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

2025 **Finalist,** Hertz fellowship
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

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*
2023 **DGRAV Travel Grant** for APS April — *Minneapolis, MN*

Research

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

Understanding FRB DM-galaxy Cross Correlations with Cosmological Simulations — *Cambridge, MA*

MIT KAVLI INSTITUTE • ADVISORS: KIYO MASUI, SHION ELIZABETH ANDREW, HAOCHEN WANG — *Aug 2023 -*

- Develop a computational framework to ray trace through the Illustris-TNG simulation
- Implement an optimal quadratic estimator to compute and simulate cross-correlations of fast radio bursts with foreground galaxies
- Investigate selection effects and non-Gaussianities in the 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

Observing Qatar 1-b with Archival MicroObservatory Data *Remote*

Exoplanet Research Workshop *Apr 2020 - Dec 2020*

- Contributed transit light curves to AAVSO from archival MicroObservatory data; developed a pipeline for citizen astronomy work

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. (In preparation) **April Qiu Cheng**, Shion Elizabeth Andrew, Haochen Wang, and Kiyoshi Masui
   Signals under the kitchen sink: exploring realistic FRB cross-correlations in Illustris-TNG
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

Aug 2023	**Research talk,** LIGO SURF final presentation	*Pasadena, CA*
Jun 2023	**Research talk,** LIGO Rates and Populations call	*Remote*
Apr 2023	**Research talk,** APS April meeting	*Minneapolis, MN*
Jan 2023	**Presentation on gravitational radiation,** MIT Physics Directed Reading Program	*Cambridge, MA*
Nov 2022	**Presentation on fast radio bursts,** Astrophysics II graduate course	*Cambridge, MA*
Jan 2022	**Presentation on the CMB power spectrum,** MIT Physics Directed Reading Program	*Cambridge, MA*
Aug 2018	**Research poster,** San Diego Supercomputer Center research intern 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 compute clusters (various, 2018-2021), MIT Supercloud (2021), Caltech LIGO Cluster (2022-23), subMIT (2023-)
Research interests	Cosmology, gravitational wave astrophysics, compact stellar remnants, fast radio bursts, physics education