OMNIA MOHAMED ABDEL RAOUF MOHAMED

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EDUCATION

10/2019 – 05/2024

Faculty of Women for Arts, Science and Education | Ain Shams University (ASU)

- B.Sc. in Science and Education | **Physics** (Graduated in Summer 2024).
- Graduated at the top **2%** of my class, with a Cumulative Grade of **'Very Good'**.
- Carried out research in the fields of **Quantum Computing, High Energy Physics, and Machine Learning**.
- **Main Courses**: Quantum Mechanics, Special Relativity, Statistical Mechanics, Electrodynamics, Solid- state Physics, Nuclear Physics, Laser Physics, Plasma Physics, Physical Optics, Electronic Circuits, Atomic Physics and Spectroscopy, Computational Physics, Mathematical Physics, Classical Mechanics, Linear Algebra, Calculus, Differential Equations, and Applied Mathematics.

Bachelor's Thesis- Dark Matter Searches. | Supervisor: Dr. Maha Reda Ahmed (ASU)

- **Conducted** an in-depth analysis of dark matter detection methods, examining both direct detection approaches and indirect detection techniques.
- Explored the innovative integration of **quantum computing (QC) and convolutional neural networks (CNN)** to enhance detection accuracy and efficiency, proposing novel frameworks for data analysis and **signal processing** in dark matter research.
- Received a grade of **A+**.

- **References**: Dr. Hebatallah Ali (*Postdoctoral Scientist at Forschungszentrum Jülich and Fritz Haber Institute of the Max Planck Society*), Dr. F. M. Abou El-Ela (*Assistant Professor of Theoretical Solid-State Physics at Ain Shams University*).

RESEARCH EXPERIENCE

03/2025 – CURRENT

National Authority for Remote Sensing & Space Sciences (NARSS) | Cairo, Egypt.

SPACE WEATHER & MACHINE LEARNING RESEARCH INTERN

- Conducted research in space weather using machine learning models, focusing on **anomaly detection** for space weather phenomena.
- Explored a Hybrid Classical-Quantum Neural Network (HCQNN) to improve space weather detection and early warning systems.

03/2025 – CURRENT

TrevasQ | Remote

QUANTUM ALGORITHMS INTERN

- **Designed** and implemented quantum algorithms for **credit risk assessment** and **fraud detection**, integrating **variational quantum eigensolvers (VQE)** and quantum kernel methods into existing financial modeling pipelines.

11/2024 – 12/2024

Joint Institute for Nuclear Research (JINR) | Dubna, Moscow Region, Russia

RESEARCH INTERN | SUPERVISOR: DR. OLEG SAMOYLOV

- Implemented **convolutional neural networks** to detect slow magnetic monopoles in NOvA detector data, achieving **90.25%** test accuracy in classification tasks.
- Reproduced and validated **linear regression** results for monopole trajectories with consistent R^2 values across Python and Standard methods.
- Generated efficiency plots and evaluated IoU scores for segmentation models, identifying challenges in overlay image detection [Project Report].

06/2024 – 08/2024

QIntern 2024 | Remote

QUANTUM COMPUTING AND ROBOTICS INTEGRATION INTERN | MENTOR: AMANY SALAMA

- **Explored** integrating quantum gates for controlling robotic movements, enhancing precision and coordination in tasks.
- Developed a **quantum-based path-planning algorithm** for swarm robotics, leveraging quantum computing, although the project was not continued.

02/03/2024 – 05/03/2024

9th EGYPlasma School | Port Said, Egypt

PARTICIPANT WITH SCHOLARSHIP

- Engaged in intensive lectures, computational tutorials, and problem-solving sessions focused on **plasma physics** and its applications.
- **Led** a team of 6 participants in the problem-solving competition and achieved **first place**.

07/2023 – 09/2023

Helmholtz-Zentrum Dresden Rossendorf Summer Student Program (HZDR) | Dresden.

INTERN

- **Admitted** as one of 29 students among more than 1500 applicants **(1.9% acceptance rate)** (Unfortunately, was unable to attend).
- **Supervisor:** Dr. Thomas Kluge | Scientist at Helmholtz Center Dresden-Rossendorf - Laser Particle Acceleration Division.

07/2022 – 08/2022

Qiskit Global Summer School

INTERN

- Explored **Quantum Machine Learning**, **Quantum Kernels**, **Quantum Error Correction**, **Quantum Annealing**, **Variational Algorithms, Quantum Cryptography and Distributed Quantum Computing.**
- Implemented **Quantum Neural Network** and Classical Convolutional Neural Network with **TensorFlow**-Quantum and **Cirq** for a Classification task.

PROJECTS

Quantum Computer Simulator

- Developed a fully-functional **GPU-accelerated quantum statevector simulator** implemented in Python.
- Integrated **OpenQASM 3.0** support to enable parsing and execution of quantum programs with mid-circuit measurements, classical control flow, and standardized circuit representation.

Protein Folding Simulations on a Quantum Computer

- **Modeled** the protein folding problem as an optimization task using **Qiskit's protein folding module**, exploring tetrahedral encoding schemes and preserving topological constraints and hydrophobic-polar interactions.
- **Benchmarked** the impact of various ansatz designs and optimizers on convergence time and energy minimization with Variational Quantum Algorithms, and validated results through classical simulations with **GROMACS**.

ASL Alphabet Learning Application

- Developed a user-friendly Windows application using Qt in **C++** for learning the ASL Alphabet.
- Integrated **OpenCV** for real-time **computer vision**, allowing the application to interpret users' sign language gestures accurately.
- Utilized **TensorFlow** models in **Python** to improve the precision of sign recognition.

Quantum Image Encoding and Processing

- Explored **quantum image representations (QIRs)** by applying different encoding methods with qubits.
- Designed quantum circuits to map grayscale and RGB image data into quantum states, evaluating key factors such as compression efficiency, retrieval accuracy, and circuit depth.
- Investigated the potential for infrared and thermal image encoding in quantum-enhanced imaging, focusing on applications in low-light conditions and biomedical fields.

Deep Q Snake PyTorch

- Implemented a **Deep Q-Network (DQN)** using **PyTorch** for training an **AI** agent to master the snake game.
- Developed a custom snake game environment using **Pygame**.
- Applied **MLOps** practices, incorporating custom plotting functions for real-time training visualization.

CONFERENCES AND WORKSHOPS

05/09/2022 – 07/09/2022

Sustainable HEP | CERN

- The workshop aimed to discuss the transition to a sustainable future in the fields of **high-energy physics (HEP)**, cosmology and astro-particle physics (APP).

11/07/2022 – 13/07/2022

Geometry and Machine Learning workshop | Heidelberg

- Contributed to the workshop's objective of applying Geometry to Machine Learning problems, emphasizing the prevailing trend of **Geometric Deep Learning** architectures, tools, and publications.

11/07/2022 – 15/07/2022

Mathematical Methods for Quantum Hardware Workshop - IMSI

- The workshop aimed to improve numerical methods to reliably simulate complicated **quantum systems,** and to identify the underlying challenges, and develop novel mathematical tools to solve these open questions.

VOLUNTEERING

03/2025 – CURRENT Remote

Quantum Women

VOLUNTEER

- Actively supporting the **Quantum Women** network, which empowers and elevates women in **Quantum Technology** and related STEM fields.
- Contributing to initiatives aimed at increasing visibility for women leaders in quantum science, promoting their voices and achievements within the global quantum community.

SKILLS

Programming Skills

- **Programming:** Python, SQL, Go, JavaScript, Rust, C/C++, Mathematica, MATLAB
- **Quantum Programming:** Qiskit, PennyLane, QuTiP, Pulser
- **Technologies and Frameworks:** Git, Docker, Linux, ROOT, Kubernetes, Arduino, Flask, Node.js, Raspberry Pi, SVN, Jenkins, ROS.
- **Machine Learning:** PyTorch, Tensorflow, scikit-learn, OpenCV
- **Software:** VizGlow, MadGraph, Zemax, JetBrains products, Vim, Phabricator
- **Database Technologies:** MySQL, Oracle, PostgreSQL, MongoDB

LANGUAGE SKILLS

Arabic (Native) | English (Fluent)