# Alan Junzhe Zhou

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## Education

**The University of Chicago** July 2024 – Expected 2027
Ph.D. in Physics (Cosmology)

**Carnegie Mellon University** Aug 2022 – July 2024
Ph.D. in Physics (Cosmology, M.S. May 2024)

**Duke University** Aug 2018 – May 2022
B.S. in Physics; B.S. in Mathematics; Minor in Classics
*Highest Honors in Physics; Magna Cum Laude; GPA: 3.94/4.00*
Dissertation: *Galaxy Clustering Statistics with the Dark Energy Survey*

**The Inter-Collegiate Center for Classical Studies in Rome** Jan 2020 – Jun 2020
*GPA: 4.00/4.00*
Coursework and fieldwork in classical archaeology and conservation

## Research Experience

**Observational and Theoretical Cosmology** Aug 2022 – Present
The University of Chicago, Kavli Institute for Cosmological Physics
CMU, McWilliams Center for Cosmology, NSF AI Planning Institute
Advisor: Scott Dodelson

**Main effort:** Designing large-scale Bayesian networks and deep probabilistic models to reconstruct the 3D matter distribution evolution of the universe using large cosmological data sets.

**Other interests:** Searching for Milky Way dark matter halos via simulation-based inference. Designing Bayesian parameter estimation algorithms for time-series imaging.

**Observational Cosmology** Apr 2020 – Aug 2022
Duke Cosmology Group, The Dark Energy Survey
Advisor: Michael Troxel

Studied noise and systenatics dominated spatial correlation statistics of galaxies in cosmological survey data sets.

**Theoretical High Energy Physics** Dec 2020 – Mar 2022
Duke Physics
Advisor: Shailesh Chandrasekharan

Found a simple finite-dimensional quantum field theory that reproduces the statistical behavior of a class of infinite-dimensional theories. Designed efficient sampling algorithms and utilized distributed computing to validate theoretical results.

**Experimental High Energy Physics** Apr 2019 – Aug 2019
CERN (Switzerland), Duke High Energy Physics Group
Advisor: Ashutosh Kotwal

Searched for beyond-the-standard-model compositeness of the top quark at the Large Hadron Collider.

## Publications


[1] **Alan Junzhe Zhou**, Xiangchong Li, Scott Dodelson, and Rachel Mandelbaum. "Accurate field-level weak lensing inference for precision cosmology". In: *Phys. Rev. D* 110 (2 2024), DOI: 10.1103/PhysRevD.110.023539. arXiv:2312.08934.

[2] **Alan Junzhe Zhou**, Yin Li, Scott Dodelson, Rachel Mandelbaum, Yucheng Zhang, Xiangchong Li, and Giulio Fabbian. "A Hamiltonian, post-Born, three-dimensional, on-the-fly ray tracing algorithm for gravitational lensing". In: *Journal of Cosmology and Astroparticle Physics* 10 (2024), DOI: 10.1088/1475-7516/2024/10/069. arXiv:2405.12913.

[3] **Alan Junzhe Zhou** and Scott Dodelson. "Field-level multiprobe analysis of the CMB, integrated Sachs-Wolfe effect, and the galaxy density maps". In: *Phys. Rev. D* 108 (8 Oct. 2023), DOI: 10.1103/PhysRevD.108.083506. arXiv:2304.01387.

[4] **Alan Junzhe Zhou**, Hersh Singh, Tanmoy Bhattacharya, Shailesh Chandrasekharan, and Rajan Gupta. "Spacetime symmetric qubit regularization of the asymptotically free two-dimensional $O(4)$ model". In: *Phys. Rev. D* 105 (5 Mar. 2022), DOI: 10.1103/PhysRevD.105.054510. arXiv:2111.13780.

[5] Tanmoy Bhattacharya, Shailesh Chandrasekharan, Rajan Gupta, Hersh Singh, and **Alan Junzhe Zhou**. "Space-time symmetric qubit regularization of asymptotically freedom". In: *APS Division of Nuclear Physics Meeting Abstracts*. Vol. 2021. APS Meeting Abstracts. 2021.


## Talks

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| "Taming the field-level likelihood of cosmological surveys," Cosmology lunch seminar, Department of astrophysical sciences, Princeton University | April 2025 |
| "Reconstructing the cosmic origin through data-driven forward modeling," lunch talk, physics & astronomy, University of Pennsylvania | April 2024 |
| "Reconstructing our cosmic origin," Jane Street graduate fellowship workshop | April 2024 |
| "Reconstructing the origin of the universe through data-driven forward modeling," NSF AI & data-driven astronomy seminar | April 2024 |
| "Accurate field-level weak lensing inference for precision cosmology," HSC weak lensing working group | Feb 2024 |
| "Accurate and precise weak lensing field-level inference," IPMU, University of Tokyo | Jan 2024 |
| "Accurate and precise weak lensing cosmology via field-level inference," CD3 x Simons Foundation Workshop, AI-driven discovery in physics & astrophysics, University of Tokyo | Jan 2024 |
| "Theory and practice of Monte Carlo methods II," McWilliams software series, CMU | May 2023 |
| "Field-level multiprobe analysis of the CMB, integrated Sachs-Wolfe effect, and galaxy density maps," invited paper presentation, ETH Zurich | May 2023 |
| "Field-level multiprobe cosmological analysis," Future science with CMBxLSS, Yukawa Institute, Kyoto University | Apr 2023 |
| "Field-level multiprobe cosmological analysis," the impossible problems seminar, McWilliams Center for Cosmology, CMU | Mar 2023 |
| "Theory and practice of Monte Carlo methods I," McWilliams software series, CMU | Mar 2023 |
| "Measuring the galaxy clustering statistics using the Dark Energy Survey's year 3 source catalog," Visible Thinking Symposium, Duke University | Apr 2022 |
| "Galaxy clustering in the Dark Energy Survey's year 3 source catalog," Duke Senior Research Symposium, Duke University | Apr 2022 |
| "Spacetime symmetric qubit regularization of asymptotic freedom," 2021 APS fall meeting | Oct 2021 |
| "Self-calibration of intrinsic alignment," Dark Energy Survey weak lensing working group | Aug 2021 |

## Awards

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| Jane Street Graduate Research Fellow | Feb 2024 |
| Reconstructing the initial conditions of the universe (**PI**), NSF Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS) | Sep 2023 |
| Daphne Chang Memorial Award, Duke University | May 2022 |
| CEU21 Award, 2021 American Physical Society Fall Meeting | Aug 2021 |
| Duke University Dean's Summer Research Fellow, Duke University | May 2021 |
| Duke University Summer IDEA Grant Award, Duke University | May 2021 |
| Duke University Faculty Scholar Award Physics Department Nominee, Duke University | Mar 2021 |
| Duke HEP Group ATLAS Research Grant, Duke University | May 2019 |