Ranit Mukherjee

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Education

2016–2021 **PhD, Engineering Science and Mechanics**, *Virginia Tech*, Blacksburg, Virginia
Advisor: Prof. Jonathan B. Boreyko

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

Research Interest Area

Experimental, Soft Condensed Matter physics

Research Experience

Virginia Tech, Blacksburg, Virginia

2016–2021 **Oil-impregnated Hydrocarbon-based Polymer Films**
A simple, cost-effective and robust method was developed to make SLIPS from low-density extruded polymer films. The motivation behind the project was to minimize product wastage from single-serving ketchup pouches.

Orientation Effect on Jumping-Droplet Condensation
Jumping droplet condensation has already been shown to be better at heat transfer than either dropwise or filmwise condensation. This is the first thorough study which further elucidates the surface orientation requirements to maximize the benefits of jumping-droplet condensation for longer periods of condensation.

Jumping Frost
A study on the surprising phenomena of ice particles breaking off from a frosted surface and jumping towards opposing liquid droplets.

Wheat-to-Wheat Pathogen Transport by Jumping Droplet Condensation
Rust disease is one of the most devastating and economically significant fungal diseases in wheat plants. In this study, we are assessing the importance of the jumping-droplet condensation on the short and long-distance dispersal of rust pathogens.

Phase Change-Induced Spore Agglomeration on Wheat Awns
Preliminary experiments reveal how morphology of wheat awns help in the formation of spore clusters from singular *Fusarium* perithecia in the presence of condensation and evaporation. Such clustering is also shown to be conducive to easier disease spreading within a field via wind or rain.

Bridging-Droplet Thermal Diodes
A novel, durable bridging-droplet thermal diode was developed. I worked on the theoretical heat transfer model for the forward and reverse mode of operation.

University of Minnesota- Twin Cities, Minneapolis, USA

2021–current **Bi-axial compression of a granular raft**
We observe the destabilization of a granular raft under bi-axial compression. By changing several parameters such as particle size, liquid density, interfacial tension we observe the mode of failure for granular rafts.

Work Experience

2014-2016 **Process Engineer**, *Thermax Limited*, Pune, India
Fired heaters are an integral part of petrochemical industries where a thermal fluid is heated to a desired temperature and pressure which is then used in subsequent processes like cracking. My job was to optimize the heater design from the client specific criteria while remaining within the guidelines of API 560 for the fired heaters.

2021-present **Postdoctoral Research Associate**, *University of Minnesota- Twin Cities*, Minneapolis, USA
Conducting experimental research work on granular rafts.

Academic/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

2017-present **Graduate Research Assistant**, *Virginia Tech*
Biomedical Engineering & Mechanics Dept., Advisor: Jonathan B. Boreyko

Professional and Synergistic Activities

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

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

2017-present **Member**, *the American Physical Society (APS)*

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*

Publications

Journal Publications

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, 2018 DOI:10.1038/s41598-018-29823-7

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, 2019 DOI:10.1016/j.joule.2019.03.004

2020 **M. Edalatpour**, K. R. Murphy, R. Mukherjee, and J. B. Boreyko, "**Bridging-Droplet Thermal Diodes**", Advanced Functional Materials, 30, 2020 DOI:10.1002/adfm.202004451

2021 **R. Mukherjee**, S.F. Ahmadi, H. Zhang, R. Qiao, and J. B. Boreyko, "**Electrostatic Jumping of Frost**", ACS Nano DOI:10.1021/acsnano.0c09153

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**", PNAS, 118, 2021 DOI:10.1073/pnas.2106938118

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**", J. R. Soc. Interface, 19, 2022 DOI:10.1098/rsif.2021.0872

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, 2023 DOI:10.1103/PhysRevFluids.8.024003

Conference Proceedings

2018 **R. Mukherjee**, A. S. Berrier, J. R. Vieitez, K. R. Murphy, and J. B. Boreyko, "Effects of Surface Orientation on Jumping-Droplet Condensation", Proceedings of the 16^{th} International Heat Transfer Conference (IHTC-16), 2018

Provisional Patents

2017 **R. Mukherjee**, M. Habibi, Z. T. Rashed, O. Berbert, X. Shi, and J. B. Boreyko, "Slippery Hydrocarbon-Based Polymer Films via Lubricant Impregnation", U.S. Provisional Patent Application No.: 62/531,635, filed 2017

2020 **M. Edalatpour**, K. R. Murphy, R. Mukherjee and J. B. Boreyko, "Planar Bridging-Droplet Thermal Diodes", U.S. Provisional Patent Application No.: 63/044,135, filed 2020

Conference Presentations

2017 **"Oil-infused Polyethylene Films"**, *70^{th} Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Denver, CO, November 19–21, 2017 (Oral)

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

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

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

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

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

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

Participation in Outreach Programs

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

2017–19 **C-Tech^2 Summer Camp**, *Interactive activity involving recent high school graduates to help them explore the engineering and research options at Virginia Tech. Organized by the Center for the Enhancement of Engineering Diversity (CEED)*, Blacksburg, Virginia

2020 **Virginia Tech Science Festival**, *Teleconferenced Meetups between learner groups and researchers to instill a love for science. Organized by Virginia Tech and the Science Museum of Western Virginia*, Blacksburg, Virginia

References

1 **Prof. Jonathan B. Boreyko**, *Associate Professor*,
Department of Mechanical Engineering, Virginia Tech, Blacksburg, Virginia 24061, USA, **email:** boreyko@vt.edu

2 **Prof. Rui Qiao**, *Professor*,
Department of Mechanical Engineering, Virginia Tech, Blacksburg, Virginia 24061, USA, **email:** ruiqiao@vt.edu

3 **Prof. S. Farzad Ahmadi**, *Assistant Professor*,
Department of Physics and Engineering, McDaniel College, College Hill, Westminster, MD 21157, USA,
email: fahmadi@mcdaniel.edu