**PART 1**

I thoroughly explored several different paths in college before landing in physics—I’ve collected minors in music and applied mathematics—experiences that make me a well-rounded student capable of appreciating interdisciplinary work while simultaneously reinforcing my decision to continue in astrophysics. I have thought carefully about whether graduate school is right for me, and I distinctly remember when I first concluded I needed to continue in the field: last year as part of a scientific computing course I wrote a physics simulator almost entirely from scratch that faithfully reproduced the Apollo 8 mission trajectory with a simulated multi-stage Saturn V, and this culminating experience quelled any doubts I might have had about continuing in graduate school. Academic experiences like this as well as my recent research experience have left me feeling capable and motivated—I’m excited to join modern computational astrophysicists in helping to answer questions in cosmology and high-energy astrophysics.

My undergraduate experience uniquely prepared me to succeed in graduate studies—the intimate instructional setting in my department enabled me to develop close and supportive relationships with professors in both my academic and research pursuits. I have had a productive research experience with my mentor, Prof. Daryl Macomb, whose interests involve the search for and analysis of accreting x-ray binary pulsars using archival CHANDRA and XMM Newton data. We’ve analyzed likely x-ray time-series observations of putative pulsar sources in the Small Magellanic Cloud to search for changes in period (using Fourier analysis) over many years driven by accretion. The trickiest problem for us has been trying to eke out detections from lower power sources that have thus far gone unnoticed, and my largest individual contribution has been developing an algorithm to test the statistical significance of finding lower-power pairs from a large background observation map I created and thus strengthen our detection confidence. For this project I’ve learned Linux, the command line and shell-scripting, learned a new programming language—Julia, have been exposed to deeper languages like Perl and Fortran, and learned to process and reduce datasets with tools like HEAsoft and SAS. Our careful analysis contributes new details to our understanding of high-energy accretion events involving dense stellar objects, as well as putting forward new candidates for further study by the astronomical community—we are writing a paper on our results that we hope will be submitted by early spring.

During my previous work involving pulsar time-series both the topic and the techniques have fascinated me, and I would like to continue developing computational expertise in graduate school. I’m incredibly excited about the possibilities for analyzing big data in astronomy—something I’ve already enjoyed in my research experiences thus far. I’m most fascinated by the study of evolving and transient systems, meaning topics as far apart as galactic evolution and binary systems are of equal interest to me. I’m also interested in simulating systems numerically, akin to my pet Saturn V project above, and I’m looking forward to combining and honing these skills further in graduate school.

**PART 2**

Advances in computing are enabling physicists to tackle previously unanswerable questions about our universe, and my deep desire to leverage and help build these technologies to contribute to our cosmic understanding motivates my application to your graduate program.

The largest reason I want to complete an advanced degree in astrophysics is because I’m transfixed by the subject—it’s the intersection of science and dreaming. I’ve engorged myself in nearly all the courses our department offered even when not required, and while I’m proud to have maintained a nearly perfect GPA in my physics coursework I’m even prouder to feel as if I’ve internalized the smallest inklings of how our universe works. I relish the opportunities where I get to impart this knowledge to others—seeing the light in someone’s eyes as everything clicks in a blissful epiphany is often even better than having the experience yourself, and this is one of the reasons I’m so passionate about teaching and outreach. I hope to remain in academia as long as possible—helping both to unlock some tiny part of the cosmos as well as to inspire and uplift others as a future professor in our discipline. I would be honored to have the opportunity to take the next step towards that ultimate goal in studying at the University of Utah—the powerful intersection of research, academic excellence, and supportive collaboration that happens in your department is unfortunately rarer than it should be in academia.

I could fit well into nearly any project at U of U, but the two groups that especially interest me are Prof. Wik’s and Prof. Zheng’s. I’ve enjoyed my work in observational x-ray astronomy thus far and I’d enjoy learning to tackle new challenges within the field with Dr. Wik. The cosmological implications of Dr. Zheng’s work, particularly on galaxy formation, is of great interest to me as well. Tackling such fundamental questions about our universe is one thing that makes Utah so attractive to me, but the way the department presents itself as a supportive and inclusive place—something I’ve already seen evidence of in my communication with some current grad students—is also of great importance to me. I hope to use the knowledge and skills I gain in graduate school not only to advance our cosmic quest but to uplift and inspire others to follow suit—especially those whose privilege hasn’t been as great as mine. I’ve been fortunate to have a wealth of opportunities to practically demonstrate these ideals, from working with inmates in prison to designing and teaching STEM programs for financially challenged youth through the YMCA. I hope to continue to help advance a more welcoming astronomy and physics culture throughout my future career, and to that end I humbly submit my application to your astrophysics program, that together we might gain some new understanding of the cosmos while simultaneously making it a little better for everyone along the way.

**PART 3—does not include Sp20 courses (those can be found on transcript if interested)**

|  |  |  |
| --- | --- | --- |
| **Course Title** | **Grade** | **Institution** |
| 1. **Lower division undergraduate studies** | | |
| Calculus I | B- | Idaho State University |
| Calculus II | B- | Idaho State University |
| Calculus III | A- | Idaho State University |
| Linear Algebra | A | Idaho State University |
| Differential Equations | A | Idaho State University |
| Introductory Computer Science | A+ | Boise State University |
| Planetary Astronomy | A | Boise State University |
| Physics I with Calculus | A+ | Boise State University |
| Physics II with Calculus | A+ | Boise State University |
| General Chemistry I | A- | Boise State University |
| Stellar Astronomy | A+ | Boise State University |
| Computational Mathematics | A+ | Boise State University |
| 1. **Upper division general physics courses** | | |
| Introductory Quantum Physics | A | Boise State University |
| Scientific Computing | A+ | Boise State University |
| Electromagnetic Theory | A | Boise State University |
| Electrodynamics | A | Boise State University |
| Introductory Relativistic Physics | A+ | Boise State University |
| Classical Mechanics | A | Boise State University |
| Thermal Physics | A | Boise State University |
| 1. **Upper division specialized physics courses** | | |
| Optics | A | Boise State University |
| Astrophysics | B+ | Boise State University |