USMAN ALI

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EDUCATION

Oklahoma University — Norman, US
Ph.D. Physics — 08/2025 – Present

Punjab University — Lahore, PK
M.Phil. High Energy Physics — 09/2020 – 09/2022
B.S. Computational Physics — 09/2016 – 09/2020

WORK EXPERIENCE

Oklahoma University — Norman, US
Graduate Assistant — 08/2025 – Present

- Developing unsupervised algorithms to detect anomalous signals from LHC data for **BSM physics searches**.
- Instructed physics courses: supervised lab experiments, graded assessments, hosted office hours, managed LMS, and proctored exams.
- Performed **quality testing** on ATLAS ITK pixel modules, including voltage and layer thickness measurements, and captured high-definition images using a Keyence VHX7000 microscope to train ML algorithms to identify various defects.

Centre for High Energy Physics — Lahore, PK
Research and Teaching Assistant — 07/2021 – 07/2023

- Facilitated the director with his conference presentations on **particle physics** and **quantum mechanics** lecture series.
- Designed posts and illustrated physics images to improve engagement and understanding of complex concepts.
- Led 4 master's fellows in their research on **collider physics** and guided them in simulation and analysis environments.
- Conducted lab sessions on **modern physics**, **digital electronics**, **scientific computing**, and **computational physics simulations**; prepared academic materials for **numerical analysis**, **mathematical methods**, and **waves** & **optics**.
- Improved academic performance of a class of 50+ undergraduates through personalized feedback on graded assessments.

PROJECTS

Anti-Proton to Proton Ratio in pp Collision at ALICE — 09/2021 – 09/2022

- Examined **ALICE** subdetectors and models for heavy-ion collisions; described quark-gluon plasma properties and signatures.
- Employed data pipelines to analyze TPC signal performance to identify charged particles' tracks through ionization.
- Regenerated data through **Monte Carlo** simulations of p_T spectra, producing nearly equal protons and anti-protons.
- Compared these results with experimental data using particle identification info from ITS, TPC, and TOF at 0.9 TeV and $|\eta| < 0.5$.

General Relativity and the Spacetime of a Cosmic String with Inner Structure — 09/2019 – 09/2020

- Derived the geodesic equation; discussed the Schwarzschild geometry (static black hole); transformed the Minkowski spacetime into rotating coordinates; and explained the FLRW cosmological model.
- Utilized symmetries to independently examine distinct solutions of **Einstein field equations** by calculating Christoffel symbols, Riemann and Ricci curvature tensors for the cosmic string (topological defects) spacetime.

Physics Computations — 2019 – 2024

- Measured muon identification efficiency via tag and probe method using object info from **CMS** 2017 J/Psi datasets.
- Developed **simulations**, such as simple harmonic motion, solar system, radioactive decay, and cluster growth models.
- Detected gravitational waves from a binary black hole merger using signal processing on **LIGO**'s time-series data.
- Queried **NASA**'s exoplanet database to determine redshifts to classify galaxies' images using a random forest algorithm.
- Analyzed energy-spectra and time-series data of **astronomical** X-ray sources to understand stellar objects.
- Performed computations to find exact and **numerical solutions** for non-linear and non-homogeneous differential equations.

INTERNATIONAL CERTIFICATIONS

Additional Physics Courses — 2023

- Quantum Information and Computing
- The Science and Technology behind Astronomical Discovery
- Data-Driven Astronomy
- Analyzing the Universe
- The Evolving Universe
- The Discovery of the Higgs Boson
- Accelerator Technology and Medical Applications
- Astronomy: Exploring Time and Space
- From the Big Bang to Dark Energy
- Black Holes

Stanford Machine Learning and Generative AI — 10/2023 – 12/2023

- Built models such as multi-class classification, tree ensembles, clustering, dimensionality reduction, anomaly detection, neural networks, recommender systems (collaborative filtering and content-based deep-learning), and reinforcement learning.
- Trained, fine-tuned, evaluated, optimized, and deployed large language models for real-world generative AI applications.

Michigan Statistics with Python — 08/2023 – 10/2023

- Created and interpreted data visualizations; and utilized inferential procedures to analyze data to extract meaningful insights.
- Applied statistical modeling techniques (i.e., regression, multilevel models, and Bayesian inference techniques) to multivariate data to understand the importance of connecting research questions to data analysis methods.

Google IT Support and Automation — 01/2021 – 12/2022

- Gained proficiency in **assembling** computer hardware and securely **managing** devices' software against digital dark arts.
- Developed scripts to automate **system administration** tasks and interact with **OS** using configuration management and **cloud**.

NFTP Technical Training — 03/2021 – 06/2021

- Practiced developing a complete responsive **website** from scratch and promoting content via **digital marketing** strategies.

VOLUNTEER WORK AND SKILLS DEVELOPMENT

Technical Support Specialist — 06/2019 – 06/2021

- Reconstructed a **computational physics lab** for over 40 undergrad students through effective tech implementations at GGCS Lahore.
- Installed and configured hardware, software, and operating systems to optimize efficiency and productivity for faculty.
- Exhibited exceptional proficiency in managing disasters through a variety of **troubleshooting** and **debugging** methods.

Private Tutor (Remote/In-Person) — 10/2023 – 12/2024

- Presented tailored lectures in physics, mathematics, and computer science to high-school and college students, aligned with Cambridge and Punjab Board curricula, boosting confidence in problem-solving and addressing gaps in understanding.

Career Preparation Fellow — 06/2019 – 08/2019

- Devoted 300+ hours to an intensive Stanford-funded Amal fellowship in honing key **professional skills** such as networking, resilience, cultural awareness, creativity, management, and so on to enhance overall impact within the workplace.

DIGITAL SKILLS

Languages:	C++ · C# · Python · Mathematica · HTML / CSS · JavaScript · PHP · Dart · MySQL · SQL
Physics Tools:	Root / Uproot · Pythia · GWpy · Astropy · DS9 · Lmfit · Dcor · AliRoot · O2Physics · CMSSW · Geant4
Data Science Libraries:	Pandas · NumPy · Matplotlib · SciPy · Seaborn · Statsmodels · Scikit-Learn · PyTorch · TensorFlow · Keras
Documentation and Multimedia:	LaTeX · Office Suite · Photoshop · Illustrator · Filmora · Canva · WordPress
Development Tools:	VS Code · Jupyter / Colab · Bash / Shell · Vim · Git · Anaconda

HONOURS AND RECOGNITION

- Earned the Harwell Endowed and SHS-France & A. Earl Ziegler Scholarships (2026 – 27) for demonstrated academic excellence.
- Ranked 4th out of 207 teams in the NextGen GPT AI Hackathon 2024 by developing an automated 'Food Complaints Resolution' app.
- Received the Higher Education Commission's Need-Based Scholarship (2018) throughout my bachelor's studies.
- Secured a merit-based Punjab Educational Endowment Fund (2014 – 16) by ranking in the top 20 performers among hundreds in college.
- Awarded a solar panel by the Govt. of Punjab for achieving 1st position at my high school (2014) in the entire village.