Kirk Long—Ford Predoctoral Fellowship Application—Proposed Plan of Graduate Study and Research

Note: I have responded to the prompt assuming that I am admitted to my top choice program and get to work with my top choice faculty—obviously neither of these things may actually happen and thus some of the substance of this plan would be changed.

Astrophysics is the intersection of science and dreaming—I'm enraptured by the cosmos and the plethora of interesting and strange systems that exist within it. Broadly, I'm fascinated by how the universe and its systems evolve, with a particular interest in dense stellar objects and transient events that push the boundaries of our understanding of physics. With the rapid pace of advance in computing and instrumentation more and more previously unsolvable problems are within reach, and that's why I am excited about the possibility of one day joining the ranks of modern computational astrophysicists—utilizing and building tools that will enable the next generation of discovery.

I hope to join Prof. Daniel Kasen's computational astrophysics lab at Berkeley to gain a deeper understanding both of our universe and the technology we use to study it. Prof. Kasen's group uses computational approaches to model high-energy transients—events like supernovae, neutron star mergers, and gamma ray bursts that are at the forefront of modern astrophysics research. Due to their relative rarity and inherently transient nature these events are hard to study classically, making them an excellent target of study for computational astrophysicists, who can employ the best of modern technology to numerically simulate the wildest events in our universe to an unprecedented level of detail while we wait for the next real data point to burst into existence. Prof. Kasen's group is very active in this research and has access to among the best computational resources available to anyone, in addition to significant observational resources as well. I particularly hope to join his group's work on supernovae, where we will utilize the MESA program to model stellar structure and simulate a star's ultimate demise. I also really enjoy data analysis, so I plan to not

only model these exploding stars but also find real examples that either confirm or disprove our model's assertions. I am interested in understanding the dynamics that create symmetrical versus asymmetrical explosions in these stars, and how these explosions and their directionality impact the galactic community as a whole.

I'm excited about attaining a Ph.D. not just because of the potential to do interesting research, but also for the opportunity to simply learn more about the subject. The classes I will have the opportunity to take at Berkeley will further inform both my future research and teaching activities. Many are directly applicable to my research interests and thus I plan to take them as early as possible—these include numerical techniques in astronomy, astrophysical techniques, high energy astrophysics, and a dedicated computational astrophysics course. More tangentially related to my research, but important for a full knowledge of the field and success as a future teacher of the material include extragalactic astronomy and physical cosmology, stellar structure and evolution, and stellar dynamics and galactic structure—I plan to fit these courses in either after the more research relevant courses are completed or wherever there is space.

Being awarded funding independent of my future institution will open many doors for me academically and allow me more freedom to pursue the projects that interest me most, but becoming a Ford fellow will also grant me access to an incredible community of like-minded scholars. I plan to continue in academia as long as possible with the ultimate goal of being a professor in my field who excels in both research and teaching. I'm also passionate about collaboration and expanding the reaches of academia to as many as possible, especially those of non-traditional backgrounds like the inmates I've taught physics and programming to in prison—experiences further detailed in my personal statement. The mission of the Ford Foundation aligns well with my personal ideals—particularly in regards to the importance of teaching and including as many voices as possible in academia. I would be honored to garner their support as I start this exciting next step in my career.