Aroosa **Ijaz**

Inquisitive Scientist · Quantum Physicist · Machine Learning Enthusiast

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Education

University of Waterloo, Vector Institute
Toronto, Canada

PhD Physics — *Sep 2020 - Jun 2024*

- **Thesis:** Quantum machine learning: algorithms and applications.
- **Supervisors:** Prof. Juan Felipe Carrasquilla, Prof. Roger Melko

ETH Zürich
Zürich, Switzerland

PhD Physics - **LEFT TO CHANGE TO COMPUTATIONAL PHYSICS*** — *Nov 2016 - Oct 2018*

- **Thesis:** Towards realization of Majorana Fermions in 2D Transition Metal Dichalcogenide heterostructures.
- **Supervisors:** Prof. Klaus Ensslin, Prof. Thomas Ihn

Ulm University
Ulm, Germany

M.Sc. Physics (Quantum Information Specialization) GPA: 1.1/5.0 (Max Grade: 1.0/5.0) — *Sep 2014 - Aug 2016*

- **Thesis:** Low temperature spectroscopy of single color centers in diamond: Investigations into Germanium vacancy center in diamond.
- **Supervisors:** Prof. Fedor Jelezko, Prof. Alexander Kubanek

Lahore University of Management Sciences
Lahore, Pakistan

B.Sc. Physics & Computer Science CGPA: 3.27/4.0 (Max Grade: 4.0/4.0) — *Sep 2009 - Aug 2013*

- **Thesis:** Experimental investigations on confined Excitons in quantum wells and quantum Dots embedded in optical microcavities.
- **Supervisors:** Prof. Ata Ul Haq

Work Experience

Xanadu
Toronto, Canada

Quantum machine learning scientist — *Sep 2019 - Aug 2020*

- Theoretical research into near-term Quantum machine learning algorithms
- Software development for PennyLane and Strawberry Fields

Xanadu
Toronto, Canada

Quantum machine learning research intern — *May 2019 - Aug 2019*

- Contributing to enhancing the features of Xanadu software PennyLane (a framework for machine learning on quantum computers)

Quantum Photonics Group, ETH Zürich
Zürich, Switzerland

Research Secondment, Prof. Atac Imamoglu — *Nov 2016 - May 2017*

- Conducted low temperature transport and optical reflection/transmission measurements on monolayer MoSe2/graphene/HBN heterostructures to explore exciton properties in dichalcogenides
- Successful experimental contributions resulted in a publication in Physical Review Letters

Institute for Quantum Optics, Ulm University
Ulm, Germany

Research assistant, Prof. Fedor Jelezko — *Jun 2015 - Aug 2016*

- Performed resonant optical extinction measurements on single Silicon Vacancy centers in diamond as an alternative high contrast detection technique
- Set up a confocal microscope

Department of Physics, Lahore University of Management Sciences
Lahore, Pakistan

Research assistant — *Jul 2013 -Jun 2014*

- Computational modelling of different open cavity QED systems in MATLAB and solving their Lindblad equations (with Dr. Ata Ul Haq)
- Computational analysis of doping in Graphene by group IV elements executed in Siesta in Linux environment (with Dr. Fakhar Ul Inam)
- Simulating portable Hallbach NMR Spectrometer in ComSol modeling software (with Dr. Sabieh Anwar)
- Development of Quantum Erasure experiment based on Mach Zender Interferometer for Freshman Physics lab (with Dr. Sabieh Anwar)

Department of Computer Science, Lahore University of Management Sciences
Lahore, Pakistan

Research Intern — *Jun 2012 - Dec 2012*

- Proposing new data center topologies with higher efficiency and resilience
- Statistical analysis of Google cluster data using Python

Publications

2020 **Quantum embeddings for machine learning**
Seth Lloyd, Maria Schuld, Aroosa Ijaz, ... Nathan Killoran,
https://arxiv.org/abs/2001.03622.
ArXiv, In submission

2018 **Realization of an electrically tunable Narrow-Bandwidth atomically thin mirror using monolayer MoSe2**
Patrick Back, Aroosa Ijaz, ... Atac Imamoglu,
https://doi.org/10.1103/PhysRevLett.120.037401.
Physical Review Letters

2017 **Optical and microwave control of germanium-vacancy center spins in diamond**
Petr Siyushev, Mathias Metsch, Aroosa Ijaz, ... FedorJelezko,
https://doi.org/10.1103/PhysRevB.96.081201.
Physical Review B

Awards and Honors

2020 **Keynote Speaker**, Canadian Conference for Undergraduate Women in Physics — *Toronto*
2016-2018 **Marie Curie Young Researcher Fellowship**, ETH Zürich — *Zürich*
2015 **Degree Scholarship [1500Euros]**, Ulm University — *Ulm*
2014-2015 **Merit scholarship award (not availed) [PKR 219, 000]**, Lahore University of Management Sciences — *Lahore*
2007-2009 **100% Honor Roll Scholarship** , Lahore Grammar School — *Lahore*

Teaching Experience

Quantum Computing Mentorship Program, Quantum Open Source Foundation — *Global*
Mentor — *Sep 2020 - Feb 2021*
- This program helps enthusiasts contribute to quantum computing software development and research
- Up to 30 out of roughly 300 applicants will be selected
- Mentors propose projects and supervise selected participants for 6 months

Department of Physics, ETH Zurich — *Zürich, Switzerland*
Teaching Assistant — *Nov 2016 - Dec 2017*
- Undergraduate Physics Lab: supervised two experiments with eight students every week
- Undergraduate Physics-1: conducted exercise classes, graded assignments and exams

Department of Physics, Ulm University — *Ulm, Germany*
Student Tutor for struggling peer students — *Jan 2016 - Mar 2016*
- Tutored 2 master students in Quantum Mechanics
- Tutored 1 master student in calculus and differential equations

Lahore University of Management Sciences — *Lahore, Pakistan*
Teaching Assistant — *Sep 2011 - Jun 2014*
- Data Structures, Quantum Mechanics-1, Mechanics, Atomic-Molecular-Laser Physics, Experimental Physics Lab-I

Skills

Programming Skills Python, MATLAB, Mathematica, C++, Octave, R
CAD & Modeling COMSOL Multiphysics, AutoCAD
Machine Learning Xanadu-PennyLane, Scikit-learn, TensorFlow, PyTorch, IBM-Qiskit

References

Prof. Seth Lloyd, MIT — *Massachusetts, USA*
: +1 617 252 1803 : slloyd@mit.edu : Google Scholar Page

Dr. Maria Schuld, Xanadu, UKZN — *Toronto, Canada*
: +1 416 304 9629 : maria@xanadu.ai : Google Scholar Page

Prof. Klaus Ensslin, ETH Zürich — *Zurich, Switzerland*
: +41 44 633 22 09 : ensslin@phys.ethz.ch : Google Scholar Page

Prof. Fedor Jelezko, Ulm University — *Ulm, Germany*
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