The largest surprise of my undergraduate career has been the enjoyment and fulfillment I’ve gotten out of computing. Advances in the field are enabling physicists like me to tackle previously unanswerable questions about our universe, and my deep desire to leverage and help build these technologies motivates my application to your graduate program. I thoroughly explored several different paths in college before I landed in physics—I’ve collected minors in music and applied mathematics—experiences that make me a well-rounded student capable of appreciating interdisciplinary work. 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 scientists and engineers in answering some of the world’s most pressing questions through the power of computing.

My undergraduate experience uniquely prepares me to succeed in graduate studies—the intimate instructional setting in the our department enabled me to develop close and supportive relationships with my professors in both academic and research pursuits, and their patient support is largely responsible for the nearly perfect GPA I’ve attained in my major coursework. Physics is of course only possible through the support of advanced mathematics, and I’ve had a rigorous foundation in linear algebra, differential equations, calculus, and statistics. I’ve also had a variety of interesting and challenging courses where I’ve learned to solve problems from a computational perspective, the two most important of which are PHYS 325—a physics computing course where I completed the Apollo 8 simulation mentioned above—and MATH 365—where I opted to independently increase my understanding in Julia to support my research as I already felt comfortable in Matlab.

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. For that work, 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 strengthening 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 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 with our results that we hope will be submitted by early spring.

Outside of research I spend a large portion of my time teaching—another benefit of our smaller department is that I have been invited to teach undergraduate physics and astronomy labs as well as hosting our department’s drop-in tutoring lab, experiences that prepare me well for the teaching requirements in graduate school and beyond. In the broader Boise community I’ve helped run the largest public observatory in the state at Bruneau Sand Dunes State Park, where I’ve given public talks and had the privilege of sharing the cosmic perspective our dark skies afford with thousands of visitors. I’m also passionate about ensuring education is accessible and equitable to everyone regardless of demographic, and I’ve put these skills to work in my latest outreach project: teaching physics and programming in prison as a volunteer for the Idaho Department of Corrections. My end-goal is to become a professor in the field who succeeds both in research and teaching/outreach, and I’m grateful that I’ve had a wealth of opportunities here in Boise to develop these crucial skills. I really like good science graphics, and I’ve recently taken some outreach online in the development of my first Twitter bot—a random three body problem generator. I use a shell script to automatically tweet out simulations rendered in Julia from random initial conditions, sending out the result to my bot account using my first ever JavaScript that I cobbled together to interface with the Twitter API.

I’m excited about a lot of the research that happens at Boise State, but the three potential faculty advisors that interest me the most are Prof. Jackson (in physics), Prof. Calhoun (in mathematics), and Prof. Kopera (also in mathematics). I’ve taken and done well in classes from both Dr. Jackson and Dr. Kopera, and they both are doing exciting research I think I could be a productive part of. Dr. Jackson does exciting work in both planetary and exoplanetary science, and I’d be honored to continue in the realm of physics with him as an advisor. I’ve already talked specifically with Dr. Kopera about the possibilities of potentially doing Ph.D. work with him, and I’m hopeful that if admitted I would be able to continue to at least work with him in some capacity. I’m excited to take my first class from Dr. Calhoun in the spring—parallel scientific computing—and have already discussed potential research opportunities with her NSF project in developing an ellipsoidal solver. I know the physics department is currently engaged in a faculty search that may potentially end in the hire of a computational astrophysicist who could be a potential advisor as well, and if such an opportunity opened up I would of course be highly interested in exploring that. I hope to gain independent funding for my graduate studies so that I have free reign to research what I’m most passionate about—I’ve already applied for a Ford fellowship this cycle and will apply for an NSF fellowship and potentially a DoE fellowship in the next cycle if I am not awarded the Ford.

The opportunity to tackle such fundamental questions about our world is incredibly exciting, but the way our university fosters diversity and inclusion within that academic excellence are at least equally important—the opportunity to collaborate with such a supportive and diverse community is rarer than it should be. 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. These experiences have been strong firsthand evidence that there is strength in diversity, and it’s important to me that my future work be done within this context and not an echo chamber. I hope to continue to help advance a more welcoming culture in academia throughout my future career, and to that end I humbly submit my application to your program, that together we might gain some new understanding of our pale blue dot while simultaneously making it a little better for everyone along the way.