

Dipanjan Ghosh

CONTACT INFORMATION

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RESEARCH INTERESTS

Active Matter, Fluid Dynamics, Optical Microscopy, Motility of Microorganisms

EDUCATION

University of Minnesota

September 2018 – present

Department of Chemical Engineering and Materials Science (CEMS)
Ph.D. candidate, Chemical Engineering

- Cumulative Grade Point Average: **3.778/4.000**

Jadavpur University

July 2014 – June 2018

Bachelor of Engineering, Chemical Engineering

- Cumulative Grade Point Average: **8.85/10.00**

PERSONAL ACHIEVEMENTS

- Awarded the **L.E. and D.H. Scriven Fellowship**, **Howard W. and Mary S. Cox Fellowship** and **H. Ted Davis Fellowship** for funding first year graduate studies at the department of CEMS at the University of Minnesota in 2019.
- Awarded the prestigious **S. N. Bose Fellowship** to pursue undergraduate research at Massachusetts Institute of Technology, USA for the summer of 2017.
- Recipient of **I. Putatunda & S. Putatunda gold medal** for highest CGPA among sophomores in Chemical Engineering at Jadavpur University for the year 2015-16.

PUBLICATIONS

- [1] *To cross or not to cross: collective swimming of Escherichia coli under two-dimensional confinement* [[arXiv:2111.07459](https://arxiv.org/abs/2111.07459)]
D. Ghosh, X. Cheng; *Physical Review Research*, in press (2022)
- [2] *Field-Directed Self-Assembly of Mutually Polarizable Nanoparticles*
Z. M. Sherman, D. Ghosh, J. W. Swan; [*Langmuir* 34, 7117-7134 (2018)]
- [3] *Fast Bayesian inference of the multivariate Ornstein-Uhlenbeck process* [[arXiv:1706.04961](https://arxiv.org/abs/1706.04961)]
R. Singh, D. Ghosh, R. Adhikari; [*Physical Review E* 98, 012136 (2018)]
- [4] *Fast Bayesian inference of optical trap stiffness and particle diffusion* [[arXiv:1610.00315](https://arxiv.org/abs/1610.00315)]
S. Bera, S. Paul, R. Singh, D. Ghosh, A. Kundu, A. Banerjee, R. Adhikari
[*Scientific Reports* 7, 41638 (2017)]

PRESENTATIONS

- *Crossing and non-crossing dictates the collective swimming of bacteria under two-dimensional confinement*
D. Ghosh, X. Cheng; Oral Presentation, American Physical Society March Meeting 2022
- *Bacterial Olympics: swimming speed is independent of body size*
S. Kamdar*, D. Ghosh*, T. Cheepuru, L. F. Francis, X. Cheng; Equally-contributing first author in Oral Presentation, American Physical Society Division of Fluid Dynamics Meeting, November 2021
- *To cross or not to cross: the collective swimming of bacteria in two-dimensional confinement*
D. Ghosh, X. Cheng; Oral Presentation, American Physical Society Division of Fluid Dynamics Meeting, November 2021
- *Soccer, American Football, and Swimming: lessons from Escherichia coli*
D. Ghosh; Invited Oral Presentation, BioActive Fluids International Seminar for Early Career Researchers, November 2021

- ***Emergence of collective states in suspensions of swimming bacteria in confined geometries***
D. Ghosh, X. Cheng; Oral Presentation, American Physical Society March Meeting 2021
- ***Activity and density dependence of collective states in confined bacterial suspensions***
D. Ghosh, X. Cheng; Oral Presentation, American Physical Society Division of Fluid Dynamics Meeting, November 2020
- ***Collective motion in suspensions of light-controlled Escherichia coli in confined geometries***
D. Ghosh, X. Cheng; Poster Presentation, Microswimmers International Conference organized by Deutsche Forschungsgemeinschaft, October 2020
- ***Activity-induced phase transitions in confined bacterial suspensions***
D. Ghosh, Z. Liu, X. Cheng; Oral Presentation, American Physical Society March Meeting 2020

GRADUATE
RESEARCH

Cheng Research Group, University of Minnesota, Minneapolis, MN, USA

Imaging the collective and individual dynamics of swimming bacteria

Supervised by Prof. Xiang Cheng

September 2018 – present

- Observed the collective behavior of swimming bacteria confined in microfluidic chambers of different thicknesses using bright-field microscopy.
- Tracked the motion of individual bacteria in microscopy videos using custom-written computer vision programs.
- Imaged bacterial flagellar filaments using fluorescence microscopy and constructed a detailed mathematical model relating the geometry of the flagella to the swimming speed of bacteria.
- Mentored undergraduate students to work independently on imaging the motion of bacteria under the microscope.
- Developing imaging techniques combining bright-field and fluorescence microscopy to image the dynamics of individual fluorescently tagged bacteria along with their flagellar filaments in a dense bacterial suspension exhibiting three-dimensional ‘active turbulence’ flow.

UNDERGRADUATE
RESEARCH

- Mapped the phase behavior of dielectric colloidal particles under an applied electric field by performing Brownian dynamics simulations, supervised by Prof. James W. Swan, Massachusetts Institute of Technology (Summer 2017).
- Developed a Bayesian statistical framework for analyzing stochastic trajectories, supervised by Prof. Ronjoy Adhikari, Institute of Mathematical Sciences, India (2016-2017).

TEACHING

- **Recitation Instructor, Transport Phenomena: Momentum & Heat (undergraduate)**
CEMS, University of Minnesota, Fall 2021
 - Taught recitation classes to a section of 30 students twice a week, taught lecture to the entire class of 120 students for 2 classes during the semester, assisted students during office hours.
- **Teaching Assistant, Junior Unit Operations Laboratory (undergraduate)**
CEMS, University of Minnesota, Spring 2021
 - Designed experiments, maintained process equipment, and supervised students working in the Unit Operations Laboratory.
- **Teaching Assistant, Transport Phenomena: Momentum and Heat (undergraduate)**
CEMS, University of Minnesota, Fall 2019
 - Assisted students during office hours, graded homeworks and examinations.

OUTREACH

- Physics teacher for *Women in Science and Engineering Initiative*, University of Minnesota (2019 - present).
- Participant in online *Frugal Science* course taught by Prof. Manu Prakash, Stanford University (Fall 2020).
- Volunteer designing and demonstrating benchtop experiments to middle-school students from the Twin Cities area as part of *Science for All*, University of Minnesota (Spring 2021).