APRIL Q. CHENG

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Education

Princeton University — *Princeton, NJ*

Ph. D. 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 Physics I-III, 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 — *Lindau, Germany*

2018-20 **Silver (x2), gold (x1),** International Olympiad on Astronomy and Astrophysics

Grants & Fellowships

2025 **Hertz fellowship**

2024 **Fulbright fellowship**, Germany study/research — *Potsdam, Germany*

2024 **NSF Graduate Research Fellowship** *(declined)*

2024 **President's fellowship**, Princeton (<10% of admitted students)

2023 **Astronaut Scholarship** — *Orlando, FL*

2023 **LIGO Summer Undergraduate Research Fellowship** — *Pasadena, CA*

Research

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

A Unified Approach to Dark Siren Cosmology in Harmonic Space

Potsdam, Germany

Albert Einstein Institute • Advisor: Jonathan Gair — *Aug 2024 -*

- Develop a formalism that clarifies the relationship between the tomographic cross-correlation method and standard galaxy catalog method
- 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 selection biases in FRB dispersion-galaxy 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 and compute cross-correlations with an optimal quadratic estimator
- 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

Hypohalous Acids in Water with Machine Learning and Density Functional Methods *San Diego, CA*

UC San Diego, San Diego Supercomputer Center • Advisor: Andreas Goetz *Jun 2018 - Aug 2018, Jun 2020 - Sep 2021*

- Developed polynomial many-body potentials for hypohalous acids (HOX) using machine learning and analyzed the performance of the model
- Produced optimized HOX clusters in order to benchmark the performance of various Density Functional Theory methods

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

MIT Physics Mentorship program *Cambridge, MA*

- Mentor undergraduate students in relativity (Fall 2022) and quantum physics (Spring 2023, Fall 2023)

MIT Physics Values Committee *Cambridge, MA*

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

MIT Undergraduate Women in Physics (UWiP) *Cambridge, MA*

Vice President of Advocacy, Publicity Chair *Feb 2021 - May 2023*

- 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

National Science Olympiad A-Team member *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

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