Layne B. Frechette

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Brandeis University, 415 South Street Waltham, MA 02453

EDUCATION

University of California, Berkeley (UC Berkeley) *August 2015 - May 2020*
Ph.D., Physical Chemistry

Brown University *September 2011 - May 2015*
Sc.B., Chemical Physics, *magna cum laude*

RESEARCH EXPERIENCE

Brandeis University Department of Physics *July 2022 - Present*
Advisors: Michael Hagan and Aparna Baskaran
Simulations and theory of self-organization of passive objects in active fluids and virus self-assembly.

NIDDK, NIH Laboratory of Chemical Physics *August 2020 - May 2022*
Advisor: Robert B. Best
Machine learning of Potts models to understand protein folding cooperativity.

UC Berkeley Department of Chemistry *October 2015 - July 2020*
Advisor: Phillip L. Geissler
Thesis: "Chemical Transformations of Nanocrystals: Theory and Molecular Simulation."

Brown University Department of Chemistry *September 2013 - May 2015*
Advisor: Richard M. Stratt
Honors Thesis: "Geodesic pathways through the potential energy landscape of liquid crystal formers."

Brown University Department of Physics *February 2012 - August 2013*
Advisor: Derek M. Stein
Development of electrospray ionization mass spectrometry for DNA sequencing.

PUBLICATIONS AND PREPRINTS

* Denotes equal contributions.

1. L.B. Frechette, A. Baskaran, and M.F. Hagan. "Active noise-induced dynamic clustering of passive colloids." *arXiv*, doi: 10.48550/arXiv.2410.05555 (2024).
2. D. Wang,* L.B. Frechette,* and R.B. Best. "On the role of native contact cooperativity in protein folding." *Proc. Natl. Acad. Sci. U.S.A.*, **121**, e231924912 (2024).
3. A. Sciortino, H. Faizi, S. Uplap, L. Frechette, M.S.E. Peterson, P. Vlahovska, A. Baskaran, M.F. Hagan, and A. Bausch. "Active membrane deformations of a minimal synthetic cell." *bioRxiv*, doi:10.1101/2023.12.18.571643 (2023).
4. G.R. Bowman, S.J. Cox, C. Dellago, K.H. DuBay, J.D. Eaves, D.A. Fletcher, L.B. Frechette, M. Grünwald, K. Klymko, J. Ku, A.K. Omar, E. Rabani, D.R. Reichman, J.R. Rogers, A.M. Rosnik, G.M. Rotskoff, A.R. Schneider, N. Schwierz, D.A. Sivak, S. Vaikuntanathan, S. Whitelam, and A. Widmer-Cooper. "Remembering the Work of Phillip L. Geissler: A Coda to His Scientific Trajectory." *Annu. Rev. Phys. Chem.*, **74**, 1-27 (2023).
5. J.C. Ondry, L.B. Frechette, P.L. Geissler, and A.P. Alivisatos. "Trade-offs between translational and orientational order in 2D superlattices of polygonal nanocrystals with differing edge count." *Nano Lett.*, **22**, 389-395 (2021).

6. L.B. Frechette, C. Dellago, and P.L. Geissler. "Elastic forces drive nonequilibrium pattern formation in a model of nanocrystal ion exchange." *Proc. Natl. Acad. Sci. U.S.A.*, **118**, e2114551118 (2021).
7. L.B. Frechette, C. Dellago, and P.L. Geissler. "Origin of mean-field behavior in an elastic Ising model", *Phys. Rev. B* **102**, 024102 (2020).
8. L.B. Frechette, C. Dellago, and P.L. Geissler. "Consequences of lattice mismatch for phase equilibrium in heterostructured solids", *Phys. Rev. Lett.* **123**, 135701 (2019).
9. M.R. Hauwiller, L.B. Frechette, M.R. Jones, J.C. Ondry, G.M. Rotskoff, P. Geissler, and A.P. Alivisatos. "Unraveling kinetically-driven mechanisms of gold nanocrystal shape transformations using graphene liquid cell electron microscopy", *Nano Lett.* **18**, 5731-5737 (2018).
10. X. Ye,* M.R. Jones,* L.B. Frechette, Q. Chen, A.S. Powers, P. Ericus, G. Dunn, G.M. Rotskoff, S.C. Nguyen, V.P. Adiga, A. Zettl, E. Rabani, P.L. Geissler, A.P. Alivisatos, "Single-particle mapping of nonequilibrium nanocrystal transformations", *Science* **354**, 874-877 (2016).
11. L. Frechette and R.M. Stratt, "The inherent dynamics of isotropic- and nematic-phase liquid crystals", *J. Chem. Phys.* **144**, 234505 (2016).
12. L. Frechette, D. Jacobson, and R.M. Stratt, "Erratum: "The inherent dynamics of a molecular liquid: Geodesic pathways through the potential energy landscape of a liquid of linear molecules" [J. Chem. Phys. 140, 174503 (2014)]", *J. Chem. Phys.* **141**, 209902 (2014).

FELLOWSHIP & AWARDS

- Mentee participant in the 2024 Future Faculty Workshop: The Chemistry, Physics, Engineering and Biology of Soft Materials
- Berkeley Statistical Mechanics Meeting Poster Prize, 2019
- Erwin Schrödinger Institute Junior Research Fellowship, 2018
- Outstanding Graduate Student Instructor Award, UC Berkeley, 2017 – 2018
- Clapp Prize for Outstanding Undergraduate Thesis, Brown Department of Chemistry, 2015
- Karen T. Romer Undergraduate Teaching and Research Award, Brown University, 2014

TEACHING EXPERIENCE

Adjunct Instructor, Montgomery College

- CHEM 131D: Principles of Chemistry I Discussion, Fall 2021
- CHEM 131L: Principles of Chemistry I Laboratory, Fall 2021

Graduate Student Instructor, UC Berkeley

- CHEM 220A: Thermodynamics and Statistical Mechanics, Fall 2017
- CHEM 120B: Physical Chemistry, Fall 2016
- CHEM 3AL: Organic Chemistry Laboratory, Fall 2015

Certifications

- Certificate of Training, 'Scientists Teaching Science', National Institutes of Health, 2020
- UC Berkeley Certificate in Teaching and Learning in Higher Education, 2020

MENTORING

- Smriti Pradhan, Physics Graduate Student, Brandeis University, 2023-
- Naren Sundararajan, Physics Graduate Student, Brandeis University, 2023-
- Sarvesh Uplap, Physics Graduate Student, Brandeis University, 2022-2023

- David Wang, Biophysics Graduate Student, Johns Hopkins University/NIH, 2022-

ORAL PRESENTATIONS

- "The interplay between activity and elasticity in model active composites", APS March Meeting 2024
- "Modeling Active Composites", APS March Meeting 2023
- "How ion exchange puts the squeeze on nanocrystals", Phillip Geissler Memorial Symposium, January 2023
- "Mean-field critical behavior and dynamics of a model lattice-mismatched solid", Northern California Theoretical Chemistry Meeting, Contributed Talk, May 2019
- "Modulated order and unconventional coexistence in a model of lattice-mismatched solids", APS March Meeting, Contributed Talk, March 2019
- "Exploring the phase behavior of an elastic Ising model for cation exchange", Pitzer Center Theoretical Chemistry Seminar, April 2018
- "The inherent dynamics of liquid crystal formers", Berkeley Statistical Mechanics Seminar, April 2016

POSTER PRESENTATIONS

- "Modeling Active Composites with Spatiotemporally Correlated Noise", Berkeley Statistical Mechanics Meeting, January 2024
- "Inverstigating fold-switching proteins with coevolutionary models", NIDDK Scientific Conference (Virtual), April 2021
- "Evoluionary models of fold-switching proteins", Annual Meeting of the Biophysical Society (Virtual), February 2021
- "Elastic phase behavior significantly biases the kinetics of model ion-exchange reactions", Berkeley Statistical Mechanics Meeting, January 2019
- "Exploring the phase behavior of an elastic Ising model for cation exchange", West Coast Theoretical Chemistry Symposium, March 2018
- "The statistical mechanics of ion exchange in nanocrystals", Berkeley Statistical Mechanics Meeting, January 2018
- "A simple model for cation exchange in nanocrystals", Chemistry and Physics of Liquids Gordon Research Conference, August 2017
- "Nonequilibrium shape transformations of etched nanocrystals", Berkeley Statistical Mechanics Meeting, January 2017

PROFESSIONAL SERVICE

- Organized and served as chair for APS March Meeting 2024 focus session: "Active Self-Assembly: Models and Model Systems"
- Served as a reviewer for *Journal of Chemical Physics*, *Nano Letters*, *Soft Matter*, and *Communications Biology*
- Assisted with reviews for *eLife*, *Nature Communications*, *Biophysical Journal*, and *PLOS Computational Biology*

OUTREACH

- Helped foster a supportive peer network for incoming chemistry graduate students through the pilot CHEMentor program

- Taught a two-hour course on computational chemistry to high school students through the Berkeley Splash program
- Co-organized and led the IRG 2 (Soft Active Materials) Workshop for the Brandeis University MRSEC
- Serve as head of the Brandeis MRSEC trainee committee