

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
Homepage: www.KosmosWalker.com
ORCID: [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 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 $z \sim 1$ 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

- **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](https://arxiv.org/abs/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

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-
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 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
- **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 Barcelona 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
✉ hjmo@umass.edu
University of Massachusetts, Amherst
- Prof. Cheng Li
✉ cli2015@tsinghua.edu.cn
Tsinghua University
- Prof. Yingjie Peng
✉ yjpeng@pku.edu.cn
KIAA, Peking University
- Prof. Zheng Cai
✉ zcaai@tsinghua.edu.cn
Tsinghua University
- Prof. Fangzhou Jiang
✉ fangzhou.jiang@pku.edu.cn
KIAA, Peking University