

Arkya Chatterjee

Curriculum Vitae

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Education

- 2019 - **Massachusetts Institute of Technology (MIT)**.
PhD student, Physics Department. GPA - 5/5.
- 2015 - 19 **Indian Institute of Technology (IIT), Bombay**.
B.Tech (with Honours) in Engineering Physics and Minor in Mathematics. GPA - 9.62/10.

Academic Honors

- 2019 - 20 **C.M. Clay and H.W. Kendall Fellowship**, *MIT*
- 2019 **K Seshia Research Excellence Award** for best undergraduate thesis, *IIT-B*
- 2018 **DAAD WISE fellowship** for a 10-week research internship in Germany
- 2018 **Institute Academic Prize** for highest GPA in the Physics department (2017-18), *IIT-B*
- 2017 Selected for the **Summer Research Fellowship Program** of the Indian Academies of Science, for a two-month research internship
- 2015 **Ranked 1st** nationally in higher secondary (10+2) board examinations, *CISCE*
- 2015 Secured **All India Rank 9** among 1.35 million candidates in *JEE Main*
- 2013 **Kishore Vaigyanik Protsahan Yojana** scholarship, awarded to **top 300** students by the Govt. of India to motivate interest in research

Publications/Pre-prints

- **A. Chatterjee**, X.-G. Wen, *Holographic theory for the emergence and the symmetry protection of gaplessness and for continuous phase transitions*, arXiv:2205.06244 [cond-mat.str-el]
- **A. Chatterjee**, X.-G. Wen, *Algebra of local symmetric operators and braided fusion n -category – symmetry is a shadow of topological order*, arXiv:2203.03596 [cond-mat.str-el]
- M. Chatterjee,[†] **A. Chatterjee**,[†] A. Nandi, A. Sain, *Dynamics and stability of contractile actomyosin ring in the cell*, Phys. Rev. Lett. 128, 068102 (2022) [†] equal contribution
- A. Fischer, **A. Chatterjee**, T. Speck, *Aggregation and sedimentation of active Brownian particles at constant affinity*, J. Chem. Phys. 150, 064910 (2019)

Research Experience

- 2020 - **Graduate Research: symmetries, anomalies, and topological phases**, *MIT*.
Supervisor: Prof. Xiao-Gang Wen, Condensed Matter Theory group, Department of Physics
 - Categorical symmetry:
 - Developed a local operator algebra approach for *categorical symmetry* in bosonic lattice models
 - Demonstrated an example of duality between anomalous and non-anomalous symmetries in 1+1D as an application of this approach
 - Used the perspective of categorical symmetries to revisit the old problem of symmetry-allowed phases and phase transitions and discovered some previously unknown or under-appreciated facts about phase transitions within the Landau paradigm
 - Time-reversal SPT and spacetime structure: Time-reversal symmetry protected topological (SPT) phases are characterized by their response to being put on an unorientable spacetime manifold: this is the cobordism theory of invertible phases. I am looking into developing a complementary Hamiltonian point of view, which is more suitable in the condensed matter setting.

- 2018 - 19 **Undergraduate Thesis: Active gel physics of actomyosin cortex**, IIT Bombay.
Supervisors: Prof. Amitabha Nandi, Prof. Anirban Sain, Department of Physics
- Studied the theoretical formalism behind active gels, based on Onsager relations and classical hydrodynamics
 - Performed linear stability analysis near the homogeneous solution to derive an analytic expression for the critical activity needed for instabilities to arise
 - Explored the robust ring closure mechanism during cytokinesis in *C. elegans* using the framework of active gels and discovered novel stability properties
- 2018 **Mean-field theory of MIPS**, Johannes Gutenberg University, Mainz.
Supervisor: Prof. Thomas Speck, Condensed Matter Theory group, Institut für Physik
- Studied the statistical field theory approach to modeling motility-induced phase separation (MIPS)
 - Developed a dynamical mean field theory using constant-affinity ensemble approach and was able to qualitatively explain the deviation of experiments from the predictions of ABP (active Brownian particle)-based models of MIPS
 - Predicted a correction to the existing estimates of sedimentation length in an active ideal gas, using the constant-affinity ensemble approach
- 2017 **ABPs in a Magnetic Field**, Indian Institute of Science, Bangalore.
Supervisor: Prof. Sriram Ramaswamy, Department of Physics
- Studied the theory of stochastic processes, and applications in Brownian motion, linear response theory and stochastic energetics formalism of non-equilibrium statistical physics
 - Solved for the exact probability distribution function in configuration space of active Brownian particles (ABPs) in a simple harmonic confining potential
 - Explored the possibility of applying a generalized version of the fluctuation-dissipation theorems in our system, in order to quantify the extent of non-equilibrium behaviour

Positions of Responsibility

- 2018 - 22 **Mentor**, Summer of Science (IIT-B) and Physics Directed Reading Program (MIT).
 Advised undergraduate students through guided reading projects on various advanced topics in Physics and Math, including conformal field theory, topology, and non-equilibrium statistical physics
- 2020 - 22 **Teaching Assistant**, for *classical mechanics and statistical physics*, MIT.
 Responsible for weekly recitations, mentoring, and grading
- 2020 - 22 **Webmaster**, PGSC, MIT.
 Responsible for maintaining the website of the Physics Graduate Students Council (PGSC) and providing web-related support to the Physics Values Committee
- 2018 - 19 **Co-Lead**, Academic Mentorship Program, Department of Physics, IIT Bombay.
 Led a team of 12 mentors to provide academic support and to facilitate outreach to ~ 200 students
- 2017 - 18 **Teaching Assistant**, for *electromagnetism and basic calculus*, IIT-B.
 Responsible for mentoring a group of 50 freshmen, conducting weekly tutorials, and grading exams

Workshops and Conferences

- Aug - Sep '22 Selected to attend a summer school on **Quantum Dynamics: from electrons to qubits**, organized by the International Centre for Theoretical Physics (ICTP) in Trieste, Italy
- Jun '22 Attended a workshop on **Global Categorical Symmetries** at the Perimeter Institute for Theoretical Physics in Waterloo, Canada
- Mar '22 Presented my research in a contributed talk at the **APS March meeting**
- Jan '22 Attended the annual meeting of the Simons Collaboration on **Ultra-Quantum Matter**
- Jun '21 Attended (virtually) the **Princeton Summer School on Condensed Matter Physics**
- May '20 Gave an invited pedagogical talk (virtually) on the quantum Hall effect to the **Maths and Physics Club** at IIT-Bombay
- Jun '19 Attended the 10th **Bangalore School on Statistical Physics** organized by the International Centre for Theoretical Sciences (ICTS) in Bengaluru, India

References

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