

Hamed Emamy

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Education

- 2012–2018 **Doctor of Philosophy**, *Wesleyan University*, Middletown, CT.
Physics
Thesis: "Nanoparticle Composite Materials: Controlling Nanoparticle Organization and Nanoparticle Effects on Polymer-Composite Dynamics"
Thesis advisor: Prof. Francis Starr
- 2010–2012 **Master of Science**, *Sharif University of Technology*, Tehran, IR.
Physics
Thesis: "Synthesize of graphene nanoribbons with a non-zero energy band gap for inactivation of alive cells using infrared irradiation"
Thesis advisor: Prof. Omid Akhavan
- 2006–2010 **Bachelor of Science**, *University of Tehran*, Tehran, IR.
Solid-State Physics

Experience

- 2020–2021 **Post-Doctoral research scientist**, *Brown University*, Providence, RI.
Studied the effects of dynamics of the proteins in the liquid-liquid phase separation (LLPS) process.
- Studied how the sequence of a protein affects its dynamics in the dense phase of LLPS by using a coarse-grained model of proteins. Utilized Machine Learning methods (Artificial Neural Network), and the already available data for training, to estimate the thermodynamics (radius of gyration) and dynamics (structural relaxation time) quantities of proteins given their sequence.
 - Used logistic regression, to create a classifier that differentiates proteins that go through LLPS at different temperatures.
- 2018–2020 **Post-Doctoral research scientist**, *Columbia University*, New York, NY.
Computational and theoretical study of polymer thin films and polymer-nanoparticle composites and self-assembly of the DNA-origami structures.
- Studied the enthalpy-entropy competition in soft materials self-assembly.
 - Used multi-scale simulations to estimate the parameters of a coarse-grained model for DNA origami objects and improve the model accuracy to design a more accurate model.
 - Utilized Monte Carlo simulations to study the growth process of DNA origami crystals. Clustering particles in groups using machine learning methods.
- 2012–2018 **Graduate Student research assistant**, *Wesleyan University*, Middletown, CT.
Used time series analysis and stochastic processes to study the time dependence of different physical quantities in the soft materials systems.

- [2013-2016] Research assistant: computational study of DNA-linked nanoparticle superlattices stability (free energy) using molecular dynamics simulation (designing and parameterizing a model for DNA-origami structures and multi-scale simulation), and normal vibrational mode analysis (calculation of dispersion relation of normal modes). Theoretical and computational study of crystallite shape of DNA-linked nanoparticle superlattices using Wulff construction method.
 - [2017-2018] Research assistant: computational study of dynamical and structural effects of nanoparticle size on the bound polymers layer in polymer-nanoparticle composite materials by using statistical methods and time series analysis.
 - [2016-2018] Research Assistant: Molecular dynamics simulation and data analysis of star polymers to study their dynamics (glass transition temperature, fragility, string-like motion, non-Gaussian parameter, . . .). Writing and maintaining the MD simulations and analysis codes in C.
- 2010–2012 **Graduate Student research assistant**, *Sharif University of Technology*, Tehran, IR.
Synthesizing and characterizing graphene nanoribbons for studying toxicity of them on living cells and cancer photothermal therapy.
- Teaching and Mentorship**
- 2018–2020 **Mentor**, *Columbia University*.
Mentored PhD students in their research projects. Designed research projects for master students.
- 2012–2017 **Lecturer**, *Wesleyan University*.
Preparation for the general physics lab. Giving lectures to students about the experiments and guiding them through the experiments.
- 2015–2016 **Teaching assistant**, *Wesleyan University*.
Teaching assistant of “Modeling and Data Analysis: From Molecules to Markets” course. Helping students understand and connect statistical concepts to solve a variety of problems in economics, natural sciences and social sciences.
- 2011–2012 **Lecturer**, *Sharif University of Technology*.
Preparation for the general physics lab. Giving lectures to students about the experiments and guiding them through them.
- 2020–present **Shiv Rekhi**, *PhD student*, Lehigh University.
Research project: effects of sequence on the dynamics of Normal modes of vibration in proteins.
- 2021–present **Rucha Railkar**, *Visitor student*, Lehigh University.
Research project: Estimating the proteins radius of gyration using Machine Learning.
- 2020–2021 **Ari Liu**, *Master Student*, Wesleyan University.
Research project: Dynamics of bridged chains in polymer nanoparticle composites. Co-author in a published article (see the publication list)
- 2018–2020 **Clement Koh**, *PhD student*, Columbia University.
Research project: Entropic effects of the polymer chain length on the dispersion of the NPs in polymer-nanoparticle composites.
- 2019–2020 **Chia (Rosemary) Hsuan Chang**, *Master Student*, Columbia University.
Research project: Effects of bond specificity in defect formation in DNA-origami lattices.

2017–2020 **Jinpeng Fan**, *Master Student*, Wesleyan University.

Research project: Dynamics of star polymers. Published an article (See the publication list) and defended his thesis successfully. A second manuscript is in preparation.

2017–2020 **Wujie Wang**, *Under Graduate Student*, Wesleyan University.

Research project: How the DNA sequence affects the stochastic motion of the DNA Holiday junction.

Publications

1. Ari Y Liu, **Hamed Emamy**, Jack F Douglas, and Francis W Starr. Effects of chain length on the structure and dynamics of semidilute nanoparticle–polymer composites. *Macromolecules*, 54(7):3041–3051, 2021
2. Wengang Zhang, **Hamed Emamy**, Fernando Vargas-Lara, Beatriz A Pazmiño Betancourt, Dong Meng, Francis W Starr, and Jack F Douglas. The interfacial layers around nanoparticle and its impact on structural relaxation and glass transition in model polymer nanocomposites. In *Theory and Modeling of Polymer Nanocomposites*, pages 101–131. Springer, 2021
3. **Hamed Emamy**, Sanat K Kumar, and Francis W Starr. Structural properties of bound layer in polymer–nanoparticle composites. *Macromolecules*, 53(18):7845–7850, 2020
4. Zhiwei Lin, **Hamed Emamy**, Brian Minevich, Yan Xiong, Shuting Xiang, Sanat Kumar, Yonggang Ke, and Oleg Gang. Engineering organization of dna nano-chambers through dimensionally controlled and multi-sequence encoded differentiated bonds. *Journal of the American Chemical Society*, 142(41):17531–17542, 2020
5. Wengang Zhang, **Hamed Emamy**, Beatriz A Pazmiño Betancourt, Fernando Vargas-Lara, Francis W Starr, and Jack F Douglas. The interfacial zone in thin polymer films and around nanoparticles in polymer nanocomposites. *The Journal of chemical physics*, 151(12):124705, 2019
6. Jinpeng Fan, **Hamed Emamy**, Alexandros Chremos, Jack F Douglas, and Francis W Starr. Dynamic heterogeneity and collective motion in star polymer melts. *The Journal of chemical physics*, 152(5):054904, 2020
7. **Hamed Emamy**, Oleg Gang, and Francis W Starr. The stability of a nanoparticle diamond lattice linked by dna. *Nanomaterials*, 9(5):661, 2019
8. **Hamed Emamy**, Sanat K Kumar, and Francis W Starr. Diminishing interfacial effects with decreasing nanoparticle size in polymer-nanoparticle composites. *Physical review letters*, 121(20):207801, 2018
9. Wenyan Liu, Miho Tagawa, Huolin L Xin, Tong Wang, **Hamed Emamy**, Huilin Li, Kevin G Yager, Francis W Starr, Alexei V Tkachenko, and Oleg Gang. Diamond family of nanoparticle superlattices. *Science*, 351(6273):582–586, 2016
10. Omid Akhavan, Elham Ghaderi, **Hamed Emamy**, and Fatima Akhavan. Genotoxicity of graphene nanoribbons in human mesenchymal stem cells. *Carbon*, 54:419–431, 2013
11. Omid Akhavan, Elham Ghaderi, and **Hamed Emamy**. Nontoxic concentrations of pegylated graphene nanoribbons for selective cancer cell imaging and photothermal therapy. *Journal of Materials Chemistry*, 22(38):20626–20633, 2012
12. **Hamed Emamy**, Francis W Starr, and Sanat K Kumar. Detecting bound polymer layers in attractive polymer-nanoparticle hybrids. *Nanosclae*, 2021

Book Chapters

1. Wengang Zhang, **Hamed Emamy**, Fernando Vargas-Lara, Beatriz A Pazmiño Betancourt, Dong Meng, Francis W Starr, and Jack F Douglas. The interfacial layers around nanoparticle and its impact on structural relaxation and glass transition in model polymer nanocomposites. In *Theory and Modeling of Polymer Nanocomposites*, pages 101–131. Springer, 2021

Professional Skills

- **Programming and software:** Python(NumPy, SciPy, Matplotlib)(Advanced), C/C++(Intermediate-Advanced), Mathematica(Intermediate-Advanced), AWK, Bash scripting, LaTeX, MATLAB (beginner).
- **Modeling and Simulations:** HOOMD-Blue and LAMMPS simulation packages.
- **Data Visualization:** Grace, VMD, OVITO.
- **Machine Learning:** TensorFlow, Keras.

Professional Membership:

- 2016-Present **American Physical Society (APS).**
2017-Present **American Chemical Society (ACS).**
2017-Present **American Institute of Chemical Engineers (AIChE).**

Invited Talks

1. Physics Colloquium, Wesleyan University. Title, “Effects of Interfaces on Polymer-Nanoparticle Composite Dynamics” (02-27-2020).

Presentation

1. APS March Meeting 2020: “Effects of Nanoparticles Motion on a Bound Layer in Strongly Attractive Polymer Nanocomposites”
2. Lehigh University 2020: “Structural Properties of Bound Layer in Strongly Attractive Polymer Nanocomposites”
3. APS March Meeting 2019: “Diminishing Interfacial Effects with Decreasing Nanoparticle Size in Polymer-Nanoparticle Composites”
4. APS March Meeting 2018: “Diminishing Effect of Bound Polymer Layers with Decreasing Nanoparticle Size”
5. Soft Matter Seminar, Columbia University, 11-2017: “Diminishing Effect of Bound Polymer Layers with Decreasing Nanoparticle Size”
6. APS March Meeting 2017: “Dynamical heterogeneity of star-polymers”
7. APS March Meeting 2016: “DNA-linked NanoParticle Lattices with Diamond Symmetry: Stability and Shape”

Poster Presentation

8. AIChE meeting 2019 meeting with faculty candidate poster session: “Organization and Effects of Nanoparticles on Polymer-Nanoparticle Composites”
9. Columbia university postdoc symposium 2019: Effects of organization of NPs on polymer-nanoparticle

composites.

10. Columbia university postdoc symposium 2018: Diminishing effects of NP on interfacial chains in polymer-nanoparticles composites.
11. Gotham-Metro Condensed matter meeting 2019: Polymer chains structure in spherical confinement: entropic or enthalpic?
12. Wesleyan university annual biophysics retreat September 2016: Cubic diamond lattice mediated by tetrahedral DNA-origami.
13. Wesleyan university annual biophysics retreat September 2015: Cubic diamond vs Hexagonal diamond stability in DNA origami superlattices.
14. University of Massachusetts, Amherst, June 2015 (Soft Matter Summer School): "Free Energy Calculation of the Self-Assembled Nanoparticle Lattices"

Awards and Honors:

1. Columbia University postdoc poster symposium top poster award 2018.
2. Top 1 percent most cited paper in its academic field according to web of science (third and fourth publications in the publications list) 2015-2017
3. Ranked 45th among 8591 participants in nation Masters Degree university entrance exam in physics 2010
4. Ranked 1st among 1995 participants in nation Masters Degree university entrance exam in electro optics 2010.
5. Ranked 2nd among 1995 participants in nation Masters Degree university entrance exam in photonics 2010.

Services

1. Conference for Undergraduate Women in Physics (CUWiP). Helping in the organization and different activities.
2. Part of the organization team for the 13th World Conference in Computational Mechanics (2018).
3. Mentoring high school students in SciRISE student group, where I mentored high school students (from ELLIS Preparatory Academy) that have recently immigrated to the US from other countries (2020).
4. Serving as a reviewer for ACS Nano journal.

Workshops

1. Columbia University Center for Teaching and Learning: Engaged Lecturing workshop (09-2019).
2. Columbia University Center for Teaching and Learning: Small Changes to Foster Inclusive Teaching (10-2019).
3. Diversity and Inclusion in STEM Workshop, Brown University (07-2020).
4. Teaching Skills Workshop, Columbia University (08-2020).