Jayam Joshi

Google Scholar

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Education

University of Chicago — September 2025 - Present
Pursuing PhD, Physics — *Chicago IL, USA*

Indian Institute of Technology (BHU) Varanasi — May 2025
B.Tech. + M.Tech. in Engineering Physics; ***CGPA: 9.53/10*** — *Varanasi, India*

Research Experience

Summer Intern | ***AG Bechinger: Soft Condensed Matter Lab*** — May 2023 - July 2023
Supervisor: Prof. Dr. Clemens Bechinger — *University of Konstanz, Germany*

- **Title: Experimental realization of swarmalators using active colloids** [Talk]
  Designed an experiment using Janus colloids to study systems consisting of coupled out-of-equilibrium components for example *'Swarmalators'*—species that swarm, oscillate, and synchronize.
- Programmed optical tweezers to induce oscillations in colloidal particles placed closely on a 2d lattice. Tuned experimental parameters like laser intensity and laser offset in the lab to obtain maximum synchronization.
- Devised and conducted measurements to characterize the system, and evaluated the data in relation to both single particle trajectories and analyze particle-particle correlations. Presented the experimental procedure and findings in a talk that I gave in the group seminar.

Master's Student | ***Thesis Stream Project*** — Aug 2022 - March 2024
Supervisor: Dr. Shradha Mishra — *IIT (BHU) Varanasi*

- **Title: Effective local density fluctuations in active Brownian disks** [Publication]
  Characterized the non-equilibrium steady state dynamics of active Brownian disks using density fluctuations, and used it to theoretically model effective single-particle dynamics in the system.
- Developed a local density-tracking algorithm and statistically analyzed density fluctuations around active particles in the Brownian dynamics simulation, revealing local density as a stationary stochastic variable.
- Modeled effective single-particle Langevin dynamics using statistical properties of density fluctuations and estimated diffusivity close to numerical values with less than 5% relative error.

Undergraduate Research Assistant | ***Collaboration Project*** — May 2024 - May 2025
Supervisor: Dr. Daniel Beller — *Johns Hopkins University (Remote)*

- **Title: Genetic segregation in a growing bacterial colony on a diffusing nutrient field**
  Computationally modeled nutrient-limited growth in a growing bacterial colony in C++ to replicate experiments on E. Coli growing on agar gel and measured spatial variations in population genetics.
- Measured radial distribution of genetic diversity in the colonies to investigate how mechanical interactions in prolific active matter systems generate evolutionary selective pressures favoring particular particle sizes.

Undergraduate Research Assistant | ***Exploratory Project*** — Dec 2021 - July 2022
Supervisor: Dr. Shradha Mishra — *IIT (BHU) Varanasi*

- **Title: Macro to micro phase separation of chiral active swimmers** [Publication]
  Explored the effects of competing activity and chirality, properties naturally present in many microswimmers.
- Identified a microscopic clustered phase for comparable activity and chirality using Brownian dynamics simulation of sterically repelling swimmers.
- Confirmed this phase by numerically calculating particle diffusivity and comparing it with single-particle predictions using Langevin dynamics, revealing significant deviations for comparable chirality and activity.

Publications and Conferences

Peer-Reviewed Publications

Europhysics Letters | *April 2025*
Effective Single-Particle Theory for Active Particles Using Local Density Fluctuations, **Jayam Joshi**, Pawan Kumar Mishra, Shradha Mishra, Europhysics Letters (EPL), Volume 150, 2025, 47001, DOI: 10.1209/0295-5075/adce2b

Physica A: Statistical Mechanics and its Applications | *Jan 2024*
Macro to Micro Phase Separation of Chiral Active Swimmers, Vivek Semwal, **Jayam Joshi**, Shambhavi Dikshit, Shradha Mishra, Physica A: Statistical Mechanics and its Applications, Volume 634, 2024, 129435, ISSN 0378-4371, DOI: 10.1016/j.physa.2023.129435

Conferences

CompFlu | *Poster Presentation* | *Dec 2024*
Presented my first-authored publication as a poster at *CompFlu 2024*, the international meeting on complex fluids and soft matter organized by the *Indian Society of Rheology*.

Relevant Courses and Skills

Courses | ***Engineering physics curriculum***
Statistical Physics, Simulation Methods in Statistical Physics, Advanced Condensed Matter Physics, Advanced Mathematical Methods, Computational Physics, Advanced Quantum Mechanics, Classical Mechanics.

Technical | ***Computational methods and experimental techniques***
Brownian dynamics simulations, molecular dynamics (MD) simulations, Monte Carlo simulations, machine learning– regression; Q-learning, differential equations, statistical analysis, optical tweezers/traps tuning.

Programming Languages | ***For building simulation and experimental control software***
Python, C/C++, Matlab, Bash.

Software & Tools | ***For data analysis and visualization, writing efficient and reproducible code, and scientific documentation***
Numpy, SciPy, Pandas, PySINDy, Gnuplot, XMGrace, Numba, Slurm, HPC, Git/GitHub, Linux OS, LaTeX.

Awards and Honors

Mitacs-GRI Award| ***2024***
Selected as a Mitacs Globalink Research Intern from a pool of 30K+ applicants to do a research internship at Western University, Canada. Could not go onboard due to some other engagements.

DAAD-WISE Scholarship | ***2023***
Awarded the prestigious DAAD-WISE (German Academic Exchange Service) Scholarship 2023, from among 6K+ applications, for pursuing a collaborative summer research internship at the University of Konstanz in Germany.

JEE MAINS | ***2020***
Scored 99.15 percentile in undergraduate college entrance exam given by roughly 1.5 million candidates from all over India every year.

Certificate of Merit | ***2018***
Awarded a certificate of merit by the Government of India's Central Board of Secondary Education (CBSE), for being in the top 0.1% in the AISSE (10^{th} standard) exam 2018.

Extracurricular

Teaching Assistant | ***Physics Department***
Helped with teaching activities and grading of the first-year undergraduate course in classical physics.

Team Member | ***Podcast & AMA Team, Research Cell***
Organized and participated in podcasts and panel discussions featuring students, faculty and alumni to highlight diverse STEM fields and promote research as a career path among undergraduate students.

Volunteer | ***HelpAge India***
Volunteered with HelpAge India foundation to manage and collect donations for the economic empowerment of vulnerable and abandoned elderly individuals in and around New Delhi.