Xiaoxiong Zuo

📞 +86 15512266896   ✉ zuoxx@bao.ac.cn
🏛 1999-05
🗔 Research Interests: Time-Domain Astronomy | Light Curve Analysis | Transient &
Variability Classification and Identification | Machine Learning in Astronomical Data

EDUCATION

Ph.D. in National Astronomical Observatories, Chinese Academy of Sciences (NAOC)   Sep 2021 - Jun 2026

Astronomical Technology and Methods , Supervisor: Prof. Chenzhou Cui   Beijing, China

- Research Group: National Astronomical Data Center
- **PhD Thesis**: Variable Source Classification and Rare Object Detection Methods for Time-Domain Surveys
- **Teaching Assistant** for the course *Astronomical Informatics,* University of Chinese Academy of Sciences

Visiting Ph.D. Student in Ludwig-Maximilian-University of Munich   Mar 2025 - Mar 2026

Supervisor: Prof. Daniel Gruen   Data Processing in Wendelstein Observations   Munich, Germany

- Research Group: Astrophysics, Cosmology and Artificial Intelligence
- Project: Identification of Anomalous AGNs from ZTF Light Curves by Deep Learning and Foundation Model

B.Sc. in China Three Gorges University   Sep 2017 - Jun 2021

Optoelectronic Information Science and Engineering   Yichang, China

RESEARCH EXPERIENCE

Foundation Model-driven Anomalous Object Identification in Kepler/TESS/ZTF Light Curves   Mar 2025 - Present

- **Extending** the Kepler-trained FALCO foundation model to **TESS** and **ZTF**, adapting to survey-specific cadences and photometric systematics.
- Developing foundation-model–based **anomaly detection** and **parameter estimation** methods across surveys to identify scientific targets, including exoplanets and anomalous AGN (with possible BBH mergers).

Construction of a Light Curve Foundation Model and Multi-task Scientific Validation   Mar 2024 - May 2025

- Developed initial **Transformer-based FALCO** models using Kepler light curves, with self-supervised pretraining and application to multiple scientific tasks.
- Designed **preprocessing pipelines** and **scientific task frameworks**, assembling a dataset of **190,000+ Kepler light curves** for classification, regression, and event detection.
- Achieved 95% accuracy on 8-class **variable sources classification,** 0.13 dex RMSE in **log g estimation**, and 87% precision in **flare detection**, outperforming traditional methods.
- Delivered **the first foundational astronomical light curve model**, integrated into the national data platform with LLM-based intelligent dialogue and online scientific services.

Application of Machine Learning Classification Models for EP Satellite X-ray Sources   Dec 2022 - Jun 2024

- Developed a robust **Random Fores**t model combining simulated and observational data, incorporating **multi-dimensional physical features** (spectral, variability, spatial).
- Achieved 95% classification accuracy on simulated data, 98% on measured data, and **nearly 100% precision in cosmic ray identification**.
- Deployed the model in the satellite data **pipeline**, enabling daily automated screening of thousands of X-ray sources and supporting transient detection.

Discovery of Rotational Modulation Periods in a Young Triple System (GW Ori)   Jan 2021 - Oct 2022

- Preprocessed TESS light curves of the GW Ori system for periodicity analysis.
- Applied Lomb-Scargle periodogram analysis to identify two stable rotational modulation periods.

TRAINING EXPERIENCE

Zhejiang Lab   Jun 2024 - Sep 2024

- Selected for a three-month "Astronomy Foundation Model Training Camp," mastering core techniques in foundation model development and optimization.
- Led light curve foundation model tasks, creating the initial FALCO prototype now in real scientific use; awarded "Outstanding Trainee" and invited for results presentation.

RESEARCH CONTRIBUTIONS

Publications

- **Zuo, Xiaoxiong**, Yihan Tao, et al. "FALCO: Foundation model of Astronomical Light Curves for time dOmain astronomy. Implementation and Applications on Kepler data" *Astronomical Journal.* (2025)
- Peng, Dao-qi, **Zuo, Xiaoxiong**, Jiang, Hong. "The History, Application Status and Future of Citizen Science in Astronomy." *Science and Society*, 2024, 14(2): 14–35. DOI: 10.19524/j.cnki.10-1009/g3.2024.02.014
- **Zuo, Xiaoxiong**, Yihan Tao, et al. "X-Ray Source Classification Using Machine Learning: A Study with EP-WXT Pathfinder LEIA." *Research in Astronomy and Astrophysics*, 24(8), 085016 (2024)
- Chen, Y. T., Tian, H. J., Fang, M., **Zuo, X. X**, et al. "Discovery of two rotational modulation periods from a young hierarchical triple system." *Science China Physics, Mechanics & Astronomy* 66.9 (2023): 299514.

Patents

- Zeng, Shuguang; **Zuo, Xiaoxiong**; Zheng, Sheng, et al. "Timestamp Extraction from Solar Film Images Using Deep Learning." CN201910765276.1, 2019-12-03.
- Zeng, Shuguang; **Zuo, Xiaoxiong**; Cai, Mingxuan, et al. "Fuzzy Image Classification Using Support Vector Machine and Wavelet Decomposition." CN201911421598.0, 2020-05-15.
- Zeng, Shuguang; **Zuo, Xiaoxiong**; Zheng, Sheng, et al. "Surface Crack Detection of Ceramic Tiles Using Machine Vision." CN201911327643.6, 2020-05-12.

Conference Presentations

- IAUS 397 UniverAI: Exploring the Universe with Artificial Intelligence, Greece-Athens, 2025-06
    Oral presentation - FALCO: a Foundation model of Astronomical Light Curves for time dOmain astronomy
- The 34th annual conference on Astronomical Data Analysis Software and Systems, Malta-Valletta, 2024-11
    Oral Report - AI-Driven X-Ray Source Classification within the NADC Framework
- The 9th Annual BRICS Astronomy Working Group Workshop (BAWG2023), South Africa-Cape Town, 2023-10
    Poster - Machine Learning Approaches for Target Classification in X-ray Time-Domain Astronomy
- BRICS Astronomy Working Group HACKATHON 2023, South Africa-Cape Town, 2023-10
    In the study of unsupervised clustering methods for SFGs and AGN, the t-SNE dimension reduction and DBSCAN clustering methods are used to carry out unsupervised learning analysis

Selected Chinese Conferences – Oral Presentations or Posters

- Annual Conference of Astronomical Informatics and Virtual Observatory 2024, Xinchang, China, 2024-11
- Annual Conference of the Chinese Astronomical Society 2024, Hangzhou, China, 2024-10
- Annual Conference of Astronomical Informatics and Virtual Observatory 2023, Renhuai, China, 2023-10
- 2nd Workshop on Machine Learning Applications in Astronomy, Yichang, China, 2023-09

FUNDING & GRANTS

- Participation in National Key R & D Program-Massive Multi-band Astronomical Data Fusion Key Technologies and Scientific Applications
- Participation in Chinese Academy of Sciences Foundation and Cross Frontier Research Pilot Project-Rare Densitized Celestial Bodies Outbreak of the Sky-Earth Integration Multi-Band Collaborative Observation and Data Fusion

SKILLS & LANGUAGES

- **Skills:** Python, TensorFlow & PyTorch, Linux, Machine Learning & Deep Learning, Data Visualization
- **Languages:** Mandarin (native), English (IELTS 6.5, fluent), German (basic)

PERSONAL SUMMARY

Currently completing my PhD in **time-domain astronomy and AI**, I develop machine learning methods for light curve analysis, with applications in **transient classification, variable source studies, and the discovery of unusual astrophysical phenomena**. My work combines practical data processing with methodological innovation, aiming to make large survey data more accessible and scientifically productive. I am passionate about **bridging astronomy and AI** to tackle challenges in **data-intensive sky surveys**.