Soudip Kundu

soudip-kundu | soudip-kundu | https://soudip-kundu.github.io/ | soudipkundu96@gmail.com | sk21ms051@iiserkol.ac.in | +91 7980330109

Summary

I am currently completing a BS–MS Dual Degree Program in Physics at IISER Kolkata, with a focus on condensed matter physics. Through internships, workshops, and term papers, I have developed research experience across various topics in the field. I aim to further deepen my understanding of condensed matter systems and contribute to the study of strongly correlated quantum materials through my PhD research. My current MS thesis focus on metal to mott-insulator transition at finite temperature using URG(unitary renormalization group). My future goal would beto use this understanding to study other quantum phase transitions.

Education

2021 - 2026	BS-MS Degree at **Indian Institute of Science Education and Research Kolkata** (currently in 5th year)Transcript	(GPA: 8.23/10)
2020	Class 12th Some Board	(93.6/100)
2018	Class 10th Some Board	(91.6/100)

Research Experience

Summer Intership 3rd year 2023

I have done intership in Quantum Information and Computation and have also participated in quantum computing workshops and programs held by IBM and quantum world .Certificate

Summer Intership 4th year 2024

I did my internship under Prof Sayan Choudhury, Reader at Harish Chandra Research Institute on "Time Crystal in periodically driven classical spin chain".There, we considered a periodically driven Floquet system, a time-dependent Hamiltonian with discrete time symmetry. The breaking of the symmetry led to the novel state of matter DTC, which is predicted by Prof Frank Wilczek. Prof Sayan Choudhury in one of his papers showed that if we change the periodicity of the Hamiltonian, then the formation of the stable time crystal is periodic, ie, for certain values of T= Time period of Hamiltonian, we see a stable DTC, but this if we work with quantum spin(Pauli matrices). My job was to see whether we observe similar behaviour with the classical spin chain. And interestingly, we have found such periodic behavior here too.Report

Current MS thesis 5th year 2024

Currently, for my master's thesis, I am working with Prof. Siddharth Lal. My main aim will be to understand the breakdown of Fermi liquid behavior and the origin of the pseudogap in doped Mott systems by solving an extended single impurity Anderson (e-siam) model using unitary renormalization group(URG) at finite temperature. URG is a technique developed by my professor and some of his PhD students. They have already studied this formation of pseudogap at zero temperature in one of their paper. By job is to extend this to finite temperature. But before I do that, first I am learning this URG technique and understanding the Kondo cloud, like formation of singlet and flattening of the Kondo cloud at high temperature, and various thermodynamic properties. Next step will be to solve the single impurity Anderson model(siam) and then the ultimate goal is to put everything together and understand the transition from Fermi liquid to Mott insulator. What makes this URG technique better than others is that it is non-perturbative.

Term Papers Click on the link to see the reports

BCS to BEC crossover(Work in Progress) , Quantum Hall Effect , Determination of 1D band structure by transfer matrix method , Differential Form in Electromagnetism , Optical Fano Resonances

Professional Skill

Programing Skills

Proficient in Python for numerical simulations and data analysis; working knowledge of C++ and Julia.

Presentation Skills

Apart from my research experience, I have also taken time to develop particular skills that will prove invaluable in an academic career.

I have given presentation on by summer intership "Time crystal" in a student colloquium. The talk was well received and gave me confidence for public speaking

Leadership Skills

I with my friends have organized IBM Quantum Fall Fest, where i gave lecture on basics of quantum computing . Around 200 student in our institute participated in that event . The IBM team recognized our effort and congratulated us by sending some souviniers. It helped me get out of my comfort zone and fear of public speaking and gave me confidence to organize large scale events and work with a group

References

Prof Siddhartha Lal(IISER Kolkata)

Email:- slal@iiserkol.ac.in

Group webpage:- EPQM

Sayan Choudhury(Reader at Harish-Chandra Research Institute(HRI))

Email:- sayanchoudhury@hri.res.in

Personal webpage:- Sayan Choudhury

Prof Bhavtosh Bansal(IISER Kolkata)

Email:- bhavtosh@iiserkol.ac.in

Personal webpage:- Bhavtosh Bansal