

JAEDEN BARDATI

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SUMMARY

I am a Caltech Ph.D. student and NSERC Graduate Fellow using magnetohydrodynamics and radiative transfer super-zoom-in simulations to make observational predictions of supermassive black holes (SMBHs) and their galactic environments. This ranges from SMBH binary signatures, to active galactic nuclei structure and feedback evolution, to little red dots.

EDUCATION

California Institute of Technology

Sept 2023 – present

Ph.D. Physics

Advisor: Philip F. Hopkins

Coursework: General Relativity I & II, Quantum Field Theory I-III, Computational Astrophysics, Astroinformatics, Mathematical Methods of Physics, Applications of Physics, Radiative Processes, Principles of University Teaching
Certificate of Interest in University Teaching

Bishop's University

Sept 2020 – June 2023

B.Sc. Physics Honours (with distinction)

Thesis: “Signatures of Massive Black Hole Mergers in Their Host Galaxy Morphologies”

Advisor: John J. Ruan

Minor in Mathematics

TECHNICAL SKILLS

Python	10+ years experience (numpy, matplotlib, scipy, pandas, scikit-learn, pytorch, tensorflow, etc.)
HPC	Used several million CPU-hours on Compute Canada Cedar and TACC Frontera
FD/RT Codes	SKIRT, GIZMO, Powderday (Hyperion + FSPS), Dedalus
Astro Tools	astropy, photutils, pynbody, tangos, yt, vorbin, statmorph, ppXF, Kinemetry
Other	C/C++ (including OpenMP, Kokkos), Java, Assembly, Bash, HTML/CSS, Javascript, LaTeX, git

AWARDS & SCHOLARSHIPS (LAST 5 YEARS)

2025-2028	Canada Graduate Scholarship (CGS-D) , Natural Sciences and Engineering Research Council of Canada (NSERC)
2024	Walter Burke Institute of Theoretical Physics Graduate Fellowship
2024	Caltech Y Hummel-Gray Award
2023	Joshua and Beth Friedman Foundation Fund Scholarship
2023	Perimeter Scholars International Scholarship (declined)
2023	The Bishop's University Prize in Physics and Astronomy (highest achievement)
2023	The David Savage Prize in Physics and Mathematics (highest achievement)
2022-2023	American Biltrite (Canada) Ltd Scholarship (merit scholarship)
2022-2023	Florence May Foreman Scholarship (merit scholarship)
2022	The Bishop's University Undergraduate Prize in Physics and Astronomy (highest achievement)
2021-2023	<i>3x awarded</i> Undergraduate Student Research Award (USRA), NSERC
2021-2023	<i>3x awarded</i> FRQNT Supplément au bourse de 1er cycle du CRSNG
2021-2022	Bourse d'Éxcclence Hydro-Québec (merit scholarship)
2021-2023	Bishop's University Academic Honour Roll (every year)
2021	The Bishop's University Faculty Prize in Physics
2020-2021	H. Greville Smith Memorial Scholarship (merit scholarship)
2020	Champlain College Highest Achievement in Physics
2020	Champlain College Academic Excellence Award

TEACHING EXPERIENCE

Teaching Assistant

Caltech Ph 2c: <i>Waves, Quantum Mechanics, and Statistical Physics</i> , Head TA	Spring 2025
Caltech Ph 21: <i>Computational Physics II</i> , Teaching Assistant	Winter 2025
Caltech Ph 20: <i>Computational Physics I</i> , Teaching Assistant	Fall 2024
Caltech Ph 1c: <i>Classical Mechanics & Electromagnetism (analytic & practical)</i> , Head TA	Spring 2024
Caltech Ph 1b: <i>Classical Mechanics & Electromagnetism (analytic track)</i> , Teaching Assistant	Winter 2024
Bishop's Mat 82: <i>Enriched Calculus Laboratory II</i> , Teaching Assistant	Winter 2023
Bishop's Phy 113: <i>Introduction to Astronomy</i> , Marker	Fall 2022
Bishop's Phy 101: <i>Statistical Methods in Experimental Science</i> , Marker	Fall 2022
Bishop's Mat 81: <i>Enriched Calculus Laboratory I (2 groups)</i> , Teaching Assistant	Fall 2022

Research Mentoring

<i>Jasper Thorne-Lyman</i> (University of Maryland Undergrad), co-mentored with Saul Teukolsky	Summer 2025
<i>Anabelle Eisner</i> (Caltech Undergrad), FSRI program	Summer 2025
<i>Frank Gomez-Montalvo</i> (Caltech Undergrad), FSRI program	Summer 2025
<i>Isabella Torres</i> (Caltech Undergrad), FSRI program	Summer 2025
<i>Angel Guerra</i> (Caltech Undergrad), FSRI program	Summer 2025

Academic Mentoring

<i>Shai Toledano</i> (University of Michigan Undergrad), CAPP Program	2024 – 2025
<i>Varun Pritmani</i> (Hunter College Undergrad), CAPP Program	2024 – 2025
<i>Lihang Zhou</i> (Caltech Grad), PMA Mentorship Program	2024 – 2025
<i>Max Kogan</i> (UCSC Undergrad), AAS DDA Mentorship	2024 – 2025
<i>Adrian Lam</i> (UCSC Undergrad), AAS DDA Mentorship	2023 – 2024

Tutoring

Caltech Y-Tutor , Pasadena Community College students, online	2023 – present
Caltech Rise , John Muir High School Early College Magnet students, in-person	2023 – 2025
Math Help Center , Bishop's University students, in-person	2022 – 2023
Nimbus Learning Platform , Bishop's University students, online & in-person	2020 – 2023
R.D.W. Howson Enrichment Centre , Bishop's College School students, online & in-person	2020 – 2021
Math and Physics Workshop , Champlain College students, online & in-person	2019 – 2020

PUBLICATIONS

Refereed or Submitted for Review

- [1] **Bardati, J.**, Hopkins, P. F. & Richards, G. T. (2025). Early Stages of Dusty Tori: The First Infrared Spectra from a Highly Multiscale Quasar Simulation. *Submitted to ApJ*. [arXiv:2509.09770](#)
- [2] Horlavage, P., Ruan, J. J., Eracleous, M., **Bardati, J.**, Runnoe, J. C., Haggard, D. (2025). Predicting Potential Host Galaxies of Supermassive Black Hole Binaries Based on Stellar Kinematics in Archival IFU Surveys. *Submitted to ApJ*. [arXiv:2504.21145](#)
- [3] Hopkins, P. F., Su K., Murray N., Steinwandel, U. P., Kaaz N., Ponnada S. B., **Bardati, J.**, et al. 2025. Zooming In On The Multi-Phase Structure of Magnetically-Dominated Quasar Disks: Radiation From Torus to ISCO Across Accretion Rates. *The Open Journal of Astrophysics* 8 (April). [doi:10.33232/001c.137296](#)
- [4] **Bardati, J.**, Ruan, J. J., Haggard, D., Tremmel, M., & Horlavage, P. (2024). Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations II: Unique Stellar Kinematics in Integral Field Unit Spectroscopy. *The Astrophysical Journal*, 977(2), 265. [doi:10.3847/1538-4357/ad9471](#)

- [5] **Bardati, J.**, Ruan, J. J., Haggard, D., & Tremmel, M. (2024). Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations I: Unique Galaxy Morphologies in Imaging. *The Astrophysical Journal*, 961(1), 34. doi:10.3847/1538-4357/ad055a

Non-Refereed

- [6] Ruan, J., **Bardati, J.**, Haggard, D., & Tremmel, M. (2024). Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations: Unique Stellar Kinematics in Spatially-Resolved Spectroscopy. *American Astronomical Society Meeting Abstracts*, 56(2), Article 456.11
- [7] **Bardati, J.**, Ruan, J. J., Haggard, D., & Tremmel, M. (2023). Host Galaxy Morphological Signatures of Massive Black Hole Mergers. *American Astronomical Society Meeting Abstracts*, 55(2), Article 268.17

ACADEMIC SERVICE

Caltech Future Faculty and Mentors (CFAM) Co-Director	2025 – present
Oversees two graduate student certificate programs, plans and leads workshops, seminars and discussion groups on effective teaching for TAs and postdocs, and trains first-year graduate students every year in university teaching.	
PMA Department TA Training Conference Lead & Facilitator , Caltech	2024
Category Award Judge , California Science & Engineering Fair	2024
ISEF Selection Judge , Orange County Science & Engineering Fair	2024
Co-founder and Co-lead , Bishop's University Astronomy, Mathematics and Physics Society (AMPS)	2021-2023
Peer Note-Taker , Bishop's University Student Accessibility & Accommodation Services	2021-2022
New Student Orientation Ambassador , Champlain College	2019-2020

PRESENTATIONS

[1] Conference talk , Massive Black Holes in First Billion Years, Kinsale, Co. Cork, Ireland.	2024
[2] Invited seminar talk , LISA Multi-Messenger Astronomy Working Group telecon.	2023
[3] Seminar talk : <i>Signatures of MBHs in their Host Galaxy Morphologies</i> , Bishop's University.	2023
[4] Seminar talk : <i>Multi-Messenger Prospects of MBH Mergers</i> , Bishop's University.	2023
[5] Seminar talk : <i>How Do We Find Supermassive Black Hole Mergers?</i> , 3-min thesis, Bishop's University.	2023
[6] Poster , American Astronomical Society Meeting 241, Seattle, WA.	2023
[7] Conference talk : <i>Host Galaxy Morphological Signatures of MBH Mergers</i> , LISA Canada Workshop.	2022
[8] Seminar Talk , Bishop's University Department of Physics & Astronomy Lunch Talk.	2022

OTHER TRAINING & WORKSHOPS

PSI Students' Training Accelerator for Research in Theory (PSI START) <i>Perimeter Institute</i>	Summer 2022
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- Selective ten-week online school consisting of 4 courses in quantum information, path integral quantum mechanics, numerical methods, and symmetry mathematics, including a small project in general relativity.
- One of ten worldwide to be offered a summer research internship (declined).

DAWN Winter School <i>Cosmic Dawn Center</i>	Feb. 2022
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- One-week school aiming to address practical knowledge in astrophysics for graduate students, from both observational and theoretical perspectives.
- One of ten worldwide to be offered a summer research internship (declined).

MEDIA COVERAGE

- 2025 Canadian News Corporation (CBC): *U.S. science funding uncertainty reshapes grad school choices for Canadians*
- 2024 BU Research Spotlights: *Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations*
- 2023 Sherbrooke Record: *Bishop's grad accepted to PhD physics program at Caltech*
- 2023 BU Research Spotlights: *Jaeden Bardati, Bishop Graduate 2023: Accepted in the PhD Physics Program at Caltech*
- 2023 Bishop's University Blog: *Training the Physicists of Tomorrow*
- 2023 Centre de Recherche en Astrophysique du Québec Calendar: *Mergers of galaxies hosting supermassive black holes*
- 2022 BU Research Spotlights: *Undergraduate Student Accepted in Prestigious International Summer Training Program*
- 2021 Sherbrooke Record: *This is going to be a big thing*