

Education

- Massachusetts Institute of Technology**, Cambridge, MA. 2023–Present
- Candidate for Ph.D. in Applied Mathematics.
 - Supervised by Prof. John Bush.
- Cambridge University – Churchill Scholarship**, Cambridge, U.K. 2022–2023
- M.Phil. in Scientific Computing, with Distinction. Supported by the 2022 Churchill Scholarship.
 - Thesis: *An Efficient, Multi-Wavenumber Model of Stratified Turbulence*.
 - Supervised by Prof. Colm Caulfield, and externally by Prof. Gregory Chini (University of New Hampshire).
- Massachusetts Institute of Technology**, Cambridge, MA. 2018–2022
- GPA: 5.0 (out of 5.0, unweighted). B.S. in Mathematics. Minor in German Studies.

Research Experience

- Field-Theoretic Quantum Analogues**, *Massachusetts Institute of Technology*, Cambridge, MA. 2022–Present
- Advisor: Prof. John Bush
 - Using a relativistic Lagrangian framework, developed a classical field theory to quantitatively replicate certain quantum phenomena, with a goal of exploring the boundary between quantum and classical dynamics. Showed convergence to quantum results in single- and double-slit experiments, in position measurements, and in position-momentum uncertainty; however, the field is sourced by the particle and the particle maintains straight-line trajectories, unlike in Bohmian mechanics.
- Stratified Turbulence**, *Cambridge University*, Cambridge, U.K. 2022–Present
- Advisors: Prof. Colm Caulfield (Cambridge University) and Prof. Gregory Chini (University of New Hampshire)
 - Developed a new sub-grid-scale model (NCQL) for stratified flows, to combine recent quasi-linear techniques with a faithful model of the forwards energy cascade. Demonstrated that NCQL significantly outperforms state-of-the-art methods in moderately stratified flows, such as straits and intertidal regions.
- Summer Student Program**, *National Security Agency (NSA)*, Cheltenham, U.K. 2022
- One of two DSP 2021 (Director's Summer Program – see below) students selected to participate in the 2022 *Summer Student Program*, in Great Britain's signals intelligence community.
- Hydrodynamic Quantum Analogues**, *Massachusetts Institute of Technology*, Cambridge, MA. 2021–2022
- Joint with Valeri Frumkin, John Bush, and Ward Struyve.
 - Experimental verification that “walking” oil droplets undergo the “surreal” trajectories predicted for quantum particles by Bohmian mechanics. Development of a numerical method to efficiently model the motion of these oil droplets on a varying potential landscape, and application of this model to corroborate our experimental results.
- Protein Folding Research**, *Massachusetts Institute of Technology*, Cambridge, MA. 2020–2022
- Joint with George Stepaniants and Prof. Philippe Rigollet.
 - Application of modified Gromov–Wasserstein metric to protein comparison, offering a faster, more flexible, and purely geometric notion of distance between proteins and protein interfaces.
- Director's Summer Program**, *National Security Agency (NSA)*, Fort Meade, MD. 2021
- Using techniques from abstract probability theory and theoretical statistics, developed and implemented an algorithm to be used at large scale on large amounts of intercepted data in mission critical cryptologic attacks and defense by the NSA. Received Top Secret Information Clearance and Sensitive Compartmented Information clearance.
 - Briefed the Director and other senior leaders of the NSA on novel cryptanalytic techniques as a result of my research project. Separately briefed professional researchers at the Institute for Defense Analyses at Princeton Center for Communications Research (CCR).
- Symplectic Topology Research**, *Massachusetts Institute of Technology*, Cambridge, MA. 2021
- Joint with Dr. Daniel Alvarez-Gavela.
 - Proved that stably trivial elements of the group $\pi_n U_n / O_n$ can be represented with only fold singularities.
- Internal DLA Research**, *Massachusetts Institute of Technology*, Cambridge, MA. 2020–2021
- Advisors: Prof. David Jerison and Pu Yu
 - Derived a convergence rate on extended-source IDLA, a diffusion model from statistical physics, to its scaling limit. Proved that fluctuations of extended-source IDLA converge weakly to geometry-dependent Gaussian random fields.
- Convex Geometry Research**, *Budapest Semesters in Mathematics*, Budapest, Hungary (offered remotely). 2021
- Advisor: Prof. Gergely Ambrus (Alfréd Rényi Institute of Mathematics)
 - Worked with other students within the BSM program to prove transversal properties of families of convex sets.
 - (Spanish-language) presentation at [XXXVI Coloquio Víctor Neumann-Lara](#), jointly with Tonatiuh Wiederhold. Awarded fourth place with an honorific mention.

- Minimal Surface Theory Research**, *Massachusetts Institute of Technology*, Cambridge, MA. 2019
 - Advisor: Prof. William Minicozzi
 - Construction of a generalized minimal surface with a non-unique tangent cone at a given point.
- MIT PRIMES USA**, *Massachusetts Institute of Technology*, Cambridge, MA. 2017–2018
 - Advisors: Prof. Alex Townsend (Cornell University) and Prof. Grady Wright (Boise State University)
 - Faster and more accurate solution of the incompressible Navier–Stokes equations in cylindrical geometries. Synthesized classical spectral methods with recent advances in low-rank compression algorithms.
- Research in Genetic Data Analysis**, *Yale University*, New Haven, CT. 2017–2018
 - P.I.: Prof. Smita Krishnaswamy, Research Advisor: Prof. Kevin Moon (now at Utah State University).
 - Created of a new high-pass filter method to accurately normalize data from mass cytometry (CyTOF).

Publications

1. David Darrow and John W. M. Bush. Revisiting de Broglie's double-solution pilot-wave theory with a Lorentz-covariant Lagrangian framework. *Symmetry*, 16(2), 2024
2. David Darrow. A convergence rate for extended-source internal DLA in the plane. *Potential Analysis*, Oct 2023
3. David Darrow. Scaling limits of fluctuations of extended-source internal DLA. *Journal d'Analyse Mathématique*, 150(2):449–484, Sep 2023
4. Valeri Frumkin, David Darrow, John W. M. Bush, and Ward Struyve. Real surreal trajectories in pilot-wave hydrodynamics. *Phys. Rev. A*, 106:L010203, Jul 2022
5. David Darrow. A quasi-optimal spectral solver for the heat and Poisson equations in a closed cylinder. *SIAM Undergraduate Research Online*, 2022
6. Daniel Álvarez-Gavela and David Darrow. Caustics of Lagrangian homotopy spheres with stably trivial Gauss map. *Journal of Symplectic Geometry*, 2021

Teaching and Service

- MIT PRIMES Mentor**, *MIT Mathematics*. 2022–present
 - Overseeing and advising the research of Eric Chen and Alexander Zitzewitz.
 - Proving that the monodromy group of the Heun equation admits an invariant Hermitian matrix if and only if the accessory parameter falls on a certain perturbed integer lattice. Development of a numerical method to identify these key accessory parameters.
 - Presentation at Joint Mathematics Meetings 2023.
- Mathematics Mentor**, *MIT Undergraduate Mathematics Association*. 2021–2022
 - Advised four new mathematics majors at MIT. Tutored them in proof-writing and specific topics they are studying, while also providing guidance on course selection, career opportunities, and life at MIT.
- MIT PRIMES Mentor**, *MIT Mathematics*. 2021
 - Oversaw and advised the research of Andrew Du.
 - Extension of recent quaternion-based techniques in inverse dynamics to muscular systems.
- Mathematics, Physics, and Computer Science Tutoring**. 2018–2022
 - Tutored Quantum Physics II through MIT's Peer Tutoring program.
 - Tutored peers at MIT and at Brandeis University in advanced STEM topics: algorithm design, discrete math, real analysis, abstract algebra, mechanics, electromagnetism, quantum physics, theoretical computer science.

Languages and Skills

German	French	Spanish	Russian	Programming
Proficient	Intermediate	Intermediate	Limited Working	C, C++, MATLAB, Python

Honors and Awards

- NDSEG Fellowship**, *National Defense Science and Engineering Graduate Fellowship Program*. 2024
- Finalist, Hertz Fellowship**, *Hertz Foundation*. 2024
- Bershadsky Mentorship**, *MIT PRIMES*. 2023
- MathWorks Fellowship**, *MathWorks*. 2023
- Levinson Fellowship**, *Massachusetts Institute of Technology*. 2023
- Phi Beta Kappa Membership**, *the Phi Beta Kappa Society*. 2022
- Churchill Scholarship**, *Winston Churchill Foundation of the United States*. 2022
- Ellen Crocker Distinguished Scholar**, *MIT Global Languages*. 2021
- Fourth Place with Honorific Mention**, *XXXVI Coloquio Víctor Neumann-Lara*. 2021

German Studies Excellence Award, Second Prize, MIT Global Languages.	2019, 2020
Regeneron Science Talent Search Semifinalist, Society for Science & the Public.	2017
Eagle Scout Rank Award, Boy Scouts of America.	2017
Siemens Competition Regional Finalist, Siemens Foundation.	2017