Matthew S. E. Peterson

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EDUCATION

Ph.D., Physics, Brandeis University, Waltham, MA — Expected August 2020
Advisors: Dr. Aparna Baskaran and Dr. Michael Hagan
Thesis: Geometrically and topologically constrained active matter

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

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

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 experimental active nematic systems using topological information
- Visualized resulting loops using Ovito and Mathematica
- These tools were used to obtain results that will be 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 will be 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

NESxx (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 Appreciation Award 2016
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

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.

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". arXiv:1909.01381 [cond-mat.soft], 2019. *(submitted to Science)*.

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

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. "Dielectic studies of nematic liquid crystals doped with carbon nanotubes."