RAIFE FOULKES

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SUMMARY

MSci Theoretical Physics student in their final year at Imperial College London with deep interest into quantum computation and its realisation, predicted First Class degree. Demonstrable experience in theoretical and computational physics, specialising in quantum physics. Familiarity with gate-based and analogue quantum algorithm design and implementation with IBM Qiskit and Pasqal Pulser as well as experience analysing QEC circuits using Stim and Crumble. Extensive knowledge of condensed matter physics. Strong communication and teamwork skills evident in my performance in oral presentations and scientific report writing, and excellent project management skills paired with extensive problem solving abilities and adaptability.

EXPERIENCE

IMPERIAL COLLEGE LONDON
FIRST-CLASS PREDICTED MSci THEORETICAL PHYSICS STUDENT **September 2022 - July 2026 (ONGOING)**

- Extensive knowledge in quantum mechanics with strong mathematical skills, educated at a world-leading university.
- Undertaken Master's-level Quantum Theory of Matter module in third year of undergraduate study, furthering familiarity with second quantisation approaches and interacting quantum many body systems – particularly in the study of superconducting physics, including the study of topological superconductors in the context of quantum computation.
- Direct experience and education in quantum information theory, with a section dedicated to trapped ion qubit modalities.
- Exceptional linear algebra skills and familiarity with Hilbert space methods, having taken graduate courses in quantum optics, quantum field theory, quantum information theory, as well as standard and further quantum mechanics courses.
- Master's research project in condensed matter physics on the theory of supersolidity in ultracold atomic systems; direct analytical and computational experience developing models to investigate spontaneously density modulated superfluids.
- Vast experience in theoretical computational physics as well as computational project work in a physical context.
- Great experience formally presenting results to a panel under strict time constraints, as well as more relaxed presentations of work accomplished to my peers and supervisors.
- Excellent problem-solving abilities directly assessed in Problem Solving and Interactive Physics examinations.
- Experience with the solution of physical and statistical problems using computational methods in collaborative group projects, requiring a familiarity with Git version control in a professional setting.
- Strong teamwork skills and ability to adapt, manifesting in clear communication and efficient progress in group work.

QISKIT GLOBAL SUMMER SCHOOL (QGSS) **JULY 2022**

- Graduated QGSS 2022, a two-week summer school offered by IBM specialising on a different application of quantum computational methods each year, and the direct implementation of these methods using IBM's qiskit platform in Python.
- QGSS 2022 was centred on quantum simulation and quantum chemistry applications. Gained direct experience and education on how to develop algorithms to be run on quantum computers to solve physical problems with further expertise on the development of algorithms for quantum simulation and quantum chemistry, as well as quantum optimization.
- Two full days of this course were dedicated to detailed education on the theory behind quantum noise, error correction and validation of results, providing me with intimate knowledge with these concepts and their direct realisation, as well as direct experience solving problems relating to these concepts.

ISAAC PHYSICS SENIOR PHYSICS CHALLENGE SUMMER SCHOOL **MAY 2021**

- Graduated Isaac Physics Senior Physics Challenge Summer School, hosted in partnership with the University of Cambridge receiving a diamond certificate for being within the top stratum of ability. Enrolment was via invitation on merit of maths and physics problem solving ability.
- Involved four days of intensive lectures and problem sets on undergraduate-level quantum mechanics and relativity, taught by professors at the University of Cambridge, undertaken during my A-Level studies. While usually held at the University of Cambridge, the school was held remotely in 2021 due to the coronavirus outbreak.

Education

MSci Physics with Theoretical Physics – Predicted First Class
Imperial College London • In progress • Tracking 1:1

Currently enrolled modules: Quantum Information, Quantum Field Theory, Symmetry and Unification, Quantum Optics

Previously enrolled modules: Advanced Classical Physics, Comprehensives, Computational Physics, Foundations of Quantum Mechanics, Group Theory, Nuclear and Particle Physics, Solid State Physics, Quantum Theory of Matter (FHEQ 7), Quantum Physics, Differential Equations and Electromagnetism, Thermal Physics and Structure of Matter, Mathematical Methods, Corporate

Finance, Mathematical Analysis, Mechanics and Relativity, Oscillations and Waves, Practical Physics, Vector Fields, Electricity and Magnetism, Suns, Stars and planets, Advanced Practical Physics, Statistics of Measurement and the Summer Project.

A-Level
4 A-levels • 4 x A* • Further Maths, Maths, Physics, Computer Science • Sir William Borlase's Grammar School • 2022
GCSEs
11 GCSEs • 9 x 9s, 1 x 8, 1xA (Highest Grade) • Sir William Borlase's Grammar School • 2020

ACHIEVEMENTS

- Winner of Caius Explore challenge, hosted by Gonville & Caius College, University of Cambridge. As the author of one of their favourite entries, I was invited to a celebratory lunch at the college with the university's Directors of Studies to discuss quantum computing in greater depth, following my answer to the question 'How will quantum technology have changed our world by 2100?', for which I wrote an essay on quantum algorithms and their realisations in modern quantum systems.
- Completed Gold CREST project in 2021 – wrote a 44-page report detailing the full realisation of modern quantum computing, providing a brief overview of potential qubit modalities, before going into detail into both the hardware and Hamiltonian mechanics behind superconducting qubits (namely the transmon qubit), as well as the derivation, explanation and running of quantum algorithms on real quantum processors.
- Completed online MOOC titled "Hands-on Quantum Error Correction with Google Quantum AI". The course covered classical error correction and the distinction of software-solvable error modes, before going into detail on repetition codes, stabilizers and the surface code, with lab exercises giving direct experience implementing and analysing QEC codes using Stim, as well as the inspection of the propagation of errors in a quantum circuit using Crumble.
- I was one of 50 in the UK to qualify for the Isaac Physics Senior Physics Challenge Summer School in May 2021, having independently solved over 400 physics and maths problems at the same time as my A level studies. The summer school consisted of 4 days of workshops on advanced problem solving in quantum mechanics, as well as bonus lectures and activities such as a lecture on special relativity and physics estimation challenges.
- One of three awarded the Youthbridge Award for excellence in German for a short essay on the future of quantum computing, written in German, receiving the top prize of the three.
- Completed Pasqal's "Quantum Quest" course, with direct experience programming neutral atom quantum computers at the laser-atom level, performing both analog and gate-based quantum algorithms
- Achieved Merit in 2019 TCS Oxford Computer Science challenge, after qualifying for this challenge with a distinction in UK BEBRAS – demonstrating my ability to think computationally and abstract problems accordingly.
- Won an additional award for my Silver CREST project on optimising classical computation, having particularly demonstrated my understanding of the topic during an interview with the assessors.
- Youngest black belt in Shotokan Karate in the UK at eight years old.

SKILLS

- Extensive experience and education in scientific programming with Python (e.g. qiskit, numpy, scipy, matplotlib, pandas).
- Quick to adapt to other programming languages – created a mobile application in Swift in 2023.
- Excellent teamwork skills and ability to communicate complicated ideas clearly.
- Strong mathematical and problem-solving abilities, unafraid to try new approaches to solve a novel problem.
- Effective at communicating scientific concepts in writing, having won awards for my writing ability.

CERTIFICATIONS

- NQCC Quantum Professional Certificate issued by Q-CTRL – 2025
- Completed "Hands-on Quantum Error Correction with Google Quantum AI" online course – 2025
- Attained IBM Basics of Quantum Information badge, subsequently member of Qiskit Advocate programme – 2025
- Completed TUDelft courses "Architecture, Algorithms, and Protocols of a Quantum Computer and Quantum Internet" and "The Hardware of a Quantum Computer" – 2025
- Attended University of Zurich Quantum Computing Summer School – 2025
- Graduated Qiskit Global Summer School – 2022
- Completed edX Critical Thinking Course – 2021
- Diamond in Isaac Physics Senior Physics Challenge, subsequently invited to quantum Summer school – 2021

INTERESTS

- Surfing, powerlifting, mountain biking

Naming Referees

Dr Derek Lee – MSci Project Supervisor
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