APRIL Q. CHENG

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Education

Princeton University — *Princeton, NJ*
PhD student in Astrophysics — *Sep 2025 -*

Massachusetts Institute of Technology — *Cambridge, MA*
B. S. in Physics, Minor in Mathematics • GPA: 4.9/5.0 — *Sep 2021 - May 2024*

Relevant Coursework

Physics General Relativity, Quantum Field Theory, Astrophysics I-II (grad), Cosmology (grad)
Mathematics Differential Equations, Linear Algebra, Group Theory, Real Analysis, Complex Analysis, Probability and Statistics, Advanced Algorithms

Honors

2024 **Winner,** MIT Barrett Prize
2024 **Inductee,** Sigma Pi Sigma Physics and Astronomy Honor Society
2024 **Recipient,** MIT Outstanding Undergraduate Research Student Award
2024 **Attendee,** 73rd Lindau Nobel Laureate Meeting
2018-20 **Silver (x2), gold (x1),** International Olympiad on Astronomy and Astrophysics

Grants & Fellowships

2025 **Hertz fellowship**
2024 **Fulbright fellowship**, Germany study/research
2024 **NSF Graduate Research Fellowship** *(declined)*
2024 Princeton University **President's fellowship** (<10% of admitted students)
2023 **Astronaut Scholarship**
2023 **LIGO Summer Undergraduate Research Fellowship**

Research

Interests: cosmology, gravitational wave astrophysics, compact stellar remnants, fast radio bursts, physics education

Optimizing the search for subpopulations with reversible-jump MCMC — *Princeton, NJ*
Princeton University • Advisor: Sylvia Biscoveanu — *Sep 2025 -*

- Introduce a novel method to search for subpopulations within the binary black hole population in LIGO data using RJMCMC
- Show that RJMCMC optimizes the model complexity while introducing minimal prior biases compared to canonical strongly modelled approaches

A unified approach to dark siren cosmology in harmonic space — *Potsdam, Germany*
Albert Einstein Institute • Advisor: Jonathan Gair — *Aug 2024 -*

- Derive a theoretical framework that unifies the canonical standard galaxy catalog and the cross-correlation methods of GW cosmology
- Formally analyze the error propagation of GW cross-correlations in harmonic space given its measurement process
- Perform the first rigorous, self-consistent cross-correlation of GWs with galaxies on synthetic catalogs with noise

Exploring biases in FRB cross-correlations with magnetohydrodynamical simulations — *Cambridge, MA*
MIT Kavli Institute • Advisors: Kiyo Masui, Shion Elizabeth Andrew, Haochen Wang — *Aug 2023 - May 2025*

- Develop an end-to-end computational framework to ray trace through magnetohydrodynamical simulations
- Using this framework, investigate selection effects and non-Gaussianities in the FRB DM–galaxy cross-correlation power spectrum

Using Mass-Spin Correlations to Probe the Tidal Spin-up of Binary Black Holes — *Pasadena, CA*
Caltech LIGO SURF • Advisors: Alan Weinstein, Jacob Golomb — *Jun 2023 - Aug 2023*

- Fit the mass-spin correlations of the binary black-hole population with an astrophysically-motivated heuristic model
- Project the feasibility of detecting such a correlation with future detectors, including 3rd-generation detectors

Systematic Analysis of Astrophysical Models in Gravitational-wave Population Analyses *Cambridge, MA*

MIT LIGO • Advisor: Salvatore Vitale *Sep 2022 - Jul 2023*

- With hierarchical Bayesian inference, infer the branching fractions between binary black-hole formation channels using gravitational-wave data
- Make future projections and investigate systematic biases of the inference using simulated data

Ray Tracing Axion-Photon Conversion in Neutron Star Magnetospheres *Cambridge, MA*

MIT Center for Theoretical Physics • Advisors: Tracy Slatyer, Joshua Foster *Feb 2022 - Aug 2022*

- Develop an end-to-end ray tracing code of the conversion of QCD axions into photons in a neutron star magnetosphere

Understanding the Spread of Dark Matter in the Illustris TNG-100 Simulation *Cambridge, MA*

MIT Kavli Institute • Advisors: Mark Vogelsberger, Josh Borrow *Sep 2021 - Dec 2021*

- Investigate the anomalously large spread of dark matter particles in the TNG-100 simulation, tracing their trajectories through hash tables

Variability of Exoplanet Hosts as a Probe of Spin-disk Alignment *Remote*

MIT Disruptive Planets • Advisors: Julien de Wit, Ben Rackham *May 2020 - Sep 2020*

- Analyzed 10,000+ TESS lightcurves to investigate planetary spin-disk alignment and stellar variability; helped operate the SPECULOOS-N telescope

Publications

2. **April Qiu Cheng**, Shion Elizabeth Andrew, Haochen Wang, and Kiyoshi Masui
   Exploring selection biases in FRB dispersion-galaxy cross-correlations with magnetohydrodynamical simulations
   arXiv:2506.03258
1. **April Qiu Cheng**, Michael Zevin, and Salvatore Vitale
   What You Don't Know Can Hurt You: Use and Abuse of Astrophysical Models in Gravitational-wave Population Analyses
   ApJ 955.2, 127 (Oct. 2023) arXiv:2307.03129 DOI:10.3847/1538-4357/ACED98

Presentations

Jul 2025	**Research talk,** GR Amaldi	*Glasgow, United Kingdom*
Aug 2023	**Research talk,** LIGO SURF final presentation	*Pasadena, CA*
Jun 2023	**Research talk,** LIGO Rates and Populations call	
Apr 2023	**Research talk,** APS April meeting	*Minneapolis, MN*
Aug 2018	**Research poster,** San Diego Supercomputer Center internship final presentation	*San Diego, CA*

Community Service and Outreach

National Science Olympiad A-Team member (2020-) *Online*

- Write and proctor Astronomy exams for various regional to national-level high school Science Olympiad tournaments (2020-)
- Helped write an astronomy textbook for high schoolers, contributing a chapter on celestial coordinates

MIT Physics Mentorship program (2023-24) *Cambridge, MA*

- Mentored undergraduate students in special relativity and quantum physics

MIT Physics Values Committee (2023-24) *Cambridge, MA*

- Discuss administrative changes and propose recommendations to the department to promote diversity, inclusion, and community well-being

MIT Undergraduate Women in Physics (2021-23) *Cambridge, MA*

Vice President of Advocacy, Publicity Chair

- Manage the UWiP website, communicate with the Physics Values Committee, and help organize social and mentorship events

MIT Educational Studies Program *Cambridge, MA*

- Taught a high school class on astronomy for Splash 2021, and relativity for Splash 2022

Skills and Interests

Computational	Python (numpy, pandas, scipy, cupy, astropy, healpy, matplotlib, Jupyter), C/C++, Linux, bash, LaTeX, Mathematica
Cluster Allocations	SDSC (2018-21), MIT Supercloud (2021), Caltech LDAS (2022-), subMIT (2023-), hypatia (CPU) and saraswati (GPU) (2024-)
Research interests	Cosmology, gravitational wave astrophysics, compact stellar remnants, fast radio bursts, physics education