

## EDUCATION

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### University of Chicago

Pursuing PhD, Physics

September 2025 - Present

Chicago IL, USA

### Indian Institute of Technology (BHU) Varanasi

B.Tech. + M.Tech. in Engineering Physics; CGPA: 9.53/10 

May 2025

Varanasi, India

## RESEARCH EXPERIENCE

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### Summer Intern | AG Bechinger: Soft Condensed Matter Lab

Supervisor: Prof. Dr. Clemens Bechinger

May 2023 - July 2023

University of Konstanz, Germany

- **Title: Active colloids as Swarmalators** [\[Talk !\[\]\(8312f31266b298cd5f59186eeb2e4296\_img.jpg\)\]](#)

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

Supervisor: Dr. Daniel Beller

May 2024 - May 2025

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 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 | Stream Project

Supervisor: Dr. Shradha Mishra

Aug 2022 - March 2024

IIT (BHU) Varanasi

- **Title: Effective local density fluctuations in active Brownian disks** [\[Publication !\[\]\(21a6558749bf9dec46f2d05fee2e137b\_img.jpg\)\]](#)

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 | Exploratory Project

Supervisor: Dr. Shradha Mishra

Dec 2021 - July 2022

IIT (BHU) Varanasi

- **Title: Macro to micro phase separation of chiral active swimmers** [\[Publication !\[\]\(a080a3cdf24a839edc6bc8e768d88e8d\_img.jpg\)\]](#)

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

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### 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

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### 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, L<sup>A</sup>T<sub>E</sub>X.

## AWARDS AND HONORS

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### 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<sup>th</sup> standard) exam 2018.

## EXTRACURRICULAR

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### 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.