Kirk Long — Ph.D. Candidate

Department of Astrophysical and Planetary Sciences
University of Colorado Boulder

kirk.long@colorado.edu
www.kirklong.space

Research Interests

I am broadly excited about employing advances in modern computing to analyze large data-sets 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.
UAT keywords: active galactic nuclei, supermassive black holes, computational astronomy

Education

08/2020 –	**University of Colorado Boulder**, Dept. of Astrophysical and Planetary Sciences Ph.D. thesis: "Unraveling the Quasar Broad-Emission Line Region" (working title, degree expected Summer 2026) M.S. awarded December 2023: "A Possible Thin Disk-Wind Launching Mechanism of Broad-Line Emission in AGN Applied to Quasar 3C 273"
08/2017 – 05/2020	**Boise State University**, Honors College B.Sc. in Physics, Astrophysics emphasis, *Magna Cum Laude* Minors in Music and Applied Mathematics, recognized as a Graduating Student Leader
08/2015 – 05/2017	**Idaho State University** (transferred prior to completing degree)

Publication List

"A Convolutional Neural Network for the Recovery of Transfer Functions From Velocity-Resolved Reverberation Mapping Data," **Long, K.**, Horne, K., Dexter, J., & Tremblay, B. 2025, Submitted to *ApJ* November 2025.

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

"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.**, et al. 2023, *ApJ*, 953, 184

Awards

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

Press

2023-2024	"Questions about Quasars: How to Best Weigh a Celestial Body", *JILA Light & Matter*, same paper also featured in *SciTechDaily*
2019-2020	"Physics Student Brings Science Class to Prison", Boise State University website, local news channel KIVI, and Boise State University alumni magazine, *Focus*

Selected Presentations (*indicates invited)

09/2025	**AstroLunch Seminar***,	St Andrews, UK
	University of St Andrews School of Physics and Astronomy	
	"Unraveling the Quasar Broad-Emission Line Region"	
09/2025	**Massive Black Holes Across Cosmic Time**,	Cambridge, UK
	Kavli Institute for Cosmology, University of Cambridge	
	Contributed talk: "Unraveling the Quasar Broad-Emission Line Region"	
07/2025	**Vasto Accretion Meeting**,	Vasto, IT
	Organized by Durham University and the INAF	
	Contributed talk: "Unraveling the Quasar Broad-Emission Line Region"	
06/2024	**SMBH Sexten**,	Sexten/Sesto, IT
	Organized by Chalmers & Virginia Initiatives on Cosmic Origins	
	Contributed talk: "Unraveling the Quasar Broad-Emission Line Region"	

Selected Teaching 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 >100 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)
09/2023 & 10/2025	**Invited Guest Lecturer**, CU Boulder Dept. of Astrophysical and Planetary Sciences Gave lectures on black holes for Prof. Jason Dexter's ASTR 2030 Black Holes and Prof. Erica Nelson's ASTR 1200 Stars and Galaxies courses, each with enrollment of >200 students

Selected Service and Outreach (including code contributions)

01/2019 –	**Volunteer Instructor**, Idaho & Colorado Correctional Facilities Taught introductory programming classes, gave physics and astronomy demonstrations/lectures, and helped > 50 students obtain their GEDs.
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` benefitting from performance of native Julia.

12/2019 –	**@ThreeBodyBot**, #scicomm Built automated Twitter/Mastodon/Tumblr/BlueSky/YouTube account that posts random three-body simulations ∼1/day. Source code here.
06/2017 – 08/2020	**Park Astronomer**, Bruneau Sand Dunes State Park Observatory Operated large telescopes to show visitors celestial objects and gave ∼45 minute public talks on astronomy topics. Interacted with >20,000 total visitors during employment.
08/2020 –	**Graduate mentor**, CU Boulder (5 students) Mentored both undergraduate and incoming first-year graduate students on both research and academic topics.
08/2020 –	**Graduate committee member**, CU Boulder Served on several department service committees with faculty and other graduate students, influencing departmental policies.

Programming Related Skills (rated basic – expert)

Much of my code is publicly available on my GitHub at https://github.com/kirklong. Most of my work during my PhD has been in Python and Julia, with occasional dabbling in C/FORTRAN/CUDA which I learned as part of a parallel scientific computing graduate course I took my senior year of undergrad.

- **Programming Languages:**
  - Advanced: Python (7 years experience), Julia (6 years experience)
  - Competent: Matlab (6 years experience), Bash (6 years experience), C (6 years experience), FORTRAN (6 years experience), CUDA (6 years experience)
  - Basic: JavaScript (4 years experience), SQL (2 years experience), C++ (1 years experience)
- **Software:**
  - Advanced: Conda, terminal/command line, FFmpeg, astropy, numpy, scipy, matplotlib, Flux.jl,
  - Competent: LaTeX, MPI, Git, Slurm/HPC applications, Vim
  - Beginner: HEASoft, SAS, HTML, CSS
- **Operating Systems:**
  - Advanced: Windows 10, Linux (my personal computers have run various flavors of Linux since 2019)
  - Competent: macOS

References

Dr. Jason Dexter, University of Colorado Boulder—jason.dexter@colorado.edu
Dr. Keith Horne, University of St Andrews—kdh1@st-andrews.ac.uk
Dr. Erica Nelson, University of Colorado Boulder—erica.june.nelson@colorado.edu
Dr. Ric Davies, Max Planck Institute for Extraterrestrial Physics—davies@mpe.mpg.de