

Kirk Long

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Research Interests

I am excited about employing advances in modern computing to analyze large data-sets and to simulate interesting systems numerically. I am broadly fascinated with the evolution of our universe and its systems, with a particular interest in dense stellar objects and the processes that form them (including the various flavors of neutron stars). I have enjoyed combining these passions in my research thus far, which has focused on identifying accreting pulsars in x-ray binaries.

Education

- 08/2017 – 05/2020 **Boise State University**, Honors College
Bachelors of Science in Physics, Astrophysics emphasis
Minors in Music and Applied Mathematics
Graduated Magna Cum Laude with recognition as a Graduating Student Leader
- 08/2015 – 05/2017 **Idaho State University**
Attended prior to transferring to Boise State, originally intended to major in math and music here.

Research Experience

- 04/2019 – **Identifying accreting x-ray binaries**, Boise State University
Mentored by Dr. Daryl Macomb, code sample available at: <https://github.com/kirklong/Research>
- Analyzed archival data taken with both the CHANDRA and XMM-Newton orbital X-ray observatories, with data reduced via HEASoft and SAS.
 - Used FFT analysis to find periods of pulsar sources, then compared periods of co-located sources in data from both instruments over time to detect changes that could be driven by accretion.
 - Used techniques like bootstrapping to generate statistical significances of potential detections from background data.
 - Built folded light curves of potential new pulsar sources and accreting pairs.

Teaching Experience

- 08/2018 – **Physics Lab Instructor**, Boise State University Department of Physics
Responsible for teaching, grading, and managing class of students (~25/class). Evaluations available for all courses upon request. Courses taught include:
- PHYS 111 (General Physics I, Fa 2018 & Su 2020)
 - PHYS 105 (Introductory Stars and Cosmology, Sp 2019)
 - PHYS 101 (Survey of Physics, Fa 2019)
 - PHYS 204 (Introductory Astronomy, Fa 2019)
 - PHYS 211 (General Physics I for Scientists and Engineers, Sp 2020)
 - PHYS 212 (General Physics II for Scientists and Engineers, Su 2020)
- 08/2018 – 08/2020 **Physics Tutor**, Boise State University Department of Physics
1/2 students selected by Department to host drop-in tutoring lab. Mostly tutored lower-division classes but occasionally helped more advanced students. Average attendance per session: ~5 students.

01/2019 – **Volunteer**, Idaho Department of Corrections
 Inspired by *Just Mercy* (**Stevenson**) to start program for inmates to learn STEM skills.
 Taught introductory programming class 1 hour/week with partial summer hiatus.
 • Created curriculum based on programming classes taken and research experiences.
 • Built Jupyter Notebook “labs” for inmates to follow.
 • Code samples available at: <https://github.com/kirklong/PrisonOutreach>).

01/2020 – 05/2020 **TA/Grader**, Boise State University Department of Physics
 Responsible for grading homework assignments in Classical Mechanics course.

Outreach

06/2015 – 08/2020 **Telescope Operator**, Bruneau Sand Dunes State Park Observatory
 Former volunteer of >300 hours before being hired in March of 2017.
 Responsible for maintenance and operation of various large telescopes and related equipment.
 • Used telescopes to show visitors celestial objects with accompanying explanations of both objects and equipment.
 • Experience with various makes of telescopes with apertures up to 0.64 m (25”).
 Tasked with creating and giving ~45 minute public talks/presentations.
 • Topics curated from latest research and most popular phenomena in astronomy, distilled into form digestable by those without any previous background knowledge.
 • Average crowd size: ~150. Total visitors during employment: >20,000.

01/2019 – **Volunteer**, Idaho Department of Corrections
 Work detailed here in addition to volunteer teaching detailed above.
 Brought outreach events each week to local prisons to stimulate interest/continued attendance in prison education programs (supplied by BSU Physics Department).
 Occasionally helped with GED lessons when applicable to physics.
 Originally volunteered at just men’s facility but have recently (11/2019) started expansion into women’s as well.
Press: Featured on Boise State University website (08/2019), on local news channel KIVI (11/2019), and in the Boise State University alumni magazine, *Focus*, (05/2020).

05/2016 – 05/2020 **STEM Lead**, Treasure Valley Family YMCA
 In charge of writing STEM curricula for summer camps and after school programs for all 4 local YMCA branches, including coding and physics programs.
 • Engaged and inspired ~1,000 program attendees during employment.
 • No child turned away: ~1/5 of participants received financial assistance.
 • Responsible for procuring/maintaining thousands of dollars worth of equipment.
 • Trained ~50 employees on STEM materials and how to effectively teach topics.
 Collected and analyzed budget and participant data throughout summer months.

08/2016 – 08/2018 **Intern**, *StarTalk*
 Wrote blog posts on convoluted and/or newsworthy astronomy/physics topics.
 • Posts disseminated to online audience of >500,000.
 • Writing can be found by searching for my name on the *StarTalk* website: <https://www.startalkradio.net/?s=kirk+long>
 • Occasionally still write guest posts, but main affiliation ended 2018.

12/2019 – **@ThreeBodyBot**, Twitter #scicomm
 Built automated Twitter account that posts random three-body simulations ~1/day.
 Source code available at <https://github.com/kirklong/ThreeBodyBot>.

Scholarships and Awards

2015 – 2017	Presidential Scholarship	\$10,000
2017 – 2018	Dean’s Transfer Scholarship	\$3,000
2018 – 2019	Whitlock Math and Science Award	\$800
2018 – 2019	BSU Foundation Honors Award	\$1,500
2018 – 2019	Physics Department Scholarship	\$1,000
2019 – 2020	Honcik Physics Scholarship	\$3,000
2019 – 2020	George Campbell Memorial Award	\$2,800
2016 – 2020	Dean’s List	

Skills (rated basic – expert)

- **Programming Languages:**

- Advanced: Python, Julia
- Competent: Matlab, Bash, C
- Basic: Perl, Fortran, JavaScript, CUDA

- **Software:**

- Expert: Microsoft Office Suite
- Advanced: Jupyter Lab/Notebook, Anaconda, terminal/command line, FFmpeg
- Beginner: HEASOFT, SAS, L^AT_EX, MPI, Git, Slurm/HPC applications
- Basic: MESA

- **Operating Systems:**

- Advanced: Windows 10
- Competent: Mac OSX, Linux (Mint)

Posters and Publications

Macomb, D. & **Long, K.** (2020). Identifying accreting x-ray binaries. *In preparation*.

Long, K. (2018). *To the Moon and Back – Simulating the Trajectory of a Multi-Stage Rocket Similar to Saturn V in an Apollo 8 Mission Analogue*.

Poster available on Github (<https://github.com/kirklong/Posters>), presented on:

- 02/2019: Research Computing Days, Boise State University
- 12/2018: Won best class poster from PHYS 325 (Scientific Computing)

Barkley, K., Belnap, K., Keller, M., Larson, J., **Long, K.**, McCarthy, K., Myers, M., & Withers, J. (2017). *Idaho State University (a campus history)*. Charleston, SC: Arcadia. ISBN: 1467125512.

Relevant Coursework

Physics & Math: Classical Mechanics (**Taylor**), Electrostatics & Electrodynamics (**Griffiths**), Introductory Quantum Mechanics (**Krane**), Introductory Relativity/Particle Physics, Optics (**Pedrotti**), Thermal & Statistical Physics (**Schroeder**), Astrophysics, Intermediate Quantum Mechanics (Independent Study, **Townsend**), Cosmology (**Ryden**), Circuits (**Scherz & Monk**), Linear Algebra, Single & Multivariable Calculus (**Stewart**), Ordinary Differential Equations (**Boyce/DiPrima**)

Computing: Scientific Computing (**Newman**), Computational Mathematics, Parallel Scientific Computing (graduate level course), Introductory Computer Science

Extracurricular Activities

I enjoy spending time outdoors (particularly hiking and skiing), tinkering with amateur science projects (I’ve built cloud chambers, homemade rockets and fireworks, DIY telescopes, a brick kiln for metallurgical experimentation, and more), and making and teaching music (I’ve partly financed my studies thus far working at a local studio). I particularly enjoy learning and performing classical piano works—the latest addition to my repertoire is Gershwin’s *Rhapsody in Blue* and my favorite piece is Rachmaninoff’s *Prelude in G Minor*.