Statement of Purpose

I have been fascinated by astrophysical observations and theories since I was in high school. It is exciting to apply the theories I learned to explain the observational results, and even more inspiring if I can learn something new from the observations. I want to pursue a Ph.D. in Physics, and aspire to establish my career as a professor. My research interests include the observational studies of star formation, interstellar medium and galaxy evolution.

My motivation for pursuing research related to star formation and interstellar medium comes from my research experience in Institute of Astronomy and Astrophysics, Academia Sinica (ASIAA). In 2016, I took part in the ASIAA Summer Student Program, where I learned radio interferometry, MIRIAD toolkit, data reduction and imaging. Then, I worked on combining the interferometer and single-dish data of the N_2H^+ 3-2 line from Orion Molecular Cloud 1 (OMC1). Later, I became interested in the environment and kinematics for star formation in such a massive hub-filament structure, and started my research work on star formation with Dr. Naomi Hirano. In our study, we conducted hyperfine spectral fitting, filament identification, and LTE/non-LTE analysis. With these analyses, we are able to determine the physical conditions, filament properties and gas motion in OMC1. Our results revealed that the gas kinetic temperature is enhanced in the eastern part of OMC1, which is likely to be caused by the external heating from the high mass stars in M42. Moreover, we found that the filament regions have a higher density and a lower temperature than the non-filament regions, which could be explained by the shielding from the external heating due to the dense gas in the filaments. In May 2018, I presented our findings at the annual meeting of the Astronomical Society of the Republic of China, one of the most significant annual events for astronomers and astrophysicists in Taiwan, and won the *best oral presentation award*.

In order to examine the existence of an extended feature in OMC1, I submitted an observing proposal to the Submillimeter Telescope (SMT) of the Arizona Radio Observatory. The proposal was accepted, and I also participated in the remote observation as the PI. For the final project of the graduate-level course *Galaxy Formation and Evolution*, I also wrote an ALMA proposal for studying the star formation in high-z Lyman-break galaxies. With these experiences in writing proposals, I began to consider more on the scientific meanings and technical feasibility of the observations. Furthermore, I have been participating in the second-shift remote operation of the Submillimeter Array (SMA) since July 2017, where I learn about interferometers and data interpretations. In the early June of 2018, I also visited the SMA site at the summit of Mauna Kea, Hawaii, and joined the on-site array operation. These observing experiences equipped me with knowledge and skills for working with other telescopes in the future.

In another ongoing project, I have been working with Prof. You-Hua Chu to study the hot ionized gas and high-velocity shocked features in the 30 Doradus region since September 2018. As the nearest giant HII region, 30 Doradus is an excellent target for studying the collective interactions among the dense interstellar medium and the embedded massive stars. We plan to combine multi-wavelength observations including optical, infrared, radio, and X-ray, and make a comprehensive analysis of the ionized gas in 30 Doradus. Currently I am working on the analysis of structure and kinematics in Hα, [OIII], and [SII] lines observed with the CTIO 4m telescope.

During the first year of my master course, I worked on a research project related to the image reconstruction in radio interferometry with Prof. Jean-Fu Kiang. The goal of this project is to develop a better imaging technique for reconstructing image from visibility data. We finally came up with a novel reconstruction

model that integrates compressed sensing and Stockwell transform. I developed codes for simulating the observed visibility, given the interferometer configuration and the test image. I also implemented common reconstruction approaches for a quantitative comparison with our proposed methods. This is a valuable experience to me, for I not only gained a comprehensive understanding of interferometric imaging, but also realized how much I enjoy the process of solving problems.

I also have undergraduate research experience on gravitational waves with Prof. Kiang. In this research, I studied general relativity, spacetime perturbation theories, and the methodology for gravitational wave detection. Moreover, I implemented Runge-kutta method to numerically solve the light orbits near a Schwarzschild and a Kerr geometry. I also simulated the gravitational waveform of a binary black hole merger based on far-field theories. By completing this project, I developed the capabilities of numerical programming, surveying papers, and organizing my studies, which are crucial for conducting research.

Apart from taking courses and doing research, I have been attending a weekly seminar organized by Prof. Paul Ho for the past two years. In this seminar, I learned from researches in a wide range of topics from planets, stars, interstellar medium, galaxies, to cosmology. I also gave a presentation in the seminar on my research in star formation. In addition, when I was a first-year master student I participated in an astrophysics study group, where we read four astrophysical theory related textbooks and took turns leading the weekly group discussion. All these experiences greatly broaden my knowledge in both theoretical and observational astronomy. I also developed my abilities to precisely convey scientific ideas and give presentations.

At UC San Diego, I would like to work with Prof. Karin Sandstrom to study star formation and interstellar medium in nearby galaxies, and with Prof. Quinn Konopacky to study the formation and evolution of stars or planets. I would also hope to work with Prof. Alison Coil on observational studies of galaxy evolution, and Prof. Adam Burgasser on the properties of low-mass and low-temperature stars. Though I am open to a wide variety of research topics, some questions particularly kindle my enthusiasm for future studies. How do the mechanisms of star formation and evolution differ in high-mass and low-mass star-forming regions? How do magnetic fields in molecular clouds affect the physical process of star formation? What are the properties of gas, dust, and stars in early galaxies? How do the star formation environment and chemical properties in galaxies change as a function of redshift? I believe these questions can be answered within the following decades, and I am eager to take part in the journey of finding the answers.

I am prepared and fully equipped for graduate studies in Astrophysics. Aiming to become an observational astronomer, I feel especially excited about UC San Diego for its rich resources in observational projects and facilities such as the Lick Observatory and the Keck Telescopes. In addition, your department provides a vigorous and inspiring environment for doing research, and offers curriculum covering research areas that I would like to explore. It would be a privilege for me to join UC San Diego, where I can learn from the outstanding faculty and contribute my skills and experience. With my extensive academic and research experiences, I am confident that I am a good fit for your program and that UC San Diego is the best place for me to pursue a Ph.D. and continue my research career.