Kirk Long

Statement of Purpose—Berkeley Astrophysics

Like many curious and excited children, when asked the dreaded “what do you want to be when you grow up?” question I always responded enthusiastically with “astronaut!” The romantic aspirational ideals of exploring the final frontier as a career have always transfixed me, but as I’ve grown up I’ve realized that becoming an astronaut might not be the most probable career path (I’m still going to apply though). Becoming an astrophysicist seemed like a more logically probable next best thing—we still get to explore the final frontier and think about the universe’s deepest mysteries, we just don’t get to go to space (the upside of this is as a profession there’s a much lower risk of death).

I’ve meandered somewhat in my undergraduate career, originally intending to major in math and music (I still collected applied math and music minors) before landing wholeheartedly in physics. As a result of this longer and more diverse education I’m much more confident that my true home is in astronomy and physics. I have thrived especially in upper division courses and taken nearly everything I possibly could that our department offers even when it wasn’t required. My undergraduate physics department is smaller compared to many universities, and although research and course opportunities have been more limited as a result I’m grateful to have fostered close relationships with many of my professors, who have patiently giving me much one-on-one attention over the years as I’ve sought to truly understand the material. I’ve also had the incredibly rewarding opportunity to teach in the department as a physics and astronomy adjunct lab instructor as well as cohosting the department’s drop-in tutoring lab.

I’m somewhat of a late-bloomer in terms of research experience—our department only has two faculty conducting astrophysics research and I have never been able to attend an REU because of financial and family constraints—but I have hit the ground running hard and fast. Since this spring I have become involved with my now-mentor Dr. Daryl Macomb in identifying accreting x-ray binaries using archival data from the CHANDRA and XMM-NEWTON orbital observatories. In just these past few months I’ve gained an incredible wealth of experience that I feel prepares me well for graduate work, especially in computational science. I’ve learned how to use tools like HEASOFT and SAS from the command line to process data and extract relevant things like lightcurves, as well as writing bash shell scripts to accomplish some of these tasks and feed the results into other programs written in my new favorite language, Julia (I also have significant experience in Python—my first language—and Matlab, with some limited experience in Perl and Fortran). I took the plunge this summer in learning how to reconfigure my laptop to dual-boot with Linux (Mint is my flavor of choice) and I’ve learned to love the terminal. Our project is still in progress but we are very close to having some exciting results—essentially what we’ve done is cross-referenced likely pulsar sources in the Small Magellanic Cloud for changes in period (using Fourier analysis) over many years that could be caused by accretion processes. The trickiest problem for us has been trying to eek out detections from lower power sources, and my largest individual contribution to the code base thus far has been developing an algorithm that allows us to test the statistical significance of finding lower-power pairs from a large background observation map I created and thus strengthen our detection confidence. I am hopeful that we will be able to publish our results in a paper by the spring!

The most surprising part of my undergraduate career thus far has been how much I’ve loved my computational work, both in classes and in research, and I believe my computer science and data analysis skills are a strong asset to whatever future research I engage in. In the spring I’m taking a parallel computing course I’m really excited about, and I’ve tried to learn outside the classroom by reaching out to grad students at various universities who are doing interesting computational work to play around with their code and software tools—at Berkeley I’ve had the pleasure of talking with Sarafina Nance, who showed me how she utilizes MESA in conjunction with Python for her supernovae research.

I’m excited about the possibility of doing computational astrophysics work and/or computationally intensive data analysis at Berkeley. The two groups that interest me most in this arena are Dr. Kasen’s computing group and Dr. Parson’s HYPERION group. Dr. Kasen’s research on highly energetic transient events fascinates me, and his perspective in tackling these kinds of interesting problems from a high-performance computing perspective is of great interest to me. I would love to hone my modelling skills under Dr. Kasen, helping to build the next-generation of models that might better explain supernovae, colliding neutron stars, and so much more. From a cosmological perspective I’m fascinated with the HYPERION project’s observational significance in detecting the monopole reionization signal and thus greatly expanding our knowledge of the early universe and better informing us on the causes of its evolution. I would be incredibly excited to join this group to use and improve my observational data science skills, a significant problem given the sensitivity of the instrument required to make the detection. Everything at Berkeley is exciting, and while these two groups may be my top choices I have I would be delighted to participate in any of the ground-breaking research here—what’s most important to me about Berkeley is how the school purposefully weaves academic excellence with diversity and inclusion. The opportunity to collaborate with such a diverse and supportive community is rarer than it should be in academia, and there seems to me no better place to do research with that mindset than Berkeley. To that end, I hope you will consider me for admission into your astrophysics program, that together we might uncover some small mystery of our universe together.