XIAOSHENG ZHAO

xszhao20@gmail.com ◇ Xiaosheng-Zhao.github.io
+33 0779117664 ◇ Paris, France

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 (Field-level) 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 DoA (Tsinghua), JBCA (Manchester) and SKAO. Oct 2021 - Mar 2022

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. Submitted to Machine Learning: Science and Technology (MLST).