Ranit Mukherjee

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Education

2016–2021 **PhD, Engineering Mechanics**, *Virginia Tech*, Virginia, USA
- Advisor: Prof. Jonathan B. Boreyko
- Dissertation title: Exploiting Interfacial Phenomena to Expel Matter from its Substrate

2010–2014 **B.Engg., Mechanical Engineering**, *Jadavpur University*, Kolkata, India

Research Interest Area

Experimental soft matter (complex fluids), Physicochemical hydrodynamics, Non-equilibrium systems

Professional Experience

2021–2025 **Postdoctoral Research Associate**, *University of Minnesota, Minneapolis*, Minnesota, USA, With Prof. Sungyon Lee
- Led a multi-departmental National Science Foundation (NSF)-sponsored project on engineering the composite behavior of particle-laden interfaces.
- Mentoring a graduate student in the experimental design and analysis of particle-laden viscous fingering phenomena.

2016–2021 **Graduate Research Assistant**, *Virginia Tech*, Blacksburg, USA, With Prof. Jonathan Boreyko
- Worked in a team to design a novel phase-change thermal-diode prototype for space-sensitive thermal management solutions and characterize the unit's thermal performance.
- Collaborated with a packaging company (formerly Bemis Company, Inc., now Amcor) to develop a low-cost and effective ultra-slippery food-grade packaging solution.
- Lead investigator on pioneering research into spontaneous ice electrification, uncovering jumping frost dendrites as a novel de-icing mechanism. Developed proof-of-concept leading to a collaboration with Rolls-Royce Research and a 500K USD NSF GOALI grant.

2014–2016 **Process Engineer**, *Thermax Limited*, Pune, Maharashtra, India
- Gained practical design experience with direct-fired heaters for processing industries and petrochemical plants, including performing flow-thermal analysis using proprietary software (e.g., FRNC-5PC) and custom in-house VBA code, which I helped develop.
- Worked in a team of process & systems engineers, computer-aided designers, and salespersons to procure million-dollar projects and designed, implemented, and executed them according to customer needs and specifications.

Publications

Journal Publications

2025 B. C. Druecke, A. Hooshanginejad, **R. Mukherjee**, P. Poureslami* and S. Lee, *"Particle-laden filaments from a draining suspension"*, **Soft Matter**, accepted, 2025

2025 **R. Mukherjee**, Z. Chen, X. Cheng, and S. Lee, *"Microscopic contact line dynamics dictate the emergent behaviors of particle rafts"*, **Phys. Rev. Fluids**, 10, 084003 , 2025

2025 M. Edalatpour, **R. Mukherjee**, and J. B. Boreyko, "*Bridging-Droplet Thermal Diodes: Modeling and Optimization*", **Int. J. Mass Heat Trans.**, 239, 126594, 2025

2023 B. C. Druecke, **R. Mukherjee**, X. Cheng, S. Lee, "*Collapse of a granular raft: transition from single particle falling to collective creasing*", **Phys. Rev. Fluids**, 8, 024003 , 2023

2022 G. J. Iliff*, **R. Mukherjee**, H. A. Gruszewski, D. G. Schmale III, S. Jung, and J. B. Boreyko, "*Phase-change-mediated transport and agglomeration of fungal spores on wheat awns*", **Journal of Royal Society Interface**, 19, 20210872, 2022

2021 **R. Mukherjee**, S.F. Ahmadi, H. Zhang, R. Qiao, and J. B. Boreyko, "*Electrostatic Jumping of Frost*", **ACS Nano**, 15, 4669–4677, 2021

2021 **R. Mukherjee**, H. A. Gruszewski, L. T. Bilyeu*, D. G. Schmale III, and J. B. Boreyko, "*Synergistic dispersal of plant pathogen spores by jumping-droplet condensation and wind*", **Proc. Natl. Acad. Sci. U.S.A. (PNAS)**, 118, e2106938118, 2021

2021 H. Zhang, J. D. Poorter, **R. Mukherjee**, J. B. Boreyko, and R. Qiao, "*Thermoelectrics in ice slabs: charge dynamics and thermovoltages*", **Phys. Chem. Chem. Phys.**, 23, 16277-16288, 2021

2020 M. Edalatpour, K. R. Murphy, **R. Mukherjee**, and J. B. Boreyko, "*Bridging-droplet thermal diodes*", **Advanced Functional Materials**, 30, 2004451, 2020

2019 **R. Mukherjee**, A. S. Berrier*, K. R. Murphy, J. R. Vieitez*, and J. B. Boreyko, "*How surface orientation affects jumping-droplet condensation*", **Joule**, 3, 1360-1376, 2019

2018 **R. Mukherjee**, M. Habibi, Z. T. Rashed*, O. Berbert, X. Shi, and J. B. Boreyko, "*Oil-Impregnated Hydrocarbon-Based Polymer Films*", **Scientific Reports**, 8, 11698 , 2018

In Review or preparation for journal

2025 Y. Lolla, V. Kulkarni, **R. Mukherjee**, and J. B. Boreyko, *"Drop Impact on a Lubricant-Infused Fiber"* (In preparation)

2025 P. Poureslami, **R. Mukherjee** and S. Lee, *"Pattern formation and particle plume dynamics in suspension flows"* (In preparation, Soft Matter)

Patent

2023 **US Patent: 20230251045A1, Status Pending**, *2023/08/10*, "**Planar Bridging-droplet thermal diodes**, Inventors: J. B. Boreyko, M. Edalatpour, K. R. Murphy, **R. Mukherjee**

(* denotes undergraduate or first-year graduate researcher)

Conference Presentations

2025 **"Can we predict the death of a granular raft?"**, *Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Salt Lake City, UT, November 23–25 (Oral)

2025 **"Elastic or granular: How a continuum model explains the dual nature of granular rafts"**, *Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Salt Lake City, UT, November 23–25 (Oral)

2024 **"Collapse of a granular raft: particle-scale features on a continuum model"**, *APS March Meeting 2024*, Minneapolis, MN, March 3–8 (Oral)

2023 **"Understanding the collapse of a granular raft"**, *SES Annual Technical Meeting 2023*, Minneapolis, MN, Oct 8–10 (Oral)

2023 **"The collapse of a granular raft under bi-axial compression"**, *APS March Meeting 2023*, Las Vegas, NV, March 5–10 (Oral)

2022 **"On the collapse of a granular raft in a funnel"**, *Granular Matter Gordon Research Conference*, Stonehill College, MA, USA, June 27–July 1, 2022 (Poster)

2021 **"Student Keynote Award Presentation: Jumping Ice"**, *Inaugural micro Flow and Interfacial Phenomena Conference*, Virtual, June 7–9, 2021 (Oral)

2019 **"Jumping Frost"**, *72nd Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Seattle, WA, November 23–26, 2019 (Oral)

2019 **"How Surface Orientation Affects Jumping-Droplet Condensation"**, *Gordon Research Conference on Micro and Nanoscale Phase Change Heat Transfer*, Lucca, Italy, February 3–8, 2019 (Poster)

2018 **"Oil-infused Polyethylene Films"**, *MII Technical Conference and Review*, Virginia Tech, Blacksburg, April 16–18, 2018 (Poster)

2018 **"Effect of Surface Orientation on Jumping-droplet Condensation"**, *16th International Heat Transfer Conference (IHTC-16)*, Beijing, China, August 10–15, 2018 (Poster)

2017 **"Oil-infused Polyethylene Films"**, *Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Denver, CO, November 19–21, 2017 (Oral)

Professional Activities

2016-present **Journals reviewed for (co-reviewed with advisor):**, *Scientific Reports, Nano Energy, Advanced Functional Materials, Physical Review Letters, ACS Nano, Soft Matter, ACS AMI, Langmuir, Physical Review Fluids, Advanced Science*

2016-2021 **Past Member**, *Bio-Inspired Science & Technology Center at Virginia Tech*

2016-2021 **Past Member**, *Macromolecules and Interfaces Institute at Virginia Tech*

Teaching Interest Area

Fluid Mechanics, Heat & Mass Transfer, Thermodynamics

Teaching Experience

Spring 2017 **ESM 2304, Introduction to Dynamics**, *Virginia Tech*, Blacksburg, Virginia
Instructor: Prof. Scott Hendricks and Dr. Jared Gregg

Fall 2016, Fall 2020 **ESM 2104, Introduction to Statics**, *Virginia Tech*, Blacksburg, Virginia
Instructor: Prof. Scott Hendricks, Dr. Sneha Davison

Outreach Programs as a Science Educator

2024 **Squishy Science Sunday**, *This was an outreach event organized to introduce concepts of soft matter physics to a general audience*, APS March Meeting, Minneapolis, Minnesota

2017–2020 **Virginia Tech Science Festival**, *Yearly expo-style, family-friendly events to engage with graduate scientists. Festival guests take part in hands-on activities and demonstrations at about 100 different exhibits*, Blacksburg, Virginia

2017–19 **C-Tech^2 Summer Camp**, *Yearly summer camp activity aimed at rising junior and senior high school girls. The purpose is to provide access to information for a successful STEM career. Organized by the Center for the Enhancement of Engineering Diversity (CEED)*, Blacksburg, Virginia

2017, 2018 **Kids Tech University (KTU)**, *An educational outreach program to inspire children between ages 9–12 years in STEM education*, Blacksburg, Virginia

References

Sungyon Lee **Associate Professor**, *Postdoc advisor*,
Department of Mechanical Engineering, University of Minnesota-Twin Cities, Minneapolis, MN 55455, USA,
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Xiang Cheng **Professor**, *Collaborator*,
Department of Chemical Engineering and Materials Science, University of Minnesota-Twin Cities, Minneapolis, MN 55455, USA,
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Jonathan B. Boreyko **Associate Professor**, *PhD advsior*,
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