Daksh Shami

PhD Student in Computer Science | Quantum Algorithms & Quantum Programming Languages

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Education

PhD in Computer Science, University of Wisconsin–Madison **2026–Present**

- **Advisor:** Prof. Charles Yuan.
- Research on quantum algorithms and software abstractions, with an emphasis on connecting algorithmic structure to resource-efficient quantum programs.

B.A. in Computer Science & Mathematics, Reed College **2018–2022**

- Senior thesis: *Exploration of the Hidden Subgroup Problem.*

Honors

- Winner, Classiq Quantum Circuit Optimization Challenge, awarded $2,000.
- Selected for MIT / The Engine Blueprint deep-tech accelerator (2024), one of 30 participants for project focused on quantum simulation.
- Finalist, Boost VC Deep Tech $50K Competition (2024).
- Engineering Excellence Award, Google (2023).
- Google Certified C++ Readability Mentor (2023).
- Putnam Exam nominee, Reed College (2021).

Selected Research

Shami, D., & Yuan, C. (2026). "Compiling Matrix Formulas to Quantum Block Encodings." *arXiv:2611.17756 [cs.PL,quant-ph].* Under review.

- Introduced MARBLE, a language that automatically synthesizes efficient block-encoding circuits from publication-style formulas for matrix entries, algebraically rewriting programs into combinations of simpler matrices with known circuit realizations.
- Built cost analysis over candidate representations, centered on the subnormalization term that dominates time complexity. MARBLE emits OpenQASM and certifies whether circuit cost is poly-logarithmic in problem size.
- Matched or surpassed 37 of 39 published baselines across fluid dynamics and physical Hamiltonians, including a 10,487× subnormalization improvement over a published fluid-dynamics construction.
- Produced exponentially smaller circuits than FABLE and compiled matrices of dimension beyond 2^{100} in under five seconds on a laptop.

Shami, D. (2022). *Exploration of the Hidden Subgroup Problem.* Undergraduate thesis, Reed College.

- Investigated the Hidden Subgroup Problem and its relationship to character-query measurements, including lower-bound comparisons with standard pretty-good-measurement approaches.

Selected research-engineering contribution: Meta Reality Labs / CTRL-Labs (2025).

- Worked directly with the research team behind Kaifosh, Reardon, et al., *Nature* (2025), to productionize the EMG-to-handwriting model for an embedded NPU.
- Reduced deployment from GB-scale research models to approximately 4 MB while preserving accuracy within 1%, using post-training quantization, custom compiler lowering, and fused kernels.

Selected Quantum & Research Software

Qitara (formerly Quantum Forge) | github.com/Daksh-Shami/Qitara

- Designed and implemented Qitara entirely in Rust as a cross-platform quantum compiler and simulator with OpenQASM support, a custom intermediate representation, and an interactive interface.
- Replaced general matrix-based simulation paths with aligned state buffers, custom bit operations, SIMD, and AVX2 kernels, running 10–450× faster than Qiskit Aer, Cirq, and PennyLane on circuits under 22 qubits on personal PCs.

PyTorch / ExecuTorch | github.com/pytorch/executorch

- Core contributor to PyTorch's embedded ML compiler stack. Optimized heterogeneous scheduling by 40% by reformulating the operation graph and using segment-tree-based global scheduling.
- Added support for exception-free quantized kernels and floating-point execution on embedded Arm targets for all PyTorch users.

Professional Experience

Graduate Research Assistant, UW–Madison Quantum Software Lab **Aug 2026 – Present**

- Conducting research with Prof. Charles Yuan on quantum algorithms and abstractions for quantum programs, with particular interest in using algorithmic structure to construct block encodings for Quantum linear algebraic frameworks like QSVT.

Senior Software Engineer, Meta Reality Labs **Mar 2025 – May 2026**

- Investigated algorithmic and hardware bottlenecks in resource-constrained neural-interface systems, identifying undocumented DMA limitations that had blocked development and enabling a 47% inference speedup.
- Architected scheduling and memory abstractions across heterogeneous ARM CPU and NPU hardware, enabling concurrent execution of EMG-to-handwriting models under strict latency constraints.
- Used Rust for embedded thermal and power-management systems work.

Software Engineer, Google Search **Jun 2022 – Mar 2025**

- Designed a C++ framework for algorithm attribution in a large distributed data-processing graph, enabling discovery of 50+ previously hidden correctness and performance failures within mature Search infrastructure.
- Built lock-free concurrent containers to remove throughput bottlenecks in petabyte-scale pipelines, resulting in a 15% speedup on the critical path.
- Earned Google C++ Readability certification and served as one of the code-quality mentors for the Search organization.

Leadership & Teaching Experience

Head Treasurer of Reed College Student Body **Apr 2019 – Jan 2022**
Portland, OR

- Responsible for the administration of a $1 million student activity budget, leading a team of four people.
- Founded and chaired the COVID-19 Emergency Fund, fundraising $150,000 to support over 100 disadvantaged students with monetary needs.
- Stayed on campus during the COVID-19 pandemic to ensure safe evacuation and continued disbursement of emergency checks for low-income students for rent and living expenses.
- Developed automated disbursement processes, reducing administrative workload by approximately 40%.

Mathematics Grader, Reed College **Aug 2019 – Dec 2021**
Portland, OR

- Graded homework assignments and provided feedback for foundational courses in Discrete Structures (Math 113) and Linear Algebra (Math 201).

Physics Tutor, Reed College **Aug 2019 – May 2021**
Portland, OR

- Provided individual and drop-in tutoring for courses in Mechanics (Physics 101), Electricity & Magnetism (Physics 102), and Oscillations & Waves (Physics 201).

Technical Skills

- **Quantum / Theory:** Quantum algorithms, algorithm design & analysis, computational complexity, linear algebra, abstract algebra, quantum circuit simulation, quantum compiler design.
- **Programming:** Rust, C++, Python, CUDA, Qiskit, Cirq, PennyLane, OpenQASM.
- **Compilers / Systems:** AST/IR transformations, lowering, optimization passes, instruction selection, static analysis, Git/GitHub, Linux, Docker, CI/CD, concurrency & parallelism, high-performance computing.