JONAH BOTVINICK-GREENHOUSE

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EDUCATION

Cornell University, Ithaca, NY *September 2021 - (expected) May 2026*

- Ph.D. Candidate in Applied Mathematics, GPA: 4.05/4.3
- Advisor: Prof. Yunan Yang
- Research interests: Dynamical systems, numerical analysis, inverse problems
- NDSEG Fellow

Amherst College, Amherst, MA *September 2017 - May 2021*

- Bachelor of Arts, Mathematics and Physics, GPA: 3.95/4.0
- Summa Cum Laude with Distinction, Phi Beta Kappa

PUBLICATIONS

- Jonah Botvinick-Greenhouse, Robert Martin, and Yunan Yang. "Invariant Measures in Time-Delay Coordinates for Unique Dynamical System Identification". In: *arXiv preprint arXiv:2412.00589* (2024)
- Jonah Botvinick-Greenhouse, Maria Oprea, Romit Maulik, and Yunan Yang. "Measure-Theoretic Time-Delay Embedding". In: *arXiv preprint arXiv:2409.08768* (2024)
- Jonah Botvinick-Greenhouse, Yunan Yang, and Romit Maulik. "Generative modeling of time-dependent densities via optimal transport and projection pursuit". In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 33.10 (2023). DOI: 10.1063/5.0155783
- Jonah Botvinick-Greenhouse, Robert Martin, and Yunan Yang. "Learning dynamics on invariant measures using PDE-constrained optimization". In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 33.6 (2023). DOI: 10.1063/5.0149673
- Aaron Kirtland, Jonah Botvinick-Greenhouse, Marianne DeBrito, Megan Osborne, Casey Johnson, Robert S Martin, Samuel J Araki, and Daniel Q Eckhardt. "An unstructured mesh approach to nonlinear noise reduction for coupled systems". In: *SIAM Journal on Applied Dynamical Systems* 22.4 (2023), pp. 2927–2944. DOI: 10.1137/22M152092X
- Jonah Botvinick-Greenhouse and Troy Shinbrot. "Juggling dynamics". In: *Physics Today* 73.2 (2020), pp. 62–63. DOI: 10.1063/PT.3.4417

TALKS AND POSTER PRESENTATIONS

- SIAM Conference on Computational Science and Engineering, minisymposium on stable prediction of dynamical systems. "Invariant measures in time-delay coordinates for unique dynamical system identification." *(upcoming) April 2025*
- SIAM Conference on the Mathematics of Data Science, minisymposium on fast and scalable Bayesian inference."Measure-Theoretic Time-Delay Embedding." *October 2024*
- SIAM Conference on the Mathematics of Data Science, poster presentation. "Invariant measures in time-delay coordinates for unique dynamical system identificaiton." *October 2024*
- Cornell University Young Researchers Workshop, poster presentation. "Generative Modeling of Time-Dependent Densities via Optimal Transport and Projection Pursuit." *October 2024*
- NDSEG Fellows Conference, poster presentation. "Learning dynamics on invariant measures using PDE-constrained optimization." *July 2024*
- Cornell University Admission to Candidacy Exam. "Measure Theoretic Modeling of Dynamical Systems." *May 2024*

- IPAM, International Conference on Multiscale Modeling and Simulation based on Physics and Data, poster presentation. "Learning dynamics on invariant measures using PDE-constrained optimization." *April 2024*
- Cornell University Scientific Computing and Numerical Analysis (SCAN) seminar. "Learning dynamics on invariant measures using PDE-constrained optimization." *December 2023*
- SIAM-NNP, contributed talk. "Learning dynamics on invariant measures using PDE-constrained optimization." *October 2023*
- ICIAM, contributed talk (virtual). "Learning dynamical systems from invariant measures." *August 2023*
- ETH-ITS workshop: Emerging topics in applications of optimal transport, poster presentation. "Generative modeling of time-dependent densities via optimal transport and projection pursuit." *June 2023*
- NJIT Frontiers in Applied and Computational Mathematics (FACM) conference, poster presentation (3^{rd} place prize). "Generative modeling of time-dependent densities via optimal transport and projection pursuit." *May 2023*
- SIAM conference on applications of dynamical systems, contributed talk. "Generative modeling of time-dependent densities via optimal transport and projection pursuit." *May 2023*
- BIRS workshop: New ideas in in computational inverse problems. "Learning dynamical systems from invariant measures." *October 2022*
- SIAM annual meeting, minisymposium on machine learning for inverse problems and dynamical systems (virtual). "Learning dynamical systems with invariant measures." *August 2022*
- UBC physics & astronomy colloquium (virtual). "Juggling dynamics." *November 2021*
- Physics Today webinar, editor series (virtual). "Juggling dynamics." *August 2021*
- Amherst College thesis defense. "An introductionto the theory of the ergodic partition." *May 2021*
- Joint Mathematics Meetings (JMM), poster presentation. "An unstructured mesh approach to nonlinear noise reduction." *January 2021*
- Southern California REU conference (virtual). "An unstructured mesh approach to nonlinear noise reduction." *July 2020*
- UMass Amherst REU conference. "On a nonlinear random walk on graphs." *July 2019*

AWARDS

- The National Defense Science and Engineering Graduate Fellowship. *September 2022 - present*
- SIAM Student Travel Award *August 2024*
- Poster presentation honorable mention, NDSEG Fellows Conference. *July 2024*
- Third place poster prize, conference on Frontiers in Applied and Computational Mathematics (FACM) at NJIT. *May 2023*
- The Robert H. Breusch Prize in Mathematics, Amherst College. *"Awarded to the senior who, in the opinion of the faculty in mathematics and statistics, has presented the best honors thesis in mathematics."* *May 2021*
- The Walker Award in Mathematics & Statistics, Amherst College. *"Awarded to a student who has demonstrated initiative, creativity, perseverance, and achievement in Mathematics and Statistics."* *May 2021*
- Poster presentation honorable mention, Joint Mathematics Meetings (JMM). *January 2021*

RESEARCH EXPERIENCE

Cornell University: PhD Research *June 2021 - present*

- PhD student in Cornell's Center for Applied Mathematics (CAM), advised by Prof. Yunan Yang.
- Used tools from optimal transport theory, ergodic theory, and machine learning to develop measure-theoretic approaches for performing dynamical system identification under challenging data circumstances.
- Published results in Chaos: An Interdisciplinary Journal of Nonlinear Science, and presented results at the SIAM MDS (2024), SIAM-NNP (2023), ICIAM (2023), and SIAM (2022) conferences, as well as BIRS and IPAM workshops (2022, 2024).

Mitsubishi Electric Research Laboraties (MERL): Internship *May 2024 - present*

- 2024 MERL intern, mentored by Dr. Saviz Mowlavi and Dr. Mouhacine Benosman
- Developed a novel framework for training physics-informed neural networks (PINNs) to achieve fast convergence when solving complex time-dependent PDEs.

Argonne National Laboratory: NSF MSGI *June 2022 - April 2023*

- 2022 NSF MSGI intern and Argonne Visiting Graduate Student, mentored by Prof. Romit Maulik.
- Developed a projection-based optimal-transport approach for modeling stochastic dynamics of high-dimensional systems that is competitive with state-of-the-art normalizing flows conditioned on time.
- Published results in Chaos: An Interdisciplinary Journal of Nonlinear Science, and presented findings at the FACM (2023) and SIAM ADS (2023) conferences, as well as an ETH-ITS workshop (2023).

Amherst College: Undergraduate Thesis *September 2020 - May 2021*

- Wrote the thesis "An Introduction to the Theory of the Ergodic Partition," advised by Prof. Ryan Alvarado.
- Studied the classification of invariant sets of dynamical systems through the theory of ergodic partitions.
- Awarded the Robert H. Breusch prize in mathematics for best thesis.

UCLA Institute for Pure and Applied Mathematics: RIPS *June 2020 - August 2020*

- Participated in the Research in Industrial Projects for Students (RIPS) program, mentored by AFRL researchers Dr. Robert Martin and Dr. Daniel Eckhardt.
- Developed an unstructured mesh approach to nonlinear noise reduction for Hall-effect thrusters alongside a team of three other undergraduates.
- Published results in the SIAM Journal on Applied Dynamical Systems, and presented work at the JMM poster session (2021) and Southern California REU conference (2020).

University of Connecticut: REU *June 2019 - July 2019*

- Participated in the Markov Chains REU, mentored by Prof. Iddo Ben-Ari.
- Classified bifurcations and regions of multistability for a nonlinear random walk on graphs alongside two other undergraduate students.
- Presented findings at the UMass-Amherst REU Conference (2019).

Rutgers University *June 2018 - August 2018*

- Investigated the relative sensitivities of various juggling patterns with Prof. Troy Shinbrot using open loop simulations of juggling patterns with Gaussian perturbations applied to throw angle and throw speed.
- Published work in a Physics Today quick study and presented results in a Physics Today webinar (2021) and at a UBC physics & astronomy colloquium.

TEACHING AND MENTORSHIP EXPERIENCE

Cornell University

- Math Explorers Club - Juggling dynamics *January 2024*
- Math REU mentor - An unstructured mesh approach to learning dynamics on invariant measures. *June 2023 - August 2023*

- Directed Reading Program mentor - Diffusion limited aggregation *January 2023 - May 2023*
- Directed Reading Program mentor - Topics in ergodic theory *September 2022 - December 2023*
- TA for Math 2130 - Calculus III *January 2022 - May 2022*
- TA for Math 1910 - Calculus for Engineers *August 2021 - December 2021*

Amherst College

- Math Fellow (TA) for Math/Physics 102 - Geometry and Relativity *February 2021 - May 2021*
- Math Fellow (TA) for Math 255 - Geometry *August 2020 - December 2020*
- Math Fellow (TA) for Math 220 - Mathematical Reasoning *January 2020 - May 2020*
- Calculus Peer Tutor for Math 106 - Calculus with Elementary Functions *January 2020 - May 2020*
- Math Fellow (TA) for Math 105 - Calculus with Algebra *September 2019 - December 2019*
- Discussion TA for Physics 117 - Electricity and Magnetism *January 2019 - May 2019*
- Homework grader for Math 211 - Multivariable Calculus *September 2018 - May 2019*
- Lab TA for Physics 116 - Introductory Mechanics *September 2018 - December 2018*

SELECTED COURSEWORK

Cornell University

- Probability Theory II (MATH 6720)
- Probability Theory I (MATH 6710)
- Applied Dynamical Systems (MATH 6270)
- Partial Differential Equations (MATH 6160)
- Numerical Analysis (MATH 5250)
- Matrix Computations (CS 6210)
- Inverse Problems (CEE 6745)
- Mathematical Modeling (CEE 6736)

Amherst College

- Honors Thesis (MATH 499)
- Climate Dynamics (GEOL 331)
- Signals and Noise Laboratory (PHYS 226)
- Functions of a Complex Variable (MATH 345)
- Analytic Number Theory (MATH 460)
- Quantum Mechanics (PHYS 348)
- Measure Theory (MATH 450)
- Cryptography (MATH 252)
- Dynamics (PHYS 343)
- Introduction to Analysis (MATH 355)
- Graph Theory (MATH 280)
- Statistical Mechanics (PHYS 230)
- Groups, Rings, and Fields (MATH 350)
- Modern Physics (PHYS 225)

ADDITIONAL INTERESTS

Juggling *January 2010 - present*

- Trained independently for the last fifteen years, won several international competitions, holds various world records, and performed at festivals across the United States.
- World Juggling Federation (WJF) Ultimate Overall Championship 2nd place (2024), International Jugglers' Association (IJA) Numbers Rings 1st Place (2018, 2019, 2023), IJA Numbers Clubs 1st Place (2017, 2019), IJA Stage Championships 2nd Place (2018), IJA Juniors Champion (2016), WJF Advanced Overall Champion (2013, 2015), WJF Juniors Champion (2012).
- Volunteered with Juggling Life (2014-2019), which is a charity organization that teaches economically and physically disadvantaged individuals how to juggle and performs shows.

Cello *November 2009 - present*

- Practiced cello for the last fifteen years, participating in various chamber ensembles, orchestras, and master classes.