Gregory Boyd

gregory.boyd@merton.ox.ac.uk
(+44) 07531542501

Education

University of Oxford, Merton College
DPhil, Third Year, Anticipated 2025
Quantum Algorithms in the Near and Future Term
Supervisors: Simon Benjamin and Bálint Koczor

University of Cambridge, Emmanuel College
Master in Science, Awarded 2021
First Class Honors in all years and awarded a Davies Scholarship and College Prize for performance in examinations. Relevant courses include: Quantum Information, Theory of Quantum Matter, Quantum Field Theory, Information Theory

Research Experience

- Parallelization of key quantum subroutines, producing a net savings in computational space-time volume
  Low-Overhead Parallelisation of LCU via Commuting Operators
  (arXiv 2023)
- Research into optimization techniques for variational quantum algorithms, leading to a quantum-aware re-expression of the problem with improved convergence.
  Training Variational Quantum Circuits with CoVaR: Covariance Root Finding with Classical Shadows (Gregory Boyd and Bálint Koczor, PRX 2022)
- Researched Quantum Topological Data Analysis during an internship as a research scientist at **Quantinuum**, working in a small team starting up a workstream of which I became a vital member, providing significant circuit optimizations, and resulting in a patent.
- Freelance consultant for **Quantum Motion**, collaborating in the work
  Low Depth Phase Oracle Using a Parallel Piecewise Circuit (arXiv 2024)
- Investigation and regularisation of unprecedentedly large subspace expansions.
  High-Dimensional Subspace Expansion Using Classical Shadows (arXiv 2024)
- Resource estimation of subroutines for a practical implementation of early fault-tolerant quantum simulation, allowing for useful hardware requirements for the earliest quantum algorithms.
- Modelling superconducting qubits at the hardware level, involving modifying and testing a state-of-the-art GPU-solver on the Cambridge Computing Cluster, developing an in-depth knowledge of modern quantum computing architectures and computational techniques.

Programming and IT Skills

- Developed simulations for complex physical systems using Python and C++, including a simulator for optimal control of superconducting qubits from the ground up in C++ and various many body simulations, and analyzing the results to provide meaningful comparisons with theory.
- Used Mathematica to produce simulations of a complex quantum variational optimization scheme.
- Used HPC resources to do large scale simulations of early quantum computers.
- Familiar with a variety of quantum simulators/software packages, including Cirq, Qiskit, QuEST, Q# and OpenFermion.

- Git proficiency, used in professional and personal projects
- Developed an Android e-reader/audiobook player app.
- Developed a WebAssembly plugin providing a full LaTeX compiler with extra utilities for the note-taking app Obsidian.

Problem Solving Skills

- Worked as part of small teams, producing and presenting solutions to problems and co-developing solutions with others. This has taught me to provide and utilize support, incorporating a variety of ideas to solve a problem.
- Analyzed datasets using statistical methods to illustrate key properties and trends, allowing for identification of problem features and routes to solutions.
- Studied a diverse range of subjects including chemistry and materials science. This broad grounding has given me experience in adapting methods for use in varied contexts.

Communication Skills

- Experience in public speaking through presenting research at the Quantum Computing Hub Project Forum, and Quantum Algorithms for Chemistry conference at CECAM
- Presented a highlighted poster at QIP 2023, and received an honourable mention for the SEEQA 2024 poster prize.
- Oxford Tutor, providing small group teaching to Undergraduates at a world-class university.
- Tutored pupils at A level with differing degrees of aptitude, clearly communicating knowledge at the correct level to provide marked improvements in results.
- Outreach to schools on behalf of University Access.

Reference: Simon Benjamin, simon.benjamin@materials.ox.ac.uk