

BENJAMIN ZHANG

<https://github.com/bzh-bzh>

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Education

University of Southern California — Los Angeles, CA

Fall 2022–Present

- PhD student in the department of Physics and Astronomy.
- Relevant coursework: Advanced Cosmology, General Relativity

University of California, Berkeley — Berkeley, CA

Spring 2017–Spring 2021

- B.A. in Astrophysics and Computer Science
- Cumulative GPA: 3.98
- Advanced astrophysics coursework: Radio Astronomy Laboratory, Optical and Infrared Astronomy Laboratory, Stellar Physics, Relativistic Astrophysics and Cosmology.
- Advanced computer science coursework: Introduction to Machine Learning, Efficient Algorithms and Intractable Problems, Operating Systems and System Programming, Introduction to Digital Design and Integrated Circuits.

Research Experience

University of Southern California — Los Angeles, CA

Fall 2022–Present

- Working with Professor Kris Pardo on developing novel estimators for the measurement of gravitational waves from stellar astrometry.

Kavli IPMU — Chiba, Japan

Summer 2020–Summer 2025

- In-person visiting researcher at Kavli IPMU from Oct 2023-Dec 2023/Dec 2024-Jan 2025, hosted by Professor Khee-Gan Lee.
- Studied the cross-correlation between galaxies and surrounding large-scale density (through absorption of the Lyman-alpha forest) for galaxies within the COSMOS Lyman-Alpha Mapping And Tomography Observations (CLAMATO) survey.
- Obtained constraints on the dark matter halo mass-galaxy stellar mass relation at high-redshifts using this cross-correlation.
- In-person visiting researcher at Kavli IPMU from Fall 2021 to Fall 2022, hosted by Professor Khee-Gan Lee.
- Researched strength of galaxy-cosmic web intrinsic alignments at high redshifts for upcoming Subaru Prime Focus Spectrograph galaxy spectroscopy survey, with Professor Khee-Gan Lee.
- Applied redshift space distortion and cosmic web reconstruction from mock spectrographic surveys to cosmological simulation & associated galaxies, to quantify how alignment signal changes with observational effects.

University of California, Berkeley — Berkeley, CA

Spring 2019–Summer 2020

- Worked with Dr. Benjamin Horowitz on universe large-scale structure reconstruction from Lyman-alpha absorption features in high-redshift quasar and galaxy spectra (Lyman-alpha forest tomography).
- Created code to quantify correlated error from high-redshift quasar/galaxy spectrum continua being misestimated, in Python. Modified Dr. Horowitz's Lyman-alpha tomography reconstruction code, TARDIS, to use the correlated error, improving reconstruction accuracy.
- Wrote Tensorflow code for new major version of TARDIS, and tested its numerical stability.
- Developed script to produce 3D movies of TARDIS converging on final structure reconstructions, using Python and yt library.

Publications

Benjamin Zhang, Kris Pardo et al. *Fast Bayesian method for coherent gravitational wave searches with relative astrometry*. *Physical Review D*, 112, 042002. doi:[10.1103/qzys-t232](https://doi.org/10.1103/qzys-t232)

Benjamin Zhang, Khee-Gan Lee et al. *Cross-correlations between the CLAMATO Lyman-alpha forest and galaxies within the COSMOS field*. *Monthly Notices of the Royal Astronomical Society*. Submitted. [arXiv:2509.07453](https://arxiv.org/abs/2509.07453)

Benjamin Zhang, Khee-Gan Lee et al. *Alignments between Galaxies and the Cosmic Web at $z \sim 1-2$ in the IllustrisTNG Simulations*. *The Astrophysical Journal*, vol. 954, no. 1, 2023. doi:[10.3847/1538-4357/ace695](https://doi.org/10.3847/1538-4357/ace695).

Benjamin Horowitz, **Benjamin Zhang** et al. *TARDIS Paper II: Synergistic Density Reconstruction from Lyman-alpha Forest and Spectroscopic Galaxy Surveys with Applications to Protoclusters and the Cosmic Web*. *The Astrophysical Journal*, vol. 906, no. 2, 2021. doi:[10.3847/1538-4357/abca35](https://doi.org/10.3847/1538-4357/abca35).

Presentations

International Pulsar Timing Array Science Meeting 2025 — California Institute of Technology 6/2025

- Contributed talk: *Fast coherent GW searches for astrometry & PTAs using LIGO methods*

International Pulsar Timing Array Science Meeting 2024 — Sexten Center of Astrophysics 6/2024

- Poster: *Searching for Coherent Gravitational Waves with Relative Stellar Astrometry*

KITP Conference: The Co-evolution of the Cosmic Web and Galaxies across Cosmic Time — University of California, Santa Barbara 2/2023

- Contributed talk: *Intrinsic Alignments Between Galaxies and the Cosmic Web at $z \sim 1-2$ in the IllustrisTNG Simulations*

YITP Molecule-type Workshop on Galaxy shape statistics and Cosmology — Kyoto University 11/2021

- Contributed talk: *Forecasting $z \sim 2$ direct galaxy-cosmic web alignment for Subaru-PFS*

Prime Focus Spectrograph Twelveth Collaboration Meeting — Virtual 03/2021

- Virtual poster: *Forecasting High- z Galaxy-Cosmic Web Alignments for the Subaru Prime Focus Spectrograph Survey*

237th meeting of the American Astronomical Society — Virtual 01/2021

- Virtual poster: *Forecasting Galaxy-Cosmic Web Alignments for High- z Galaxies*

Other Experience

Open Computing Facility — Berkeley, CA Fall 2017–Spring 2021

- **Core technical staff** Fall 2017–Spring 2021
 - Maintained and expanded Linux-based server and desktop infrastructure serving 6000+ Berkeley students per semester.
 - Wrote code in Python, shell languages, and Puppet (automated Linux system configuration language).
 - Gained experience designing new infrastructure in large groups, with code stringently reviewed by other staff before deployment. Ex. "[bridge](#)" between [Slack](#) and [IRC chat](#) systems.
- **Site manager (lead technical officer)** Spring 2019–Fall 2019
 - [Configured Puppet code](#) to automatically deploy a high-performance computing (HPC) cluster, free for Berkeley students to use. Used industry-standard HPC software, such as Slurm resource scheduler and Singularity containers.
 - [Won a grant](#) from Berkeley Student Tech Fund for \$350,000 of operating/capital expenses over 2 years, including \$45,000 earmarked for expanding the HPC cluster.
- **Linux System Administration DeCal Instructor** Taught for DeCal (student-run Berkeley course) on overview of Linux, security, and modern system administration tools like Docker.

Berkeley Research Computing — Berkeley, CA Spring 2018–Spring 2019

- As paid Operations Intern, installed scientific software and dependencies on Linux for users of Berkeley's Savio supercomputing cluster.
- Used Python to automate granting Matlab access to Savio users.
- Using Python & Pandas, analyzed 2 years of Savio's computing job logs for software usage statistics.

Skills

- Extensive experience with using high-performance computing systems. Experienced with Slurm, Docker, environment modules.
- Extensive experience with Python scientific computing libraries:
 - Numpy
 - Scipy
 - JAX
 - astropy
 - Matplotlib