

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. 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 prepares me to succeed in graduate studies—the intimate instructional setting in the Boise State Physics Department enabled me to develop close and supportive relationships with my professors in both my academic and research pursuits, and their patient support is largely responsible for the 4.0 I've attained in my physics coursework. I also 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 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 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 in the process of writing a paper on 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 and helped run our department's drop-in tutoring lab, experiences that prepare me well for the teaching requirements in graduate school and beyond—I hope to one day be a professor who succeeds both as a researcher and a teacher. 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. It's important for grad students and scientists in general to be able to teach and communicate technical knowledge in a succinct and accessible way, and I'm grateful that I've had a wealth of opportunities here in Boise to develop these crucial skills. 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 computer programming in local prisons as a volunteer for the Idaho Department of Corrections.

Given the broad applications of computational science to astrophysics, I could fit well into nearly any project at Arizona, but I am especially intrigued by the work being done by professors Chan and Krause. During my previous work involving pulsar time-series, both the topic and the techniques have fascinated me and I would like to continue developing expertise in these techniques in graduate school. As a result I'm interested in working with Prof. Chan's computational research, in particular in relation to the Event Horizon Telescope project—in talking with Dr. Chan he mentioned additionally that I might also be a good fit to work with Dr. Psaltis or Dr. Ozel. I would also enjoy applying my data manipulation and processing skills in any of Dr. Krause's projects—she mentioned she would likely need motivated graduate students to work through the wealth of DESI, LSST, and SPHEREx data that will be available in the coming years, all projects which I would be thrilled to be a part of.

Tackling such fundamental questions about our universe is certainly one thing that makes Arizona attractive to me, but the way the department presents itself as collaborative, inclusive, and open within that academic excellence are at least equally important. The opportunity to collaborate with such a supportive community is rarer than it should be in academia, and I've already been impressed by the limited contact I've had with professors Krause and Chan. 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—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 underserved inmate populations teaching physics and coding in prisons to designing and teaching STEM programs for financially challenged youth through the YMCA. These experiences have been strong firsthand evidence that there is incredible strength in diversity, and it's important to me that any future work I do be done within context and not an echo chamber. 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.