

Yangyao Chen

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Research

Interests

- 📌 **Density field and dark matter halos:** halo structure, assembly and environment; halo merger trees; field reconstruction.
- 📌 **Galaxy model:** halo-based galaxy model; field-based galaxy model; galaxy mock catalogs; hydrodynamic simulations; reconstruction of galaxy distribution; reconstruction of formation history of massive galaxy clusters.
- 📌 **Observations:** galaxy statistics; cosmic variance and extremely rare objects; Bayesian inference; combined analysis of multiple observations.

Skills

- 📌 **Software engineering:** algorithms; platform/architecture-specific optimization; parallel computation for large problem; web development from front- to back-end; programming languages such as C/C++, Fortran, Python, JavaScript, also ready for Rust.
- 📌 **Statistical (machine) learning:** traditional statistical models; modern deep learning models and algorithms; Bayesian inference of massive physical model.

Experience

Employment

- 📌 **2022 – present, Postdoc,** Department of Astronomy, University of Science and Technology of China
In collaboration with: Huiyuan Wang

Education

- 📌 **2019 – 2021, Visiting Scholar,** Department of Astronomy, University of Massachusetts Amherst
Supervisor: Houjun Mo
- 📌 **2017 – 2022, Ph.D. in Astronomy,** Tsinghua University
Supervisors: Cheng Li & Houjun Mo
Thesis: Modeling Galaxy Formation and Evolution Across Cosmic Time with Combined Empirical Approach and Hydrodynamic Simulations
- 📌 **2013 – 2017, B.S. in Physics,** Wuhan University

Honors and Grants

- 📌 **2022, Mozi Fellowship,** University of Science and Technology of China
- 📌 **2022, Special Funding from Chinese Postdoctoral Science Foundation,** China Postdoctoral Science Foundation
- 📌 **2022, Outstanding Ph.D. Thesis,** Tsinghua University
- 📌 **2020, National Scholarship for Ph.D. Students,** Ministry of Education of China
- 📌 **2019, China Scholarship Council Scholarship Program,** China Scholarship Council
- 📌 **2018, AMD Scholarship,** Tsinghua Center for Astrophysics

Honors and Grants (continued)

2014, National Scholarship for Undergraduate Students, Ministry of Education of China

Publications

Articles that I have major contribution

- 1 **Chen, Yangyao**, H. J. Mo, C. Li, K. Wang, H. Wang, and X. Yang, “A conditional abundance matching method of extending simulated halo merger trees to resolve low-mass progenitors and sub-halos,” *Monthly Notices of the Royal Astronomical Society*, Aug. 2023. [DOI: 10.1093/mnras/stad2336](https://doi.org/10.1093/mnras/stad2336).
- 2 **Chen, Yangyao**, H. J. Mo, and K. Wang, “Massive dark matter haloes at high redshift: Implications for observations in the JWST era,” *Monthly Notices of the Royal Astronomical Society*, vol. 526, pp. 2542–2559, Dec. 2023. [DOI: 10.1093/mnras/stad2866](https://doi.org/10.1093/mnras/stad2866).
- 3 **Chen, Yangyao**, H. Mo, and H. Wang, “A two-phase model of galaxy formation: II. The size-mass relation of dynamically hot galaxies,” *arXiv e-prints*, Nov. 2023. [DOI: 10.48550/arXiv.2311.11713](https://doi.org/10.48550/arXiv.2311.11713).
- 4 H. Mo, **Chen, Yangyao**, and H. Wang, “A two-phase model of galaxy formation: I. The growth of galaxies and supermassive black holes,” *arXiv e-prints*, Nov. 2023. [DOI: 10.48550/arXiv.2311.05030](https://doi.org/10.48550/arXiv.2311.05030).
- 5 **Chen, Yangyao**, H. J. Mo, C. Li, and K. Wang, “How to empirically model star formation in dark matter halos: I. Inferences about central galaxies from numerical simulations,” *Monthly Notices of the Royal Astronomical Society*, vol. 504, no. 4, pp. 4865–4884, May 2021. [DOI: 10.1093/mnras/stab695](https://doi.org/10.1093/mnras/stab695).
- 6 **Chen, Yangyao**, H. J. Mo, C. Li, K. Wang, H. Wang, X. Yang, Y. Zhang, and N. Katz, “MAHGIC: A Model Adapter for the Halo-Galaxy Inter-Connection,” *Monthly Notices of the Royal Astronomical Society*, vol. 507, no. 2, pp. 2510–2530, Aug. 2021. [DOI: 10.1093/mnras/stab2377](https://doi.org/10.1093/mnras/stab2377).
- 7 **Chen, Yangyao**, H. J. Mo, C. Li, H. Wang, X. Yang, Y. Zhang, and K. Wang, “Relating the Structure of Dark Matter Halos to Their Assembly and Environment,” *ApJ*, vol. 899, no. 1, p. 81, Aug. 2020. [DOI: 10.3847/1538-4357/aba597](https://doi.org/10.3847/1538-4357/aba597).
- 8 **Chen, Yangyao**, H. J. Mo, C. Li, H. Wang, X. Yang, S. Zhou, and Y. Zhang, “ELUCID. VI. Cosmic Variance of the Galaxy Distribution in the Local Universe,” *ApJ*, vol. 872, no. 2, p. 180, Feb. 2019. [DOI: 10.3847/1538-4357/ab0208](https://doi.org/10.3847/1538-4357/ab0208).

Other co-authored articles

- 1 J. Meng, C. Li, H. J. Mo, **Chen, Yangyao**, Z. Jiang, and L. Xie, “Galaxy Populations in Groups and Clusters: Evidence for a Characteristic Stellar Mass Scale at $M_{\text{sat}} \sim 10^{9.5} M_{\odot}$,” *The Astrophysical Journal*, vol. 944, p. 75, Feb. 2023. [DOI: 10.3847/1538-4357/acae86](https://doi.org/10.3847/1538-4357/acae86).
- 2 K. Wang, **Chen, Yangyao**, Q. Li, and X. Yang, “Late-formed halos prefer to host quiescent central galaxies. I. Observational results,” *Monthly Notices of the Royal Astronomical Society*, Apr. 2023. [DOI: 10.1093/mnras/stad1175](https://doi.org/10.1093/mnras/stad1175).
- 3 K. Wang, H. J. Mo, **Chen, Yangyao**, and J. Schaye, “An efficient and robust method to estimate halo concentration,” *arXiv e-prints*, Sep. 2023. [DOI: 10.48550/arXiv.2310.00200](https://doi.org/10.48550/arXiv.2310.00200).
- 4 K. Wang, H. J. Mo, **Chen, Yangyao**, H. Wang, X. Yang, J. Wang, Y. Peng, and Z. Cai, “Characterize the assembly of dark matter halos with protohalo size histories: I. Redshift evolution, relation to descendant halos, and halo assembly bias,” *arXiv e-prints*, Sep. 2023. [DOI: 10.48550/arXiv.2309.01039](https://doi.org/10.48550/arXiv.2309.01039).
- 5 K. Wang, H. Mo, C. Li, and **Chen, Yangyao**, “Relating galaxies across different redshift to study galaxy evolution,” *Monthly Notices of the Royal Astronomical Society*, vol. 520, pp. 1774–1788, Apr. 2023. [DOI: 10.1093/mnras/stad262](https://doi.org/10.1093/mnras/stad262).
- 6 K. Wang, Y. Peng, and **Chen, Yangyao**, “Dissect two-halo galactic conformity effect for central galaxies: The dependence of star formation activities on the large-scale environment,” *Monthly Notices of the Royal Astronomical Society*, Apr. 2023. [DOI: 10.1093/mnras/stad1169](https://doi.org/10.1093/mnras/stad1169).
- 7 K. Wang, X. Wang, and **Chen, Yangyao**, “Environmental Dependence of the Mass-Metallicity Relation in Cosmological Hydrodynamical Simulations,” *The Astrophysical Journal*, vol. 951, p. 66, Jul. 2023. [DOI: 10.3847/1538-4357/acd633](https://doi.org/10.3847/1538-4357/acd633).
- 8 K. Wang, H. J. Mo, C. Li, and **Chen, Yangyao**, “Finding proto-clusters to trace galaxy evolution: I. The finder and its performance,” *Monthly Notices of the Royal Astronomical Society*, vol. 505, no. 3, pp. 3892–3906, Jun. 2021. [DOI: 10.1093/mnras/stab1608](https://doi.org/10.1093/mnras/stab1608).

- 9 Z. Wang, **Chen, Yangyao**, Y. Mao, H. Mo, H. Wang, H. Guo, C. Li, J. Fu, Y. Jing, J. Wang, X. Yang, and Z. Zheng, “The Breakdown Scale of H I Bias Linearity,” *ApJ*, vol. 907, no. 1, p. 4, 2021. [DOI: 10.3847/1538-4357/abcb8a](#).
- 10 X. Yang, H. Xu, M. He, Y. Gu, A. Katsianis, J. Meng, F. Shi, H. Zou, Y. Zhang, C. Liu, Z. Wang, F. Dong, Y. Lu, Q. Li, **Chen, Yangyao**, H. Wang, H. Mo, J. Fu, H. Guo, A. Leauthaud, Y. Luo, J. Zhang, and Y. Zu, “An Extended Halo-based Group/Cluster finder: Application to the DESI legacy imaging surveys DR8,” *ApJ*, vol. 909, no. 2, p. 143, Mar. 2021. [DOI: 10.3847/1538-4357/abddb2](#).
- 11 J. Meng, C. Li, H. Mo, **Chen, Yangyao**, and K. Wang, “Measuring galaxy abundance and clustering at high redshift from incomplete spectroscopic data: Tests on mock catalogs and application to zCOSMOS,” Aug. 2020. [DOI: 10.48550/arXiv.2008.13733](#).
- 12 K. Wang, H. J. Mo, C. Li, J. Meng, and **Chen, Yangyao**, “Identifying galaxy groups at high redshift from incomplete spectroscopic data – I. The group finder and application to zCOSMOS,” *Monthly Notices of the Royal Astronomical Society*, vol. 499, no. 1, pp. 89–105, Oct. 2020. [DOI: 10.1093/mnras/staa2816](#).

Academic Activities

Selected Talks

- 2023, **Conference on Observations and Theories of Galaxies in the Era of Space Telescopes**, Beijing, China
Talk: *The physical origin of the size-mass relation for dynamically hot galaxies throughout cosmic history*
- 2023, **25th Guoshoujing Conference of Galaxy Formation**, Huangshan, China
Talk: *Massive Dark Matter Halos at $z > 7$ and Implications for Observations in the JWST Era*
- 2023, **Collaboration Workshop on Cosmology and Galaxy Formation**, Shanghai, China
Talk: *MAHGIC: A Model Adapter for the Halo-Galaxy Inter-Connection*
- 2022, **3rd JMLC MachineLearning Session**, Joined Remotely
Talk: *MAHGIC: a Model Adapter for the Halo-Galaxy Inter-Connection*
- 2021, **Lunch Talk at Kavli-IPMU, University of Tokyo**, Joined Remotely
Talk: *How to Empirically Model Star Formation in Dark Matter Halos*
- 2019, **11th PFS Collaboration Meeting**, Pasadena, U.S.
Talk: *Identifying galaxy protocluster at high redshift*
- 2019, **21th Guoshoujing Conference of Galaxy Formation**, Xiamen, China
Talk: *Cosmic variance of galaxy distribution in the local universe*
- 2018, **PFUNT - Doctoral Academic Forum of the Five University Alliance**, Shanghai, China
Talk: *Cosmic variance of galaxy distribution in the local universe*
- 2018, **10th PFS Collaboration Meeting**, Shanghai, China
Talk 1: *Cosmic variance of galaxy distribution in the local universe*
Talk 2: *An empirical model of galaxy formation in dark matter halos*

Education and Service

- 2017 Autumn, **Observational cosmology**, Teaching Assistant, Tsinghua University
- 2018 - 2019, **Speaker Lunch at the Tsinghua Center for Astrophysics**, Co-organizer, Tsinghua University

References

Houjun Mo	Professor, University of Massachusetts, Amherst hjmo@umass.edu
Cheng Li	Professor, Tsinghua University cli2015@tsinghua.edu.cn
Huiyuan Wang	Professor, University of Science and Technology of China whywang@ustc.edu.cn