

Arky Chatterjee

Junior Undergraduate

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Education

- 2015-Present **Indian Institute of Technology, Bombay.**
B.Tech (with Honours) in Engineering Physics and Minor in Mathematics. Overall CPI - 9.48/10
- 2013-2015 **Intermediate/+2, Vivekananda Mission School, Kolkata, Percentage - 99.75.**
- 2013 **Matriculation, Vivekananda Mission School, Kolkata, Percentage - 96.8.**

Academic Achievements

- 2017 Ranked 6th/42 in the Physics department
- 2016 **AP grade** (given only to top 1%) **for exceptional performance** in Partial Differential Equations course (MA 207)
- 2015 Secured an All India Rank of **288** out of 1.5 lakh candidates in *JEE Advanced*
- 2014 Among the **Top 300** candidates from throughout India who qualified for the **INPhO** (Indian National Physics Olympiad) and the **INChO** (Indian National Chemistry Olympiad)
- 2014 Secured certificate of merit for being in the national **Top 1%** in **National Standard Examination in Physics** (NSEP) organized by HBCSE
- 2013 Recipient of **Kishore Vaigyanik Protsahan Yojana** Scholarship awarded to **top 300** students by the Govt. of India to motivate interest in research

Research Internship

May-July '17 **Active Brownian Particles in Magnetic Field**, Indian Institute of Science, Bangalore.
Supervisor: Prof Sriram Ramaswamy

- 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 in a simple harmonic confining potential, in the overdamped limit
- 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

Research Projects

July '17- **Decay of False Vacua in Relativistic Field Theory (Reading Project)**, *Department of Physics, IIT Bombay, Supervisor: Prof Urjit Yajnik.*

- Studied the Klein-Gordon and Dirac equations, also introduced to topological solutions (solitary waves and soliton) in classical field theory, studied the kink solution of ϕ^4 theory
- Studied the semi-classical approach to the decay of false vacua in relativistic field theories, and the role of soliton-mediated tunneling in this decay process

August '16- **Collective motion and Tissue Dynamics**, *Department of Physics, IIT Bombay.*
Ongoing *Supervisor: Prof Amitabha Nandi*

- Studied the **vertex model of tissue dynamics**, and flocking models of collective motion in active matter
- Reproduced simulation results of the standard **Vicsek model** of collective motion
- Currently working on developing simulation code (from scratch) for modeling polymers
- Exploring the possibility of studying the dynamics of boundaries of active fluids (as models for tissues, active

colloids) by modeling the intermediary membrane as a polymer

May-July '16 **Simulation of Particle Decays**, *Department of Physics, IIT Bombay.*
Supervisor: Prof Basanta Kumar Nandi

- Developed Monte Carlo simulations of two and three-body decay processes
- Wrote data analysis routines in **CERN Root framework**, including a deconvolution algorithm to remove a simulated noise signal from the useful data

Key Course Projects

Spring '17 **Digit Recognition with Perceptrons**, *Course Project - Electronics Lab III.*
Supervisor: Prof Pradeep Sarin, Department of Physics

- Designed a **perceptron-based digit recognition** algorithm on an **FPGA** board, using VHDL
- Integrated an LCD display for displaying outputs

Spring '17 **Simulation of Grover's algorithm using coupled oscillator model**, *Course Project - Waves and Oscillations, Supervisor: Prof Tapanendu Kundu, Department of Physics.*

- Studied **Grover's** probabilistic $O(\sqrt{N})$ quantum search algorithm for an unsorted database
- Used a system of coupled oscillators as a **physical model** to simulate the algorithm
- Performed graphical simulations of the model using the Python Numpy package

Fall '16 **Dynamics of Internet memes**, *Course Project - Nonlinear Dynamics.*
Supervisor: Prof Amitabha Nandi, Department of Physics

- Studied the temporal spread of internet memes, modeled as a **viral propagation**
- Used the **SIR** (susceptible-infected-recovered) model of viral propagation for multiple pathogens, to study the competitive and collaborative effects of different memes on the minds of internet users
- Used data from **Google trends** as a basis for popularity of memes, and used it to fit proposed model

Key Courses

Physics Classical Mechanics, Nonlinear Dynamics, Thermal Physics, Quantum Mechanics I and II[†], Group Theory Methods[†], Continuum Mechanics, Special Theory of Relativity

Mathematics Real Analysis, General Topology, Topics in Topology[†], Basic Algebra[†], Differential Equations, Numerical Analysis, Complex Analysis, Linear Algebra

Others Analog and Digital Electronics lab, Microprocessor lab[†], Digital Systems, Economics

[†] to be completed by November 2017

Software skills

Programming C++, Python, Java

Science Packages Root, Matlab, Mathematica, Numpy, Scipy, Matplotlib, Pandas, Origin

Software Git, Arduino, \LaTeX , Django, Jekyll, SolidWorks, AutoCAD

Positions of Responsibility

2017-18 **Academic Mentor**, *D-AMP team, Department of Physics, IIT Bombay.*

Part of the D-AMP (department academic mentorship program) team of the Physics department, responsible for mentoring sophomore students throughout the academic session

Spring '17 **Teaching Assistant**, *PH108 - Basics of Electricity and Magnetism, IIT Bombay.*

Responsible for mentoring a batch of 50 freshman students throughout the course; involved in evaluation of exams and quizzes