

# KAI WANG | 王凯

---

## Contact Information:

Ogden Centre for Fundamental Physics - West,  
Department of Physics, Durham University,  
Durham, DH1 3LE, United Kingdom

Email: [wkcosmology@gmail.com](mailto:wkcosmology@gmail.com)

Homepage: [www.KosmosWalker.com](http://www.KosmosWalker.com)

OCRID: [0000-0002-3775-0484](https://orcid.org/0000-0002-3775-0484)

## RESEARCH

---

- **Galaxy Formation Model:** *Toward a simulation-motivated and observation-calibrated semi-analytical model.*
- **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?*
- **Galaxy Evolution:** *What drives galaxy quenching, metal enrichment, and morphology transformation?*

## 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  $z \sim 1$  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  $z \sim 0.6$  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

---

- **Zeyu Gao**, graduate at Peking University since Nov. 2022  
Decoding the SEDs of galaxies with a prior from hydrodynamical simulations [[arXiv: 2408.07749](https://arxiv.org/abs/2408.07749)]
- **Chengyu Ma**, graduate at USTC since Dec. 2023  
Revisiting the fundamental metallicity relation with observation and simulation [[arXiv: 2407.21716](https://arxiv.org/abs/2407.21716)]
- **Haochen Jiang**, undergraduate at USTC since Dec. 2023  
Dissecting the quenching of massive central galaxies in TNG [[in prep.](#)]

- **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

---

- 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

## HONORS

---

- T. D. Lee Postdoctoral Fellowship (declined) 2024
- MUST Fellowship (declined) 2022
- Comprehensive scholarship (2nd class) of Tsinghua University 2020
- Comprehensive scholarship (1st class) of Tsinghua University 2019
- Future Scholar Scholarship of Tsinghua University 2017
- Outstanding Graduate of USTC 2017
- The annual scholarship of National Astronomical Observatories, CAS 2016
- National Inspirational Award 2016
- Excellent Student Scholarship (Silver Award) 2014
- Excellent Student Scholarship (Bronze Award) 2013

## SERVICE

---

- **Professional Service**  
Referee for MNRAS (since 2024), ApJ (since 2023), and A&A (since 2022)
- **Departmental Service**  
Co-organizer of Friday Lunchtime Astronomy Talks (FLAT) at Durham University 2025-  
Local Organising Committee of National Astronomical Meeting (NAM) 2025 at Durham 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

## TALKS

---

- 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  
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
- Expanding the boundaries of dark matter halo  
Local Group Analogs in a cosmological context Shanghai, May 2025
- Friday Lunchtime Astronomy Talks at Durham University  
Local Group Analogs in a cosmological context Durham, Mar. 2025
- Mock Barcelone 2024 **(invited)**  
Stellar mass-halo mass relation to the second order Barcelona, Oct. 2024
- 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
- 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
- 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 I 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
- The 2nd Shanghai Assembly on Cosmology and Structure Formation  
Characterizing the assembly of dark matter halos with protohalo size histories Shanghai, Oct. 2023
- Collaboration Workshop on Cosmology and Galaxy Formation  
Relating Galaxies across Cosmic Time to study galaxy evolution Shanghai, Jun. 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
- 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

- 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

---

◆**33** publications; **12** as the first/corresponding author; **>310** citations; *H*-index: **>11**; open in [NASA/ADS](#)

### First and Corresponding<sup>†</sup> author papers:

1. **Kai Wang<sup>†</sup>**, Yingjie Peng<sup>†</sup>, **ApJ** 980 233 (2025) [[arXiv: 2408.07743](#)]  
*Testing galaxy formation models with the stellar mass-halo mass relations for star-forming and quiescent galaxies*
2. Chengyu Ma, **Kai Wang<sup>†</sup>**, Enci Wang<sup>†</sup>, et al. **ApJL** 971 L14 (2024) [[arXiv: 2407.21716](#)]  
*Revisiting the fundamental metallicity relation with observation and simulation*
3. **Kai Wang<sup>†</sup>**, 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*
4. **Kai Wang<sup>†</sup>**, 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*
5. **Kai Wang<sup>†</sup>**, Xin Wang<sup>†</sup>, Yangyao Chen, **ApJ** 951, 66 (2023) [[arXiv: 2305.08161](#)]  
*Environmental dependence of the mass-metallicity relation in cosmological hydrodynamical simulations*
6. **Kai Wang<sup>†</sup>**, 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*
7. **Kai Wang<sup>†</sup>**, Yingjie Peng<sup>†</sup>, 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*
8. **Kai Wang<sup>†</sup>**, Houjun Mo, Cheng Li, Yangyao Chen, **MNRAS** 520, 1774 (2023) [[arXiv: 2211.00485](#)]  
*Relating galaxies across different redshift to study galaxy evolution*
9. **Kai Wang<sup>†</sup>**, 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*
10. **Kai Wang<sup>†</sup>**, 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*
11. **Kai Wang**, Larissa Santos, Jun-Qing Xia, Wen Zhao<sup>†</sup>, **JCAP** 01, 053 (2017) [[arXiv: 1608.04189](#)]  
*Thermal gravitational-wave background in the general pre-inflationary scenario*
12. Yi-Fan Wang, **Kai Wang<sup>†</sup>**, Wen Zhao, **RAA** 16, 4 (2016) [[arXiv: 1511.01220](#)]  
*Smoothing methods comparison for CMB E- and B-mode separation*

### Co-author papers:

13. Cheng Jia et al. **ApJL** accepted (2025) [[arXiv: 2504.18820](#)]  
*Potential-Driven Metal Cycling: JADES Census of Gas-Phase Metallicity for galaxies at  $1 < z < 7$*
14. Xunda Sun et al. **ApJ** accepted (2025) [[arXiv: 2409.09290](#)]  
*The physical origin of positive metallicity radial gradients in high-redshift galaxies: insights from the FIRE-2 cosmological hydrodynamic simulations*

15. 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*
16. 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*
17. 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*
18. 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*
19. Qinxun Li et al. **ApJL** 969 L25 (2024) [arXiv: 2402.10740]  
*Black-Hole-to-Halo Mass Relation From UNIONS Weak Lensing*
20. Tao Wang† et al. **Nature** (2023) [arXiv: 2311.07653]  
*Black holes regulate cold gas accretion in massive galaxies*
21. 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*
22. 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*
23. 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*
24. 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*
25. Qingyang Li et al. **ApJ** 933 9 (2022) [arXiv: 2205.05517]  
*Groups and Protocluster Candidates in the CLAUDS and HSC-SSP Joint Deep Surveys*
26. Yangyao Chen et al. **MNRAS** 507 2510 (2021) [arXiv: 2106.03984]  
*MAHGIC: A Model Adapter for the Halo-Galaxy Inter-Connection*
27. 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*
28. 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*
29. Yangyao Chen et al. **ApJ** 899 81 (2020) [arXiv: 2003.05137]  
*Relating the structure of dark matter halos to their assembly and environment*
30. 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*
31. 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*
32. 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  
✉ [hjmo@umass.edu](mailto:hjmo@umass.edu)  
University of Massachusetts, Amherst
- Prof. Cheng Li  
✉ [cli2015@tsinghua.edu.cn](mailto:cli2015@tsinghua.edu.cn)  
Tsinghua University
- Prof. Yingjie Peng  
✉ [yjpeng@pku.edu.cn](mailto:yjpeng@pku.edu.cn)  
KIAA, Peking University
- Prof. Zheng Cai  
✉ [zcaai@tsinghua.edu.cn](mailto:zcaai@tsinghua.edu.cn)  
Tsinghua University
- Prof. Fangzhou Jiang  
✉ [fangzhou.jiang@pku.edu.cn](mailto:fangzhou.jiang@pku.edu.cn)  
KIAA, Peking University