

JAEDEN BARDATI

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SUMMARY

I am a Caltech Ph.D. candidate and NSERC Graduate Fellow studying how supermassive black holes grow, evolve, and shape their environments from accretion disk to galactic scales. My work often involves semi-analytic modeling, radiative transfer and magnetohydrodynamics simulations, and data analysis including statistical and machine learning techniques.

EDUCATION

California Institute of Technology – CA, United States

Ph.D. Physics

Expected June 2028

Thesis: *A Multiscale View of Active Galactic Nuclei: Predictions from Bridging Scale Simulations*

Advisor: Philip F. Hopkins

M.S. Physics completed en route.

June 2026

Coursework includes GR I & II, QFT I-III, multiple computational physics and ML courses, etc.

Bishop's University – QC, Canada

B.Sc. Honours Physics with Distinction (Minor in Mathematics, 4.0 GPA)

June 2023

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

Advisor: John J. Ruan

TECHNICAL SKILLS

Python	10+ years experience (numpy, matplotlib, scipy, pandas, scikit-learn, pytorch, tensorflow, etc.)
HPC	Used 10+ million CPU-hours on Compute Canada Cedar and TACC Frontera
MHD & RT Codes	GIZMO, SKIRT, 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/JS, LaTeX, Git

AWARDS & SCHOLARSHIPS

2025-2028	Canada Graduate Scholarship (CGS-D) , Natural Sciences and Engineering Research Council of Canada (NSERC)
2024-2025	Walter Burke Institute of Theoretical Physics Graduate Fellowship
2025	Certificate of Interest in University Teaching
2024	Caltech Y Hummel-Gray Award
2023-2024	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'Écellence 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

PUBLICATIONS

First-Author

- [1] **Bardati, J.**, Hopkins, P. F. (2026). Zooming in to a Little Red Dot Candidate. *In prep.*
- [2] **Bardati, J.**, Hopkins, P. F., Kammoun E. (2026). The Nature of a Broad Line Region Generated from a Multiscale Quasar Simulation. *In prep.*
- [3] **Bardati, J.**, Hopkins, P. F. & Faucher-Giguère, C.-A. (2026). A Hot DOG Forged in FIRE: Nuclear and Starburst Spectral Decomposition of a Luminous Infrared Galaxy Simulation with a Resolved Dust Torus. *The Astrophysical Journal*, 1007(1), 28. doi:[10.3847/1538-4357/ae8841](https://doi.org/10.3847/1538-4357/ae8841)
- [4] **Bardati, J.**, Hopkins, P. F. & Richards, G. T. (2026). Early Stages of Dusty Tori: The First Infrared Spectra from a Highly Multiscale Quasar Simulation. *The Astrophysical Journal*, 997(1), 10. doi:[10.3847/1538-4357/ae29af](https://doi.org/10.3847/1538-4357/ae29af)
- [5] **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](https://doi.org/10.3847/1538-4357/ad9471)
- [6] **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](https://doi.org/10.3847/1538-4357/ad055a)

Major Co-Author

*Student-led paper under my direct supervision in a project of my design. In all other papers found in this section, I contributed significantly to the project design, data collection, and/or interpretation of results.

- [7] *Moradi, D., **Bardati, J.**, Hopkins, P. (2026). Comparing Phenomenological Spectra to a Self-Consistently Simulated Dust Torus. *In prep.*
- [8] Surprenant-Coache, A.-A., Ruan, J. J., **Bardati, J.**, Haggard, D., & Tremmel, M. (2026). Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations: Unique Stellar Formation Histories. *In prep.*
- [9] Horlavage, P., Ruan, J. J., Eracleous, M., **Bardati, J.**, Runnoe, J. C., Haggard, D. (2026). Predicting Potential Host Galaxies of Supermassive Black Hole Binaries Based on Stellar Kinematics in Archival IFU Surveys. *The Astrophysical Journal*, 1003(2), 229. doi:[10.3847/1538-4357/ae6662](https://doi.org/10.3847/1538-4357/ae6662)

Other Co-Author

- [10] Hopkins, P. F., et al., including **Bardati, J.** (2026). Zooming Out From Magnetically-Dominated Quasar Disks: Radiation and Outflows from ISCO to Parsec Scales. *In prep.*
- [11] Hopkins, P. F., et al., including **Bardati, J.** (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. doi:[10.33232/001c.137296](https://doi.org/10.33232/001c.137296)

PRESENTATIONS

Invited

- [1] **Introduction talk**, Obscured Quasars Workshop, IA FORTH, University of Crete, Greece. Sep 2026
Insights into the Growth and Feedback of Supermassive Black Holes from AGN Simulations
- [2] **Workshop talk**, Obscured Quasars Workshop, IA FORTH, University of Crete, Greece. Sep 2026
Observational Predictions of Quasar Components from Multi-Scale Quasar Simulations
- [3] **Seminar**, Diego Portales University, Santiago, Chile (virtual). Apr 2026
Simulation of a Hot Dust Obscured Galaxy with a Resolved Dust Torus

- [4] **Seminar**, Mathematics Teaching Seminar, Caltech. Nov 2025
Beyond the Lecture Room: How to Guide Student Learning and Give Effective Feedback
- [5] **Seminar**, LISA Multi-Messenger Astronomy Working Group telecon. Jun 2023
Host Galaxy Morphological Indicators of MBH Mergers

Contributed

- [6] **Conference talk**, Supermassive Black Holes and Blue Notes, Montreal, QC, Canada. Jul 2026
Spectral Predictions from a Super- Eddington Quasar Simulation Zoomed in to Innermost Stable Orbit
- [7] **Conference talk**, Breaking the limits 2026, Sardinia, Italy. Jun 2026
Tracing the Spectral Properties of a Super-Eddington Quasar from Galactic to ISCO Scales
- [8] **Poster**, American Astronomical Society Meeting 248, Pasadena, CA. Jun 2026
Predictions from a Super-Eddington Quasar Simulation Spanning Extragalactic to Sub-pc Scales
- [9] **Workshop talk**, Bridging Scales in Black Hole Feedback, Harvard CfA, Cambridge, MA. May 2026
Observational Predictions of AGN Structure in Multi-Scale Quasar Simulations
- [10] **Conference talk**, American Physical Society Global Physics Summit, Denver, CO. Mar 2026
Observational Predictions from a Cosmological Simulation of a Quasar Starburst Galaxy Zoomed to the Supermassive Black Hole's Innermost Stable Orbit
- [11] **Conference talk**, Massive Black Holes in First Billion Years, Kinsale, Co. Cork, Ireland. Apr 2024
Signatures of Massive Black Hole Merger Host Galaxies in Morphology and Stellar Kinematics
- [12] **Seminar**: Bishop's University, Sherbrooke, QC, Canada. Apr 2023
Signatures of MBHs in their Host Galaxy Morphologies
- [13] **Seminar**: Bishop's University, Sherbrooke, QC, Canada. Mar 2023
Multi-Messenger Prospects of Massive Black Hole Mergers
- [14] **3 minute thesis**, Bishop's University, Sherbrooke, QC, Canada. Jan 2023
How Do We Find Supermassive Black Hole Mergers?
- [15] **Poster**, American Astronomical Society Meeting 241, Seattle, WA, USA. Jan 2023
Host Galaxy Morphological Signatures of Massive Black Hole Mergers
- [16] **Conference talk**: LISA Canada Workshop 2022 (virtual). Aug 2022
Host Galaxy Morphological Signatures of MBH Mergers
- [17] **Seminar**, Bishop's University Department of Physics & Astronomy Lunch Meeting. Jul 2022

TEACHING EXPERIENCE

Teaching Assistant

Caltech Ph 12b : Waves, Quantum Physics, and Statistical Mechanics, Teaching Assistant	Winter 2026
Caltech Ph 2c : Waves, Quantum Mechanics, and Statistical Physics, Head TA	Spring 2025
Caltech Ph 21 : Computational Physics II, Teaching Assistant	Winter 2025
Caltech Ph 20 : Computational Physics I, Teaching Assistant	Fall 2024
Caltech Ph 1c : Classical Mechanics & Electromagnetism (analytic & practical), Head TA	Spring 2024
Caltech Ph 1b : Classical Mechanics & Electromagnetism (analytic track), Teaching Assistant	Winter 2024
Bishop's University Mat 82 : Enriched Calculus Laboratory II, Teaching Assistant	Winter 2023
Bishop's University Phy 113 : Introduction to Astronomy, Marker	Fall 2022
Bishop's University Phy 101 : Statistical Methods in Experimental Science, Marker	Fall 2022
Bishop's University Mat 81 : Enriched Calculus Laboratory I (2 groups), Teaching Assistant	Fall 2022

Research Mentoring

<i>Siyuan Zhou</i> (Caltech), FSRI program	<i>Summer 2026</i>
<i>Sebastian Cornejo</i> (Caltech), FSRI program	<i>Summer 2026</i>
<i>Dana Moradi</i> (Santa Monica College), Caltech Connection	<i>2025 – 2026</i>
<i>Shaun Chen</i> (Pasadena Community College), Caltech Connection	<i>2025 – 2026</i>
<i>Anabelle Eisner</i> (Caltech Undergrad), FSRI program	<i>Summer 2025</i>
<i>Frank Gomez-Montalvo</i> (Caltech Undergrad), FSRI program	<i>Summer 2025</i>
<i>Isabella Torres</i> (Caltech Undergrad), FSRI program	<i>Summer 2025</i>
<i>Angel Guerra</i> (Caltech Undergrad), FSRI program	<i>Summer 2025</i>
<i>Jasper Thorne-Lyman</i> (University of Maryland Undergrad), co-mentored with Saul Teukolsky	<i>Summer 2025</i>

Academic Mentoring

Served as a recurrent advisor for 8 students through various formal weekly/monthly academic mentoring programs.

Undergraduate students: *Jonathan Sar-Shalom* (University of Central Florida), *Christian Captain* (Clemson University), *Shai Toledano* (University of Michigan), *Varun Pritmani* (Hunter College), *Max Kogan* (UCSC), *Adrian Lam* (UCLA).

Graduate students: *Tryston Raecke* (Caltech), *Lihang Zhou* (Caltech).

Tutoring

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

ACADEMIC SERVICE & OUTREACH

Caltech Project for Effective Teaching (CPET) Co-Director	<i>2025 – present</i>
Oversees graduate student certificate programs in university teaching, organizes and leads workshops, seminars and discussion groups on effective teaching for TAs and postdocs, and is responsible for training all new graduate students as teaching assistants. Spearheaded a rebranding campaign including renaming the organization to Caltech Future Faculty and Mentors (CFAM).	
Caltech PMA Graduate Student Advisory Board Representative	<i>2025 – present</i>
Member of an advisory board to the Division of Physics, Astronomy and Physics (PMA) at Caltech and helps organize and lead future and ongoing PMA graduate student programming.	
Caltech Astro Outreach Volunteer	<i>2025 – present</i>
Recurring volunteer for many Caltech Astro Outreach public events including Stargazing lectures, Pasadena Astro on Tap, and Pasadena City of Astronomy Science Festivals.	
Scientific Journal Peer Reviewer , Astronomy & Astrophysics	<i>2026 – present</i>
GIZMO Code Contributor	<i>2025 – present</i>
Physics, Mathematics & Astronomy (PMA) Department Mentor , Caltech	<i>2024 – 2026</i>
Caltech Connection Mentor	<i>2025 – 2026</i>
Caltech Accountability Partners Program (CAPP) Advisor	<i>2024 – 2026</i>
Caltech Mentoring Conference Planning Committee & Facilitator	<i>2026</i>
Adopt-a-Physicist Outreach Program Volunteer , Sigma Pi Sigma	<i>2026</i>
Prospective Graduate Student Visit Volunteer , Caltech PMA Department	<i>2026</i>
Seminar Day Poster Judge , Caltech	<i>2025</i>
First-Year Success Research Institute (FSRI) Mentor , Caltech	<i>2025</i>
TA Conference Facilitator , Caltech PMA Department	<i>2024 & 2025</i>
Division of Dynamical Astronomy (DDA) Mentor , American Astronomical Society (AAS)	<i>2023 – 2025</i>
Physics & Astronomy (Senior) Category Award Judge , California Science & Engineering Fair	<i>2024</i>
International Science & Engineering Fair (ISEF) Selection Judge , Orange County Science Fair	<i>2024</i>

Co-Founder and Co-Lead , Bishop's University Astronomy, Mathematics and Physics Society	2021 – 2023
Peer Note-Taker , Bishop's University Student Accessibility & Accommodation Services	2021 – 2022
Student Ambassador , Champlain College	2019 – 2020

OTHER TRAINING & WORKSHOPS

Ivy+ Graduate Student Teaching Transformations Summit May 2026
Ivy League Universities (virtual)

- Yearly gathering of graduate students across Ivy Plus institutions who are committed to improving the support, discourse, and practice of pedagogy in higher education. I was sent on behalf of Caltech for 2026.

PSI Students' Training Accelerator for Research in Theory (PSI START) Summer 2022
Perimeter Institute

- 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 Feb 2022
Cosmic Dawn Center

- One-week school aiming to address practical knowledge in astrophysics for graduate students, from both observational and theoretical perspectives.

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

WRITTEN TEACHING/MENTORING TESTIMONIALS

FSRI Mentoring	"This will definitely be one of the most memorable projects that I will work on while at Caltech."
FSRI Mentoring	"Thank you for giving this opportunity to explore an intriguing research topic, I truly learned a lot."
FSRI Mentoring	"I have enjoyed getting to learn new skills on Python and learning about active galactic nuclei."
FSRI Mentoring	"You helped make tackling something unfamiliar much more feasible."
Ph 12b	"Overall very effective [teaching]. Thank you for great recitation!"
Ph 12b	"Jaeden is good at explaining things."
Ph 1b (analytical)	"I really enjoyed your teaching."
Caltech Connections	"Jaeden [is] an amazing teacher, mentor, and friend."
Caltech Connections	"I've been able to learn so much [...] all thanks to Jaeden's guidance."