Ruo-Yu Guan

Research interests: gravitational-wave astrophysics; Galactic double white dwarfs; Milky Way structure; population inference

+86 186 0451 1940 | ruoyuguan.physics@gmail.com | LinkedIn | GitHub | Portfolio | Wuhan, China

ORCID | Google Scholar | ADS

Education

Huazhong University of Science and Technology (HUST) — Wuhan, China

School of Physics; National Gravitation Laboratory — *Sep. 2025 – Jun. 2029 (expected)*

Ph.D. in Physics (Theoretical Physics) (in progress) — *Supervisor: Prof. Yan Wang*

- Research focus: gravitational-wave astrophysics (galactic double white dwarfs).

The University of Hong Kong (HKU) — Hong Kong SAR, China

Department of Physics, Faculty of Science — *Sep. 2023 – Jul. 2024; degree conferred Nov. 2024*

M.Sc. in Physics — *Supervisor: Assoc. Prof. Stephen Chi-Yung Ng*

- Capstone project: *Identifying Sources in Cygnus OB2 Using Multiwavelength Observations.*

Jilin University (JLU) — Changchun, China

Department of Materials Science, School of Materials Science and Engineering — *Sep. 2018 – Jun. 2022*

B.Sc. in Materials Physics

- Graduation thesis: *Study on the Prompt Emission of Gamma-ray Bursts and its Polarization.*
- Research mentor: Prof. Mi-Xiang Lan (Center for Theoretical Physics & College of Physics, Jilin University).

Research Positions

Huazhong University of Science and Technology — Wuhan, China

Research Assistant (contract), Department of Astronomy — *Nov. 2024 – Jun. 2025*

- Supervisor: Prof. Yuan-Chuan Zou.
- Gamma-ray burst (GRB) research (see Research Experience / Publications).

Publications

Refereed journal articles

[1] **Ruo-Yu Guan** and Mi-Xiang Lan. "Interpreting time-integrated polarization data of gamma-ray burst prompt emission." *Astronomy & Astrophysics*, **670**, A160 (2023). doi:10.1051/0004-6361/202243805.

[2] **Ruo-Yu Guan**, Fei-Fei Wang, and Yuan-Chuan Zou. "Hurst index of gamma-ray burst light curves and its statistical study." *Journal of High Energy Astrophysics*, **51**, 100559 (2026). doi:10.1016/j.jheap.2026.100559.

Research Experience

Milky Way Structure Inference from Multi-Messenger Observations of Double White Dwarf (DWD) Binaries

National Gravitation Laboratory and School of Physics, HUST — *Wuhan, China*

Ph.D. research (Supervisor: Prof. Yan Wang) — *Jul. 2025 – Present*

- Research focus: gravitational-wave (GW) astrophysics and Milky Way structure inference using Galactic double white dwarf (DWD) binaries as multi-messenger targets.
- Building a simulation-based inference pipeline integrating population synthesis (`COSMIC`) with hierarchical Bayesian inference (e.g., `GWpopulation`).
- Quantifying selection effects, detector response, and observational uncertainties for space-based GW observations (Laser Interferometer Space Antenna (LISA) / TianQin context).
- **Milestone:** Ph.D. proposal approved; proposal title: *Milky Way Structure Inference from Multi-Messenger Observations of Double White Dwarf Binaries.*

Time-Series and Correlation Analysis of Gamma-Ray Burst (GRB) Light Curves

Department of Astronomy, HUST — *Wuhan, China*

Pre-Ph.D. research (Research Assistant, contract; Supervisor: Prof. Yuan-Chuan Zou) — *Oct. 2024 – Jan. 2026*

- Conducted GRB light-curve time-series analysis using detrended fluctuation analysis (DFA) and Hurst exponent estimation; performed statistical correlation studies in `Python`.
- Maintained `Python`-based workflows for preprocessing, feature extraction, statistical analysis, and visualization; supported manuscript preparation.
- Resulted in a first-author refereed journal article (see Publications).
- Supported by the National SKA Program of China (Grant No. 2022SKA0130100).

Identifying Sources in Cygnus OB2 Using Multiwavelength Observations
Department of Physics, Faculty of Science, HKU — *Hong Kong SAR, China*
M.Sc. capstone project (Supervisor: Assoc. Prof. Stephen Chi-Yung Ng) — *Sep. 2023 – Jun. 2024*

- Reduced and analyzed *Chandra* X-ray observations using standard pipelines with the Chandra Interactive Analysis of Observations (CIAO) software, including source detection and quality control.
- Merged 18 X-ray observations in the Cygnus OB2 region and assembled a catalog of detected X-ray sources.
- Cross-matched X-ray sources with *Gaia* counterparts to classify association members versus foreground/background objects.

Gamma-Ray Burst Prompt Emission and Polarization
Center for Theoretical Physics and College of Physics, JLU — *Changchun, China*
Undergraduate research (Mentor: Prof. Mi-Xiang Lan) — *2022 – Feb. 2023*

- Collected and organized GRB prompt-emission spectral parameters and polarization measurements from the literature by instrument and energy band.
- Computed time-integrated polarization degrees for ∼37 GRBs under a synchrotron-emission framework using `IDL`; filtered unphysical solutions and compared model predictions with observations.
- Resulted in a first-author refereed journal article (see Publications).
- Supported by the National Natural Science Foundation of China (Grants No. 11903014 and 12147217).

Skills

Languages: Chinese (Mandarin: native; Cantonese: conversational); English (IELTS 6.5, 2023; completed an English-taught M.Sc. at HKU).

Programming: **`Python`** (primary); `MATLAB`, `Mathematica`, `R` (familiar); `IDL`, `C++` (prior experience).

Methods: time-series analysis; statistical correlation analysis; hierarchical Bayesian inference (`GWpopulation`; Markov chain Monte Carlo (MCMC)); Monte Carlo simulation and mock-catalog generation.

Scientific computing: `NumPy`, `SciPy`, `Pandas`, `Matplotlib`; `Jupyter`; Flexible Image Transport System (FITS) data handling; pipeline automation (bash/Python scripts).

Astrophysics & gravitational-wave (GW): population synthesis (`COSMIC`); gravitational-wave population inference; catalog-based population studies.

Scholarly writing: LaTeX; `BibTeX`.

Computing environment: `Git/GitHub`; `bash` (shell scripting); Windows, macOS, Linux (Ubuntu); high-performance computing (HPC) (remote Linux servers; batch jobs); Secure Shell (SSH)-based workflows.

Talks & Presentations

2024 PKU International PhD Student Forum on the Frontiers of Modern Astronomy
Poster presentation: "Time-integrated Polarizations of Gamma-ray Burst Prompt Phase" — *Dec. 2024*
Kavli Institute for Astronomy and Astrophysics, Peking University

Conferences & Workshops

2025 Gravitational Wave Data Analysis Summer School
Participant — *Aug. 2025*
Lanzhou Center for Theoretical Physics

The First Edinburgh School for Extragalactic Astronomy (ESEA-I)
Participant — *Jun. 2025*
Institute for Astronomy, The University of Edinburgh

Gravitational Wave Open Data Workshop 2025
Participant *May 2025*
Gravitational Wave Open Science Center (GWOSC)

2024 PKU International PhD Student Forum on the Frontiers of Modern Astronomy
Poster presenter *Dec. 2024*
Kavli Institute for Astronomy and Astrophysics, Peking University

International Conference on Space Sustainability 2024
Volunteer (conference support) *Dec. 2024*
Laboratory for Space Research, The University of Hong Kong (HKU); École Polytechnique Fédérale de Lausanne (EPFL)

Celestial Holography Summer School 2024
Participant *Jul. 2024*
Perimeter Institute for Theoretical Physics

International Symposium on Cosmology and Particle Astrophysics 2023 (CosPA 2023)
Participant *Nov. 2023*
Department of Physics and Institute of Theoretical Physics, The Chinese University of Hong Kong (CUHK)

Multimessenger Astronomy: Bridging Transients, Lensing, and Dark Matter (Cosmic Frontiers)
Participant *Nov. 2023*
Department of Physics, CUHK

Professional Activities

LISA (Laser Interferometer Space Antenna) Consortium
Member *Jan. 2026 – Present*
Laboratory for Space Research, The University of Hong Kong Hong Kong SAR, China
Member *Oct. 2023 – Nov. 2024*
Chinese Physical Society (CPS)
Student Member *May 2021 – Apr. 2022*

Outreach Activities

China Skywatcher Asteroid Search Campaign Jan. 2025 – Feb. 2025
Participant *International Astronomical Search Collaboration (IASC)*

References

References available upon request.