Adam Holmes

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Education

The University of Chicago
Ph.D. in Computer Science - Concentration in Quantum Computing Architecture
Expected 2020

Cornell University
Bachelor of Arts in Physics - Concentration in Computer Science

Relevant Experience

Intel Corporation, *Quantum Systems Architecture Intern*

Hillsboro, Oregon

June 2017 - September 2017

- Developed low level scheduling and compilation software interfacing with ScaffCC toolchain targeting custom system architectures to enable fast, efficient design space exploration and architectural performance evaluation
- Evaluated customized system architectures by performing hand optimization and scheduling of quantum algorithms including Grover's Search, Quantum Fourier transform, and the Jordan-Wigner transform
- Analyzed the execution of topological error correction protocols on exotic system architectures to evaluate feasibility, scalability, and performance overhead of various system design decisions
- Designed and developed system architecture automated evaluation tools to enable fast, seamless GUI-based system architecture performance and overhead evaluation

Quantum and Nanoscale Computing Architecture Laboratory, *NSF Research Associate and Graduate Student*

Chicago, IL
Santa Barbara, CA

May 2014 – Present

- Developed key components of ScaffCC, a software toolchain for quantum computation programming, compilation, and low level instruction scheduling
- Built a subcompiler "RKQC: Revkit for Quantum Computation" for use within the Scaffold compiler as a subroutine for compilation of reversible logic oracles
- Developed implementations of quantum algorithms, as well as a quantum implementation of the SHA-1 hash algorithm
- Designed implementations of novel scheduling algorithms and compiler optimizations for incorporation into an LLVM-based infrastructure
- Analyzed effects of scheduling techniques on quantum algorithm performance with a Multi-SIMD distributed architectural design
- Applied numerical analysis and simulations to various implementations of fault tolerance, including concatenated codes and surface codes
- Evaluated the interaction of atomic ion trap and superconducting qubit physical hardware constraints with proposed architecture designs

Cornell Laboratory for Elementary and Particle Physics, *Head Research Assistant / Research Associate*

Ithaca, NY

December 2012 – June 2016

Head Research Assistant

- Examined the effect of magnetic field strength and orientation on trapped flux within superconducting niobium samples
- Investigated superconducting samples of unknown composition, applying experimental design and analysis to find critical temperatures
- Developed experimental apparatus and method to examine manufacturing technique of Niobium Nitride developed by Fermilab
- Applied quantitative methods to cryogenic analysis of superconducting samples, contesting a claim held by Fermilab

Research Associate

- Developed computational model of liquid helium flow through cooling manifolds, modeled to examine optimization for future application within synchrotrons and linear accelerators
- Applied modeling, quantitative, and investigative skills to examine helium flow, manifold physics, cryogenic analysis, and optimization techniques, resulting in a published paper

Relevant Coursework

- Object-Oriented Programming and Data Structures
- Discrete Structures and Mathematics
- Networks
- Circuits for Electrical and Computer Engineers
- Computer Architecture
- Systems Programming
- Basics of Quantum Mechanics
- Intermediate Quantum Mechanics
- Applications of Quantum Mechanics
- Advanced Computer Architecture
- Multivariable Calculus
- Differential Equations
- Linear Algebra
- Electricity and Magnetism
- Oscillations, Waves, and Quantum Physics

Publications

- Cui, W., Ding, Y., Dangwal, D., Holmes, A., McMahon, J., Javadi-Abhari, A., Tzimpragos, G., Chong, T., Sherwood, T. "*Charm: A Language for Closed form High-level Architecture Modeling*," ISCA 2018. 2 June 2018.
- Ding, Y., Holmes, A., Martonosi, M., Franklin, D., Chong, F. "*Magic-State Functional Units: Mapping and Scheduling Multi-Level Distillation Circuits for Fault-Tolerant Quantum Architectures*," Manuscript submitted for publication
- Javadi-Abhari, A., Gokhale, P., Holmes, A., Franklin, D., Brown, K. R., Martonosi, M., Chong, F., "*Optimized surface code communication in superconducting quantum computers*," 50th Annual IEEE/ACM International Symposium on Microarchitecture.
- JavadiAbhari, A., Holmes, A., Heckey, J., Patil, S., Kudrow, D., Franklin, D., Brown, K., Martonosi, M., Chong, F. "*Compiler Management of Communication and Parallelism for Fault-Tolerant Quantum Computation.*" TOCS 2016
- Chong, F., Heckey, J., Patil S., JavadiAbhari, A., Holmes, A., Franklin, D., Kudrow, D., Brown, K., Martonosi, M. "*Compiler Management of Communication and Parallelism for Quantum Computation.*" ASPLOS 2015. 7 August 2014.
- Eichhorn, R., Markham, S., Holmes, A., Sabol, D., Smith, E. "*Managing Parallel Cryogenic Flows to the Thermal Intercepts in the Cornell ERL.*" AIP Publishing. 17 June 2013.
- Eichhorn, R., Ganshin, A., Holmes, A., Kaufman, J., Markham, S., Posen, S., Smith, E. "*Recent Findings on Nitrogen Treated Niobium*" SRF France 2013. 22 September 2013.