

# Ruo-Yu Guan

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## RESEARCH PROFILE

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- Gamma-ray burst astrophysics (prompt emission, polarization modeling, time-series analysis).
- Multiwavelength data analysis (Chandra X-ray observations and Gaia astrometric cross-matches).
- Compact stellar binaries (double white dwarfs) and Galactic structure inference via population synthesis and Bayesian methods (LISA/TianQin).

## EDUCATION

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### Huazhong University of Science and Technology (HUST)

*School of Physics; National Gravitation Laboratory*

*Ph.D. in Physics (Theoretical Physics) (in progress)*

Wuhan, China

*Sep. 2025 – Jun. 2029 (expected)*

*Supervisor: Prof. Yan Wang*

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

### The University of Hong Kong (HKU)

*Department of Physics, Faculty of Science*

*M.Sc. in Physics*

Hong Kong SAR, China

*Sep. 2023 – Jul. 2024; degree conferred Nov. 2024*

*Supervisor: Assoc. Prof. Stephen Chi-Yung Ng*

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

### Jilin University (JLU)

*Department of Materials Science, School of Materials Science and Engineering*

*B.Sc. in Materials Physics*

Changchun, China

*Sep. 2018 – Jun. 2022*

- 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

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### Huazhong University of Science and Technology

*Research Assistant (contract), Department of Astronomy*

Wuhan, China

*Nov. 2024 – Jun. 2025*

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

## PUBLICATIONS

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### 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

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

*National Gravitation Laboratory and School of Physics, HUST*

*Ph.D. research (Supervisor: Prof. Yan Wang)*

Wuhan, China

*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  $\sim 37$  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

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**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:** L<sup>A</sup>T<sub>E</sub>X; Bib<sub>T</sub>E<sub>X</sub>.

**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

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### 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

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### **2025 Gravitational Wave Data Analysis Summer School**

*Participant*

*Lanzhou Center for Theoretical Physics*

*Aug. 2025*

### **The First Edinburgh School for Extragalactic Astronomy (ESEA-I)**

*Participant*

*Institute for Astronomy, The University of Edinburgh*

*Jun. 2025*

### **Gravitational Wave Open Data Workshop 2025**

*Participant*

*Gravitational Wave Open Science Center (GWOSC)*

*May 2025*

### **2024 PKU International PhD Student Forum on the Frontiers of Modern Astronomy**

*Poster presenter*

*Kavli Institute for Astronomy and Astrophysics, Peking University*

*Dec. 2024*

### **International Conference on Space Sustainability 2024**

*Volunteer (conference support)*

*Laboratory for Space Research, The University of Hong Kong (HKU); École Polytechnique Fédérale de Lausanne (EPFL)*

*Dec. 2024*

### **Celestial Holography Summer School 2024**

*Participant*

*Perimeter Institute for Theoretical Physics*

*Jul. 2024*

### **International Symposium on Cosmology and Particle Astrophysics 2023 (CosPA 2023)**

*Participant*

*Department of Physics and Institute of Theoretical Physics, The Chinese University of Hong Kong (CUHK)*

*Nov. 2023*

### **Multimessenger Astronomy: Bridging Transients, Lensing, and Dark Matter (Cosmic Frontiers)**

*Participant*

*Department of Physics, CUHK*

*Nov. 2023*

## PROFESSIONAL ACTIVITIES

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### **LISA (Laser Interferometer Space Antenna) Consortium**

*Member*

**Laboratory for Space Research, The University of Hong Kong**

*Member*

### **Chinese Physical Society (CPS)**

*Student Member*

*Jan. 2026 – Present*

*Hong Kong SAR, China*

*Oct. 2023 – Nov. 2024*

*May 2021 – Apr. 2022*

## OUTREACH ACTIVITIES

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### **China Skywatcher Asteroid Search Campaign**

*Participant*

*Jan. 2025 – Feb. 2025*

*International Astronomical Search Collaboration (IASC)*