Sanket Chirame

Department of Physics
Indian Institute of Technology, Bombay
Mumbai, India 400076

Mail: sanketchirame12@gmail.com
Phone: +91-9623541294
Web: https://sites.google.com/view/sanketchirame

Research Interests

Theoretical Condensed Matter Physics: Non-equilibrium physics of quantum systems, Phase transitions, Topological phases of quantum matter

Education

Indian Institute of Technology, Bombay — *August 2019 (Expected)*
B.Tech. + M.Tech. *in Engineering Physics with specialization in* ***Nanoscience***

Research Experience

Master's Thesis - Non-equilibrium Physics of Many Body States — *July '18 - Present*

Guide: Prof. Soumya Bera, Department of Physics, IIT Bombay

- Simulated nearest neighbour non-interacting fermion model with **Aubry-Andre potential** driven by external time dependent electric field and calculated correlation matrices
- Analysing **entanglement entropy** and charge current to understand the effect of drive frequency on phase transition from localized to delocalized phase of the model
- Studied **DMRG** algorithm using **Matrix Product State** formalism to simulate time evolution of many body state of one dimensional lattice models

Summer Internship - Universität Konstanz, Germany — *Summer 2017*

Guide: Prof. Dr. Wolfgang Belzig, Dr. Akashdeep Kamra

- Studied effective Hamiltonian of **a qubit in photon cavity** system in dispersive regime important for experimental measurement of qubit state dependent photon occupation number
- Calculated first and second order corrections to interaction Hamiltonian in the presence of squeezing in the photonic mode using **time dependent perturbation theory**
- Analysed terms obtained **without** making **Rotating Wave Approximation** in the presence of squeezing

Dynamics of Cellular Networks — *May '16 - Sep '16*

Guide: Prof. Mandar Inamdar, Department of Civil Engineering, IIT Bombay

- Learnt **Chaste** C++ package enabling efficient simulations of cell monolayer as a vertex based model
- Studied dynamics of epithelial monolayer due to mechanical coupling of actomyosin cable contraction tensile force and cell crawling motile force
- Simulated crescent shaped wound in cell population to study the dynamics of boundary cells in the presence of **curvature dependent motile force** on the boundary vertices

Key Course Projects and Seminars

Decoherence in Quantum Dots [Poster] — *Autumn 2017*

Guide: Prof. Kasturi Saha, Department of Electrical Engineering, IIT Bombay — *Spintronics*

- Examined interplay of **Zeeman and Hyperfine interaction** to obtain an effective Hamiltonian for central electron spin in a quantum dot nuclear spin bath
- Performed simulations to determine decoherence in InAs quantum dot using **pseudospin solution** and analysed the effect of external magnetic field on the decoherence time scale

Spin-Orbit Coupling in Graphene [Presentation] — *Spring 2017*

Guide: Prof. Anshuman Kumar, Department of Physics, IIT Bombay — *Physics of nanostructures*

- Analysed band structure of graphene considering **spin-orbit coupling** in the presence of electric field
- Studied the implications of time reversal symmetry on the degeneracy at the Dirac point

Introduction to String Theory [Report] *Autumn 2016*
Guide: Prof. Kumar Rao, Department of Physics, IIT Bombay *Supervised Learning*

- Studied the motion of classical relativistic strings using the **Nambu-Goto string action** and conserved currents arising from translational and Lorentz symmetries
- Developed an understanding of Gauss law and gravitational constant in extra compactified dimensions

Technical Experience

Advitiy - Student Satellite Project, IIT Bombay Feb '17 - Present
The 2^{nd} student satellite of IIT Bombay, technically advanced and efficient version of the 1^{st}, Pratham

- Developed a **quality assured simulation frame-work** for attitude dynamics of satellite in **python** and performed extensive simulations to determine attitude deviations in an uncontrolled satellite
- Determined the **feasible specifications for magnetorquer** (actuator) considering constraints imposed by all subsystems along with ensuring the successful detumbling of 1U satellite
- Evaluated 'Measuring Hardness ratio of Blackhole X-ray spectrum' as a potential payload idea for Advitiy considering on-board computational capabilities and X-ray detector specifications

Subsystem Head, ADC Subsystem, Advitiy *Feb' 17 - July' 18*

- Headed an **interdisciplinary team of 10 members** to generate a Baseline Design of Attitude Determination and Control Subsystem (ADCS) for Advitiy
- Executed **three stage recruitment process** to test technical skills, practical approach and team work of candidates thereby selecting 8 candidates out of 30 applicants
- Developed and implemented **quality assurance guidelines** to make the design process more reliable
- Contributed to **Satellite 101 wiki**, a compilation of exhaustive knowledge of satellite project which reached 5.8k page views and **1.4k users** around the globe within a month

Teaching Experience

Teaching Assistant - Microcontroller Lab *Autumn 2018*

- Entrusted with tutoring **40+ students** for electronics lab based on **Arduino** programming
- Assisting in design of lab assignments, solving experimental and theory doubts, and evaluating papers

Scholastic Achievements

- Secured **All India Rank - 38** in Physics Graduate Aptitude Test in Engineering (GATE) *2018*
- Awarded **AP grade** for exceptional performance in Physics of Nanostructures and Nanodevices *2018*
- Recipient of prestigious National Talent Search **(NTS)** scholarship *2010*
- Secured **State Rank - 1** in Maharashtra state board secondary school examination *2012*

Relevant Coursework

Physics Theoretical Condensed Matter Physics, Superconductivity and Low Temperature Physics, Physics of Nanostructures, Relativistic Quantum Mechanics, Advanced Statistical Physics, Physics of Quantum Devices, Advanced Simulation Techniques

Mathematics Group Theory methods in Physics, Complex Analysis, Calculus, Numerical Analysis, Differential Equations (I & II)

Technical Skills

Programming Languages Python, C++, LaTeX

Simulation Softwares MATLAB, Mathematica, Simulink, Origin

Extra-curricular Activities

- Devised modules to work with peer learning based pedagogy and flipped classroom model of teaching as an intern at **Avanti Learning Centres**, an emerging education company *Summer 2015*
- Tutored 6^{th} standard students from NGO Vidya and LCCWA in Maths and Science as a part of **National Service Scheme** educational outreach program *'14 - '15*
- Secured **A grade** in both **Elementary** and **Intermediate** Drawing grade examinations conducted by the Maharashtra State Government *'08 , '10*
- Completed three levels of **ICMAS Abacus** Mathematics program *'08 -'09*