Qian Hu

Kelvin Building 233a – University of Glasgow, Glasgow, UK – G12 8QQ

🌐 http://marinerq.github.io   ✉ qian.hu@glasgow.ac.uk

EMPLOYMENT

University of Glasgow   **2024 - Present**
Postdoctoral Researcher

EDUCATION

University of Glasgow   **2021 - 2024**
PhD in gravitational-wave astronomy
Thesis: Towards high-precision gravitational wave astronomy: robust and efficient data analysis for ground-based detectors. (Link)
Advisor: Dr. John Veitch

University of Western Australia   **2019 - 2021**
Undergraduate Research Intern. Research topic: Gravitational wave source localization.
Advisor: Prof. Linqing Wen

University of Science and Technology of China (USTC)   **2017 - 2021**
B.S. (Honor) in astrophysics, GPA: 3.90/4.30.
Thesis: Rapid Sky Localization of Gravitational Waves from Compact Binary Coalescences
Advisors: Prof. Wen Zhao & Prof. Linqing Wen

REASEARCH INTERESTS

- **Gravitational-Wave (GW) Astrophysics**
  - Higher-order characteristics from compact binaries: precession, eccentricity, higher modes etc, and their astrophysical implications.
  - Tests of GR with GWs: methods and robustness.
  - Properties of compact objects: spins, equations of state, etc.
  - Data-driven GW waveform modelling: surrogate models and models with uncertainties.
- **GW Data Analysis Techniques**
  - Waveform systematics in parameter estimation and ways of mitigating it.
  - Difficult sources in the next-generation detectors: overlapping signals, long signals, etc.
  - Fast parameter estimation (including fast localization) of CBC sources.
  - Application of machine learning to GW data analysis: detection, parameter estimation, and follow-up sciences.

SELECTED PUBLICATIONS

Full publication list including collaboration papers can be found at: Inspire-HEP, Google Scholar.

- **Qian Hu**, John Veitch, Costs of Bayesian Parameter Estimation in Third-Generation Gravitational Wave Detectors: a Review of Acceleration Methods. Submitting to PRD. ET-0666A-24.
- **Qian Hu**, Jessica Irwin, Qi Sun, Chris Messenger, Lami Suleiman, Ik Siong Heng, John Veitch, Decoding long-duration GW from BNS with machine learning: Parameter estimation and equations of state. Submitting to PRL. LIGO-P2400567.

- **Qian Hu**, John Veitch, Rapid pre-merger localization of binary neutron stars in third generation gravitational wave detectors. ApJ Lett. 958 (2023) 2, L43.
- Qianyun Yun, Wen-Biao Han, **Qian Hu**, Haiguang Xu, Precessing Binary Black Holes as Better Dark Sirens. MNRAS Lett. 527 (1), L60-L65 (2023).
- **Qian Hu**, John Veitch, Accumulating errors in tests of general relativity with gravitational waves: overlapping signals and inaccurate waveforms. ApJ 945 (2023) 2, 103.
- **Qian Hu**, John Veitch, Assessing the model waveform accuracy of gravitational waves. PRD 106, 044042 (2022).
- **Qian Hu**, Cong Zhou, Jhao-Hong Peng, Linqing Wen, Qi Chu, Manoj Kovalam, Semianalytical Approach for Sky Localization of Gravitational Waves. PRD 104, 104008 (2021).
- **Qian Hu**, Mingzheng Li, Rui Niu, and Wen Zhao. Joint Observations of Space-based Gravitational-wave Detectors: Source Localization and Implication for Parity-violating Gravity. PRD 103, 064057 (2021).
- Wen Zhao, Tan Liu, Linqing Wen, Tao Zhu, Anzhong Wang, **Qian Hu**, and Cong Zhou. Model-independent test of the parity symmetry of gravity with gravitational waves, EPJC, 80(7), Jul 2020.

SELECTED TALKS & PRESENTATIONS

- (Forthcoming) Seminar at the University of Science and Technology of China. Dec 24 2024
- (Forthcoming) Seminar at the Kavli Institute for Astronomy and Astrophysics at Peking University. Dec 11 2024
- Decoding Long-duration Gravitational Waves from Binary Neutron Stars with Machine Learning: Parameter Estimation and Equations of State, ET 3rd annual meeting, Nov 2024, Warsaw, Poland.
- Realtime pre-merger localization of BNS in 3G GW detectors (poster), ET 3rd annual meeting, Nov 2024, Warsaw, Poland.
- Decoding Long-duration Gravitational Waves from Binary Neutron Stars with Machine Learning: Parameter Estimation and Equations of State (poster), 2024 September LVK Meeting, Sept 2024, Barcelona, Spain.
- Realtime pre-merger localization of BNS in 3G GW detectors (poster), GWNext, Mar 2024, Beijing.
- Realtime pre-merger localization of BNS in 3G GW detectors, National Astronomy Meeting 2023 (NAM23), July 2023, Cardiff, UK.
- Systematic error accumulation in testing GR: Overlapping signals and waveform systematics, XIII ET Symposium, May 2023, Cagliari, Italy.
- Assessing the model waveform accuracy of gravitational waves, invited talk for TianQin group at Sun Yat-Sen University (online), June 2022.
- On the model waveform accuracy of gravitational waves, BritGrav 2022 (online), Apr 2022.
- Quantitative measurement of model differences for CBCs, 2022 March LVK Collaboration Meeting (online), Mar 2022.

SOFTWARE DEVELOPMENT

- SealGW: A Python package for fast source localization. Implemented in the SPIIR online detection pipeline.
- WaveCheck: Waveform accuracy check pipeline for online parameter estimation runs, currently running for LVK O4.
- river: A Python package for gravitational wave source parameter estimation with normalizing flows.

TEACHING

Gravitational Wave Detection   **2024 @UofGlasgow**
Co-Lecturer

Astronomy 1   **2022-2024 @UofGlasgow**
Teaching assistant

Physics 1   **2021-2022 @UofGlasgow**
Teaching assistant

Physics experiment software development   **July 2020 - Dec 2020 @USTC**
National virtual experiment teaching project

Classical Mechanics & Electrodynamics   **2020 Fall @USTC**
Teaching assistant

OUTREACH

- Research Outreach Volunteer, WorldCon Glasgow, Aug 2024.
- Research Outreach Volunteer, Glasgow Science Festival, June 2024.

HONORS & AWARDS

- Poster prize (1st place), GWNext Beijing, 2024.
- Lord Kelvin / Charles Lindie Mitchell Bequest Postgraduate Scholarship, University of Glasgow, 2023
- Honorary Undergraduate, USTC, 2021
- National Scholarship, Ministry of Education of the PRC, 2020
- National Astronomical Observatory Scholarship, National Astronomical Observatories of China, 2020
- CGN Scholarship (Gold), USTC, 2019
- Outstanding Student Scholarship, USTC, 2018 & 2019

PROFESSIONAL SKILLS

- **Programming:** Python, C, Cython, Matlab, Mathematica.
- **High-performance computing:** Linux systems, HTCondor, Slurm.
- **Research-relevant software:** Bilby, PyCBC, LALSuite, PyTorch.