

Matthew S. E. Peterson

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EDUCATION

Ph.D., Physics, Brandeis University, Waltham, MA

Expected December 2020

Thesis: Geometrically and topologically constrained active matter

Advisors: Dr. Aparna Baskaran and Dr. Michael Hagan

B.S., Engineering Physics, Tufts University, Medford, MA

May 2016

Magna Cum Laude, Highest Thesis Honors

Overall GPA: 3.79, Major GPA: 3.98

SKILLS

- | | | | |
|--|---------------|-------------------------|------------------------------|
| • Modern C++ | • CMake | • Version control (Git) | • Data analysis |
| • Python (NumPy, SciPy, Matplotlib, Pandas, Jupyter) | • Matlab | • GNU/Linux | • Data visualization |
| | • Mathematica | • Technical writing | • High performance computing |
| | • \LaTeX | • Communication | |

PROJECTS

Topological Structures in Active Nematics (Python)

2019

- Built a tool in Python (using NumPy, SciPy, and SciKit) to automate the detection of defect structures in both experimental and simulated active nematic systems using topological information
- Visualized resulting loops using Ovito and Mathematica
- These tools were used to obtain results that were published in the journal *Science*

Active Rouse Chains (C++, Python)

2019

- Simulated active bead-spring polymers using molecular dynamics code written in C++
- Analyzed resulting data using Python (NumPy, Matplotlib, and Jupyter Notebooks)
- Findings were published in the *Journal of Statistical Mechanics*

MTL (C++)

(In Progress)

- Designing a C++ library mainly focused on mathematical computation, including multi-dimensional arrays (inspired by NumPy) and lazy evaluation

ReNES (C++)

(In Progress)

- Building a NES emulator in C++ to learn basics of processors, memory management, and graphics

RESEARCH EXPERIENCE

Graduate Researcher

Full Time, June 2016 – Present

Martin A. Fisher School of Physics, Brandeis University

- Develops simulations to model experimental systems of confined active particles
- Analyzes experimental and simulation data to identify novel behaviors in 3D active systems
- Designs and implements innovative methods to classify 3D structures in active fluids
- Collaborates across disciplines and communicates findings at national and international conferences

Undergraduate Research Assistant

Part Time, January 2013 – May 2016

Department of Physics and Astronomy, Tufts University

- Examined the impact of carbon nanotubes on the electro-optic properties of liquid crystals
- Devised experiments, collected data, and analyzed results, culminating in an honors thesis and a first-author publication in a peer-reviewed journal
- Managed laboratory equipment, including writing documentation and training new students

OTHER EXPERIENCE

Teaching Assistant

Part Time, August 2017 – May 2018

Martin A. Fisher School of Physics, Brandeis University

- Led weekly lab sections for the introductory physics course for non-physics majors
- Achieved outstanding ratings on course evaluations for clear and effective communication, strong engagement with students, and thorough feedback on graded assignments

Resident Head Tutor

Part Time, January 2013 – May 2016

Academic Resource Center, Tufts University

- Tutored undergraduate students in physics, mathematics, and computer science
- Contributed significantly to the Bridges to Engineering Success at Tufts (BEST) program by mentoring students from disadvantaged backgrounds during their transition to college

Engineering Outreach Intern

Part Time, August 2014 – May 2015

Office of Undergraduate Admissions, Tufts University

- Wrote articles spotlighting professors' research for Tufts University's JUMBO Magazine
- Coordinated open house events for prospective and accepted students

AWARDS & FELLOWSHIPS

NSF IGERT Fellowship

2016 – 2017

Benjamin G. Brown Scholarship

2016

For promise in scientific research

Bridge to Engineering Success at Tufts

2016

Appreciation Award

For continual commitment to provide a diverse and inclusive learning environment

Nadia Medina Memorial Prize

2016

For extraordinary contributions to collaborative learning

Tufts University Summer Scholar

2015

Tau Beta Pi, the engineering honors society

2015

Sigma Pi Sigma, the physics honors society

2015

Tufts Undergraduate Research Fund

2014

Tufts National Merit Scholarship

2012

PUBLICATIONS

G. Duclos, R. Adkins, D. Banerjee, **M. S. E. Peterson**, M. Varghese, I. Kolvin, A. Baskaran, R. A. Pelcovits, T. R. Powers, A. Baskaran, F. Toschi, M. F. Hagan, S. J. Streichan, V. Vitelli, D. A. Beller, Z. Dogic. "Topological structure and dynamics of three dimensional active nematics." *Science* **367** (6482), 1120-1124 (2020).

M. S. E. Peterson, M. F. Hagan, A. Baskaran. "Statistical properties of a tangentially driven active filament." *Journal of Statistical Mechanics: Theory and Experiment* **2020** (1), 013216 (2020).

M. S. E. Peterson, G. Georgiev, T. J. Atherton, P. Cebe. "Dielectric analysis of the interaction of nematic liquid crystals with carbon nanotubes." *Liquid Crystals*, **45** (3), 450-458 (2018).

SELECTED PRESENTATIONS

MRSEC Winter School, Carroll, NH

February 2020

M. Peterson, M. Hagan, A. Baskaran, "Active matter in vesicles"

India Institute of Science, Bengaluru, Karnataka, India

July 2018

M. Peterson, M. Hagan, A. Baskaran, "Structure and dynamics of active polar polymers and confined active nematics"

American Physical Society, Los Angeles, CA

March 2018

M. Peterson, A. Joshi, M. Hagan, A. Baskaran. "Structure and dynamics of active nematics under circular confinement - a microscopic simulation study."

American Physical Society, Baltimore, MD

March 2016

M. S. E. Peterson, G. Georgiev, T. J. Atherton, P. Cebe. "Dielectric studies of nematic liquid crystals doped with carbon nanotubes."