Xingchen Zhou

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Educations

National Astronomical Observatories, CAS 2018 Sep – 2023 Jun
PhD in Astrophysics Beijing, China
Supervisor: Prof. Yan Gong

Dalian University of Technology 2014 Sep – 2018 Jun
Bachelor in Applied Physics Dalian, China

Employments

National Astronomical Observatories, CAS 2024 Apr – present
Reseach assistant in CSST scientific team, NAOC Beijing, China

Research Interests

- Machine learning and deep learning
- Photometric and spectroscopic data analysis
- Galaxy morphology
- Line intensity mapping

Skills

Programming
Skilled in Python, TensorFlow, Keras, PyTorch
Basic knowledge in C and C++

Language
English (Proficient); Chinese (Native)

Projects

Photometric Redshifts for CSST Optical Survey
- Photo-z for simulated photometry and imaging data expected to be observed by CSST.
- Methods: multi-layer perceptron (MLP), convolutional neural network (CNN) and Bayesian neural network (BNN).
- Highlights: Accurate Photo-z and corresponding uncertainty.

Spectroscopic Redshifts for CSST Slitless Spectroscopic Survey
- Spec-z for simulated 1d-slitless spectra expected to be observed by CSST.
- Methods: Bayesian neural network (BNN).
- Highlights:
  - Spectra simulated from BOSS and DESI observational data;
  - Accurate spec-z and corresponding uncertainty.
- Future:
  - Explore if spec-z can be estimated from 2d-spectral images;

- Investigate the blending effects for slitless spectra.

Foreground Removal for Line Intensity Mapping
- Remove foreground in CO line intensity mapping survey.
- Methods: Principle component analysis (PCA) and U-Net.
- Highlights:
  - Foreground components, including dust, sychrotron and CMB anisotropy, are considered;
  - Different CO luminosity models are investigated;
  - Recovery for deviations of power spectra induced by antenna Beam effects.

DESI Photometric Redshift Catalogue
- Photo-z estimations from galaxy images for DESI sources.
- Methods: Bayesian neural networks (BNN).
- Highlights:
  - Networks models are trained exclusively by DESI-EDR;
  - Categorization of sources based on characteristics and estimations within each group provides more accurate results;
  - New photo-z catalogue for DESI sources .
- Future: Update photo-z catalogue with further release of DESI.

MUST Target Selection
- Target Selection of emission line galaxies (ELGs) and Lyman break galaxies (LBGs) for MUltiplexed spectroscopic Telescope (MUST) led by Tsinghua University.
- Methods: Color selection.
- Highlights:
  - Select higher density of ELGs and LBGs;
  - Galaxy bias are calculated for cosmological constraints.

GalaxyEmulator
- A wrapper to emulate galaxies for photometric surveys from IllustrisTNG simulations.
- Methods: SKIRT.
- Highlights:
  - Wrap preparations for running SKIRT and postprocessing for surveys together;
  - Modifications of emulation can be easily made by editing the configuration file.
- Code: https://github.com/xczhou-astro/galaxyEmulator

Disentangle features of galaxy morphologies
- Disentangle features for galaxies from representation learning.
- Methods: InfoGAN or Beta-VAE (in experiments).

Publications

First Author Papers:

- **Xingchen Zhou**, Nan Li, Hu Zou, Yan Gong, Furen Deng, Xuelei Chen, Qian Yu, Zizhao He and Boyi Ding, Estimating photometric redshifts for galaxies from the DESI Legacy Imaging Surveys with Bayesian neural networks trained by DESI EDR, accepted *by* MNRAS.

- **Xingchen Zhou**, Yan Gong, Xin Zhang, Nan Li, Xian-Min Meng, Xuelei Chen, Run Wen, Yunkun Han, Hu Zou, Xian Zhong Zheng, Xiaohu Yang, Hong Guo and Pengjie Zhang, Accurately estimating redshifts from CSST slitless spectroscopic survey using deep learning, *ApJ*, 2024

- **Xingchen Zhou**, Yan Gong, Furen Deng, Meng Zhang, Bin Yue and Xuelei Chen, Foreground Removal of CO Intensity Mapping using Deep Learning, MNRAS, 2023

- **Xingchen Zhou**, Yan Gong, Xian-Min Meng, Xuelei Chen, Zhu Chen, Wei Du, Liping Fu and Zhijian Luo, Photometric redshift estimates using Bayesian neural networks in the CSST survey, *RAA*, 2022
- **Xingchen Zhou**, Yan Gong, Xian-Min Meng, Ye Cao, Xuelei Chen, Zhu Chen, Wei Du, Liping Fu and Zhijian Luo, Extracting photometric redshift from galaxy flux and image data using neural networks in the CSST survey, *MNRAS*, 2022
- **Xingchen Zhou**, Yan Gong, Xian-Min Meng, Xin Zhang, Ye Cao, Xuelei Chen, Valeria Amaro, Zuhui Fan, and Liping Fu, Spectroscopic and Photometric Redshift Estimation by Neural Networks for the China Space Station Optical Survey (CSS-OS), *ApJ*, 2021

Collaborations:

- Qi Xiong, Yan Gong, **Xingchen Zhou**, Hengjie Lin, Furen Deng, Ziwei Li, Ayodeji Ibitoye, Xuelei Chen, Zuhui Fan, Qi Guo, Ming Li, Yun Liu, Wenxiang Pei, Cosmological forecast for the weak gravitational lensing and galaxy clustering joint analysis in the CSST photometric survey, *submitted to ApJ.*
- Zhijian Luo, Yicheng Li, Junhao Lu, Zhu Chen, Liping Fu, Shaohua Zhang, Hubing Xiao, Wei Du, Yan Gong, Chenggang Shu, Wenwen Ma, Xian-Min Meng, **Xingchen Zhou**, Zuhui Fan, Photometric Redshift Estimation for CSST Survey with LSTM Neural Networks, *accepted by MNRAS.*
- Zhijian Luo, Zhirui Tang, Zhu Chen, Liping Fu, Wei Du, Shaohua Zhang, Yan Gong, Chenggang Shu, Junhao Lu, Yicheng Li, Xian-Min Meng, **Xingchen Zhou**, Zuhui Fan, Imputation of Missing Photometric Data and Photometric Redshift Estimation for CSST, *submitted to MNRAS*
- Junhao Lu, Zhijian Luo, Zhu Chen, Liping Fu, Wei Du, Yan Gong, Yicheng Li, Xian-Min Meng, Zhirui Tang, Shaohua Zhang, Chenggang Shu, **Xingchen Zhou**, Zuhui Fan, Estimating Photometric Redshift from Mock Flux for CSST Survey by using Weighted Random Forest, *submitted to MNRAS*
- Yuer Jiang, Yan Gong, Meng Zhang, Qi Xiong, **Xingchen Zhou**, Furen Deng, Xuelei Chen, Yin-Zhe Ma, Bin Yue, Cross-Correlation Forecast of CSST Spectroscopic Galaxy and MeerKAT Neutral Hydrogen Intensity Mapping Surveys, *RAA*, 2023

References

- **Dr. Nan Li**
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  Email: nan.li@nao.cas.cn
- **Dr. Yan Gong**
  Professor, CSST cosmology research team, NAOC
  Email: gongyan@bao.ac.cn
- **Dr. Song Huang**
  Associate Professor, Department of Astronomy, Tsinghua University
  Email: shuang@tsinghua.edu.cn