

Yihao Zhou

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RESEARCH INTERESTS

Keywords: cosmological hydrodynamic simulations, gravitational waves, the dynamics of massive black holes, massive black hole seeding, AGN feedback, multi-messenger astronomy

EDUCATION

Carnegie Mellon University, Pittsburgh, PA

Aug 2022 – Expected 2027

Ph.D. Physics

Advisors: Tiziana Di Matteo

Xi'an Jiaotong University, Xi'an, China

Sep 2017 – May 2021

B.S. Physics (with honours)

Advisors: Jun Feng, HaiGuang Xu

Thesis: A Semi-Analytical Model for the Formation and Evolution of Radio Relics in Galaxy Clusters

Honours and Awards

NASA Goddard Space Flight Center Travel Grant (\$1,500) for the 16th LISA Symposium	June 2026
Future Investigators in NASA Earth and Space Science and Technology (FINESST) (\$150,000)	2025-2028
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

First-Author Publications

- 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*, *arXiv e-prints* (2026) arXiv:2604.01123 [2604.01123]
- 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 [2510.13976]
- 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 [2502.01845]
- Y. ZHOU**, D. Mukherjee, N. Chen, T. D. 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. D. 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. L. Plante, *Understanding the impact of semi-numeric reionization models when using cnns*, *PASP* **134** (2022) 044001

Publications with Major Contributions

- N. Chen, **Y. ZHOU**, E. Dadiani, T. Di Matteo, C. Wang, A. Palmese et al., *Connecting current and future dual AGN searches to LISA and PTA gravitational wave detections*, *arXiv e-prints* (2025) arXiv:2512.16844 [2512.16844]

- 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 [2503.24304]
- 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 [2409.19095]
- 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*, *arXiv e-prints* (2026) arXiv:2605.04176 [2605.04176]
- 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 [2502.01024]
- 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 [2409.10666]

Other Co-author Papers

- F. Hafezianzadeh, T. Zhang, P. Rogozenski, P. Lachance, **Y. ZHOU**, T. Di Matteo et al., *The Galaxy Luminosity Functions in ASTRID: Predictions for LSST*, *arXiv e-prints* (2026) arXiv:2605.13843 [2605.13843]
- 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 e-prints* (2026) arXiv:2605.00092 [2605.00092]
- 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 e-prints* (2025) arXiv:2512.13957 [2512.13957]
- P. LaChance, R. A. C. Croft, T. D. Matteo, **Y. ZHOU**, F. Pacucci, Y. Ni et al., *The Properties of Little Red Dot Galaxies in the ASTRID Simulation*, *The Open Journal of Astrophysics* **9** (2026) 55493 [2505.20439]
- R. Croft, P. Shaw, A.-M. Alexis, N. Chen, **Y. ZHOU**, T. D. Matteo et al., *Large-scale surveys of the quasar proximity effect*, *The Open Journal of Astrophysics* **8** (2025) 124 [2504.03848]
- J. Feng, J.-J. Zhang and **Y. ZHOU**, *Thermality of the unruh effect with intermediate statistics*, *Europhysics Letters* **137** (2022) 60001

PRESENTATIONS

- The 16th LISA Symposium**, the University of Maryland June 2026
Poster: *LISA Sources from Cosmological Simulations: MBH Mergers in ASTRID and AMBRA*
- Bridging Scales Workshop**, Black Hole Initiative at Harvard May 2026
Talk: *Building the First Massive Black Holes: Improving Seeding Models in Cosmological Simulations*
- The 8th Neighborhood Workshop**, Penn State University Apr 2026
Talk: *From Nano- to Milli-Hz: Predicting Gravitational Wave Signals with the ASTRID/AMBRA Simulation*
- Texas Symposium on Relativistic Astrophysics**, Arizona State University Dec 2025
Talk: *From Nano- to Milli-Hz: Predicting PTA and LISA Signals with the ASTRID Simulation*
- Gravity in the Local Group**, Carnegie Mellon University Jun 2025
Poster: *The Seed Massive Black Hole Mergers in Dwarf Galaxies What can we learn about the LISA sources from the cosmological simulation ASTRID and MAGICS*
- Ten Years to LISA**, Jet Propulsion Laboratory Apr 2025
Talk: *Understanding Massive Black Hole Seed Mergers: Insights from the MAGICS Simulations and Implications for LISA Observations*
- Aspen 2025 Winter Conferences**, Aspen Center for Physics Feb 2025
Poster with Flash Talk: *Central Cluster Galaxies: A Hotspot for Detectable Gravitational Waves from Black Hole Mergers*

Frontera User Meeting , the Texas Advanced Computing Center	Aug 2024
Talk: Gravitational wave emitted by massive blackholes: predictions from cosmological simulation Astrid	
Cosmology Seminar , Max Planck Institute for Astrophysics, remote	July 2024
Talk: MAGICS: The Crucial Role of Tidal Stripping in Seed Black Hole Binary Evolution	
European Astronomical Society Annual Meeting , Padova Congress, Italy, remote	July 2024
ePoster with short presentation: Modeling Quasar Proximity Zones in a Realistic Cosmological Environment with a Self-consistent Light Curve	
Galaxies Group Talk , University of Michigan, remote	Feb 2024
Talk: Modeling quasar proximity zones with self-consistent light curves and cosmological environment.	
SAZERAC regular specialist sessions: Learning the high-redshift Universe , remote	Feb 2022
Talk: Understanding the Impact of Semi-Numeric Reionization Models when using CNNs.	
4th Global 21-cm Workshop , University of Colorado Boulder, remote	Oct 2021
Poster: Understanding the Impact of Semi-Numeric Reionization Models when using CNNs.	

Press Releases

CMU Newsletter: <i>Ph.D. Student Wins NASA FINESST Grant</i>	Dec 2025
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OUTREACH & SERVICES

Referee

Monthly Notices of the Royal Astronomical Society (MNRAS)

The Open Journal of Astrophysics (OJAp)

Member: Laser Interferometer Space Antenna (LISA) Astrophysics Working Group

Conference LOC: Gravity in the Local Group, <i>Carnegie Mellon University</i>	Jun 2025
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Mentoring & Teaching

Student Advising

Fatemeh Hafezianzadeh (Graduate student, CMU)

Cici Wang (Undergraduate student, CMU)

Abdulla Alhosani (Graduate student, CMU)

Bonny Wang (Master student, CMU)

William Chen (Undergraduate student, CMU)

Ines Rodriguez Hsu (Undergraduate student, CMU)

Teaching Assistant

Physics I for Science Students, *CMU, Fall 2023*

Physics I for Engineering Students, *CMU, Spring 2023*

Physics I for Science Students, *CMU, Fall 2022*