Ramanuj Raman

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Current Position

Indian Institute of Science Education and Research, Mohali 4th year-BSMS student
August 2024 - Present

Current Courses

- PHY660:Nonlinear Optics
- PHY665:Quantum Phases of Matter and Phase Transitions
- PHY640:Non-Equilibrium Statistical Mechanics
- IDC402:Nonlinear dynamics, chaos and complex systems

Education

Indian Institute of Science Education and Research Mohali, India
BS-MS in Physics major *Dec. 2021 - 2026*
- **CPI:** 9.01
- **SPI:** 8.0

Kendriya Vidyalaya Bangana,Mohali
Higher Secondary Education-12th *Mar. 2021*
- **Percentage:** 95.8%
- **Class Rank:** 2nd

Kendriya Vidyalaya Bangana,Mohali
Secondary Education-10th *Mar. 2019*
- **Percentage:** 93.6%
- **Class Rank:** 2nd

Experience

Reading Project on Fourier Optics
Dr. Sandeep Kumar Goyal, IISER Mohali
- ✳ We worked together to understand the interference and diffraction patterns formed by slits of different shapes and then get a general expression for any random shape. This project included learning scalar diffration theory and finally deriving Kirchoff-Fresnel diffraction formula.

Reading Project on Quantum Machine Learning and Quantum Deep Learning
Dr.Kuntal Roy at IISER Bhopal
- We worked together to understand the basics of Quantum Computing starting off with learning basic algorithms such as quantum teleportation, Deutcsh-Jozsa algorithm, Bernstein-Vazirani algorithm, Simon's algorithm.Then we moved toward learning few of the more advanced algorithms such as HHL algorithm and tried to understand the foundations of quantum machine learning and quantum deep learning by studying the training of deep restricted quantum boltzmann's machine using quantum algorithms GEQS and GEQAE

Second Quantisation, Ising Model, Kitaev Chain:A literature survey
Prof.NS Vidhyadhiraja at JNCASR Bangalore
- Our objective during the project has been to simulate strongly correlated systems on a quantum computer and to understand the noise and find ways to eradicate it. Most of the work has been centered around creating a foundation .During the course of internship I also gave presentation on Qiskit covering a basic introduction and some basic algorithms. We also studied quantum harmonic oscillator, lattice vibrations, ising model and transverse field ising model.

Solving Quantum Hisenberg Chain Model using Quantum Computer
Prof.NS Vidhyadhiraja at JNCASR Bangalore
- Our objective during the project has been to try to solve Hisenberg Chain Model using Quantum Computer and a failed attempt to find its eigenvalues using Quantum Phase Estimation. Time Evolution Circuit for Hisenberg Chain Model has been implemented using qiskit on a simulator.

Dynamics of Slip-bond and slip-catch-slip bond cluster under applied force
Dr.Anil Kumar Dasanna at IISER Mohali
- In this project we made an attempt to study the dynamics of slip bonds under applied force on the cluster and tried to find the quantities like critical force, variation of Time of Dissociation with applied force and time evolution of number of closed bonds under given applied force. Another failed attempt has been made to study the dynamics of slip-catch-slip bond cluster under applied force and try to find similar quantities for this model. We found a equation giving bond dissociation as function of applied force. The models has been studied by solving mean field equations using RK-4 method in python and all stochastic simulations has been done using Gillespie Algorithm in C++.

Analytical and numerical investigation of fully quantized light-matter interaction in few-level systems
Prof.Dr. Torsten Meier and supervised by Dr.Hendrik Rose at Institute for Photonic Quantum Systems, Paderborn University,Germany
- In this project we extended the original 2-level JCM for a 3-level system and attempted to study the excitation dynamics of the system. We have also studied the excitation dynamics of the system under different quantum statistics of light like coherent states, squeezed vaccum states, thermal light etc. In this project we have attempted to solve the 3-level JCM using both analytical and numerical methods. For numerical methods we have mainly used python library qutip.

Skills

Languages: Python(Intermediate level),C++(Intermediate level)

Python Libraries: Numpy, Scipy, Sympy, Pandas, Matplotlib, Qutip, Qiskit

Miscellaneous: Latex,Typst,Sleap.ai

Workshops and Seminars

- Physics of Life 2024–9th Annual Monsoon School at Simons Centre at NCBS, Bangalore (July 1-10, 2024)

- Participated in NEXT Epoch 2024,the deep learning workshop at Harvard Medical School, aimed at applications of deep learning on biochemistry and secondary structure prediction.

- Participated in Qiskit Global Summer School-2024:Path to Utility

Honors and Achievements

- Awarded Quantum Excellence Badge in 2024 Quantum Global Summer School: Path to Utility

Talks and Presentation

- Talk at Vidhyadhiraja Group,JNCASR Bengaluru on "An Introduction to Qiskit and Quantum Computing" in May,2023

- Presentation at 9th-Physics of Life Monsoon School at NCBS Bengaluru on "Dynamics of slip-bond cluster" on 9,August,2024

- Lecture on "Vectors, Tensors and Electromagnetism" at Phi Club IISER Mohali

- Conducted help session for PHY102:Electromagnetism for first year students at IISER Mohali.

- Conducted help session for PHY101:Mechanics for first year students at IISER Mohali.