Haowen Si

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Objective

Graduate student in high-energy astrophysics, modeling black hole jets and their connections to cosmic ray generation and detection in multi-wavelength and multi-messenger studies.

Education

M.Sc. in Physics and Astronomy Sept 2024 – Present

University of Amsterdam

Selected Coursework: Extreme Astrophysics, Disks and Accretion, Space Instrumentation for High-Energy Astrophysics, General Relativity, Machine Learning.

B.Sc. in Mathematics and Applied Mathematics Sept 2020 – June 2024

The Chinese University of Hong Kong, Shenzhen

Selected Coursework: Complex Analysis, Real Analysis, Coding Theory, Electrodynamics, Fluid Mechanics, Quantum Mechanics, Computational Methods.

Skills & Languages

Programming: Python, C++, Fortran (basic), Bash scripting, Julia (basic), MATLAB

Data & Modeling: Machine Learning, Semi-analytical Modeling, Numerical Simulations, Data Analysis

Astrophysics Tools: ISIS (X-ray spectral modeling), SPEX (spectral fitting), DISKLAB (disk modeling)

Version Control & Collaboration: Git, GitHub

Languages: Mandarin (Native), English (Fluent), Cantonese (Conversational), Dutch (Beginner), Spanish (Basic)

Research

Constraining Hadronic Processes in Microquasar Jets Sept 2025 – Present

University of Amsterdam

Supervisor: Prof. Sera Markoff — Tools: Python, BHJet/HADJet, ISIS, Gammapy

- Model microquasar jets (e.g., V4641 Sgr) with a multi-zone lepto–hadronic framework, linking cosmic-ray production to detector-space predictions.
- Reproduce multi-wavelength (MWL) baselines in ISIS and refine HADJet with physically motivated proton-injection setups.
- Model jet termination/interaction regions and particle transport through the Galactic plane environment.

- Fold model outputs through CTA and KM3NeT instrument response functions to forecast detectable gamma-ray and neutrino signatures.

XENONnT Experiment: Dark Matter & Detector Calibration Feb 2024 – Sept 2024

The Chinese University of Hong Kong, Shenzhen

Supervisor: Prof. Jingqiang Ye — Tools: Python, Data Analysis Pipelines, Correction Algorithms

- Worked on detector calibration and low-energy event analysis.
- Calibrated with Krypton-83m injections to monitor xenon purity, drift fields, and PMT stability.
- Developed correction algorithm for false photoionization events, improving low-energy sensitivity.
- Identified detector artifact mimicking neutrino magnetic moment signals, reducing systematic errors.

MHD Simulation: Tracing Alfvén Waves in Solar Wind July 2023 – Sept 2023

Nanjing University

Supervisor: Prof. Xin Cheng — Tools: Python, MPI-AMRVAC, Fortran, Bash

- Modeled Alfvén wave propagation in the slow solar wind using MPI-AMRVAC (1D diffusion setup).
- Configured grid, boundary conditions, and solvers to study wave transport and damping.
- Gained experience in MHD theory, plasma simulations, and numerical stability challenges.
- Built foundation for future higher-dimensional plasma modeling projects.

LAMOST Survey: Stellar Activity & Spectral Variations June 2021 – Aug 2021

Nanjing University

Supervisor: Prof. Pengfei Chen — Tools: Python, FITS, K-means clustering, correlation analysis

- Analyzed LAMOST spectra to study stellar activity (H-alpha, Fe lines) in solar-like stars (G6–G9).
- Processed spectra and applied machine learning (K-means) to detect anomalies and variability.
- Found activity correlates with lower surface gravity and higher radial velocity, not metallicity.
- Gained hands-on skills in spectral data reduction and stellar activity diagnostics.