


Mathew W. Bub

 [mwbub.github.io](https://github.com/mwbub)

1200 E. California Blvd.
Mail Code 452-48
Pasadena, CA 91125
United States

 mbub@caltech.edu
 +1 626-995-7996
 github.com/mwbub
 orcid.org/0000-0003-4251-0845
 linkedin.com/in/mathew-bub

Education

2022–Present	California Institute of Technology PhD, Physics
2021–2022	Perimeter Institute / University of Waterloo MSc, Physics
2017–2021	University of Toronto Honours BSc, Mathematics and Physics

Research Experience

2021–2022	Perimeter Institute for Theoretical Physics Supervised by Prof. Asimina Arvanitaki Studied black hole superradiance in binary systems, investigating whether the gravitational wave signatures of such systems might be used to discover ultralight bosons such as the QCD axion.
2020	University of Toronto, Department of Physics Supervised by Prof. Erich Poppitz Studied confinement in supersymmetric Yang-Mills theory compactified to $\mathbb{R}^3 \times \mathbb{S}^1$, performing a numerical study of confining strings and their string tensions.
2019	Canadian Institute for Theoretical Astrophysics Supervised by Prof. Cristobal Petrovich Investigated whether dynamical processes in the Galactic centre might enhance the rate of compact-object binary mergers of the type detected by the LIGO/Virgo gravitational wave detectors.

2018–2019	<p>University of Toronto, Department of Astronomy & Astrophysics Supervised by Prof. Jo Bovy</p> <p>Developed computational tools to simulate the orbits of large numbers of stars under the influence of the Galaxy’s spiral arms, galactic bar, and other non-axisymmetric perturbers.</p>
2018	<p>University of Toronto, Department of Astronomy & Astrophysics Supervised by Prof. Jo Bovy</p> <p>Studied galactic dynamics using data from the European Space Agency’s <i>Gaia</i> mission and statistical techniques from machine learning.</p>

Publications

- [1] **Mathew W. Bub**, Yanbei Chen, Yufeng Du, Dongjun Li, Yiwen Zhang, and Kathryn M. Zurek, *Quantum gravity background in next-generation gravitational wave detectors*, *Phys. Rev. D* **108** (2023) 064038 [[arXiv:2305.11224](#)].
- [2] **Mathew W. Bub**, Erich Poppitz, and Samuel S. Y. Wong, *Confinement on $\mathbb{R}^3 \times \mathbb{S}^1$ and double-string collapse*, *JHEP* **01** (2021) 044 [[arXiv:2010.04330](#)].
- [3] **Mathew W. Bub** and Cristobal Petrovich, *Compact-Object Mergers in the Galactic Center: Evolution in Triaxial Clusters*, *Astrophys. J.* **894** (2020) 15 [[arXiv:1910.02079](#)].
- [4] Jason A. S. Hunt, **Mathew W. Bub**, Jo Bovy, J. Ted Mackereth, Wilma H. Trick, and Daisuke Kawata, *Signatures of resonance and phase mixing in the Galactic disc*, *Mon. Not. R. Astron. Soc.* **490** (2019) 1026 [[arXiv:1904.10968](#)].

Presentations and Posters

Nov 2020	<p>Confinement and double-string collapse Theoretical High Energy Physics Seminar, University of Toronto [Recording]</p>
Aug 2019	<p>Compact-Object Mergers in the Galactic Centre (Poster) CITA Summer Undergraduate Research Program</p> <p><i>Awarded prize for the top three student posters.</i></p>
Jul 2019	<p>Secular Evolution of Binaries in the Galactic Centre CITA Summer Undergraduate Research Program</p>
Mar 2019	<p>Galactic Dynamics with <i>Gaia</i> (Poster) University of Toronto Undergraduate Research Forum</p>

Outreach

2017	Science Camp Counsellor The STEAM Project Richmond Hill, ON, Canada
	Delivered fun, educational activities to children and youth relating to science, technology, engineering, art, and mathematics.
2015–2016	Tour Guide at the David Dunlap Observatory Royal Astronomical Society of Canada Richmond Hill, ON, Canada
	Hosted guests during public event nights at the David Dunlap Observatory, assisting with tours, operating telescopes, and answering questions about the observatory or amateur astronomy.

Technical Skills

Programming	<ul style="list-style-type: none">• Python• C	<ul style="list-style-type: none">• Mathematica• SQL	<ul style="list-style-type: none">• High-Performance Computing• L^AT_EX
Operating Systems	<ul style="list-style-type: none">• Linux/Unix	<ul style="list-style-type: none">• Windows	

Honours and Awards

2021	Loudon-Hines Gold Medal and Scholarship in Physics University of Toronto [Link]
	Presented annually to a top graduating student in the Specialist or Major program in Physics who also demonstrates creativity and clear promise in the discipline of physics.
2021	Prince Philip Silver Medal Victoria College, University of Toronto [Link]
	Awarded to the student graduating with the second highest overall A standing among candidates for the Bachelor of Science degree.
2019, 2020	Class of 3T0 and Associates Scholarship in Mathematics and Physics University of Toronto
	Awarded to one or more students enrolled in the Specialist program in Mathematics and Physics or the Specialist program in Physics based on performance in second or third year.

- 2020 | **University of Toronto Excellence Award**
University of Toronto
- Awarded to undergraduate students for the purpose of conducting a summer research project under the supervision of a faculty member.
- 2019 | **NSERC Undergraduate Student Research Award**
Natural Sciences and Engineering Research Council of Canada
- Research grant awarded to candidates on the basis of their academic record and research aptitudes.