Sanket Chirame

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Research Interest

My primary research interest lies in **Theoretical Condensed Matter Physics**. I am particularly interested in studying Physics of **Quantum Many Body systems**.

Education

- Indian Institute of Technology, Bombay [2014 - Present]
  B.Tech + M.Tech with specialization in ***Nanoscience***
- 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 [2008]
- Secured **State Rank - 1** in Maharashtra state board secondary school examination [2012]

Research & Technical Experience

Dynamic Quantum Phase Transitions using DMRG

July '18 - Present

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

- Understood time dependent variational principle using Matrix Product state formalism
- Simulated quench dynamics of transeverse Ising chain using existing DMRG framework
- Analysed the non-analyticity of the loschmidt echo to determine the corelation between phase transition and singular values

Summer Internship - Universität Konstanz, Germany

May '17 - July'17

Qubit in Squeezed Boson Cavity

Guide: Prof. Wolfgang Belzig, Dr. Akashdeep Kamra

- Investigated the **excitations in squeezed boson cavity** due to interaction with single two level system
- Analysed the time evolution of number operator expectation value **without** making **Rotating Wave Approximation** in presence of squeezed mode
- Compared the results obtained by perturbation theory and exact diagonalization to determine the contribution of non energy conserving terms in Hamiltonian

Advitiy - Student Satellite Project, IIT Bombay

Feb '17 - Present

The 2nd student satellite of IIT Bombay, technically advanced and efficient version of the 1st, 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 Balckhole 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

- Studied closure dynamics of wound in epithelial monolayer due to mechanical coupling of actomyosin cable contraction tensile force and cell crawling motile force
- Performed simulations for cellular monolayer as a **vertex based model** in Chaste C++ library
- Analyzed effect of **curvature dependent motile force** on the wound closure time and trajectories of boundary cells for crescent shaped wound

Growth of Bacterial Cell Wall
Jan '16 - May'16

Guide: Prof. Anairban Sain, Department of Physics, IIT Bombay

- Studied mechanism of addition of peptidoglycan strands in existing network during cell growth and its effect on the shape of cell
- Understood mathematical model of cell wall growth,remodeling and division dynamics in Gram-negative bacteria during binary cell division

Key Course Projects

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 nuclear spin bath
- Performed simulations to determine decoherence in InAs quantum dot using pseudospin evolution and analysed it's dependence on external magnetic field

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
- Examined the presence of at least two-fold degeneracy at Dirac point protected by time reversal symmetry

Position of Responsibility

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

- Headed **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 therby 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

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 at Avanti Learning Centers
- Volunteered as a tutor for NGOs Vidya & LCCWA under **National Service Scheme** (NSS) educational outreach program
- Surveyed several physically challenged students as part of project to develop interactive learning modules
- Secured **A grade** in both Elementary and Intermediate Drawing grade examinations conducted by the Government of Maharashtra state