

Shravan Pradeep

Penn Soft Earth Dynamics (PennSED) Lab and Penn Complex Fluids Group, University of Pennsylvania
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EDUCATION & TRAINING

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| Postdoctoral Researcher Earth and Environmental Sciences Mechanical Engineering and Applied Mechanics University of Pennsylvania, Philadelphia, PA | 2021-Present |
| Ph.D. in Chemical Engineering <i>Minor</i> : Materials Science and Engineering North Carolina State University, Raleigh, NC | 2016-2021 |
| M.S. in Chemical Engineering Birla Institute of Technology and Science (BITS) Pilani, Pilani Campus, India | 2013-2015 |
| B.S. in Chemical Engineering First Class with Distinction (<i>Summa Cum Laude</i>) Amrita Vishwa Vidyapeetham University, Coimbatore, India | 2008-2012 |

RESEARCH INTERESTS

Dense structured fluids, suspension rheology, soft matter tribology, structure-property relationships, confocal tribo-rheometry, materials geomimicry, and additive manufacturing.

PROFESSIONAL EXPERIENCE

RESEARCH:

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| Postdoctoral Researcher , University of Pennsylvania, Philadelphia, PA <i>Mentor(s)</i> : Profs. Douglas J. Jerolmack and Paulo E. Arratia <i>Research Focus</i> : Exploring tribo-rheological properties of soft-earth materials | 2021-Present |
| Graduate Research Assistant , North Carolina State University, Raleigh, NC <i>Advisor</i> : Prof. Lilian C. Hsiao (Hsiao SMART Lab) <i>Dissertation</i> : Flow mechanics in dense suspensions of anisotropic colloids | 2017-2021 |
| Research Assistant , Indian Institute of Technology Delhi, New Delhi, India <i>Advisor(s)</i> : Profs. Shalini Gupta and Ravikrishnan Elangovan <i>Project</i> : Immunomagnetic capture chip development for optical detection of bacteria | 2015-2016 |
| Research Assistant , Birla Institute of Technology & Science, Pilani, India <i>Advisor</i> : Sonal Mazumder, PhD (<i>Current Position</i> : Scientist, US-FDA, Silver Springs, MD) <i>Thesis</i> : Quantum dots for photocatalytic degradation of biological pollutants | 2014-2015 |
| Research Assistant , Amrita School of Engineering, Coimbatore, India <i>Advisor</i> : Prof. Kanakasabai Panchanathan <i>Senior Project</i> : Titania nanoparticles-embedded polyvinyl alcohol membranes | 2011-2012 |
| Research Intern , Research & Development Establishment (Eng.), Pune, India <i>Advisor</i> : Anoop Anand, PhD (Composite Research Center) <i>Project</i> : Graphene in advanced structural composites | Summer 2011 |

INDUSTRY:

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| Management Trainee , Mangalore Chemicals & Fertilizers Ltd., Mangalore, India Production Engineering, Ammonia Production Plant | 2012-2013 |
| In-Plant Trainee (Co-Op) , Exide Industries, Hosur, India Industrial Battery Division | Summer 2010 |

AWARDS & HONORS

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| Victor K. LaMer Award Finalist , ACS Colloids and Surface Science Division | 2023 |
| Postdoctoral Poster Award - Honorable Mention , APS Forum for Early Career Scientists | 2023 |
| Postdoctoral Poster Award - Third Place , Society of Rheology 93 rd Annual Meeting | 2022 |
| Diverse Leaders for Future , Future Faculty Workshop, University of Delaware | 2022 |
| James K. Ferrell Outstanding Ph.D. Graduate Award , NC State | 2022 |
| Langmuir Graduate Student Award Finalist , ACS Colloids and Surface Science Division | 2021 |
| Travel Assistance Award , Graduate Student Association, NC State | 2019 |
| Conference Travel Award , College of Engineering, NC State | 2019 |
| Provost's University Graduate Fellowship , College of Engineering, NC State | 2016-2017 |
| Department 1st Rank , Chemical Engineering Department, BITS Pilani | 2015 |
| Poster Award - Second Place , Indian Institute of Chemical Engineers, Pilani Chapter | 2015 |
| University 3rd Rank , Amrita Vishwa Vidyapeetham University | 2012 |
| School of Engineering Merit Award , Amrita Vishwa Vidyapeetham | 2009-2011 |
| Prime Minister's Merit Scholarship , Ministry of Defence, Government of India | 2008-2012 |

JOURNAL PUBLICATIONS

† Equal Contribution | ♣ Supervised Undergrad | [Google Scholar](#)

1. Bryan Torres, Shravan Pradeep, Ranjiangshang Ran, Douglas Jerolmack, Paulo Arratia, "Sedimentation dynamics of passive particles in dilute bacterial suspensions: emergence of bioconvection". *Submitted* [[Preprint](#)]
2. Liam Lasting, Mostafa Akbari, Destynn Keuchel, Na Kyung Lee, Shravan Pradeep, Shivani Chawla, Abigail Weinstein, Masoud Akbarzadeh, Laia Mogas-Soldevila, "Terrene 2.0: Biomaterial Composites Design and Shellular Structures Optimization for Augmented Earthen Construction". *Submitted*
3. Ranjiangshang Ran, Shravan Pradeep, Sebastien Kosgodagan Acharige, Brendan C Blackwell, Christoph Kammer, Douglas J. Jerolmack, and Paulo E. Arratia, "Understanding the rheology of kaolinite clay suspensions using Bayesian inference", **Journal of Rheology** 67:241-252 (2023). [[Paper](#)]
 - *Highlight*: Editor's Featured Article
4. Bryan O. Torres Maldonado, Ranjiangshang Ran, K. L. Galloway, Quentin Brosseau, Shravan Pradeep, and Paulo E. Arratia, "Phase-separation during sedimentation of dilute bacterial suspensions", **Physics of Fluids**, 34: 113305 (2022). [[Paper](#)]
5. Robert Kostynick[†], Hadis Matinpour[†], Shravan Pradeep[†], Thomas Dunne, Sarah Haber, Alban Sauret, Eckart Meiburg, Paulo E Arratia, and Douglas J Jerolmack, "Rheology of debris flows controlled by the distance from jamming", **Proceedings of the National Academy of Sciences**, 119:44 (2022). [[Paper](#)]
 - *Highlights*: Physics of disaster: How mudslides move. [NSF News](#) | [Penn News](#) | [AAAS EurekAlert!](#)
6. Shravan Pradeep, Alan Wessel[♣], and Lilian C Hsiao, "Hydrodynamic origin for the suspension viscoelasticity in rough colloids", **Journal of Rheology**, 66: 895 (2022). [[Paper](#)]
 - *Highlight*: Editor's Featured Article
7. Shravan Pradeep, Paulo E. Arratia, "To biofilm or not to biofilm", **eLife**, 80891 (2022). [[Paper](#)]
8. Zijian Dai, Shravan Pradeep, Jie Zhu, Wenyi Xie, Heather F Barton, Yang Si, Bin Ding, Jianyoung Yu, and Gregory Parsons, "Freestanding metal organic framework-based microfiltration membranes fabricated *via* pseudomorphic replication toward liquid- and gas hazards abatement", **Advanced Materials Interfaces**, 2101178 (2021). [[Paper](#)]
9. Shravan Pradeep, Mohammad Nabizadeh, Alan R. Jacob, Safa Jamali, and Lilian C. Hsiao, "Jamming distance dictates colloidal shear thickening", **Physical Review Letters**, 127: 158002 (2021). [[Paper](#)]
 - *Highlights*: New images lead to better prediction in shear thickening. [Phys.Org](#) | [NC State News](#)
10. Jie Zhu, Weiwang Qiu, Hua Han, Chengjian Yao, Chun Wang, Dequn Wu, Shravan Pradeep, and Zijian Dai, "Water stable UiO-66-NH₂ metal organic frameworks armed poly(vinyl) alcohol nanofibrous wound dressing with anti-infective therapy", **Journal of Colloid and Interface Science**, 603: 243-251 (2021). [[Paper](#)]

11. Shravan Pradeep, Lilian C. Hsiao, "Contact criterion in suspensions of smooth and rough colloids", **Soft Matter**, 16:4980-4989 (2020). [\[Paper\]](#)
12. Lilian C. Hsiao, Shravan Pradeep, "Experimental synthesis and characterization of frictional particles for colloidal and granular rheology", **Current Opinion in Colloid and Interface Science**, 43:94-112 (2019). [\[Paper\]](#)
13. Shravan Pradeep, Sai Raghuram, and Sonal Mazumder, "Rapid synthesis of pure and doped ZnS quantum dots for photocatalytic degradation of biological dye pollutants", **Materials Focus**, 6:657-667 (2017). [\[Paper\]](#)
14. Shravan Pradeep[†], Sai Raghuram[†], Mahua Chaudhury, and Sonal Mazumder, "Synthesis and characterization of Fe³⁺ and Mn²⁺ doped ZnS quantum dots for photocatalytic application: Effect of mercaptoethanol and chitosan as capping agent", **Journal of Nanoscience and Nanotechnology**, 17:1125-1132 (2017). [\[Paper\]](#)
15. Sai Raghuram, Shravan Pradeep, Subhra Dash, Rajdeep Chowdhury, and Sonal Mazumder, "Chitosan encapsulated ZnS:M (M: Fe³⁺ and Mn²⁺) quantum dots for fluorescent labelling of sulphate reducing bacteria", **Bulletin of Materials Science**, 39:405-413 (2016). [\[Paper\]](#)

Manuscripts Under Preparation:

- Shravan Pradeep, Xiangyu Chen, Paulo Arratia, Douglas Jerolmack, "Tribo-rheological origins of baseball *Magic Mud* gripping mechanics". *Pre-Publication Highlights*: [Philly Inquirer](#) | [Penn News](#)
- Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Origins of complexity in rheology of soft earth matter".
- Shipeng Liu, Shravan Pradeep, Sen Gao, John Bush, John Ruck, Doug Jerolmack, Feifei Qian, "Universal dependence of shear responses from mud: from frictional to cohesive regime".

PROFESSIONAL ACTIVITIES, SERVICE & OUTREACH

Academic Peer-Review: (WOS Researcher ID: AAB-1603-2019)

- *Journals*: Nature Communications, Physical Review Letters, Journal of Colloid and Interface Science, Physics of Fluids, Scientific Reports.

Conference Chair/Co-Chair:

- American Physical Society March Meeting
 - *Session*: Functionality through Nonlinearity in Metamaterials 2023
 - *Session*: Rheology, Flow & Instabilities of Soft Materials 2022
 - *Session*: Interfaces and Mixing & Kadanoff Prize Talk 2022
- Society of Rheology Annual Meeting
 - *Session*: Colloids and Suspensions 2022

Professional Member: American Institute of Chemical Engineers (AIChE), American Society of Mechanical Engineers (ASME), Society of Rheology (SOR), American Chemical Society (ACS), American Physical Society (APS), and American Geophysical Union (AGU).

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| Early Career Member , APS Division of Soft Matter (DSOFT) Membership Committee | 2024 |
| Session Organizer , Division of Soft Matter (DSOFT): <i>Soft Earth Geophysics</i> , APS March Meeting | 2024 |
| Poster Session Judge , AIChE Materials Engineering & Sciences Division, AIChE Annual Meeting | 2023 |
| Science Instructor , Skype-a-Scientist (Non-Profit), Philadelphia | 2023-Present |
| Primary Member , Climate, Diversity, Equity & Inclusion Committee (CDEIC), UPenn | 2022-Present |
| Volunteer Staff , Diversity Equity Engagement at Penn in STEM (DEEPenn STEM), UPenn | 2022-Present |
| Visiting Researcher , Kavli Institute of Theoretical Physics, <i>Multiphase Flows</i> | 2022 |
| Participant , Boulder Summer School for Condensed Matter, <i>Hydrodynamics Across Scales</i> | 2022 |
| Student Affairs Committee Member , Division of Soft Matter (DSOFT), American Physical Society | 2019-2022 |
| Mentor , Alumni Mentoring Program, Chemical & Biomolecular Engineering, NC State | 2021-2022 |
| Captain , Graduate Recruitment Event, Chemical & Biomolecular Engineering, NC State | 2019 |
| Student Organizer , Future Leaders in Chemical Engineering, NC State | 2018-2019 |
| Vice-President , Chemical & Biomolecular Engineering Graduate Student Association, NC State | 2017-2018 |
| Department Ambassador (Chemical & Biomolecular), Office of International Services, NC State | 2016-2018 |
| Department Representative (Master's Student Body), Chemical Engineering, BITS Pilani | 2014-2015 |

TEACHING EXPERIENCE & CERTIFICATIONS

Teaching Assistant & Guest Lecturer, University of Pennsylvania

Department of Mechanical Engineering & Applied Mechanics | Department of Earth & Environmental Sciences

- MEAM 2020 Introduction to Thermo-Fluids Engineering (Prof. Paulo E. Arratia) Fall 2023, Fall 2022
- EESC 6720 Landslides | Lecture Focus: Subaqueous Granular Matter Failure Modes Spring 2023
- MEAM 225 Environmental Engineering (Prof. Douglas Jerolmack) Spring 2022

Teaching and Communication Certificate, The Graduate School, NC State

Spring 2021

Teaching Assistant, Department of Chemical & Biomolecular Engineering, NC State

- CHE 713 Chemical Engineering Thermodynamics (Prof. Keith Gubbins) Fall 2019
- CHE 205 Chemical Process Calculations (Profs. Lilian Hsiao, Milad Abolhasani & Qingshan Wei) Fall 2017
- CHE 312 Transport Processes II (Prof. Fanxing Li) Spring 2017

Teaching Assistant, Chemical Engineering Department, BITS Pilani

- CHE F312 Chemical Engineering Lab I (Transport Phenomena) Fall 2014, Fall 2013
- CHE F322 Chemical Engineering Lab II (Chemical Kinetics & Process Control) Spring 2015, Spring 2014

MENTORING EXPERIENCE

University of Pennsylvania

- Bryan Torres (Ph.D. Mechanical Engineering); Lidan Gou (M.S. Chemical Engineering)
- Xiangyu Chen and Eric Sigg (B.S. Mechanical Engineering); Phillip Choi (B.A. Physics)

North Carolina State University

- Alan Wessel, Sara Wozniak, Christine Dang, Colin Donaldson, and Alex Kramer (B.S. Chemical Engineering)

SCIENTIFIC PRESENTATIONS

INVITED TALKS

1. Shravan Pradeep, "Rheological signatures of microstructural annealing in the yielding dynamics of model soft earth suspensions", *Future of Rheology*, Society of Rheology Virtual Seminar Series (2024).
2. Shravan Pradeep, "Frictional interactions anneal yielding dynamics in model earth suspensions", *ACS Colloids and Surface Science Symposium*, Raleigh, NC (2023). **LaMer Keynote Speaker**
3. Shravan Pradeep, "Material constraints dictate flow mechanics in dense suspensions", Session: Frontiers in Soft Matter, *APS March Meeting*, Las Vegas, NV (2023).
4. Shravan Pradeep, "Steady shear rheological flow curves in model earth suspension mixtures", Disordered Colloids, Nanoparticles, Atoms, and Particulates Seminar Series, Penn MRSEC, Philadelphia, PA (2023).
5. Shravan Pradeep, "Distance to jamming dictate colloidal shear thickening", *The Plot Thickens*, Shear Thickening Virtual Seminar Series (2021).
6. Shravan Pradeep, "Probing contact microstructure in shear thickening colloidal suspensions", *ACS Colloids and Surface Science Symposium*, Virtual (2021). **Langmuir Graduate Student Speaker**

ORAL PRESENTATIONS

1. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Less is more: *Simple* complex fluids reveal rheological fingerprints in environmental flows", *AIChE Annual Meeting*, Orlando, FL (2023).
2. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Rheological state diagrams for model earth suspensions under shear flow", *APS March Meeting*, Las Vegas, NV (2023).

3. Shravan Pradeep, Robert Kostynick, Hadis Matinpour, Sarah Haber, Alban Sauret, Eckart Meiburg, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Dense suspension rheology approach towards debris flows" *New England Complex Fluids Workshop*, Harvard University, Cambridge, MA (2022).
4. Shravan Pradeep, Eckart Meiburg, Paulo Arratia, Douglas Jerolmack, "Rheological flow curves for model earth suspension mixtures", *Society of Rheology Annual Meeting*, Chicago, IL (2022).
5. Shravan Pradeep, Robert Kostynick, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Constraint-based approach towards debris flow rheology", *APS March Meeting*, Chicago, IL (2022).
6. Shravan Pradeep, Alan Wessel, Lilian Hsiao, "Elucidating the effect of surface roughness-induced geometric frustration on linear viscoelasticity in colloids suspensions", *APS March Meeting*, Chicago, IL (2022).
7. Shravan Pradeep, Alan Wessel, Lilian Hsiao, "Effect of geometric frustration on the linear viscoelasticity in dense colloidal suspensions", *Society of Rheology Annual Meeting*, Bangor, ME (2021).
8. Shravan Pradeep, Alan Wessel, Lilian Hsiao, "Elasticity in dense suspensions of geometrically frustrated colloids", *APS March Meeting*, Virtual (2021).
9. Shravan Pradeep, Alan Jacob, Lilian Hsiao, "Distance to jamming dictates onset stress and strength of shear thickening", *International Congress on Rheology*, Virtual (2020). **Keynote Speaker - Colloids, Suspensions, and Granular Media Session**
10. Shravan Pradeep, Alan Jacob, Lilian Hsiao, "Universal correlation between jamming distance and shear thickening strength in dense colloidal suspensions", *Annual Meeting of the APS Division of Fluid Dynamics*, Virtual (2020).
11. Shravan Pradeep, Alan Jacob, Lilian Hsiao, "Distance to jamming defines shear thickening strength in colloids", *AIChE Annual Meeting*, Virtual (2020).
12. Shravan Pradeep, Lilian Hsiao, "Contact numbers and radial distributions in suspensions of smooth and rough colloids", *APS March Meeting*, Boston, MA (2019).
13. Shravan Pradeep, Sai Raghuram, Sonal Mazumder, "Synthesis and characterisation of Fe³⁺ doped ZnS based colloidal quantum dots in aqueous media", *International Conference on Nanotechnology*, Haldia, India (2015).

POSTER PRESENTATIONS (Selected)

1. Shravan Pradeep, Lilian Hsiao, Paulo Arratia, Douglas Jerolmack, "Jamming distance: physics-informed design parameter for dense suspension rheology", *APS March Meeting*, Las Vegas, NV (2023). **APS Forum for Early Career Scientists Poster Award - Honorable Mention**
2. Shravan Pradeep, Robert Kostynick, Hadis Matinpour, Sarah Haber, Alban Sauret, Eckart Meiburg, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Jamming distance controls rheology of debris flows", *KITP Conference: Multiphase Flows Atmospheres, Oceans, Earths*, Santa Barbara, CA (2022).
3. Shravan Pradeep, Lilian Hsiao, "Engineering flow mechanics in dense suspensions of surface-anisotropic colloids", *Society of Rheology Annual Meeting*, Chicago, IL (2022). **Poster Award - Third Place**
4. Shravan Pradeep, Robert Kostynick, Hadis Matinpour, Sarah Haber, Alban Sauret, Eckart Meiburg, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Yield, jam, and flow: Unpacking physics of debris flows", *Gordon Research Seminar: Granular Matter*, Boston, MA (2022).
5. Shravan Pradeep, Yunhu Peng, Lilian Hsiao, "Connecting frictional dissipation to rheology of confined suspensions", *Society of Rheology Annual Meeting*, Raleigh, NC (2020).
6. Shravan Pradeep, Alex Kramer, Lilian Hsiao, "Programmable self-assembly and suspension rheology in light-responsive colloidal systems", *ACS Colloids & Surface Science Symposium*, State College, PA (2018).
7. Shravan Pradeep, Sai Raghuram, Sonal Mazumder, "Synthesis and characterization of Fe³⁺ and Mn²⁺ doped ZnS nanocrystals", *Workshop on Analytical Instruments for Chemical & Environmental Engineers*, Pilani, India (2015). **Poster Award - Second Place**