Shravan Pradeep

Penn Soft Earth Dynamics (PennSED) Group and Complex Fluids Lab, University of Pennsylvania
251 Hayden Hall, 240 South 33rd Street, Philadelphia, PA 19104-6316, USA
Email: spradeep@sas.upenn.edu || Webpage || LinkedIn || X: @pradeep_shravan

EDUCATION & TRAINING

2024-Present	**Penn Center for Soft and Living Matter Postdoctoral Fellow** **Postdoctoral Fellow** | NSF-ERC for the Internet of Things for Precision Agriculture
2021-Present	**Postdoctoral Researcher** | Department of Mechanical Engineering & Applied Mechanics Department of Earth & Environmental Science University of Pennsylvania, Philadelphia, PA
2016-2021	**Ph.D. in Chemical Engineering** | *Minor*: Materials Science and Engineering North Carolina State University, Raleigh, NC
2013-2015	**M.Eng. in Chemical Engineering** Birla Institute of Technology and Science (BITS) Pilani, Pilani Campus, India
2008-2012	**B.Tech. in Chemical Engineering** | First Class with Distinction Amrita Vishwa Vidyapeetham University, Coimbatore, India

RESEARCH INTERESTS

Soft particulate synthesis, suspension mechanics, living matter-mediated transport, sustainable geomaterials, confocal microscopy, rheology, tribometry, microfluidics, non-linear dynamics, and experimental "big data".

PROFESSIONAL EXPERIENCE

RESEARCH:

2021-Present	**Postdoctoral Researcher**, University of Pennsylvania, Philadelphia, PA *Mentor(s)*: Prof. Douglas J. Jerolmack and Prof. Paulo E. Arratia *Research Focus*: Mechanics of earth-inspired sustainable soft materials and living matter
Fall 2022	**Visiting Affiliate**, Kavli Institute of Theoretical Physics (KITP), UC Santa Barbara, CA *Program*: Multiphase Flows in Geophysics and the Environment
2017-2021	**Graduate Research Assistant**, North Carolina State University, Raleigh, NC *Advisor*: Prof. Lilian C. Hsiao *Dissertation*: Designing flow mechanics in suspensions of surface-anisotropic colloids
2015-2016	**Research Assistant**, Indian Institute of Technology Delhi, New Delhi, India *Advisor(s)*: Shalini Gupta, PhD (*Current:* Founder & CEO at Asima Health Inc., Toronto) *Project*: Immunomagnetic capture chip development for optical detection of bacteria
2014-2015	**Research Assistant**, Birla Institute of Technology & Science, Pilani, India *Advisor:* Sonal Mazumder, PhD (*Current:* Regulatory Scientist, US-FDA, Silver Springs, MD) *Thesis:* Quantum dots for photocatalytic degradation of biological pollutants
2011-2012	**Research Assistant**, Amrita School of Engineering, Coimbatore, India *Advisor*: Prof. Kanakasabai Panchanathan *Senior Project*: Titania nanoparticles-embedded polyvinyl alcohol membranes
Summer 2011	**Research Intern**, Research & Development Establishment (Eng.), Pune, India *Advisor:* Anoop Anand, PhD (Composite Research Center) *Project:* Graphene in advanced structural composites

INDUSTRY:

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

AWARDS & HONORS

2024 **Penn CSLM Postdoctoral Fellowship**, Center for Soft & Living Matter, University of Pennsylvania
2024 **APS FECS Mini Grant Recipient**, APS Forum for Early Career Scientists
2023 **Future Investigator Travel Award**, APS Division of Soft Matter
2023 **Victor K. LaMer Award Finalist**, ACS Colloids and Surface Science Division | Postdoctoral Award
2023 **Postdoctoral Poster Award - Honorable Mention**, APS Forum for Early Career Scientists
2022 **Postdoctoral Poster Award - Third Place**, Society of Rheology 93rd Annual Meeting
2022 **Summer School Fellowship**, University of Colorado, Boulder & National Science Foundation
2022 **Diverse Leaders for Future**, Future Faculty Workshop Scholar, University of Delaware
2021 **James K. Ferrell Outstanding Ph.D. Graduate Award**, NC State University
2021 **Langmuir Award Finalist**, ACS Colloids and Surface Science Division | Graduate Student Award
2019 **Travel Assistance Award**, Graduate Student Association, NC State University
2019 **Conference Travel Award**, College of Engineering, NC State University
2016 **Provost's University Graduate Fellowship**, College of Engineering, NC State University
2015 **Department 1st Rank**, Chemical Engineering Department, BITS Pilani
2015 **Poster Award - Second Place**, Indian Institute of Chemical Engineers, Pilani Chapter
2012 **University 3rd Rank**, Amrita Vishwa Vidyapeetham University
2009 **School of Engineering Merit Awards**, Amrita School of Engineering
2008 **Prime Minister's Merit Scholarship**, Ministry of Defence, Government of India

JOURNAL PUBLICATIONS

†Equal Contribution | Total Publications: 17 | First-Author: 9 | Google Scholar | Research Highlights

1. **Shravan Pradeep**, Xiangyu Chen, Ali Seiphoori, David R. Vann, Paulo E. Arratia, Douglas J. Jerolmack, "Soft matter mechanics of baseball's Rubbing Mud", ***PNAS***, 121 (2024). [Paper]
   Developed a multiscale mechanical framework towards geoinspired sustainable materials design
   - *Pre-Publication Highlights:* Philly Inquirer | Penn News

2. **Shravan Pradeep**, Paulo E. Arratia, Douglas J. Jerolmack, "Origins of complexity in the rheology of Soft Earth suspensions". ***Nature Communications***, 15 (2024). [Paper]
   Engineered geoinspired soft particulate system with interaction-controlled brittle-ductile failure transition

3. Bryan O. Torres Maldonado, **Shravan Pradeep**, Ranjiangshang Ran, Douglas Jerolmack, Paulo E. Arratia, "Sedimentation dynamics of passive particles in dilute bacterial suspensions: emergence of bioconvection", ***Journal of Fluid Mechanics***, 988 (2024). [Paper]
   Uncovered novel bioconvection transport mechanics in sedimenting colloids stirred by bacterial suspensions

4. 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 and Shellular Structures Optimization for Augmented Earthen Construction", ***Materials & Design***, 239 (2024). [Paper]

5. Ranjiangshang Ran, **Shravan Pradeep**, Sebastien Kosgodagan Acharige, Brendan C Blackwell, Christoph Kammer, Douglas J. Jerolmack, Paulo E. Arratia, "Understanding the rheology of kaolinite clay suspensions using Bayesian inference", ***Journal of Rheology***, 67 (2023). [Paper]
   Employed Bayesian inference tool to understand structural parameters in rheological constitutive equations
   - *Highlight:* Editor's Featured Article

6. Bryan O. Torres Maldonado, Ranjiangshang Ran, K. L. Galloway, Quentin Brosseau, **Shravan Pradeep**, Paulo E. Arratia, "Phase-separation during sedimentation of dilute bacterial suspensions", ***Physics of Fluids***, 34 (2022). [Paper]

7. Robert Kostynick†, Hadis Matinpour †, **Shravan Pradeep**†, Thomas Dunne, Sarah Haber, Alban Sauret, Eckart Meiburg, Paulo E. Arratia, Douglas J. Jerolmack, "Rheology of debris flows controlled by the distance from jamming", ***PNAS***, 119 (2022). [Paper]
   Examined material failure using transport phenomena framework to improve hazard prediction models
   - *Highlights:* Physics of disaster: How mudslides move. NSF News | Penn News | AAAS EurekAlert!

8. **Shravan Pradeep**, Paulo E. Arratia, "To biofilm or not to biofilm", ***eLife***, 11 (2022). [Insight Article]

9. **Shravan Pradeep**, Alan Wessel, Lilian C. Hsiao, "Hydrodynamic origin for the suspension viscoelasticity in rough colloids", ***Journal of Rheology***, 66 (2022). [Paper]
Designed dense particulate suspensions with colloidal surface anisotropy-controlled material elasticity
   - *Highlight:* Editor's Featured Article

10. Zijian Dai, **Shravan Pradeep**, Jie Zhu, Wenyi Xie, Heather F. Barton, Yang Si, Bin Ding, Jianyoung Yu, Gregory Parsons,"Freestanding metal organic framework-based microfiltration membranes fabricated *via* pseudomorphic replication toward liquid- and gas hazards abatement", ***Advanced Materials Interfaces***, 8 (2021). [Paper]

11. **Shravan Pradeep**, Mohammad Nabizadeh, Alan R. Jacob, Safa Jamali, Lilian C. Hsiao, "Jamming distance dictates colloidal shear thickening", ***Physical Review Letters***, 127 (2021). [Paper]
Reported the first experimental 3D contact network microstructure in shear thickening complex fluids
   - *Highlights:* New images lead to better prediction in shear thickening. Phys.Org | NC State News

12. Jie Zhu, Weiwang Qiu, Hua Han, Chengjian Yao, Chun Wang, Dequn Wu, **Shravan Pradeep**, 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 (2021). [Paper]

13. **Shravan Pradeep**, Lilian C. Hsiao,"Contact criterion in suspensions of smooth and rough colloids", ***Soft Matter***, 16 (2020). [Paper]
Established a protocol to estimate contact length scales in colloidal particles with tunable roughness

14. 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 (2019). [Paper]

15. **Shravan Pradeep**, Sai Raghuram, Sonal Mazumder, "Rapid synthesis of pure and doped ZnS quantum dots for photocatalytic degradation of biological dye pollutants", ***Materials Focus***, 6 (2017). [Paper]

16. **Shravan Pradeep**†, Sai Raghuram†, Mahua Chaudhury, 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 (2017). [Paper]

17. Sai Raghuram, **Shravan Pradeep**, Subhra Dash, Rajdeep Chowdhury, 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 (2016). [Paper]

In Preparation:

- **Shravan Pradeep**†, Nandish Vora†, Ranjiangshang Ran, Paulo E. Arratia, "Stretching field statistics in time-periodic flows with dilute bacterial suspensions".
- **Shravan Pradeep**, Albáne Thery, Paulo E. Arratia, Douglas Jerolmack, "Unified rheology framework for particulate suspensions yielding under shear".

TEACHING EXPERIENCE & CERTIFICATIONS

Teaching Assistant & Guest Lecturer, University of Pennsylvania
Department of Mechanical Engineering & Applied Mechanics | Department of Earth & Environmental Science

- MEAM 202 Introduction to Thermo-Fluids Engineering — Fall 2024, Fall 2023, Fall 2022
- MEAM 225 Engineering in the Environment — Spring 2024, Spring 2022
- MEAM 5360 Viscous Fluid Flows and Modern Applications — Spring 2024
- EESC 6720 Landslides - Granular Matter Failure Modes — Spring 2022

Teaching Assistant, North Carolina State University
Department of Chemical and Biomolecular Engineering

- CHE 713 Chemical Engineering Thermodynamics — Fall 2019
- CHE 205 Chemical Process Calculations — Fall 2017
- CHE 312 Transport Processes II — Spring 2017

Teaching and Communications Certificate, The Graduate School, NC State — Spring 2021

Teaching Assistant, Birla Institute of Technology and Sciene Pilani
Department of Chemical Engineering
- 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

Graduate	Julia Radzio (Ph.D. Mechanical) | *Project:* Microfluidics-mediated extensional rheometry
	Bryan Maldonado (Ph.D. Mechanical) | *Project:* Sedimentation in bacterial suspensions
	John Ruck (Ph.D. Geophysics) | *Project:* Intrusion dynamics in granular media
	Nandish Vora (Ph.D. Physics) | *Project:* Chaotic mixing dynamics stirred by bacterial activity
	Lidan Gou (M.S. Chemical) | *Project:* Tribology of bacterial biofilms
Undergraduate	Xiangyu Chen (B.S. Mechanical) | *Project:* Soft tribology of baseball's Rubbing Mud
	Eric Sigg (B.S. Mechanical) | Analogs for ocean floor granular failure dynamics
Summer REU	Ivanellys Tirado (IoT4Ag) Program | *Project:* Complex fluid flow in branched networks
	Alan Gao (Penn VIPER Program) | *Project:* Moisture sensing in living porous media

North Carolina State University

Undergraduate	Alan Wessel | *Project:* Linear viscoelasticity in rough colloidal suspensions
(B.S. Chemical)	Sara Wozniak | *Project:* Contact number estimation from colloidal microstructure
	Christine Dang | *Project:* Synthesis and characterization of rough colloidal particles
	Colin Donaldson | *Project:* Synthesis and characterization of aqueous colloidal particles
	Alex Kramer | *Project:* Synthesis and characterization of double emulsions

PROFESSIONAL ACTIVITIES, SERVICE & OUTREACH

Academic Peer-Review:
- *Grant Proposal:* NASA: Ad-hoc reviewer and online panelist
- *Journals*: Nature Communications, Physical Review Letters, Journal of Colloid & Interface Science, Journal of Rheology, Geophysical Research Letters, Physical Review E, Rheologica Acta, and others.
- *Conference Session*: AAAS Annual Meeting Scientific Session

Conference Chair/Co-Chair:
- American Institute of Chemical Engineers Annual Meeting
  - *Session*: Nonlinear Flows and Combined Transport Processes — 2024
- 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

University & Scientific Community Service and Science Outreach:
- *Science Instructor*, Skype-a-Scientist (Non-Profit), Philadelphia, PA — 2023-Present
- *Poster Session Judge*, Society of Rheology and AIChE Annual Meetings — 2024
- *Membership Committee*, Divison of Soft Matter (DSOFT), American Physical Society — 2024
- *Session Organizer*, Soft Earth Geophysics - DSOFT Focus Session, APS March Meeting — 2024
- *Poster Session Judge*, Materials Engineering & Sciences Division, AIChE Annual Meeting — 2023
- *Student Activities Committee*, Division of Soft Matter (DSOFT), American Physical Society — 2019-2022
- *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 Engg. Graduate Student Association, NC State — 2017-2018
- *Student Senate Member*, Academic Counselling Cell, BITS Pilani — 2014-2015

Diversity, Equity, and Inclusion Activities:

- *Mentor*, IoT4Ag Pathway to PhD Program, University of Pennsylvania 2024
- *Admissions Committee*, Diversity Equity Engagement at Penn (DEEPenn) in STEM Event 2024
- *Postdoc Rep*, Climate, Diversity, Equity & Inclusion Committee (CDEIC), UPenn 2022-Present
- *Volunteer Staff*, Diversity Equity Engagement at Penn (DEEPenn) in STEM Event 2022, 2023
- *Mentor*, Alumni Mentoring Program, Chemical & Biomolecular Engineering, NC State 2021-2022

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*), American Geochemical Society (AGS), and American Geophysical Union (*AGU*).

SCIENTIFIC PRESENTATIONS

INVITED TALKS:

1. **Shravan Pradeep**, "Soft matter mechanics framework for engineering sustainable geomaterials", Session: Rheology and Flow of Soft Materials, *APS Global Physics Summit*, Anaheim, CA (2025).
2. **Shravan Pradeep**, "Engineering earth-inspired hierarchical soft materials", *Soft, Fluid, and Living Matter (SoFLivMat) Seminar Series*, Yale University, New Haven, CT (2024).
3. **Shravan Pradeep**, "Rheological signatures of yielding in model Soft Earth suspensions", *Future of Rheology*, Society of Rheology Virtual Seminar Series (2024).
4. **Shravan Pradeep**, "Frictional interactions anneal yielding dynamics in suspensions", *ACS Colloids and Surface Science Symposium*, Raleigh, NC (2023). LaMer Award (Colloids Early Career) Keynote Speaker
5. **Shravan Pradeep**, "Material constraints dictate flow mechanics in dense suspensions", Session: Frontiers in Soft Matter, *APS March Meeting*, Las Vegas, NV (2023). Invited Soft Matter Postdoctoral Scholars Session
6. **Shravan Pradeep**, "Distance to jamming dictate colloidal shear thickening", *The Plot Thickens*, Shear Thickening Virtual Seminar Series (2021).
7. **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, "Ductile-to-brittle transition in Soft Earth particulate systems", *Society of Rheology Annual Meeting*, Austin, TX (2024).
2. **Shravan Pradeep**, Xiangyu Chen, Paulo Arratia, Douglas Jerolmack, "Rheo-Tribological Origins of Baseball *Magic Mud* Mechanics", *ACS Colloids and Surface Science Symposium*, Seattle, WA (2024).
3. **Shravan Pradeep**, Paulo Arratia, Douglas Jerolmack, "Rheological fingerprints of soft earth suspensions", *APS March Meeting*, Minneapolis, MN (2024).
4. **Shravan Pradeep**, "*Soft* Soil Mechanics: Discovering rheological constitutive models via. Soft Earth Geophysics", *Mid-Atlantic Soft Matter Workshop*, Georgetown University, Washington D.C. (2024).
5. **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).
6. **Shravan Pradeep**, Paulo Arratia, Douglas Jerolmack, "Less is more: *Simple* complex fluids reveal rheological fingerprints in environmental flows", *AIChE Annual Meeting*, Orlando, FL (2023).
7. **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).
8. **Shravan Pradeep**, Eckart Meiburg, Paulo Arratia, Douglas Jerolmack, "Rheological flow curves for model earth suspension mixtures", *Society of Rheology Annual Meeting*, Chicago, IL (2022).
9. **Shravan Pradeep**, Robert Kostynick, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Constraint-based approach towards debris flow rheology", *APS March Meeting*, Chicago, IL (2022).

10. **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).
11. **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).
12. **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
13. **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).
14. **Shravan Pradeep**, Lilian Hsiao, "Contact numbers and radial distributions in suspensions of smooth and rough colloids", *APS March Meeting*, Boston, MA (2019).

POSTER PRESENTATIONS (Selected):

1. **Shravan Pradeep**, Xiangyu Chen, Paulo Arratia, Douglas Jerolmack, "Baseball gripping mechanics as a multiscale soft matter problem", *International Soft Matter Conference*, Raleigh, NC (2024).
2. **Shravan Pradeep**, Paulo Arratia, Douglas Jerolmack, "Unifying yielding mechanics in multiphase soft particulate matter systems", *International Soft Matter Conference*, Raleigh, NC (2024).
3. **Shravan Pradeep**, Paulo Arratia, Douglas Jerolmack, "Rheological toolkit for multiphase soft matter manufacturing", *Princeton Advanced Manufacturing Symposium*, Princeton University, Princeton, NJ (2024).
4. **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
5. **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).
6. **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
7. **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).
8. **Shravan Pradeep**, Lilian Hsiao, "Towards designing flow mechanics in dense suspensions", *Triangle Soft Matter Workshop*, Virtual (2021).
9. **Shravan Pradeep**, Lilian Hsiao, "Geometric frustration-induced phase behavior in spherically symmetric colloids", *AIChE Annual Meeting*, Virtual (2020).
10. **Shravan Pradeep**, Yunhu Peng, Lilian Hsiao, "Connecting frictional dissipation to rheology of confined suspensions", *Society of Rheology Annual Meeting*, Raleigh, NC (2020).
11. **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).
12. **Shravan Pradeep**, 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