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Education

B. Tech in **Engineering Physics** from **Indian Institute of Technology, Roorkee** Syllabus CGPA: 8.062 **2020-current (Expected 2024)**

- Relevant coursework: Condensed Matter Physics, Thermal Physics and Statistical Mechanics, Quantum Mechanics, Nanotechnology, Quantum Computing, Numerical Analysis and Computational Physics, Atomic and Laser Physics, Mathematical Physics, A Primer Quantum Field Theory (ongoing)
- Additional Coursework: Signal Processing, Machine Learning, Data Mining

12th Grade from **Central Board of Secondary Education India** at **Padma Seshadri Bala Bhawan Senior Secondary School (2020)** and scored **99/100 in Physics, Mathematics and Computer Science, among top 1% of my Country. My overall score is 97.8%**

Experience

Internship: A Study of Electronic Properties of P-EDOT at **Indian Institute of Space Science and Technology Trivandrum**
May 2023 – July 2023

Mentor/Supervisor: Professor Nirmala Rachel James from **Indian Institute of Space Science and Technology**

- I studied the concepts of Density Functional Theory and Molecular Mechanics to aid in Simulation. I also conducted an extensive literature study of transparent conductors like Indium Tin Oxide(ITO) and compared it with equivalent properties found in Cu, Au, and Ag Nanowires.
- I used Gaussian and GaussView software to implement Density Functional Theory calculations on oligomers of **EDOT (3,4-Ethylenedioxythiophene)** and studied its properties, obtaining information regarding the bond lengths, bond angles, HOMO-LUMO distribution of electrons.
- I practiced utilizing Schrodinger Material Sciences Suite to calculate properties of the polymer like conjugation length and Peierel's Distortion and simulate the Cu Nanowire using Molecular Dynamics.
- I reported the findings obtained so that the work to check the feasibility of Cu Nanowire as substitute for ITO in the case of Organic Hole-only Devices with **PEDOT: PSS (Polymer of EDOT in Polystyrene Sulphonate Gel**) being deposited on it can be continued.

Studying Analytic Integrability and Non-Integrability in Bosonic String Theory at **IIT Roorkee** **July 2023 – Ongoing**

Mentor/Supervisor: Professor Dibakar Roychowdhury from **Indian Institute of Technology, Roorkee**

- I studied the concepts related to Analytic Integrability, and practiced methods to verify integrability of certain systems as a part of a literature review. I studied the Kovacic algorithm to study the integrability of differential equations in general.
- In due course, I studied the concepts related to String Theory from David Tong's String Theory notes to build a base. Understood concepts related to Classical Strings like the symmetries of the actions and the Polyakov Action's implications in detail.
- As a final step I used the Kovacic Algorithm on a classical string configuration placed in an $AdS^5 \times T^{p,q}$ manifold space given the metric and applying it to the Polyakov lagrangian.
- Utilizing the same method on other string configurations and extend my study to other aspects of string theory.

Transport Properties of Thin Films: Studying 1/f conductivity noise at **IIT Roorkee** **January 2023- May 2023**

Mentor/Supervisor: Professor Vivek Kumar Malik from **Indian Institute of Technology, Roorkee**

- I used the facilities available at the instrumentation laboratory to perform **Four Probe Method** and measure the transport properties of fabricated samples.
- I studied the effects of **Weak Localization** in thin films and reviewed experimental results produced by previous authors and researchers.
- I studied the theory behind 1/f noise in Condensed Matter Physics. I also learnt the usage of a lock-in amplifier provided by the instrumentation laboratory to study noise in material and used it to isolate 1/f conductivity noise in several thin film samples.

Demystifying Frequency Filters Using Laplace Analysis at **IIT Roorkee** **September 2022 – November 2022**

Mentor/Supervisor: Professor Peayush Choubey from **Indian Institute of Technology, Roorkee**

- I ratified my knowledge of **signal processing** and MATLAB/Python libraries to analyze frequency filters.
- I studied Low Pass, High Pass, Band Pass and Band Reject filters using circuit analysis and analytically leveraging Laplace Transform. I produced characteristic frequency and bode plots using MATLAB and verified predictions made by hand. I also explored applications involving each filter like image processing and time series analysis and implementing them using MATLAB.

Using GEANT4 for simulation of Optical Photon processes at **IIT Roorkee** **May 2022 – December 2022**

Mentor/Supervisor: Professor Anil Kumar Gourishetty from **Indian Institute of Technology, Roorkee**

- I investigated phenomena like scintillations, built a form of Cerenkov Radiation Detector model while familiarizing myself with the concepts related to the above processes.
- I experimented with the idea of multiple gamma emitters and coincidence summing and how to detect gamma photons to determine the energy dependence of efficiency in a more precise manner
- I implemented ROOT software to analyze the data outcome of the events happening in the simulations of GEANT4. These are software provided by CERN and Fermilab.

Study of Disordered 1D Quantum Systems at **IIT Roorkee** **October 2021 – March 2022**

- I studied the tight-binding model and understood the effect of disordered (randomized) potentials on 1D systems using simulation on Python and MATLAB. I worked as a member in a team of 4.
- We covered aspects of Anderson Localization and Aubry-Andre' Model and their implications in Condensed Matter Physics. We also worked on Off Diagonal Disorder. These are phenomena occurring as a result of different randomized potential configurations.
- We investigated the Time Evolution of Wave functions in randomized potentials and their corresponding energy variations. We also simulated and checked for the case of 1D systems, varying the chain lengths, and explored the case for a 2D lattice.

IBM Qiskit Fall Fest Quantum Hackathon: Quantum Chess at **IIT Roorkee** **September 2021 – November 2021**

- I collaborated as a team member in a team comprising of 5 people to create a rendition of chess, a quantum variation of the original game.
- We used Quantum Random Number Generator to introduce Superposition among the chess pieces. I programmed the part implementing QRNG using Qiskit and IBMQ, tailored for the larger Game Code. Our Project got placed 2nd in the regional round & our team participated in the global round of the hackathon.

Skills

Languages: English, Hindi, Tamil, (Learning) Japanese
Programming Languages: Python, C++, Fortran90, Java
Software Packages: MATLAB, Octave, GEANT4, Gaussian, GaussView, Schrodinger
Activities: Cricket, Badminton

Extra-Curricular

Additional Secretary of **Physics and Astronomy Club IIT Roorkee** **May 2023 – Present**

- I lead the mathematics vertical of the club, organizing, and conducting events like Integration Bee (inspired from MIT's original), Journal Club where we take up intellectual discussions on any relevant published paper and taking part in amateur astronomy.
- We take excursions to capture rare astronomical events like the comet of 2023.
- I mentor and undertake projects in physics to increase the research experience amongst students; One of which I am undertaking currently on Studying Disorder and Randomized Potentials.
- I help organizing lectures and talks by renowned professors and eminent people in the field.

UG Teaching Assistant for a course in Physical Chemistry I helped first year students go through the course by helping with their assignments and study process.

Volunteered at **National Service Scheme (NSS IIT Roorkee)** to help underprivileged kids or kids from rural areas prepare for the JEE exam.

Participation in **IRMUN (Model United Nations at IIT Roorkee)** and **won High Commendation** in **Special Committee September 2021**

I participated in **a Journal Writing Competition** Hyperion 2021 by Indian Institute of Technology (IIT), Kanpur **,** where as a member of a team of 3, I had to go through articles and solve problems, both computational and analytical and summarize them all in a journal article format. The problems involved questions associated with classical mechanics, signal processing involving noise reduction, thermodynamics and some logical reasoning leading from data obtained on Dark Matter. The hosting group from IIT Kanpur provided the source material on Dark Matter. **The team secured the 7th position in India.**

Participated in **the [Physics Bowl] Competition in 2021. Team of 4 secured 18th position in the world.** **January 2021**

President of **The Global Education and Leadership Foundation (TGELF) Youth Leadership Program** at **Padma Seshadri Bala Bhawan Senior Secondary School** **July 2019 – March 2020**

- Was President of The Global Education and Leadership Foundation's school leader's club.
- Headed the group of leaders towards a sustainability project to reuse plastic waste generated in the school campus, to make useful products.