

**DR. TARIQ MAHMOOD**  
*ASSISTANT PROFESSOR*  
*CENTRE FOR HIGH ENERGY PHYSICS,*  
*UNIVERSITY OF THE PUNJAB, LAHORE*

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## **EDUCATION**

**Centre for High Energy Physics, University of the Punjab**

PhD. High Energy Physics

**Title: Neural Network Based Study of Charmonium Spectrum**

**GC University Lahore**

MS. Computer Sciences (Quantum Artificial General Intelligence and Consciousness)

**Title: Modeling and Simulation of Quantum Cognitive Perceptual Associative Memory for Computer Vision using Unified Theory of Mind for Machine Consciousness**

**Centre for High Energy Physics, University of the Punjab**

M.Sc Computational Physics.

**Thesis Title: Microcontroller Based Digital Locking System**

**University of the Punjab**

B.Sc. Physics & Math (A+B)

[Majors: Physics, Mathematics (A+B)]

**BISE, Lahore**

Intermediate in Pre-Engineering

[Majors: Physics, Mathematics, Chemistry]

**BISE, Lahore**

**Matriculation**

[Majors: Physics, Mathematics, Chemistry, GTD]

## **COMPUTER SKILLS**

**Programming Skills**

Having excellent programming skills in:

- C / C++, In Windows
- C# using DOT NET framework
- Python, tensorflow, pytorch, pandas, sklearn, matplotlib, qiskit, pennylane
- MPI Programing, High Performance Computing

## THESIS SUPERVISION

### PhD

Sr. #	Scholar Name	Session	Thesis Title	Status
1	Muhammad Imran	2023-27	Forecasting Electricity Demand and Supply in Pakistan: An Analysis for Sustainable Policy Solutions	In-Process

### MPhil

Sr. #	Scholar Name	Session	Thesis Title	Status
1	Rana Tanveer Nasir	2023-25	Study of $\Psi(3S)$ Decays into $\Lambda^0 \bar{\Lambda}^0$ at BES III	Completed
2	M. Jamshaid	2023-25	Charmed mesons studies at BESIII	Completed
3	Tooba Leghari	2020-22	THE ROLE OF HIGHER-ORDER CURVATURE CORRECTIONS IN SHAPING THE BOUNCING BEHAVIOR IN F(R) GRAVITY	Completed

## PUBLICATIONS

Sr. No.	Authors	Title	Status
1	<b>Tariq Mahmood</b> , Talab Hussain, Maqsood Ahmad	<i>Quantum Computer Architecture: A Quantum Circuit-Based Approach Towards Quantum Neural Network</i>	<b>published in PAS, year=2023</b>
2	<b>Tariq Mahmood</b> , Jumanah Ahmed Darwish, Talab Hussain, Maqsood Ahmad, Rehan Ahmed Khan Sherwani	<i>Solving Schrödinger Wave Equation for the Charmonium Spectrum Using Artificial Neural Networks</i>	<b>Published</b> in Advances in High Energy Physics, <b>IF=1.7</b> , year=2024
3	Muhammad Atif Khan, <b>Tariq Mahmood</b> , Ambreen Sarwar, Maria Faiq Javaid, Munawar Iqbal	<i>Prediction of Stock Market Movement Using Long Short-Term Memory (LSTM) Artificial Neural Network: A Case Study of KSE 100 Index</i>	<b>Published</b> in Pakistan Journal of Life and Social Sciences, year=2024
4	Hafiza Hina Ibraheem, Muhammad Rizwan Tariq, Shinawar Waseem Ali, Zujaja Umer, Zunaira Basharat, Azeem Intisar, <b>Tariq Mahmood</b> , et.al	<i>Assessing Nutritional Probing and Storage Stability of Functional Aloe Vera (Aloe barbadensis) based Guava Jam: A Machine Learning Approach for Predictive Modeling</i>	<b>Published</b> in International Journal of Food Science: <b>IF=3.0</b> , 2024
5	<b>Tariq Mahmood</b> , Muhammad Shafiq, Naila Farooq, Adana Sami, Muhammad Zeeshan Haider, Qurban Ali, Shimming Han	<i>A Quantum Cognition Based Parallel Architecture of Body Sensor Network for Man-Machine Communication in Cancer Management</i>	<b>Under review</b>
6	<b>Tariq Mahmood</b> , Hassan Habib, Rehan Ahmad Khan Sherwani	<i>Comparative Analysis of Quantum Error Correction Codes: A Quantum Circuit Based Approach</i>	Submitted
7	<b>Tariq Mahmood</b> , Hassan Habib, Rehan Ahmad Khan Sherwani	<i>Grover's Algorithm for Astrophysical Data Analysis: A Quantum Computing Approach</i>	Submitted
8	<b>Tariq Mahmood</b> , Ibtasam Ahmad, Malik Muhammad Zeeshan Ansar, Jumanah Ahmed Darwish, Rehan Ahmad Khan Sherwani	<i>Comparative Study of Long Short-Term Memory (LSTM) and Quantum Long Short-Term Memory (QLSTM): Prediction of Stock Market Movement</i>	Submitted

9	Uswa Sehar, Rehan Ahmad Khan Sherwani, <b>Tariq Mahmood</b> , Jumanah Ahmed Darwish	<i>Exploring the Quantum Frontier: Road Accident Prediction Using Quantum Neural Networks and Traditional Machine Learning</i>	Submitted
10	Rehan Ahmad Khan, Iqra Altaf, <b>Tariq Mahmood</b> , Jumanah Ahmed Darwish	<i>Quantum Neural Networks and Conventional Machine Learning for Human Development Index Prediction</i>	Submitted
11	<b>Tariq Mahmood</b> , Rehan Ahmad Khan Sherwani	<i>Modeling of Quantum Cognitive Perceptual Associative Memory for Conscious Agents: A Parametrized Circuit of Quantum Neural Networks</i>	Accepted IET Quantum Communication
12	<b>Tariq Mahmood</b> , Rehan Ahmad Khan Sherwani, Muhayyuddin	<i>Quantum Cognitive Conscious Dreamer: A Hybrid Approach for Emotion-Based Selection of Dream Contents Using Quantum Neural Networks and Quantum Genetic Algorithms</i>	Submitted
13	Rehan Ahmad Khan, Amna Riaz, <b>Tariq Mahmood</b>	<i>Quantum computing in health care, current status and future prospects: a comprehensive review</i>	Submitted
14	<b>Tariq Mahmood</b> , Muhammad Afnan, Ikrma	<i>Loss Detection in Smart Grids: A Hybrid Model of Long Short-Term Memory and Highway Super Network</i>	Submitted
15	Rehan Ahmad Khan Sherwani, Amna Riaz, <b>Tariq Mahmood</b> , Jumanah Ahmad Darwish	<i>Quantum Computing in Finance: Current Status and Future Prospects – A Comprehensive Review</i>	Submitted
16	Azeem Intisar, Shahzar Hafeez, Ayesha Ishaq, <b>Tariq Mahmood</b> , et. al.	<i>Predictive modelling for the adsorptive and photocatalytic removal of phenolic contaminants from water using artificial neural networks</i>	<b>Published In Heliyon IF=3.4 year=2024</b>
17	Tariq Mahmood, Khadija Imran, Rehan Ahmad Khan Sherwani, Ahtisham Shabbir Ahmad	<i>Models of Machine Consciousness: A Review</i>	Submitted

## AREAS OF INTEREST

- High Energy Physics and Particle Phenomenology
- Quantum Computing and Quantum Algorithms
- Quantum Machine Learning (QNN, QLSTM, QCNN)
- Quantum Cognition and Quantum Consciousness
- Computational Physics and Monte Carlo Simulations
- Mathematical and Physical Modeling of Complex Systems
- Artificial Intelligence, Deep Learning, and Machine Consciousness
- Hybrid Classical–Quantum Architectures for Scientific Computing
- Data Science, Predictive Analytics, and Statistical Modeling
- Computer Vision and Image-Based Data Analysis
- Quantum-Inspired Neural and Cognitive Architectures
- Quantum Information Processing and Quantum Error Correction
- Numerical Methods and Scientific Computing
- Simulation and Optimization in Physics and Engineering Systems

# ONGOING PROJECTS

## Quantum–Classical Synergy and High-Energy Physics Simulations

- **Quantum and Classical Synergy for Event Classification in Monte Carlo Simulations of LHC Collisions**  
Developing hybrid quantum–classical architectures to enhance event classification accuracy in simulated proton–proton collisions at the LHC using Monte Carlo techniques.
  - **Classical and Quantum Neural Networks for Triggering and Reconstruction in High-Energy Physics**  
Implementing AI-driven event triggering and track reconstruction models using CNNs and Quantum Convolutional Neural Networks (QCNNs) for high-throughput data environments.
  - **Event Triggering at the LHC Using CNN and QCNN**  
Comparative study of classical and quantum convolutional architectures for low-latency triggering decisions in collider experiments.
  - **Track Fitting with Recurrent Neural Networks and Quantum LSTMs**  
Leveraging classical RNNs and Quantum Long Short-Term Memory (QLSTM) networks for precise trajectory reconstruction in particle tracking systems.
  - **Quantum Machine Learning Algorithms for Track Fitting in Proton–Proton Collision Events**  
Exploring QML-based regression and classification algorithms to enhance fitting accuracy and reduce computational complexity in LHC event reconstruction.
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## ◆ Quantum Algorithm Design and Simulation Frameworks

- **Python-Based Framework for Quantum Circuit Simulation**  
Developing a modular simulation environment in Python for executing, visualizing, and benchmarking quantum circuits and algorithms.
  - **Implementation of the Harrow–Hassidim–Lloyd (HHL) Algorithm for Charmonium/Bottomonium Spectroscopy**  
Designing and executing the HHL quantum algorithm to compute energy eigenvalues for quark–antiquark systems, linking quantum simulation to spectroscopic predictions.
  - **Quantum Estimation and Error Correction Algorithms**  
Comparative analysis of quantum error correction codes and estimator algorithms to enhance reliability in noisy intermediate-scale quantum (NISQ) devices.
  - **Quantum Circuit Design for Quantum Neural Networks (QNNs)**  
Developing parameterized quantum circuits to predict unknown particles in experimental high-energy and astrophysical datasets.
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## ◆ Quantum Cognitive Computing and Conscious Systems

- **Quantum Cognitive Models for Perceptual Associative Memory**  
Modeling conscious behavior in artificial systems through quantum-inspired perceptual and associative memory architectures.
  - **Quantum Genetic Algorithms for Emotion-Based Dream Content Selection**  
Integrating Quantum Neural Networks (QNNs) and Quantum Genetic Algorithms (QGAs) to simulate emotion-driven cognitive selection processes in conscious artifacts.
  - **Algorithms for Quantum Estimators**  
Formulating and testing novel quantum estimator models for improved measurement precision and cognitive inference in quantum systems.
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## ◆ Comparative Quantum–Classical Machine Learning

- **Hybrid Comparison of AI/ML and Quantum AI/ML Algorithms**  
Investigating the efficiency and scalability of classical versus quantum machine learning algorithms for experimental high-energy physics and astrophysical data analysis.

### PROFESSIONAL EXPERIENCE

- Working as Assistant Professor at Centre for High Energy Physics, University of the Punjab, Lahore.

#### **Teaching following course to BS and MPhil classes**

- Computational Physics Simulation I (Theory&Lab)
  - Computational Physics Simulation II (Theory&Lab)
  - Electronics
  - Digital Electronics
  - Analytical geometry and Integral calculus
  - Scientific Computation I&II
  - Mathematical methods I&II
  - Discrete mathematics
  - Introduction to computer science
  - Advanced mathematical methods
  - Computer programing
  - Advance computer programming
  - Machine learning with python
- Worked as Lecturer in Department of Computer Science, GC University, Lahore.  
**Taught following courses to BS and MS classes.**
    - Numerical & Symbolic Computing
    - Parallel and Distributed Computing
    - Quantum Computing
    - Algorithm Analysis
    - Artificial Intelligence
    - Visual Programing
    - Introduction to Computing

- Visiting Lecturer in **Skill Development Center, University of the Punjab, Lahore.**
  - Artificial Intelligence
- Visiting Lecturer in **National College of Business Administration and Economics, Lahore.**

**Taught following courses to BS class.**

  - Artificial Intelligence
  - Data Structures and Analysis of Algorithm
- Worked as Visiting Lecturer in “College of Technology”, **University of Lahore.**

**Major Subjects taught to B.Tech**

  - Electronics
  - Applied Physics.
- Worked as Lecturer Scholar College Shadman Chowk Lahore.
- Worked as an Internee in **School Education Department, Civil Secretariat, Lahore** through **National Internship Program of Punjab Government, Pakistan.**

#### PERSONAL PROFILE

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|---|-----------------|-----------------|
| ▪ | Father’s Name:  | Barkat Ali      |
| ▪ | NIC No:         | 35101-1267214-1 |
| ▪ | Date of Birth:  | Nov 15, 1986    |
| ▪ | Place of Birth: | Kasur, Pakistan |
| ▪ | Marital Status: | Married         |