

Micah Brush — CV

Department of Biology – University of Victoria, BC, CA

✉ mbrush@uvic.ca • 📄 micah-brush.netlify.app • 🌐 Canadian Citizen

Education

- 2016 – 2021 **PhD**, *Physics*, The University of California, Berkeley.
Thesis: *Macroecological patterns out of steady state*
Supervisor: John Harte
- 2015 – 2016 **MASt**, *Part III of the Mathematical Tripos*, Trinity College, University of Cambridge.
- 2010 – 2015 **BSc**, *Honours Physics*, Simon Fraser University.
Undergraduate thesis: *Early Universe Interactions of Magnetic Monopoles and Domain Walls*
Supervisor: Levon Pogosian

Publications

- Submitted **Brush, M.**, Lewis, M.A., *Mountain pine beetle spread in forests with varying host resistance.*, bioRxiv doi: 10.1101/2024.01.17.575462.
- 2023 **Brush, M.**, Lewis, M.A., *Coupling mountain pine beetle and forest population dynamics predicts transient outbreaks that are likely to increase in number with climate change*, *Bulletin of Mathematical Biology* **85**(108), doi: 10.1007/s11538-023-01215-7, ERA postprint doi: 10.7939/r3-2q34-b676.
Misutka, M., Glover, C., **Brush, M.**, Goss, G., Veilleux, H., *A validated and optimized environmental DNA and RNA assay to detect Arctic grayling (*Thymallus arcticus*)*, *Environmental DNA* **5**(6), doi: 10.1002/edn3.460.
- 2022 Harte, J., **Brush, M.**, Newman, E.A., Umemura, K., *An Equation of State Unifies Diversity, Productivity, Abundance and Biomass*, *Communications Biology* **5**(874), doi: 10.1038/s42003-022-03817-8.
Brush, M., Matthews, T.J., Borges, P.A.V., Harte, J., *Land use, macroecology, and the accuracy of the Maximum Entropy Theory of Ecology: A case study of Azorean arthropods*, *Ecography* **2022**(8), doi: 10.1111/ecog.06141, bioRxiv doi: 10.1101/2021.09.14.460355.
- 2021 Kitzes, J., **Brush, M.**, Walters, K., *A unified framework for species spatial patterns: Linking the occupancy area curve, Taylor's Law, the neighborhood density function, and two-plot species turnover*, *Ecology Letters*, **24**(10), 2043–2053, doi: 10.1111/ele.13788.
Brush, M., Harte, J., *Relating the strength of density dependence and the spatial distribution of individuals*, *Frontiers in Ecology and Evolution*, **9**, 390, bioRxiv doi: 10.1101/827238.
Franzman, J., **Brush, M.**, Umemura, K., Ray, C., Blonder, B., Harte, J., *Shifting macroecological patterns and static theory failure in a stressed alpine plant community*, *Ecosphere*, **12**(6) e03548, doi: 10.1002/ecs2.3548, Authorea doi: 10.22541/au.159527004.40155464.

Harte, J., Umemura, K., **Brush, M.**, *DynaMETE: A Hybrid MaxEnt-plus-Mechanism Theory of Dynamic Macroecology*, *Ecology Letters*, **24** 935–949, doi: 10.1111/ele.13714, Authorea doi: 10.22541/au.160193464.48676767/v2.

2019 **Brush, M.**, Linder, E., Zumalacàrregui, M., *No Slip CMB*, *Journal of Cosmology and Astroparticle Physics* **01** 029, doi: 10.1088/1475-7516/2019/01/029, arXiv: 1810.12337.

2015 **Brush, M.**, Pogosian, L., Vachaspati, T., *Magnetic monopole–domain wall collisions*, *Physical Review D* **92** 045008, doi: 10.1103/PhysRevD.92.045008, arXiv: 1505.08170.

Non peer-reviewed publications.

2023 Newman, E.A., **Brush, M.**, Umemura, K., Xu, M., Harte, J., *Defining an ecological equation of state: Response to Riera et al. 2023*, *Ecological modelling* **486**(110532), doi: 10.1016/j.ecolmodel.2023.110532.

2021 **Brush, M.**, Liu, J., Yu, Q., *Revamping graduate biophysics education*, *Commentary in Physics Today*, doi: 10.1063/PT.6.3.20210623a.

Funding and Scholarships

2023 – 2025 NSERC Postdoctoral Fellowship (CAD\$90 000)

2023 – 2024 Mitacs Accelerate

2018 – 2020 NSERC Postgraduate Scholarships - Doctoral program (CAD\$42 000)

2017 – 2018 Berkeley Connect Fellowship (USD\$22 000 + tuition/fees)

2015 – 2016 Trinity College Scholarship in Mathematics (£27 000 + tuition/fees)

2015, 2014 NSERC Undergraduate Student Research Award (CAD\$4500)

Teaching and Mentoring Experience

Spring 2022 **Primary Instructor**, *Math 101 - Calculus II (for engineers)*.

(May–June) Primary instructor for a class of 86 students. Incorporated active learning with pre-lecture videos. Condensed six week semester with 70 minute classes each day, and two weekly labs. Additionally managed five TAs.

Fall 2023 **Grader and Guest Lecturer**, *Math 475/575 - Elements of Mathematical Ecology*.

Graded 3 of 5 assignments for a split undergraduate and graduate course. Gave 4 lectures on graduate level topics in mathematical ecology.

Instructor: Mark Lewis

Spring 2020 **Mentor**, *UC Berkeley*, GSPDP 301 - Mentoring in Higher Education.

Mentored an undergraduate in my research lab as an applied part of a course discussing the role of mentoring in US higher education.

Instructors: Linda von Hoene and Sabrina Soracco

Fall 2018 **Graduate Student Instructor**, *UC Berkeley*, Astro C13 - Origins: from the Big Bang to the Emergence of Humans.

Instructors: Eliot Quataert and Charles Marshall

- 2017 – 2018 **Berkeley Connect Fellow**, *UC Berkeley*, Physics 98BC, 198BC - Berkeley Connect.
Served as a graduate student mentor for around 40 undergraduate students each semester for an academic year. Met and advised each student individually and facilitated small group discussions.
Instructors: Bernard Sadoulet and Matt Pyle
- Spring 2018, **Graduate Student Instructor**, *UC Berkeley*, Letters and Science 22 - Sense and Sensibility
2017 and Science.
Instructors: Saul Perlmutter, Tania Lombrozo, and John Campbell
- Fall 2016 **Graduate Student Instructor**, *UC Berkeley*, Physics 89 - Introduction to Mathematical
Physics.
Instructor: James Analytis
- Spring 2015 **Teaching Assistant**, *Simon Fraser University*, Physics 102 - Physics for the Life Sciences II.
Instructor: Barbara Frisken
- Teaching Assistant**, *Simon Fraser University*, Physics 190 - Introduction to Astronomy.
Instructor: Howard Trottier
- Fall 2013 **Teaching Assistant**, *Simon Fraser University*, Physics 121 - Optics, Electricity, and
Magnetism.
Instructor: Michael Chen
- Summer **Astronomy Interpreter**, *NRC-CNRC: Centre of the Universe*.
2012 Public outreach including telescope tours, planetarium programming, observation nights, and
youth summer camps.

Conference Contributions

- 2023 **Brush, M.**, Lewis, M.A., *Modelling mountain pine beetle dynamics and spread under changing forest resilience*, TRIA-FoR Annual General Meeting, Invited talk. Edmonton, AB, CA.
Brush, M., Lewis, M.A., *Modelling mountain pine beetle dynamics and spread under changing forest resilience*, Ecological Society of America Annual Meeting, Contributed talk. Portland, OR, USA.
- 2022 **Brush, M.**, Lewis, M.A., *Modelling Long Term Mountain Pine Beetle Population Dynamics*, Workshop on Advances in Mathematical Ecology, Poster. Fields Institute, Toronto, ON, CA.
Brush, M., Lewis, M.A., *Modelling long term mountain pine beetle dynamics with changing tree resilience*, Canadian Mathematical Society Winter Meeting, Contributed talk. Toronto, ON, CA.
Brush, M., Kitzes, J., *Predicting the species-area relationship and Sørensen similarity index from species-level spatial patterns*, Gordon Research Conference and Seminar - Unifying Ecology Across Scales, Poster. Discussion leader for GRS. Southern New Hampshire University, Manchester, NH, USA.
Brush, M. Lewis, M., *Modelling Long Term Mountain Pine Beetle Population Dynamics*, Canadian Applied and Industrial Mathematics Society (CAIMS) Annual Meeting 2022, Contributed talk. Hybrid (presented online), Kelowna, BC, CA.

- Brush, M.** Matthews, T.J., Borges, P.A.V., Harte, J., *Land use change through the lens of macroecology: New insights from Azorean arthropod communities*, International Biogeography Society Biennial Conference, Contributed talk. Hybrid (presented online), Vancouver, BC, CA.
- 2020 **Brush, M.**, Umemura, K., Harte, J., *Dynamic Maximum Entropy Theory*, Joint Berkeley Initiative for Microbiome Sciences – Theory for Microbiome Research Workshop, Invited talk. Online, hosted by UC Berkeley.
- Brush, M.**, Umemura, K., Harte, J., *DynaMETE: A dynamic extension to the Maximum Entropy Theory of Ecology (METE)*, Ecological Society of America Annual Meeting, Contributed talk. Online.
- Brush, M.**, Suess, K., *Respect is Part of Research: Peer-Led Graduate SVSH Prevention Workshops*, Public Summit of the National Academies’ Action Collaborative on Preventing Sexual Harassment in Higher Education, Poster. Online, hosted by the University of Wisconsin.
- Brush*, M.**, Suess*, K., Workshop: How To Start A Peer-Led SVSH Prevention Program, Co-lead organizer and presenter (*Contributed equally), Berkeley, CA, USA.
Organized and led a two day workshop sharing the Respect is Part of Research model of peer-led sexual violence and sexual harassment prevention training with graduate students in physics and astronomy at other institutions.
- 2019 **Brush, M.**, Harte, J., Franzman, J., Umemura, K., *The effects of density dependence on spatial aggregation in the maximum entropy theory of ecology*, Ecological Society of America Annual Meeting, Contributed talk, doi: 10.7490/f1000research.1117483.1. Louisville, KY, USA.
Awarded the Volterra Prize for Best Student Talk in Theoretical Ecology.
- 2018 **Brush, M.**, Lukić, Z., *Characterizing WHIM in Simulations*, Intergalactic Interconnections, Contributed talk. Marseille, FR.

Other Presentations

- 2022 **Brush, M.**, *Modelling long term mountain pine beetle dynamics*, Applied Math Seminar, University of Victoria, Invited talk. Victoria, BC.
- 2021 **Brush, M.**, *Macroecology, Maximum Entropy, and Disturbance*, Mathematical Biology Seminar, University of Alberta, Invited talk. Edmonton, AB, CA.
- Brush, M.**, *Modelling mountain pine beetle spread*, Postdoctoral Fellow Research Day - Speed talks, University of Alberta, 3 minute speed talk. Edmonton, AB, CA.
Won a best talk award.
- 2020 **Brush*, M.**, Suess*, K., *Respect is Part of Research Facilitator Training*, Harvard University Department of Physics, Co-facilitator (*Contributed equally), Online.
Assisted in leading the facilitator training for the Harvard implementation of Respect is Part of Research.

- 2019 **Brush*, M.,** Suess*, K., *Respect is Part of Research: Peer-Led Training to Improve Departmental Climate*, Graduate Assembly Meeting, Physics Faculty Retreat, and Astronomy Department Lunch Talk, UC Berkeley, Co-presenter (*Contributed equally), Berkeley, CA, USA.
- Brush, M.,** Smith, R., *Strategies for Responding to Harassment and Hostile Climates*, Rocky Mountain Biological Laboratory, Co-facilitator, Gothic, CO, USA.
- Brush, M.,** *Theoretical Ecology and Physics*, Physics Graduate Student Seminar, UC Berkeley, Invited talk. Berkeley, CA, USA.
- 2018 **Brush, M.,** *Illuminating Dark Matter*, Grounds for Science, Emeryville, CA, USA. Public talk for Dark Matter Day.
- 2015 **Brush, M.,** Pogosian, L., *The monopole problem, and the interactions of topological defects*, Part III Seminar Series, University of Cambridge, Contributed talk. Cambridge, UK.
- 2014 **Brush, M.,** Sigurdson, K., *3D cosmological observables in spherical coordinates*, Cosmology Seminar, Simon Fraser University, Invited talk. Burnaby, BC, CA.
- 2012 **Brush, M.,** *Extreme Environments and Astrobiology*, Centre of The Universe Public Talk Series, Saanich, BC, CA.

Professional Service

- 2024 – Biology EDI Committee, Postdoc Representative
- 2024 – Canadian Association of Postdoctoral Scholars, VC Operations
- 2023 – Support our Science, University of Victoria Ambassador
- 2018 – 2021 Respect is Part of Research, Peer-led Sexual Assault and Sexual Harassment Prevention Training, Co-head Coordinator with K. Suess
RPR is a graduate student run group that leads peer-led sexual assault and sexual harassment prevention training for incoming first year graduate students in 8 STEM departments at UC Berkeley.
- 2020 – 2021 UC Berkeley's Coordinated Community Review Team for Sexual and Gender-Based Violence and Misconduct, Invited Representative from Respect is Part of Research
- 2017 – 2020 Campus Committee on Teaching, Graduate Student Representative
- 2019 – 2020 Physics Graduate Admissions Committee, Graduate Student Representative
- 2017 – 2019 Graduate Assembly, Physics Delegate
- 2018 – 2019 Physics Graduate Curriculum Committee, Graduate Student Representative
- 2017 – 2018 Physics Graduate Student Seminar, Co-founder and Organizer with J. Liu
- 2018 Physics Graduate Student Association, President
- 2017 Respect is Part of Research, Facilitator
- 2017 Physics Faculty Search Committee, Graduate Student Representative
- 2017 Graduate Open House Committee, Organizer

Awards

- 2021 Postdoctoral Fellow Research Day Speed Talk Award, University of Alberta
- 2019 Volterra Prize for Best Student Talk, ESA Theoretical Ecology Section
- 2015 Gordon M. Shrum Gold Medal, Simon Fraser University
Awarded for high scholastic achievement and involvement in extracurricular activities.
- 2015 Physics Charter Faculty Prize, Simon Fraser University
Awarded to a top graduating student in Physics.
- 2015, 2013 Evelyn and Leigh Palmer Scholarship, Simon Fraser University
- 2014, 2013 John F. Cochran Physics Award, Simon Fraser University
- 2011 – 2015 Simon Fraser University Open Scholarship
- 2011 – 2014 Simon Fraser University Alumni Scholarship