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, and I have enjoyed combining these passions in my research thus far, which has focused on identifying accreting pulsars in x-ray binaries and the simulation of broadline emission from accretion disks surrounding quasars.

Education

08/2020 – **University of Colorado Boulder**, Dept. of Astrophysical and Planetary Sciences
Graduate student working towards Ph.D., expected graduation ≈ May 2026.

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.

Research Experience

08/2020 – **Disk-wind modelling of quasar broadline emission**, CU Boulder

Mentored by Prof. Jason Dexter.

Performed simplified calculations following on Chiang & Murray et. al, 1996, to investigate if the observation of broadline region emissions from quasars can be adequately explained by a disk-wind model viewed at relatively low inclinations, as opposed to the convential model that assumes a thick disk of puffy particle clouds viewed close to face on, with potential implications for the inferred masses of the central black holes.

04/2019 – 07/2020 **Identifying accreting x-ray binaries**, Boise State University

Mentored by Prof. Daryl Macomb.

Analyzed archival data from CHANDRA and XMM-Newton (with the help of HEASoft and SAS) to attempt to find both new pulsars that may not have been previously detected (through pairings that increased statistial significance) and of pulsars whose periods had changed substantially (indicating potential accretion from a binary companion).

Teaching Experience

08/2020 – **Graduate TA**, CU Boulder Dept. of Astrophysical and Planetary Sciences

Taught recitations/labs for both lower-division and upper-division courses, assisted with grading assignments/exams, and occasionally assisted in the development of class materials (like Jupyter notebook labs).
Evaluations for all courses available upon request.

08/2018 – 08/2020 **Physics Lab Instructor**, Boise State University Dept. of Physics

Taught (and was instructor of record for) undergraduate physics and astronomy lab courses up to physics II, for both majors and non-majors.
Evaluations available for all courses upon request.

08/2018 – 08/2020 **Physics Tutor**, Boise State University Department of Physics

Lead department hosted drop-in tutoring lab, average attendance ≈ 5 students.

01/2019 – 08/2020 **Volunteer**, Idaho Department of Corrections

Inspired by *Just Mercy* 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

06/2017 – 08/2020 **Astronomer**, 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 – 08/2020 **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/chemistry/maths.

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.

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

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, LaTeX, MPI, Git, Slurm/HPC applications
  - Basic: MESA, HTML, CSS
- **Operating Systems:**
  - Advanced: Windows 10, Linux (Mint)
  - Competent: macOS

Posters and Publications

Long, K. & Macomb, D.(2021). 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.

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.*