Ksenija Kovalenka

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EDUCATION

The University of Manchester   **Manchester, UK**
Master of Physics   *September 2019 – present*
Current grade average: 79%   *(Anticipated graduation date: July 2023)*

Master's Research Project
Modelling Quantum Lattices Using a Combination of Deep Learning and Quantum Computing Methods
Supervisor: Dr Mohammad Saeed Bahramy

- Studied topology of a wavefunction in complex electronic systems.
- Examined the topological transition of BiTeI crystal under hydrostatic pressure.
- Interpolated the energy band structure of two adiabatically connected phases of matter.
- Exploited parallel computation to create an extensive training data set for a neural network.

Main program developed
- Minimum band gap calculation for interpolation of two adiabatically connected phases of electronic system. *(Fortran90)*
  - Generalised source code developed together with a specific example for BiTeI crystal.
  - Scalability ensured by utilising Message Passing Interface (MPI) standard.

Completed courses include: Computational Physics (93%), Introduction to Programming for Physicists (88%), Condensed Matter Physics (77%), Quantum Computing (80%), Topology, Advanced Quantum Mechanics, Electrodynamics, Quantum Field Theory, Frontiers of Solid state Physics.

Laboratory work includes: Nuclear Magnetic Resonance (87%), Properties of Gamma Radiation (81%), Digital Electronics (83%), Cepheid Variables (86%), Galactic Hydrogen (83%), Analysing Events with W and Z Bosons in the ATLAS experiment (72%).

Computational Projects
- Monte Carlo Techniques for Modelling Penetration of Neutrons Through Shielding. (*Python*)
- Numerical Integration of Differential Equations: The Damped Harmonic Oscillator. (*Python*)
- Measuring Spreading Law: using curve fitting to experimental data to determine spreading law for picolitre droplets. (*Python*)
- Doppler Spectroscopy: analysis of exoplanets using function minimization. (*Python*)

For project descriptions and relevant laboratory work please visit https://ksenijakovalenka.github.io.

Awards
- Nuclear Technology Education Consortium prize at the undergraduate poster competition. *(November 2022)*
- Runner-up presentation prize at the undergraduate research conference. (*September 2022*)

John Leggott College   **Scunthorpe, UK**
Sixth Form   *September 2017 – August 2019*
- Graduated with three A* grades and the best student award for one of the subjects.
- Showed initiative in organising open day events for new students.

OTHER RESEARCH EXPERIENCE

Summer Research Project at the University of Manchester   **Manchester, UK**
Quantum Mechanics and Machine Learning   *July 2022 – August 2022*
Supervisor: Dr Mohammad Saeed Bahramy

- Developed a knowledge of the principles of Machine Learning and Quantum Computing.
- Created a neural network to explore the potential use and functionality of machine learning.
- Enhanced the network by adding a quantum circuit to the algorithm.
- Researched the possible applications of the quantum neural networks in solid state physics.

Main program developed

- Quantum neural network simulation for written digit recognition. (*Python)*
  - Based on a classical fully connected neural network implementing stochastic gradient decent with efficiency of ~99%.
  - Contains a small-scale quantum circuit simulation with a CNOT gate applied.

Summer Research Project at Center for Physical Sciences and Technology   **Vilnius, Lithuania**
Variational Quantum Eigensolver Algorithm and its Applications   *July 2021 – September 2021*
Supervisor: Dr Audrius Alkauskas

- Studied Hartree-Fock theory to determine the ground state separation of the hydrogen molecule.
- Compared the results to the output of variational quantum eigensolver on the Qiskit simulator.

Summer Research Project at Center for Physical Sciences and Technology   **Vilnius, Lithuania**
Modelling Vibrational Modes in Solids, Classical Interpretation   *July 2020 – September 2020*
Supervisor: Dr Audrius Alkauskas

- Studied tight binding problem in 2D lattice to solve for energy bands for different configurations analytically as well as using a Python script.

TECHNICAL SKILLS

Software and Programming: Linux, Python, Fortran, MPI, HTML, C++, Jupyter Notebook, LaTeX, Git, Qiskit (IBM), Pennylane (Xanadu).

TEACHING AND ADMINISTRATIVE EXPERIENCE

Physics and Maths Tutor   **Manchester, UK**
MyTutor and Private Practice   *December 2019 - present*
- Completed over 300 lessons for ~20 students in A-level Maths and Physics.
- Prepared comprehensive study material for long-term, achievement focused work with students.
- Described as a knowledgeable, patient and encouraging tutor by students and their parents.

Student Representative   **Manchester, UK**
The University of Manchester   *September 2022 - present*
- Organised feedback collection from students for assigned courses.
- Practiced assertiveness, diplomacy, and persuasion skills by delivering comments to the lecturers.

PASS Leader   **Manchester, UK**
The University of Manchester   *December 2019 - present*
- Facilitated learning of a group of 10 first year students.
- Created specialised activities to enhance the academic experience of fellow students.

ADDITIONAL INFORMATION

Schools and universities Polo Association (SUPA) Winter Nationals 2022 winner (B4 division), Summer Nationals 2022 2nd place (B3 division). Active Manchester University Hiking Society member.

Languages: Fluent in English, Lithuanian and Russian.