution would translate seamlessly to astrophysical simulations that can inform instrumentation decisions for the next generation of gravitational-wave detectors. Additionally, I am interested in the analysis and simulation of cosmological observations. My previous experience working with various astrophysical data sets has prepared me to further the current understanding of the nature of dark matter, dark energy, and structure formation. I am broadly interested in gravitational-wave physics and cosmology but am particularly interested in the research of Prof. Niemack, Prof. Battaglia, Prof. Teukolsky, Prof. Chernoff, and Prof. Flanagan.

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 Cornell.