Shravan Pradeep

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

Postdoctoral Researcher 2021-Present
Earth and Environmental Sciences || Mechanical Engineering and Applied Mechanics
University of Pennsylvania, Philadelphia, PA

Ph.D. in Chemical Engineering || *Minor*: Materials Science and Engineering 2016-2021
North Carolina State University, Raleigh, NC

M.S. in Chemical Engineering 2013-2015
Birla Institute of Technology and Science (BITS) Pilani, Pilani Campus, India

B.S. in Chemical Engineering || First Class with Distinction (*Summa Cum Laude*) 2008-2012
Amrita Vishwa Vidyapeetham University, Coimbatore, India

RESEARCH INTERESTS

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

PROFESSIONAL EXPERIENCE

RESEARCH:

Postdoctoral Researcher, University of Pennsylvania, Philadelphia, PA 2021-Present
Mentor(s): Profs. Douglas J. Jerolmack and Paulo E. Arratia
Research Focus: Exploring tribo-rheological properties of soft-earth materials

Graduate Research Assistant, North Carolina State University, Raleigh, NC 2017-2021
Advisor: Prof. Lilian C. Hsiao (Hsiao SMART Lab)
Dissertation: Flow mechanics in dense suspensions of anisotropic colloids

Research Assistant, Indian Institute of Technology Delhi, New Delhi, India 2015-2016
Advisor(s): Profs. Shalini Gupta and Ravikrishnan Elangovan
Project: Immunomagnetic capture chip development for optical detection of bacteria

Research Assistant, Birla Institute of Technology & Science, Pilani, India 2014-2015
Advisor: Sonal Mazumder, PhD (*Current Position:* Scientist, US-FDA, Silver Springs, MD)
Thesis: Quantum dots for photocatalytic degradation of biological pollutants

Research Assistant, Amrita School of Engineering, Coimbatore, India 2011-2012
Advisor: Prof. Kanakasabai Panchanathan
Senior Project: Titania nanoparticles-embedded polyvinyl alcohol membranes

Research Intern, Research & Development Establishment (Eng.), Pune, India Summer 2011
Advisor: Anoop Anand, PhD (Composite Research Center)
Project: Graphene in advanced structural composites

INDUSTRY:

Management Trainee, Mangalore Chemicals & Fertilizers Ltd., Mangalore, India 2012-2013
Production Engineering, Ammonia Production Plant

In-Plant Trainee (Co-Op), Exide Industries, Hosur, India Summer 2010
Industrial Battery Division

AWARDS & HONORS

Future Investigator Travel (FIT) Award, APS Division of Soft Matter	2023
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 93rd 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

Manuscripts Under Preparation:

1. Shravan Pradeep, Xiangyu Chen, Paulo Arratia, Douglas Jerolmack, "Tribo-rheological origins of baseball *Magic Mud* gripping mechanics". *Pre-Publication Highlights:* Philly Inquirer | Penn News
2. Bhavana Balasububrahmaniam, Shravan Pradeep, Shivani Chawla, Laia Mogas-Soldevila, "Additive manufacturing of sustainable biowaste-clay composites".
3. 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".

Manuscripts Under Review:

1. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Origins of complexity in the rheology of Soft Earth suspensions". *Submitted* [Preprint]
2. Bryan O. Torres Maldonado, Shravan Pradeep, Ranjiangshang Ran, Douglas Jerolmack, Paulo Arratia, "Sedimentation dynamics of passive particles in dilute bacterial suspensions: emergence of bioconvection". *Submitted* [Preprint].
3. 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*

Manuscripts Published/Peer-Reviewed:

1. 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
2. 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]
3. 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!

4. 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
5. Shravan Pradeep, Paulo E. Arratia, "To biofilm or not to biofilm", ***eLife***, 80891 (2022). [Paper]
6. 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]
7. 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
8. Jie Zhu, Weiwang Qiu, Hua Han, Chengjian Yao, Chun Wang, Dequn Wu, Shravan Pradeep, and Zijian Dai, "Water stable UiO-66-NH_2 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]
9. Shravan Pradeep, Lilian C. Hsiao,"Contact criterion in suspensions of smooth and rough colloids", ***Soft Matter***, 16:4980-4989 (2020). [Paper]
10. 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]
11. 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]
12. Shravan Pradeep†, Sai Raghuram†, Mahua Chaudhury, and Sonal Mazumder, "Synthesis and characterization of Fe^{3+} and Mn^{2+} 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]
13. Sai Raghuram, Shravan Pradeep, Subhra Dash, Rajdeep Chowdhury, and Sonal Mazumder, "Chitosan encapsulated ZnS:M (M: Fe^{3+} and Mn^{2+}) quantum dots for fluorescent labelling of sulphate reducing bacteria", ***Bulletin of Materials Science***, 39:405-413 (2016). [Paper]

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 Engg.); John Ruck (Ph.D. Geophysics); Lidan Gou (M.S. Chemical Engg.)
- 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)

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*: Soft Earth Geophysics 2024
  - *Session*: Functionality through Nonlinearity in Metamaterials 2023
  - *Session*: Rheology, Flow & Instabilities of Soft Materials 2022
  - *Session*: Interfaces and Mixing & Kandanoff 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*).

Early Career Member, APS Divison of Soft Matter (DSOFT) Membership Committee 2024
Session Organizer, Division of Soft Matter (DSOFT): *Soft Earth Geophysics*, 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, *Multiphase Flows* 2022
Participant, Boulder Summer School for Condensed Matter, *Hydrodynamics Across Scales* 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

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 (Selected)

1. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Rheological fingerprints of non-inertial debris flows", *Annual Meeting of the APS Division of Fluid Dynamics*, Washington, DC (2023).
2. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Less is more: *Simple* complex fluids reveal rheological fingerprints in environmental flows", *AIChE Annual Meeting*, Orlando, FL (2023).
3. Shravan Pradeep, Paulo Arratia, Douglas Jerolmack, "Rheological state diagrams for model earth suspensions under shear flow", *APS March Meeting*, Las Vegas, NV (2023).
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, 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).
6. 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).
7. Shravan Pradeep, Alan Wessel, Lilian Hsiao, "Elasticity in dense suspensions of geometrically frustrated colloids", *APS March Meeting*, Virtual (2021).
8. 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**
9. Shravan Pradeep, Alan Jacob, Lilian Hsiao, "Distance to jamming defines shear thickening strength in colloids", *AIChE Annual Meeting*, Virtual (2020).
10. Shravan Pradeep, Lilian Hsiao, "Contact numbers and radial distributions in suspensions of smooth and rough colloids", *APS March Meeting*, Boston, MA (2019).
11. Shravan Pradeep, Sai Raghuram, Sonal Mazumder, "Synthesis and characterisation of Fe^{3+} 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 Pradeepp, Sai Raghuram, Sonal Mazumder, "Synthesis and characterization of Fe^{3+} and Mn^{2+} doped ZnS nanocrystals", *Workshop on Analytical Instruments for Chemical & Environmental Engineers*, Pilani, India (2015). **Poster Award - Second Place**