# KAI WANG | 王凯

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## RESEARCH

- **Galaxy Formation Model**: *Toward a simulation-motivated and observation-calibrated semi-analytical model.*
- **Galaxy Evolution**: *What drives galaxy quenching, metal enrichment, and morphology transformation?*
- **Galaxy-Halo Connection**: *To what extent are the properties of galaxies shaped by their dark matter halos?*
- **Dark Matter Halo**: *How do halo structure, assembly history, and spatial distribution interplay with each other?*

## EXPERIENCE

- Postdoctoral Research Associate, ICC and CEA, **Durham University** — Since Jul. 2024
- KIAA Fellow, Kavli Institute for Astronomy and Astrophysics, **Peking University** — Jul. 2022 - Jun. 2024

## EDUCATION

- Ph.D. in Astronomy, **Tsinghua University** — Sep. 2017 - Jul. 2022
  Supervisors: Cheng Li & Houjun Mo, Thesis: Finding galaxy groups/clusters at z~1 and its application
- Visiting Scholar, **University of Massachusetts, Amherst** — Nov. 2019 - Oct. 2021
  Supervisor: Houjun Mo
- B.S. in Astronomy, **University of Science and Technology of China (USTC)** — Sep. 2013 - Jul. 2017

## GRANTS

- KIAA fellow start-up research funding — Jul. 2022 - Jul. 2024
  (50,000CNY)
- China Scholarship for the Visiting Scholar — Nov. 2019 - Oct. 2021
  China Scholarship Council ($45,600)
- National Astronomy Training Base — Jun. 2016 - Jun. 2017
  Measure the conditional luminosity functions of galaxies at z~0.6 using CLAUDS and BOSS (20,000CNY)
- National Astronomy Training Base — May 2015 - May 2016
  Thermal gravitational-wave background in the general pre-inflationary scenario (20,000CNY)

## MENTORSHIP

- **Thomas Power**, L4 student at Durham University — since Oct. 2024
  The Dance of Milky Way and Andromeda: A Celestial Ballet Across Cosmologies
- **Thomas Richardson**, L4 student at Durham University — since Oct. 2024
  Where Shadows Follow Light: Baryon-Induced Dark Matter Halo Contraction in Hydrodynamical Simulations
- **Zeyu Gao**, graduate at Peking University — Nov. 2022 - Jul. 2024
  Decoding the SEDs of galaxies with a prior from hydrodynamical simulations [arXiv: 2408.07749]

- **Chengyu Ma**, graduate at USTC — Dec. 2023 - Jul. 2024
  Revisiting the fundamental metallicity relation with observation and simulation [arXiv: 2407.21716]
- **Haochen Jiang**, undergraduate at USTC — Dec. 2023 - Oct. 2025
  Dissecting the quenching of massive central galaxies in TNG [arXiv: 2510.24886]
- **Xunda Sun**, graduate at the University of Chinese Academy of Sciences — Jun. 2023 - Oct. 2024
  Characterizing the spatial distribution of the metal content for galaxies in FIRE2 [arXiv: 2409.09290]
- **Zhijun Zhang**, undergraduate at Peking University — Sep. 2022 - Jun. 2023
  Identify protoclusters from high-redshift photometric surveys [Bachelor Thesis]

## TEACHING

- ExGal Summer School on Astrophysical Simulations — Tutorial assistant, Durham University, 2025
- Level-1 Physics Tutorial — Tutor, Durham University, 2024
- Cosmology and Galaxy Evolution — Guest Lecturer, Peking University, Autumn 2023
- Observational Cosmology — Teaching Assistant, Tsinghua University, Autumn 2017
- Particle Cosmology — Teaching Assistant, USTC, Spring 2017
- General Relativity — Teaching Assistant, USTC, Autumn 2016

## SERVICE

- **Professional Service**
  Referee for MNRAS (since 2024), ApJ (since 2023), and A&A (since 2022)
- **Departmental Service**

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| Co-organizer of Friday Lunchtime Astronomy Talks (FLAT) at Durham University | 2025- |
| Co-lead of morning arXiv journal club at Durham University | 2025- |
| LOC member of National Astronomy Meeting (NAM) 2025 at Durham University | 2025 |
| Faculty Candidate Interview Committee at KIAA, Postdoc Representative | 2023, 2024 |
| Co-organizer of weekly Galaxy Party at KIAA | 2023 |
| Co-organizer of the Postdoc Science Day at KIAA | 2022 |
| Co-organizer of the Speaker Lunch at the Tsinghua Center for Astrophysics | 2018-2019 |

## SEMINAR TALKS

- Lunchtime Talks at Astronomy Group, University of St Andrews **(invited)**
  Metallicity as an Astrophysical Diagnostic — St Andrews, Oct. 2025
- Informal Talk at Tsinghua University
  Local Group Analogs in a cosmological context — Beijing, Jun. 2025
- KIAA-DoA Seminar at Peking University
  Towards the next-generation semi-analytical galaxy formation model — Beijing, Jun. 2025
- USTC Astronomy Seminar Series **(invited)**
  Towards the next-generation semi-analytical galaxy formation model — Hefei, Jun. 2025
- DoA Seminar at Shanghai Jiao Tong University
  Towards the next-generation semi-analytical galaxy formation model — Shanghai, May 2025
- Friday Lunchtime Astronomy Talks at Durham University
  Local Group Analogs in a cosmological context — Durham, Mar. 2025

- Galaxy & Cosmology seminar at Tsinghua University **(invited)**
  Dark matter halo and its structure, assembly, and clustering — Beijing, May 2024
- Lunch talk at South-Western Institute For Astronomy Research, Yunnan University **(invited)**
  Galaxy formation within and without dark matter halos — Kunming, Apr. 2024
- Astronomical Seminar at the Huazhong University of Science and Technology **(invited)**
  Galaxy formation within and without dark matter halos — Wuhan, Mar. 2024
- ITC Luncheon at the Center for Astrophysics | Harvard & Smithsonian
  How to connect galaxies across cosmic time? — Cambridge, Jan. 2024
- Steward/NOIRLab Galaxy Group Talk
  How to connect galaxies across cosmic time? — Tucson, Jan. 2024
- Carnegie arXiv Tea
  Relating galaxies across different redshift to study galaxy evolution — Pasadena, Jan. 2024
- KIPAC tea talk at Stanford University
  Characterizing the assembly of dark matter halos with protohalo size histories — Stanford, Jan. 2024
- UC Santa Cruz CGI (Cosmology/Galaxies/IGM) Seminar **(invited)**
  Central Galaxy Quenching and its Relation to Halo Formation Time & Large-scale Environment — Santa Cruz, Jan. 2024
- Galread: Princeton/IAS Galaxy Journal Club
  Characterizing the assembly of dark matter halos with protohalo size histories — Remote, Oct. 2023
- UC Santa Cruz CGI (Cosmology/Galaxies/IGM) Seminar
  Characterizing the assembly of dark matter halos with protohalo size histories — Remote, Oct. 2023
- Collaboration Workshop on Cosmology and Galaxy Formation
  Relating Galaxies across Cosmic Time to study galaxy evolution — Shanghai, Jun. 2023
- KIAA-DoA Seminar, Peking University **(invited)**
  Central Galaxy Quenching and its Relation to Halo Formation Time & Large-scale Environment — Beijing, Mar. 2023
- Lunch Talk at the Department of Astronomy, Tsinghua University **(invited)**
  Relating galaxies across different redshift — Beijing, Nov. 2022
- Lunch Talk at Kavli-IPMU, University of Tokyo
  Finding proto-clusters to trace galaxy evolution — Remote, Jun. 2021

## CONFERENCE TALKS

- SWIFTCON 2025
  Dissecting the scatter of stellar mass-halo mass relation in COLIBRE — Leiden, Oct. 2025
- L-GALAXIES workshop 2025
  GALFORM++: Next-generation semi-analytical galaxy formation model — Berlin, Oct. 2025
- National Astronomy Meeting (NAM)
  **Contributed talks**: — Durham, Jul. 2025
  ✦Local Group Analogs in a cosmological context: Relating the velocity structure to the cosmic web
  ✦Testing galaxy formation models with the stellar mass-halo mass relations for star-forming and quiescent galaxies
  ✦Environmental Dependence of the Mass–Metallicity Relation in Cosmological Hydrodynamical Simulations
  **Poster**:
  ✦Dissecting two-halo galactic conformity effect for central galaxies
- Expanding the boundaries of dark matter halo
  Local Group Analogs in a cosmological context — Shanghai, May 2025

- Mock Barcelone 2024 **(invited)**
  Stellar mass-halo mass relation to the second order — Barcelona, Oct. 2024
- Conference of the Co-evolution of galactic eco-systems and their large-scale environments **(invited)**
  Dissecting two-halo galactic conformity effect for central galaxies — Hangzhou, Apr. 2024
- The 2nd Shanghai Assembly on Cosmology and Structure Formation
  Characterizing the assembly of dark matter halos with protohalo size histories — Shanghai, Oct. 2023
- 25th Chinese Astronomical Society Guoshoujing Symposium on Galaxies and Cosmology
  Central Galaxy Quenching and its Relation to Halo Formation Time & Large-scale Environment — Huangshan, May 2023
- Conference of Star Formation and Nuclei Activity in Galaxies
  Central Galaxy Quenching and its Relation to Halo Formation Time & Large-scale Environment — Nanjing, Mar. 2023
- The 11-th Prime Focus Spectrograph collaboration meeting
  Identifying galaxy groups from high-z and incomplete spectroscopic surveys — Pasadena, Dec. 2019
- The 10-th Prime Focus Spectrograph collaboration meeting
  Finding groups/clusters of galaxies in the PFS galaxy evolution survey — Shanghai, Dec. 2018

## PUBLICATION

✦**35** publications; **14** as the first/corresponding author; **>380** citations; *H*-index: **>12**; open in NASA/ADS

***First and Corresponding† author papers:***

1. Haochen Jiang, Enci Wang†, **Kai Wang†**, Chengyu Ma, Xu Kong†, ApJ accepted (2025) [arXiv: 2510.24886]
   *Dissecting the mass quenching in TNG50: Galaxy size determines the quenching mode*
2. **Kai Wang†**, submitted, (2025) [arXiv: 2510.02573]
   *The origin of the galaxy size-stellar metallicity relation: A semi-analytical perspective*
3. **Kai Wang†**, Yingjie Peng†, **ApJ** 980 233 (2025) [arXiv: 2408.07743]
   *Testing galaxy formation models with the stellar mass-halo mass relations for star-forming and quiescent galaxies*
4. Chengyu Ma, **Kai Wang†**, Enci Wang†, et al. **ApJL** 971 L14 (2024) [arXiv: 2407.21716]
   *Revisiting the fundamental metallicity relation with observation and simulation*
5. **Kai Wang†**, Houjun Mo, Yangyao Chen, Joop Schaye, **MNRAS** 527 10760 (2023) [arXiv: 2310.00200]
   *An efficient and robust method to estimate halo concentration based on the method of moments*
6. **Kai Wang†**, Houjun Mo, Yangyao Chen, et al. **MNRAS** 528, 2046 (2024) [arXiv: 2309.01039]
   *Characterizing the assembly of dark matter halos with protohalo size histories: I. Redshift evolution, relation to descendant halos, and halo assembly bias*
7. **Kai Wang†**, Xin Wang†, Yangyao Chen, **ApJ** 951, 66 (2023) [arXiv: 2305.08161]
   *Environmental dependence of the mass-metallicity relation in cosmological hydrodynamical simulations*
8. **Kai Wang†**, Yangyao Chen, Qingyang Li, Xiaohu Yang, **MNRAS** 522, 3188 (2023) [arXiv: 2304.07189]
   *Late-formed halos prefer to host quiescent central galaxies. I. Observational results*
9. **Kai Wang†**, Yingjie Peng†, Yangyao Chen, **MNRAS** 523, 1268 (2023) [arXiv: 2304.06886]
   *Dissect two-halo galactic conformity effect: The dependence of star formation activities on the large-scale environment for central galaxies*
10. **Kai Wang†**, Houjun Mo, Cheng Li, Yangyao Chen, **MNRAS** 520, 1774 (2023) [arXiv: 2211.00485]
    *Relating galaxies across different redshift to study galaxy evolution*
11. **Kai Wang†**, Houjun Mo, Cheng Li, Yangyao Chen, **MNRAS** 505, 3892 (2021) [arXiv: 2104.12223]
    *Finding proto-clusters to trace galaxy evolution: I. The finder and its performance*

12. **Kai Wang**†, Houjun Mo, Cheng Li, Jiacheng Meng, Yangyao Chen, **MNRAS** 499, 89 (2020) [arXiv: 2006.05426]

    *Identifying galaxy groups at high redshift from incomplete spectroscopic data: I. The group finder and application to zCOSMOS*

13. **Kai Wang**, Larissa Santos, Jun-Qing Xia, Wen Zhao†, **JCAP** 01, 053 (2017) [arXiv: 1608.04189]

    *Thermal gravitational-wave background in the general pre-inflationary scenario*

14. Yi-Fan Wang, **Kai Wang**†, Wen Zhao, **RAA** 16, 4 (2016) [arXiv: 1511.01220]

    *Smoothing methods comparison for CMB E- and B-mode separation*

***Co-author papers:***

15. Tiancheng Yang et al. submitted (2025) [arXiv: 2510.12235]

    *A census of quiescent galaxies across 0.5<z<8 with JWST/MIRI: Mass-dependent number density evolution of quiescent galaxies in the early Universe*

16. Hanwen Sun et al. **ApJL** accepted (2025) [arXiv: 2508.21356]

    *The Bigfoot: A footprint of a Coma cluster progenitor at z=3.98*

17. Cheng Jia et al. **ApJL** 986 L24 (2025) [arXiv: 2504.18820]

    *Potential-Driven Metal Cycling: JADES Census of Gas-Phase Metallicity for galaxies at 1 < z < 7*

18. Xunda Sun et al. **ApJ** 986 179 (2025) [arXiv: 2409.09290]

    *The physical origin of positive metallicity radial gradients in high-redshift galaxies: insights from the FIRE-2 cosmological hydrodynamic simulations*

19. Dingyi Zhao et al. **ApJ** 979 42 (2025) [arXiv: 2408.12442]

    *From Halos to Galaxies. VI. Improved Halo Mass Estimation for SDSS Groups and Measurement of the Halo Mass Function*

20. Cheqiu Lyu et al. **ApJ** 972 108 (2025) [arXiv: 2407.03409 ]

    *From Halos to Galaxies. IX. Estimate of Halo Assembly History for SDSS Galaxy Groups*

21. Zeyu Gao, Yingjie Peng†, **Kai Wang** et al. **ApJ** 979 66 (2024) [arXiv: 2408.07749]

    *From Halos to Galaxies. X: Decoding Galaxy SEDs with Physical Priors and Accurate Star Formation History Reconstruction*

22. Cheqiu Lyu et al. **ApJ** 959 5 (2024) [arXiv: 2407.03409]

    *From Halos to Galaxies. IX. Accurate estimate of halo assembly history for SDSS galaxy groups*

23. Qinxun Li et al. **ApJL** 969 L25 (2024) [arXiv: 2402.10740]

    *Black-Hole-to-Halo Mass Relation From UNIONS Weak Lensing*

24. Tao Wang† et al. **Nature** (2023) [arXiv: 2311.07653]

    *Black holes regulate cold gas accretion in massive galaxies*

25. Yangyao Chen†, H.J Mo, **Kai Wang,** **MNRAS** 526 2542 (2023) [arXiv: 2304.13890]

    *Massive Dark Matter Halos at High Redshift: Implications for Observations in the JWST Era*

26. Cheqiu Lyu et al. **ApJ** 959 5 (2023) [arXiv: 2310.10733]

    *From Halos to Galaxies. VII. The Connections Between Stellar Mass Growth History, Quenching History, and Halo Assembly History for Central Galaxies*

27. Jiacheng Meng et al. **ApJ** 964 2 (2024) [arXiv: 2008.13733]

    *Measuring galaxy abundance and clustering at high redshift from incomplete spectroscopic data: Tests on mock catalogs*

28. Yangyao Chen et al. **MNRAS** 525 1254 (2023) [arXiv: 2301.08972]

    *A Conditional Abundance Matching Method of Extending Simulated Halo Merger Trees to Resolve Low-Mass Progenitors and Sub-halos*

29. Qingyang Li et al. **ApJ** 933 9 (2022) [arXiv: 2205.05517]
*Groups and Protocluster Candidates in the CLAUDS and HSC-SSP Joint Deep Surveys*
30. Yangyao Chen et al. **MNRAS** 507 2510 (2021) [arXiv: 2106.03984]
*MAHGIC: A Model Adapter for the Halo-Galaxy Inter-Connection*
31. Zhaoyu Wang et al. **Sci. China Phys. Mech. Astron.** 64 289811 (2021) [arXiv: 2106.14159]
*The clustering of galaxies in the DESI imaging legacy surveys DR8:I. the luminosity and color dependent intrinsic clustering*
32. Yangyao Chen et al. **MNRAS** 504 4865 (2021) [arXiv: 2009.12467]
*How to empirically model star formation in dark matter halos: I. Inferences about central galaxies from numerical simulations*
33. Yangyao Chen et al. **ApJ** 899 81 (2020) [arXiv: 2003.05137]
*Relating the structure of dark matter halos to their assembly and environment*
34. Jia-Ni Ye, **Kai Wang**, Yi-Fu Cai, **Eur. Phys. J. C** 77:720 (2017) [arXiv: 1705.10956]
*Superconducting cosmic strings as sources of cosmological fast radio bursts*
35. Larissa Santo et al. **JCAP** 01 043 (2017) [arXiv: 1612.03564]
*Statistical imprints of CMB B-type polarization leakage in an incomplete sky survey analysis*
36. Larissa Santo et al. **JCAP** 07 029 (2016) [arXiv: 1510.07779]
*Probing the statistical properties of CMB $B$-mode polarization through Minkowski Functionals*

## REFERENCES


- Prof. Houjun Mo — University of Massachusetts, Amherst
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