XIAOSHENG ZHAO

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EDUCATION & EXPERIENCE

Tsinghua University, China Sep 2018 - Jun 2024
PhD in Astronomy
Thesis title: Explore the cosmic dawn and 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 the origin, content, and evolution of our universe. Currently, my research interests mainly focus on cosmological inference from (synergies of multi-modal) cosmological probes with the aid of ML. Broadly, my research interests include but are not limited to, implicit-likelihood (or simulation-based) inference from the 3D fields, generative modeling as an alternative to cosmological simulations, geometric ML for 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 per year)*
Future Scholar Scholarship of Tsinghua University 2018
(*University-level scholarship)*
National Scholarship 2015 - 2016

TALKS & PRESENTATIONS (SELECTED)

Astro Coffee Sept 2023
Invited 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* *Virtual*

3D Tomographic 21 cm Lightcone Images

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, 56 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 (18 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. (33 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 The International Conference on Learning Representations (ICLR) 2024.