

Arpan Dey

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Physics master's student at Montpellier University, working across statistical physics, nonlinear dynamics, and biophysical modeling.

EDUCATION

- **University of Montpellier**, France, 2025–Present. M1 grade: 18.21/20
M.Sc. in Fundamental Physics and Applications, IDIL Graduate Program (Modeling Biological and Environmental Systems)
Core courses: Stochastic processes, Biological physics, Hydrodynamics, Statistical physics, Complex fluids and active matter, Physical modeling of living systems
- **St. Xavier's College, Kolkata**, India, 2022–2025. CGPA: 8.02/10 (A+)
B.Sc. (Honors) in Physics, dissertation on path integral formulation of quantum mechanics (Supervisor: Tanaya Bhattacharyya)

RESEARCH EXPERIENCE

- **M1 internship, Laboratoire Charles Coulomb, Montpellier**, France, Jan–Jul 2026
Supervisor: Jean-Charles Walter; investigated variational approaches to construct a phase diagram of a semiflexible magnetic polymer, also investigated structural competition in lattice polymer ground states.
- **Summer research intern, The Institute of Mathematical Sciences, Chennai**, India, Jun 2025
Supervisor: Sitabhra Sinha; investigated networks of Kuramoto oscillators with nonlinear feedback.
- **Summer research fellow, Physical Research Laboratory, Ahmedabad**, India, Jun–Jul 2024
Supervisor: Ketan Patel; investigated modular symmetry and the fundamental domain of the modular group, received fellowship from the Indian Academy of Sciences.

SELECTED ARTICLES

- Arpan Dey. **Foresight-dependent entropy production in stochastic two-agent dynamics**. 2026. arXiv: 2610.30189.
- Linda Delimi, Arpan Dey, Jean-Charles Walter. **Phase diagram of a semiflexible magnetic polymer in three dimensions**. 2026. arXiv: 2610.08958.
- Arpan Dey. **Blockwise friction heterogeneity redistributes stretching in a 2D Gaussian polymer under Batchelor-Kraichnan random flow**. 2026. arXiv: 2609.31707.
- Arpan Dey. **Collective drift and pinning in active rotator networks with Kuramoto coupling and mixed-sign feedback disorder**. 2026. arXiv: 2606.10032.
- Arpan Dey. **Mobility heterogeneity in a 2D Gaussian lattice polymer: a dynamic Monte Carlo study**. 2026. arXiv: 2606.04002. Accepted for publication in *Polymer Science, Series A*.
- Arpan Dey. **Is statistical mechanics just a tool?** 2026. PhilSci-Archive. <https://philsci-archive.pitt.edu/id/eprint/31218>.
- Arpan Dey. **Path integral formulation of quantum mechanics. 2025. B.Sc. dissertation**. Zenodo: 10.5281/zenodo.15564781.
- Arpan Dey. **Investigations on the fundamental domain of the modular group**. 2024. Summer research project. Zenodo: 10.5281/zenodo.15737745.

SELECTED PRESENTATIONS

- Linda Delimi, Arpan Dey. **Phase diagram of a semiflexible magnetic polymer in three dimensions**. 2026. Supercoiling @ Sète, Scientific retreat, Sète.
- Arpan Dey. **Collective drift and pinning in active rotator networks with Kuramoto coupling and mixed-sign feedback disorder**. 2026. WE-Heraeus Seminar: Half a Century of the Kuramoto Model, Physikzentrum, Bad Honnef.
- Linda Delimi, Arpan Dey. **How stiffness and interactions shape the structure of magnetic polymers**. 2026. ANR project meeting on bacterial DNA segregation, Laboratoire Charles Coulomb, Montpellier.
- Linda Delimi, Arpan Dey, Jean-Charles Walter. **Phase diagram and ground states of the semiflexible magnetic polymer**. 2026. GDR ADN-G meeting, ENS de Lyon, Lyon.
- Arpan Dey. **Dyadic emotional modeling: a nonlinear dynamics approach**. 2026. International School on Urban Physics for Environmental Research (iSUPER), Montpellier.
- Arpan Dey. **Path integrals, uncertainty, entropy and information**. 2025. Quantum Foundations Summer School, Bhaktivedanta Institute and CDAC, Kolkata.
- Arpan Dey. **Exploring synchronized oscillations in Kuramoto-type oscillators with nonlinear feedback**. 2025. The Institute of Mathematical Sciences, Chennai.
- Arpan Dey. **Complexity: the next big thing in physics**. 2024. Spectrum, St. Xavier's College, Kolkata.

EXTRACURRICULARS

- **Founder and reviewer**, The Journal of Young Physicists, 2020–Present.
- **Senior physics editor**, Young Scientists Journal, 2020–2026.

- **Mentor**, Young Scientists Journal Research Program, 2026.
- **Associate student editor-in-chief**, Pebbles 2025, St. Xavier's College Science Association, 2025.
- **Research mentor**, Xaverian Astronomical Society, St. Xavier's College, Kolkata, 2024–2025.
- **Young member**, Junior Academy, New York Academy of Sciences, 2020–2022.

BOOKS AND BOOK CHAPTERS

- Arpan Dey. **The city of equilibrium: a scientific allegory and selected essays on physics**. 2026. ISBN: 979-8906064868.
- Arpan Dey. **Our physics so far: a journey through spacetime, consciousness and the fundamental nature of reality**. 2021. ISBN: 978-1685090234.
- Fabeha Shafaat, Roberto Parisi, Arpan Dey, Nipun Gorantla, Fahad Hassan Shah. **Properties and Biomedical Applications of Graphene-based Nanotechnologies**. 2021. In *Nanotherapeutic Strategies and New Pharmaceuticals (Part 1)*, *Bentham Science Publishers*. DOI: 10.2174/9789815036694121010007.

SKILLS

- **Research areas:** Statistical mechanics, stochastic processes, nonlinear dynamics, complex systems, polymer physics, biological systems, quantum mechanics.
- **Methods:** Monte Carlo simulations, mean-field theory, nonlinear differential equations, lattice models.
- **Computational tools:** Python, NumPy, SciPy, Matplotlib, GitHub, LaTeX.
- **Other:** Academic writing, editing, science communication, leadership, mentoring.