

XIAOSHENG ZHAO

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EDUCATION & EXPERIENCE

Tsinghua University, China

Sep 2018 - Jun 2024

PhD in Astronomy

Thesis title: Explore the epoch of reionization with machine learning

Institut d'Astrophysique de Paris (IAP), France.

Nov 2022 - May 2024

Visitor

Wuhan University, China

Sep 2014 - Jun 2018

BS in Physics

RESEARCH INTERESTS

I am interested in interactions between machine learning (ML) techniques and astrophysics/cosmology, to understand our universe's origin, content, and evolution. Currently, my research interests mainly focus on Bayesian inference through (the synergies of) multi-modal astrophysical and cosmological probes, such as 21 cm probes, galaxy surveys, and the CMB, with the aid of ML. Broadly, my research interests include but are not limited to, implicit-likelihood (or called simulation-based and likelihood-free) inference from the 3D fields, generative models to accelerate forward modeling, geometric ML leveraging the appropriate geometric structures within large-scale surveys, interpretable ML, and automatic knowledge discovery by symbolic regression from multi-modal information of the universe.

AWARDS

Comprehensive Scholarship (First-class)

2021 - 2022

(University-level scholarship)

AMD Scholarship

2020 - 2021

(Top scholarship awarded to two graduate students in the department this year)

Future Scholar Scholarship of Tsinghua University

2018

(University-level scholarship)

National Scholarship

2015 - 2016

TALKS & PRESENTATIONS (SELECTED)

Astro Coffee

Sept 2023

Informal talk: *Can Diffusion Model Conditionally Generate Astrophysical Images?*

IAS

Understanding the epoch of reionization

Mar 2023

Contributed talk: *Implicit Likelihood Inference of Reionization Parameters from 21 cm Power Spectrum and solid harmonic wavelet scattering coefficients*

Sexten, Italy

SAZERAC 21cm 2022

Mar 2022

Contributed talk: *Implicit Likelihood Inference of Reionization Parameters from the 21 cm Power Spectrum*

Virtual

SAZERAC SIP, learning the high-redshift universe

Feb 2022

Contributed talk: *Simulation Based Inference of Reionization Parameters From 3D Tomographic 21 cm Lightcone Images* Virtual

SKA CD/EoR Science Telecon July 2021
Contributed talk: *Simulation Based Inference of Reionization Parameters From 3D Tomographic 21 cm Images* Virtual

HERA telecon Jun 2021
Invited talk: *Simulation Based Inference of Reionization Parameters From 3D Tomographic 21 cm Images* UC, Berkeley

SKILLS

Coding languages: {Python, Jax} (Fluent), {C, Shell, html&CSS}(Basic)
General: Data science and Machine learning application with Pandas, Scikit-learn, Tensorflow and Pytorch.

TRAINING AND SUMMER SCHOOL

Big Data Capability Enhancement Project Sep 2021 - July 2022
Courses: *e.g. big data system, big data analysis, big data application* Tsinghua University
Big-data challenge: *Multi-modal short-video classification*

Chinese Survey Space Telescope (CSST) summer school July 2022
Got certification of data processing practice Peking University

OUTREACH & SERVICE

I am a member of [Simons Foundation on Learning the Universe \(LtU\)](#) Jul 2023 - Present
I organized the [machine learning session](#) at DoA, Tsinghua. Mar 2021 - Mar 2022
I co-organized the joint machine learning session among Oct 2021 - Mar 2022
DoA (Tsinghua), JBCA (Manchester) and SKAO.

MENTORING & TEACHING EXPERIENCE

Teaching Assistant in undergraduate *Physics* course. Feb - Jun 2019

REFERENCES

Prof. Yi Mao, Tsinghua University ymao@mail.tsinghua.edu.cn
Prof. Benjamin D. Wandelt, Sorbonne Université & Flatiron Institute bwandelt@iap.fr
Prof. Yuan-Sen Ting,
Australian National University & The Ohio State University yuan-sen.ting@anu.edu.au

PUBLICATION

Refereed (first author, 60 cited from ads)
[Can Diffusion Model Conditionally Generate Astrophysical Images?](#) (5 cited)
Xiaosheng Zhao; Yuan-Sen Ting; Kangning Diao; Yi Mao
2023, MNRAS, 526, 1699

[Implicit Likelihood Inference of Reionization Parameters from the 21 cm Power Spectrum](#) (20 cited)

Xiaosheng Zhao; Yi Mao; Benjamin D. Wandelt
2022, ApJ, 933, 236

[Simulation-Based Inference of Reionization Parameters From 3D Tomographic 21 cm Lightcone Images.](#) (35 cited)

Xiaosheng Zhao; Yi Mao; Cheng Cheng ; Benjamin D. Wandelt
2022, ApJ, 926, 151

Conference proceedings

[3D ScatterNet: Inference from 21 cm Light-cones](#)

Xiaosheng Zhao; Shifan Zuo; Yi Mao
2023, ICML 2023 Workshop on Machine Learning for Astrophysics

[Evaluating Summary Statistics with Mutual Information for Cosmological Inference.](#)

Ce Sui; **Xiaosheng Zhao**; Tao Jing; Yi Mao
2023, ICML 2023 Workshop on Machine Learning for Astrophysics

Under review

[Simulation-based Inference of Reionization Parameters from 3D Tomographic 21 cm Light-cone Images - II: Application of Solid Harmonic Wavelet Scattering Transform.](#)

Xiaosheng Zhao; Yi Mao; Shifan Zuo; Benjamin D. Wandelt
2023, Submitted to ApJ, a more detailed complement to the accepted ICML paper “3D ScatterNet: Inference from 21 cm Light-cones”.

[Information-Ordered Bottlenecks for Adaptive Semantic Compression.](#)

Matthew Ho; **Xiaosheng Zhao**; Benjamin D. Wandelt
2023, arXiv.