

Dylan Counsell

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Technical Skills

Languages: Rust, Fortran, C++, Python

High-Performance Computing: MPI, Rayon, OpenMP, Slurm

Performance Engineering: x86-64 SIMD, AVX2, AVX-512, FMA, perf

Development: Linux, Git, Cargo

Scientific Computing: PySCF, libcint, Qiskit

Projects

Stochastic Non-orthogonal Coupled Cluster & Configuration Interaction

Sep 2025 – Present

PhD Research, University of Cambridge

- Developed noci-rs, a high-performance Rust package using hybrid Rayon and MPI parallelism, achieving an $8.7\times$ speedup over an existing C++ implementation (libgnme) in matched matrix-element benchmarks.
- Implemented and profiled hand-written AVX2 and AVX-512 FMA kernels with runtime CPU-feature dispatch, achieving a $2.8\times$ speedup for AVX2 over scalar evaluation for matrix elements.
- Developed stochastic Non-orthogonal Configuration Interaction (NOCIQMC) methods recovering a larger proportion of the FCI correlation energy than competing approaches.
- Applied matrix-free NOCI-PT2 with the non-orthogonal Wick's theorem to ethene torsion, solving GMRES systems over operators with 96.9 billion unique elements per geometry without forming the full matrix.

Finite-Size Error Correction in Stochastic Determinant-Based Methods

Mar 2025 – Sep 2025

MPhil Thesis, University of Cambridge

- Extended a finite-size error-correction method for stochastic determinant-based electronic-structure methods including Full Configuration Interaction Quantum Monte Carlo (FCIQMC) and Coupled Cluster Monte Carlo (CCMC).
- Achieved up to a 78% reduction in finite-size errors in the Uniform Electron Gas and real periodic systems.

Imaginary-Time Evolution on Quantum Circuits

Jan 2025 – Mar 2025

MPhil Coursework, University of Cambridge

- Implemented probabilistic imaginary-time evolution in Qiskit for the transverse-field Ising and Hubbard models, reproducing published benchmark results.

Education

University of Cambridge

Sep 2025 – Present

PhD in Theoretical Chemistry

- Method development in stochastic and non-orthogonal quantum chemistry, with a focus on high-performance implementations of electronic-structure methods.

University of Cambridge

Sep 2024 – Sep 2025

MPhil in Scientific Computing

- Grade: Distinction (75%).
- Thesis: *Improved Convergence to the Thermodynamic Limit in Periodic Systems with Full Configuration Interaction and Coupled Cluster Quantum Monte Carlo Methods.*
- Distinction in Thesis, Electronic Structure and Introduction to Topological Materials.
- Additional training in C++, Advanced Research Computing, OpenMP, MPI, CUDA.

University of Leeds

Sep 2020 – Jul 2023

BSc in Chemistry

- First-Class Honours; Firsts in Dissertation, Quantum Mechanics and Machine Learning.
- Dissertation: *An Ab-Initio Study into the Fundamentals of Physical Aromatic Chemistry.*

Experience

Laboratory Technician

Leeds, UK

AETC — Precision Casting Facility

Jun 2023 – Jun 2024

- Monitored physical and chemical parameters of 11 production investment-casting slurries.
- Conducted experiments assessing the feasibility of new slurry formulations before production use.
- Updated Standard Practice Instructions and managed controlled documentation using SAP.