Kirk Long

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Research Interests

I am broadly excited about employing advances in modern computing to analyze large datasets and to simulate interesting systems numerically, techniques I am currently using to better understand the true nature of the broad emission line region in active galactic nuclei.

Education

08/2020 –	**University of Colorado Boulder**, Dept. of Astrophysical and Planetary Sciences M.S. awarded December 2022, Ph.D. expected Summer 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** (transferred prior to completing degree)

Research Experience

08/2020 –	**Unraveling the true nature of the quasar broad-emission line region (BLR)** Mentored by Prof. Jason Dexter at CU Boulder. We are interested in understanding the underlying structure and kinematics of the BLR, with implications for properly constraining the masses of supermassive black holes as well as the physical environments and processes that surround them. We accomplish this via kinematic modelling and deep-learning approaches, utilizing observations of quasars taken by the interferometric VLTI instrument GRAVITY as well as high-cadence reverberation mapping data to fit and compare various physical and statistical models.
04/2019 – 07/2020	**Identifying accreting x-ray binaries,** Mentored by Prof. Daryl Macomb at Boise State University. Analyzed archival CHANDRA and XMM-Newton data 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).

Selected Teaching, Outreach, and Service Experience

01/2023 – 05/2023 **Graduate Part-Time Instructor**
CU Boulder Dept. of Astrophysical and Planetary Sciences

Instructor of record for ASTR 2030 Black Holes with enrollment of 109 students. Responsible for all course content and managing TA, grader.

08/2020 – 12/2023 **Graduate Teaching Assistant** (4 semesters)
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).
Courses TA'd: ASTR 3730 (Astrophysics I), ASTR 1040 (Accelerated Intro to Astronomy II), ASTR 2030 (Black Holes)

08/2020 – **Graduate mentor**, CU Boulder (5 students)

Mentored both undergraduate and incoming first-year graduate students. Currently have two active mentees.

08/2020 – **Graduate committee member**, CU Boulder

Served on department service committees with faculty and other graduate students.

01/2020 – **Open-source software contributor**

Contributed to various open-source Julia and Python projects as well as distributing my own code in easily installable format.
Top ∼2% contributor on StackOverflow.

Notable software releases:
- `BroadLineRegions.jl` – A fast and flexible toolkit for modeling the broad-line region (BLR) in Julia.
- `BinnedStatistics.jl` – An analogue to SciPy stat's `binned_statistic` that's faster and written in native Julia.

12/2019 – **@ThreeBodyBot**, #scicomm

Built automated Twitter/Mastodon/Tumblr/YouTube account that posts random three-body simulations ∼1/day. Source code available at https://github.com/kirklong/ThreeBodyBot.

01/2019 – **Volunteer Instructor**, Idaho & Colorado Correctional Facilities

Inspired by *Just Mercy* to start program for inmates to learn STEM skills. Taught introductory programming classes, gave physics and astronomy demonstrations/lectures, and tutored individual students working towards their GEDs.

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).

06/2017 – 08/2020   **Astronomer**, Bruneau Sand Dunes State Park Observatory
Former volunteer of >300 hours before being hired March 2017.

Operated large telescopes to show visitors celestial objects and gave ∼45 minute public talks/presentations on astronomy. Average crowd of ≈150 with >20,000 total visitors during employment.

Publications and Posters

"Constraining Model-Dependent Systematics in Broad-Line Region Measurements," **Long, K.**, Dexter, J., et al. 2025, *in prep.*

"A Convolutional Neural Network for the Recovery of Transfer Functions From Velocity-Resolved Reverberation Mapping Data," **Long, K.**, Dexter, J., et al. 2025, *in prep.*

"`BroadLineRegions.jl` A fast and flexible toolkit for modeling the broad-line region (BLR) in Julia," **Long, K.**, 2025, Submitted to *JOSS*

"Reverberation Mapping Data of NGC 5548 Imply a Multicomponent Broad-line Region," **Long, K.** & Dexter, J., 2025, *ApJ*, 987, 196

"Confronting a Thin Disk-Wind Launching Mechanism of Broad-Line Emission in AGN with GRAVITY Observations of Quasar 3C 273," **Long, K.**, Dexter, J., et al. 2023, *ApJ*, 953, 184

"To the Moon and Back —Simulating the Trajectory of a Multi-Stage Rocket Similar to Saturn V in an Apollo 8 Mission Analogue," **Long, K.**, 2018, Research Computing Days, Boise State University

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.

Conference Presentations

"Unraveling the Quasar Broad-Emission Line Region," **Long, K.**, Dexter, J., et al. 2024, *SMBH Sexten*, Sexten/Sesto, IT, contributed talk

"Unraveling the Quasar Broad-Emission Line Region," **Long, K.**, Dexter, J., et al. 2025, *Vasto Accretion Meeting*, Vasto, IT, contributed talk in week 2 (AGN)

Scholarships and Awards

2025	GPSG DEI Excellence Award	$400
2021 – 2022	Astrophysics Graduate Fellowship (APS department prize)	$1,000
2015 – 2020	All undergraduate scholarship awards	$22,000
2016 – 2020	Dean's List (undergraduate)	