Sanket Chirame

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Research Interests

Theoretical Condensed Matter Physics: Non-equilibrium physics of quantum systems, Critical phenomenon

Education

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

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*

Research & Technical Experience

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

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

- Understood **Matrix Product state formalism** for efficient simulation of quantum many body states
- Studied **DMRG algorithm** for quench simulation of transverse field Ising model to study dynamical quantum phase transitions characterized by non-analytic behaviour of Loschmidt echo
- Analysing time evolution of entanglement entropy in **periodically driven tight binding fermion chain** with site dependent chemical potential by computing two-point correlators

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 qubit state dependent photon occupation number
- Calculated corrections to interaction Hamiltonian in the presences of squeezing in the photonic mode using **time dependent perturbation theory**
- Analysed the terms obtained without making Rotating Wave Approximation in the presence of squeezing

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
- Studied 'Measuring Hardness ratio of Blackhole X-ray spectrum' as a potential payload idea for Advitiy and determined the system and subsystem level requirements

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
Autumn 2017

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

- Studied the **decoherence** of an electron spin in quantum dot due to interaction with a nuclear spin bath
- Performed simulations to determine decoherence in InAs quantum dot using **pseudospin evolution** and analysed its dependence on external magnetic field

Introduction to String Theory
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

Spin-Orbit Coupling in Graphene
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

Position of Responsibility

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 Assistant - Microcontroller Lab
Fall 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

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 a part of summer internship program at Avanti Learning Centres *Summer 2015*
- Tutored students from NGOs as a part of **National Service Scheme** *'08 -'09*
- 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*