Yihao Zhou

McWilliams Center for Cosmology, Carnegie Mellon University
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Research Interests

Cosmological hydrodynamic simulations • gravitational waves • dynamics of massive black holes • massive black hole seeding • AGN feedback • multi-messenger astronomy

Education

Carnegie Mellon University, *Pittsburgh, PA* — *Aug* 2022 – *present*
Ph.D. Physics (*expected May* 2027)
Advisor: Tiziana Di Matteo

Xi'an Jiaotong University, *Xi'an, China* — *Sep* 2017 – *May* 2021
B.S. Physics (*with honors*)
Advisors: Jun Feng, Haiguang Xu
Thesis: *A Semi-Analytical Model for the Formation and Evolution of Radio Relics in Galaxy Clusters*

Honors and Awards

NASA FINESST Fellowship (**$150,000**) — 2025–2028
NASA Goddard Travel Grant (**$1,500**), 16th LISA Symposium — *Jun* 2026
Outstanding Graduate, *Xi'an Jiaotong University* — 2021
Exchange Program Scholarship for Excellent Undergraduate, *Xi'an Jiaotong University* — 2019
Siyuan Scholarship, *Xi'an Jiaotong University* — 2018–2021

Publications

Full publication list: NASA ADS

- 24 papers in total (8 first-author, 10 second/third-author, 6 other co-authored)
- 199 citations • *h*-index 9 — *NASA ADS, Oct 2026*

† Paper led by a student I supervised

First-Author Papers

Y. Zhou, T. Di Matteo, C. E. Williams, A. K. Bhowmick, M. Reina-Campos, C. L. Rodriguez et al., *ACORN I. Massive Black Hole Seeding and Tidal Disruption Events from Star Clusters in Cosmological Simulations*, arXiv:2610.12398 (2026)

Y. Zhou, A. K. Bhowmick, T. Di Matteo, P. LaChance, R. Croft, L. Blecha et al., *First Results of AMBRA: Abundant Seeds and Early Mergers as a Pathway to the First Massive Black Holes*, ApJ **1008** (2026) 229

Y. Zhou, T. Di Matteo, S. Bird, R. Croft, Y. Ni, Y. Yang et al., *The ASTRID Simulation at z = 0: From Massive Black Holes to Large-scale Structure*, ApJ **999** (2026) 41

Y. Zhou, T. Di Matteo, N. Chen, L. Z. Kelley, L. Blecha, Y. Ni et al., *Central Cluster Galaxies: A Hot Spot for Detectable Gravitational Waves from Black Hole Mergers*, ApJ **988** (2025) L74

Y. Zhou, D. Mukherjee, N. Chen, T. Di Matteo, P. H. Johansson, A. Rantala et al., *MAGICS. II. Seed Black Holes Stripped of Their Surrounding Stars Do Not Sink*, ApJ **980** (2025) 79

Y. Zhou, H. Chen, T. Di Matteo, Y. Ni, R. A. C. Croft and S. Bird, *Modeling quasar proximity zones in a realistic cosmological environment with a self-consistent light curve*, MNRAS (2024) stae172

Y. Zhou, H. Xu, Z. Zhu, Y. Zhao, S. Fan, C. Shan et al., *A semi-analytical model for the formation and evolution of radio relics in galaxy clusters*, MNRAS **517** (2022) 1299

Y. Zhou and P. La Plante, *Understanding the Impact of Semi-numeric Reionization Models when Using CNNs*, PASP **134** (2022) 044001

Publications with Major Contributions

C. E. Williams, S. Naoz, **Y. Zhou**, T. Akiba-Lewis, M. Vogelsberger, B. Burkhart et al., *Wandering intermediate-mass black holes and off-nuclear tidal disruption events from early star clusters*, arXiv:2610.20719 (2026)

P. LaChance, **Y. Zhou**, A. K. Bhowmick, R. A. C. Croft, T. Di Matteo, L. Blecha et al., *The lifetimes and properties of Little Red Dots in the AMBRA simulation*, arXiv:2609.26999 (2026)

N. Chen, **Y. Zhou**, E. Dadiani, T. Di Matteo, X. Wang, A. Palmese et al., *Connecting Current and Future Dual Active Galactic Nucleus Searches to LISA and Pulsar Timing Array Gravitational-wave Detections*, ApJ **1008** (2026) 89

†B. Y. Wang, **Y. Zhou**, W. Chen, N. Chen, T. Di Matteo, R. Croft et al., *Gravitational Waves from Massive Black Hole Mergers in ASTRID: Predictions for LISA*, ApJ **993** (2025) 199

D. Mukherjee, **Y. Zhou**, N. Chen, U. N. Di Carlo and T. Di Matteo, *MAGICS. III. Seeds Sink Swiftly: Nuclear Star Clusters Dramatically Accelerate Seed Black Hole Mergers*, ApJ **981** (2025) 203

E. Dadiani, A. Palmese, **Y. Zhou**, N. Chen, T. Di Matteo, A. Eróstegui et al., *Cosmic Pairs: A DESI Census of Dual and Offset AGN as Precursors to Massive Black Hole Binaries*, arXiv:2607.27390 (2026)

Y. Yang, S. Bird, **Y. Zhou**, T. Di Matteo, R. Croft, Y. Ni et al., *Matter Clustering in Astrid: Reduced Baryonic Suppression from Realistic Black Hole Dynamics*, ApJ **1007** (2026) L20

N. Chen, T. Di Matteo, **Y. Zhou**, L. Z. Kelley, L. Blecha, Y. Ni et al., *The Gravitational-wave Background from Massive Black Holes in the ASTRID Simulation*, ApJ **991** (2025) L19

Y. Ni, N. Chen, **Y. Zhou**, M. Park, Y. Yang, T. Di Matteo et al., *The Astrid Simulation: Evolution of Black Holes and Galaxies to $z = 0.5$ and Different Evolution Pathways for Galaxy Quenching*, ApJ **990** (2025) 120

Other Co-authored Papers

Y. Yao, K. Grasha, S. Wyithe, E. Wang, N. Chen, P. LaChance et al., *Theoretical emission lines and metallicity calibrations of H II regions in ASTRID simulation*, MNRAS **552** (2026) stag1688

F. Hafezianzadeh, T. Zhang, P. Rogozenski, P. LaChance, **Y. Zhou**, T. Di Matteo et al., *The Galaxy Luminosity Functions in ASTRID: Predictions for LSST*, ApJ **1010** (2026) 60

D. Izquierdo-Villalba, M. Habouzit, M. Bonetti, S. Bonoli, A. Gualandris, M. Volonteri et al., *The LISA Astrophysics MBHcatalogues Project: A comparison of predictions of simulated massive black hole binaries*, arXiv:2605.00092 (2026)

P. LaChance, A. K. Bhowmick, R. A. C. Croft, T. Di Matteo, **Y. Zhou**, F. Pacucci et al., *From ASTRID to BRAHMA – The role of overmassive black holes in little red dots in cosmological simulations*, arXiv:2512.13957 (2025)

P. LaChance, R. A. C. Croft, T. Di Matteo, **Y. Zhou**, F. Pacucci, Y. Ni et al., *The Properties of Little Red Dot Galaxies in the ASTRID Simulation*, *OJAp* **9** (2026) 55493

R. Croft, P. Shaw, A.-M. Alexis, N. Chen, **Y. Zhou**, T. Di Matteo et al., *Large-scale surveys of the quasar proximity effect*, *OJAp* **8** (2025) 124

J. Feng, J.-J. Zhang and **Y. Zhou**, *Thermality of the Unruh effect with intermediate statistics*, *Europhysics Letters* **137** (2022) 60001

Presentations

Invited Talks

Galaxy Seminar, *Flatiron Institute CCA* *Nov* 2026
Massive Black Hole formation within Star Clusters: Insights from Cosmological Simulations

Department Seminar, *University of California, Riverside* *Sep* 2026
From Star Clusters to Gravitational Waves: Massive Black Hole Evolution in ASTRID and MAGICS

Group Meeting, *University of California, Los Angeles* *Sep* 2026
Cosmological Simulations in the JWST Era: Massive Black Holes in Star Clusters

Physics Department Faculty Meeting, *Carnegie Mellon University* *Aug* 2025
Understanding Massive Black Hole Mergers: Insights from the ASTRID / MAGICS Simulations

Cosmology Seminar, *Max Planck Institute for Astrophysics* (*remote*) *Jul* 2024
MAGICS: The Crucial Role of Tidal Stripping in Seed Black Hole Binary Evolution

Galaxies Group Meeting, *University of Michigan* (*remote*) *Feb* 2024
Modeling Quasar Proximity Zones with Self-Consistent Light Curves and Cosmological Environment

Contributed Talks

Bridging Scales Workshop, *Black Hole Initiative, Harvard University* *May* 2026
Building the First Massive Black Holes: Improving Seeding Models in Cosmological Simulations

The 8th Neighborhood Workshop, *Penn State University* *Apr* 2026
From Nano- to Milli-Hz: Predicting Gravitational Wave Signals with the ASTRID/AMBRA Simulation

Texas Symposium on Relativistic Astrophysics, *Arizona State University* *Dec* 2025
From Nano- to Milli-Hz: Predicting PTA and LISA Signals with the ASTRID Simulation

Ten Years to LISA, *Jet Propulsion Laboratory* *Apr* 2025
Massive Black Hole Seed Mergers: Insights from MAGICS and Implications for LISA

Frontera User Meeting, *Texas Advanced Computing Center* *Aug* 2024
Gravitational Waves Emitted by Massive Black Holes: Predictions from the Cosmological Simulation ASTRID

SAZERAC Specialist Session: Learning the High-Redshift Universe, *remote* *Feb* 2022
Understanding the Impact of Semi-Numeric Reionization Models when Using CNNs

Posters

The 16th LISA Symposium, *University of Maryland* *Jun* 2026
LISA Sources from Cosmological Simulations: MBH Mergers in ASTRID and AMBRA

Gravity in the Local Group, *Carnegie Mellon University* *Jun* 2025
Seed Black Hole Mergers in Dwarf Galaxies: LISA Sources in the ASTRID and MAGICS Simulations

Aspen 2025 Winter Conference, *Aspen Center for Physics* *Feb* 2025
Central Cluster Galaxies: A Hotspot for Detectable Gravitational Waves from Black Hole Mergers

European Astronomical Society Annual Meeting, *Padova, Italy* (*remote*) *Jul* 2024
Modeling Quasar Proximity Zones in a Realistic Cosmological Environment with a Self-Consistent Light Curve

4th Global 21-cm Workshop, *University of Colorado Boulder* (*remote*) *Oct* 2021
Understanding the Impact of Semi-Numeric Reionization Models when Using CNNs

Press

TACC Feature Story: *A Cosmic Look From Near Beginning to Now* *Aug* 2026

CMU Newsletter: *Ph.D. Student Wins NASA FINESST Grant* *Dec* 2025

Service and Outreach

Referee

The Astrophysical Journal (ApJ)
Monthly Notices of the Royal Astronomical Society (MNRAS)
The Open Journal of Astrophysics (OJAp)

Membership

Laser Interferometer Space Antenna (LISA) Astrophysics Working Group

Service

Local Organizing Committee, *Gravity in the Local Group*, Carnegie Mellon University *Jun* 2025

Organizer, *McWilliams Center Journal Club*, Carnegie Mellon University 2026–2027

Simulation data portal: *ASTRID public database* *since* 2025

Public Outreach

Astronomy on Tap, *Pittsburgh* — Supermassive Black Holes in the Baby Universe *Jul* 2026

Mentoring and Teaching

Student Advising

Abdulla Alhosani (Graduate student, CMU)
Bonny Wang (Master student, CMU; now Ph.D. student at the University of Chicago)
Cici Wang (Undergraduate student, CMU)
William Chen (Undergraduate student, CMU)
Ines Rodriguez Hsu (Undergraduate student, CMU)

Teaching Assistant

Physics I for Science Students, *Carnegie Mellon University* *Fall* 2023
Physics I for Engineering Students, *Carnegie Mellon University* *Spring* 2023
Physics I for Science Students, *Carnegie Mellon University* *Fall* 2022

Academic References

Prof. Tiziana Di Matteo (Carnegie Mellon University)
Prof. Laura Blecha (University of Florida)
Prof. Simeon Bird (University of California, Riverside)
Prof. Haiguang Xu (Shanghai Jiao Tong University)
Prof. Paul La Plante (University of Nevada, Las Vegas)