

# SANKET CHIRAME

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

Mail: [sanketchirame12@gmail.com](mailto:sanketchirame12@gmail.com)  
Phone: +91-9623541294  
Web: <https://sites.google.com/view/sanketchirame>

## RESEARCH INTERESTS

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

## EDUCATION

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Indian Institute of Technology, Bombay  
*Dual Degree - Bachelor of Technology + Master of Technology*  
*Major - Engineering Physics with specialization in Nanoscience*

July '14 - Aug '19 (Expected)

## RESEARCH EXPERIENCE

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**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 states of one dimensional lattice models

**Summer Internship - Universität Konstanz, Germany** Summer 2017  
Guide: Prof. Dr. Wolfgang Belzig, Dr. Akashdeep Kamra

- Studied the 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 the 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

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**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 the 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

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### Advitiy - Student Satellite Project, IIT Bombay

Feb '17 - Present

The 2<sup>nd</sup> student satellite of IIT Bombay, technically advanced and efficient version of the 1<sup>st</sup>, 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

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### Teaching Assistant - Microcontroller Lab

Autumn 2018

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

## SCHOLASTIC ACHIEVEMENTS

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- 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

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**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

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**Programming Languages** Python, C++, L<sup>A</sup>T<sub>E</sub>X

**Simulation Softwares** MATLAB, Mathematica, Simulink, Origin

## EXTRA-CURRICULAR ACTIVITIES

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- 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<sup>th</sup> 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