Mandeep

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Personal Statement

My journey into quantum physics began with a simple fascination: understanding how the fundamental building blocks of our universe behave. Through my academic experiences, from studying pentaquark systems to studying quantum information theory, I've developed a deep appreciation for the complex interplay between quantum mechanics, computational methods, and theoretical physics.

My research aims to bridge theoretical understanding with practical applications, exploring how quantum information theory can provide insights into fundamental physical systems. The opportunity to contribute to advancing our understanding of quantum phenomena drives my academic and research pursuits.

Education

Dr. BR Ambedkar National Institute of Technology, Jalandhar 2022 – 2024
Master of Science in Physics
CGPA: 7.08/10

St. Aloysius College, Mangalore 2019 – 2022
Bachelor of Science in Physics, Chemistry, and Mathematics
CGPA: 7.92/10

Certifications

- **Qubit x Qubit - Quantum Computing Course** (2024-25). In-depth course on quantum computing, covering quantum gates, algorithms, and quantum key distribution (QKD).
- **Harvard CS50 - Introduction to Computer Science** (2024). A comprehensive introduction to computer science, covering algorithms, data structures, and software development.
- **ICTS - Curves and Surfaces** (2022), International Centre for Theoretical Sciences. Certification in the theory of curves, surfaces, and their applications in mathematical and physical contexts.
- **Fellow of Physics Training and Talent Search (PTTS)** (2021). Prestigious selection for intensive training in advanced physics concepts.
- **Vedic Mathematics Program** (2021). Certificate in the ancient Indian system of mathematics for efficient mathematical calculations.

Skills

- **Quantum Computing:** Quantum algorithms design, quantum information theory principles, quantum communication protocols
- **Programming:** C++, Python (Quantum programming with Qiskit), LaTeX
- **Software:** TensorFlow, MATLAB, Quantum simulation tools
- **Research:** Scientific analysis, quantum system modeling, mathematical modeling

Projects

Medium Modification of Pentaquark July 2023 - May 2024
Supervised by **Dr. Sunnel Dutt**.

- Investigated exotic pentaquark baryon Θ^+ (quark content: $uudd\bar{s}$) using chiral SU(3) quark mean field model, incorporating key QCD features including chiral symmetry breaking
- Analyzed medium modifications in nuclear and strange matter by studying scalar-vector potential interactions and meson exchange effects

- Developed calculations for effective mass modifications using confining potential and spin-spin interactions
- Found significant mass reduction with increasing baryon density, particularly pronounced in strange matter environment
- Applied theoretical framework incorporating scalar fields (σ, ζ, δ) and vector fields (ω, ρ, ϕ) for comprehensive analysis

Galaxy Image Classification May 2023 - July 2023

- Implemented a Convolutional Neural Network (CNN) using Python and TensorFlow to classify galaxy images into three categories: elliptical, spiral, and irregular
- Processed and prepared dataset of galaxy images from the Sloan Digital Sky Survey (SDSS) for training
- Applied basic data augmentation techniques like rotation and flipping to increase the training dataset diversity
- Successfully trained the model to classify galaxy types with high accuracy on the test dataset
- Created a simple command-line interface for testing new galaxy images with the trained model

High Fidelity FM Broadcaster May 2022 - July 2022
Supervised by **Dr. Narayana Moolya B**,

- Designed and constructed a small-scale FM broadcasting system operating in the 88-108 MHz frequency band
- Implemented frequency modulation using voltage-controlled oscillator (VCO) circuit with audio input
- Assembled RF amplifier stage to achieve stable transmission range of approximately 100 meters
- Optimized audio quality by incorporating low-pass filters to reduce noise and interference
- Built and tested prototype on breadboard before finalizing design on PCB

Coursework

Physics:

- Mechanics, Wave Motion, Quantum Mechanics, Circuit Fundamentals, Optics, Electricity, Magnetism, Thermal Physics, Modern Physics, Nuclear Physics, Solid State Physics, Relativistic Quantum Mechanics

Mathematics:

- Differential Geometry, Tensor Analysis, Linear Algebra, Differential Equations, Mathematical Methods

Activities & Leadership

- Co-founder, The Socratic Circle Book Club - Organized regular discussions on scientific literature and contemporary research
- Member, Web Committee, Physical Science Society (PSS) at NIT Jalandhar
- Academic Representative, Senate Postgraduate Committee - Represented student interests in curriculum development
- Class Representative, MSc Physics - Coordinated between faculty and students
- Languages: Fluent in English and Hindi; Intermediate proficiency in Kannada and Haryanvi

Interests

- Amateur Astronomy, Scientific Computing
- Reading Scientific Literature
- Physical Fitness: Cycling, Calisthenics

Declaration

I declare that the information in this curriculum vitae is accurate and authentic. All achievements, certifications, and academic records mentioned are genuine and can be verified upon request.