Alan Junzhe Zhou

The University of Chicago
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Education

The University of Chicago July 2024 - Present
Ph.D. program in physics
Cosmological data analysis, large-scale probabilistic deep learning

Carnegie Mellon University Aug 2022 - July 2024
Ph.D. program in physics (M.S. May 2024)
Cosmological data analysis, large-scale probabilistic deep learning

Duke University Aug 2018 - May 2022
B.S. in physics; B.S. in mathematics; Minor in classics
Highest honor 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
Course/fieldwork in classical archaeology and conservation
GPA: 4.00/4.00

Robert Louis Stevenson School Sep 2015 – May 2018
National cum laude society, GPA 4.12/4.00

Research Experience

Observational and theoretical cosmology Aug 2022 – Present
The University of Chicago
CMU, McWilliams Center for Cosmology, NSF AI Planning Institute
Advisor: Scott Dodelson
Design large-scale Bayesian networks and deep probabilistic models to reconstruct the 3-dimensional matter distribution evolution of the universe using large cosmological data sets.

Observational cosmology Apr 2020 – Aug 2022
Duke Cosmology Group, The Dark Energy Survey
Advisor: Michael Troxel
Studied the statistics of galaxy clustering correlations using cosmological imaging surveys 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 theory. Designed efficient sampling algorithms and leveraged distributed computing to validate the theoretical results.

Experimental high energy physics Apr 2019 – Aug 2019
CERN, Duke High Energy Physics Group
Advisor: Ashutosh Kotwal
Searched for top quarks' Beyond-Standard-Model compositeness through its decay products in the Large Hadron Collider in Geneva, Switzerland.

Publications

[1] **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: (2024). arXiv:2405.12913.

[2] 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:2304.01387.

[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:2312.08934.

[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 and Presentations

"Reconstructing the cosmic origin through data-driven forward modeling," lunch talk at Physics & Astronomy at 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 inference for precision cosmology," ML Session of Department of Astronomy, Tsinghua University	Feb 2024
"Accurate field-level weak lensing inference for precision cosmology," The HSC Weak Lensing Working Group	Feb 2024
"Accurate and precise weak lensing field-level inference," IPMU, the 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, the 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 the galaxy density maps," invited paper presentation, ETH Zurich	May 2023
"Field-level multi-probe 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
"Space-time 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

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
Arnold Bowhay Award for Laboratory Science, Stevenson School	Aug 2018

Leadership, Service, and Outreach

Two video channels to record and explain the process behind physics research with $>$ 40K subscribers and $>$ 800K views	Aug 2023 – Present
CMU McWilliams Center Software Development Series, Organizing Committee	Dec 2022 - Present
Duke Physics Department Conduct Accountability Committee	Dec 2020 – May 2022
Duke Lyceum Interdisciplinary Mathematics Society, Executive	Sep 2020 – May 2021