



Personal details

Name Dr. Vishal Kumar
Date of birth 31 December 1995
Nationality Indian

Research Interests

Mathematical modeling, Electrokinetic transport phenomena, Complex fluids, Porous media

With a background in physical chemistry, my research has focused on theoretical modeling of transport phenomena at the micro- and nanoscale levels, with a particular focus on electrokinetic phenomena such as electroosmosis, streaming potential, and electrophoresis. I have employed a combination of analytical techniques, including asymptotic methods and regular perturbation approaches, as well as numerical methods, to address complex nonlinear problems. My thesis work includes modeling of combined electromechanical pulsating flow of viscoelastic fluids through narrow channels and multiscale modeling of electrophoretic motion of uniformly charged spherical particles, accounting for hydration interactions within the electric double layer (EDL) region using Molecular dynamics (MD) and continuum approaches (MATLAB). Further, we model the electrokinetic phenomena such as electro-osmosis, streaming phenomena for channel flow, and electrophoretic motion of non-uniformly charged spherical particles for modified Poisson-Nernst-Planck and Navier-Stokes (PNP-NS) systems using both analytical and numerical techniques (using COMSOL). Currently, my research focuses on modeling transport phenomena in porous media with applications in hydroelectric energy conversion and biomedical devices.

Work Experience

2025-present Assistant Professor in Physical chemistry, Lovely Professional University, Punjab
2018-2019 Assistant Professor in Physical chemistry, Gujranwala Guru Nanak Khalsa College, Ludhiana, Punjab, India-141001

Education

2019–2024 **PhD, Theoretical and Computational Physical Chemistry, Department of Chemistry, Indian Institute of Technology Ropar**, Rupnagar, Punjab, India-140001, Thesis defended on 05-Dec-2024. .
Thesis title: Theoretical studies of electrokinetic phenomena in Newtonian and non-Newtonian fluids. [Thesis link](#)
2015–2017 : **Master of Science, Chemistry, S. Govt. College of Science Education and Research, Jagraon, Punjab, affiliated to Panjab University Chandigarh, India.**
2012–2015 : **Bachelor of Science, S. C. D. Govt. College, Ludhiana, Punjab, affiliated to Panjab University Chandigarh, India.**

Publications

Journal Articles

- 2024 **Vishal Kumar**, Naresh Kumar, Uddipta Ghosh, and Sudipta Kumar Sinha. Predicting the electrophoretic mobility of charged particles in an aqueous medium. *Langmuir*, volume 40, pages 16521–16529, 2024. PMID: 39044404.
- 2022 **Vishal Kumar**, Joydeb Mukherjee, Sudipta Kumar Sinha, and Uddipta Ghosh. Combined electromechanically driven pulsating flow of nonlinear viscoelastic fluids in narrow confinements. *Journal of The Royal Society Interface*, volume 19, page 20210876, 2022.

Communicated/in preparation Journal Article

- 2024 **Vishal Kumar, Rajnandan Borthakur, Uddipta Ghosh, and Sudipta Kumar Sinha**, Electrophoretic motion of non-uniformly charged particles in the presence of ion-ion correlations, (Manuscript in preparation).
- 2024 **Vishal Kumar, Uddipta Ghosh, and Sudipta Kumar Sinha**, Ion-correlation mediated flow of viscoelastic fluid through narrow confinements, (Manuscript in preparation).

Conferences/Poster Presented/Workshops/Schools/Delivered Talks

- 2024 Poster presented at DAE-BRNS Symposium on Current Trends in Theoretical Chemistry (CTTC-2024), September 26-28, 2024, DAE Convention Centre, Anushaktinagar, Mumbai, India
- 2023 Poster presented at International Conference on Complex Fluids and Soft Matter (CompFlu), December 18-20 2023 at IIT Madras, Chennai, Tamilnadu, India
- 2023 Oral and poster presentation at Complex Fluid Dynamics Symposium: Rheology and Instabilities in Complex Fluids, December 02 2023 at IIT Ropar, Rupnagar, Punjab, India
- 2023 Oral Presentation at Indian Conference on Micro Nanofluidics (ICOM), Sept 29 to Oct 01 2023, IIT Madras, India
- 2022 Poster presented at TCB (Theoretical Chemistry and Biology) Symposium, October 15 2022, IISER Mohali, India (Best Poster)

Fellowships & Awards

- 2021 – 2024 **Senior research fellowship** from University Grant Commission, Government of India, as a PhD research scholar at Indian Institute of Technology Ropar.
- 2019 – 2021 **Junior research fellowship** from University Grant Commission, Government of India, as a PhD research scholar at Indian Institute of Technology Ropar.

Academic Achievements & Recognitions

- 2022 **Best poster awrad** in *TCB (Theoretical Chemistry and Biology) Symposium, 15-october-2022*, IISER Mohali, India

Computer skills

Languages MATLAB, Python
Softwares COMSOL, Maple, GROMACS, AutoDock-Vina, Autodesk Fusion-360
Typograph L^AT_EX, MS-Word

Languages

Punjabi Native
Hindi Native
English Fluent

Teaching Assistantship

Spring, 2021 : **CY-401: Physical Chemistry Lab**, *Department of Chemistry*, IIT Ropar.

Fall, 2021 : **CY-401: Physical Chemistry Lab**, *Department of Chemistry*, IIT Ropar.