Yunong Shi

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EXPERIENCE

Quantum Scientist **Oct 20 -**
Amazon Braket quantum computing cloud service
Leading the development of the Amazon Braket compilation service.

QISE-NET fellow **Aug 18 - Sep 19**
IBM T.J Watson Center
Quantum compilation optimizations; Fault-tolerant protocols for bosonic qubit architectures; Automated program verification.

W.J Cody fellow **Jun, 17 - Sep 17**
Argonne National laboratory
Use formal verification and model checking to facilitate the safe migration of large numerical software to heterogeneous supercomputing architectures.

EDUCATION

The University of Chicago, Chicago, IL
Ph.D, Physics, Dec, 2020

- Advisor: Prof. Fred T. Chong
- Thesis: Compilation, Optimization and Verification of Near-term Quantum Computers

M.S, Physics, Jun, 2020

University of Illinois, Urbana-Champaign, Urbana, IL
B.S, Applied Mathematics Jun, 2013

SOFTWARE

Amazon Braket Quantum Compilation Service Leading a team of scientists in developing the Amazon Braket compilation service

IBM Qiskit Designed and implemented the commutation analysis and optimization pass in the Qiskit Terra compiler of IBM.

CertiQ Designed and implemented most of Giallar (formerly known as CertiQ), the first verification framework for a realistic quantum compiler. Giallar is mostly-automated and largely extensible.

ScaffCC Designed and implemented the circuit optimization module, the QAOA library and a backend that directly compiles to control pulses in the hardware.

PUBLICATIONS

- **Y. Shi**, P. Gokhale, P. Murali, J. Baker, C. Duckering, Y. Ding,C. Chamberland, A.W. Cross, D.I. Schuster, K.R. Brown, M.R. Martonosi, D. Franklin, F.T. Chong, "Resource-efficient quantum computing by breaking abstractions", *Proceeding of the IEEE* **PIEEE 2020**
- **Y. Shi**, C. Chamberland, A.W. Cross, "Fault-tolerant Preparation of Approximated GKP states", *New Journal of Physics*, 21(9), 093007. **NJP 2019**
- **Y. Shi**, N. Leung, P. Gokhale, Z. Rossi, D.I. Schuster, H. Hoffmann, F.T. Chong, "Optimized Compilation of Aggregated Instructions for Realistic Quantum Computers", *International Symposium on Architectural Support for Programming Languages and Operating Systems* **ASPLOS 2019**

- R. Tao, **Y. Shi**, X. Li, J. Lin, F.T. Chong, R. Gu, "Gleipnir: Bounding Errors in Quantum Programs via Tensor Networks", *Conference on Programming Language Design and Implementation* **PLDI 2021**.
- R. Tao, **Y. Shi**, J. Yao, X. Li, A. Javadi-Abhari, A.W. Cross, F.T. Chong, R. Gu Conference on Programming Language Design and Implementation **PLDI 2022**.
- G. Li, **Y. Shi**, A. Javadi-Abhari, "Software-Hardware Co-optimization for Computational Chemistry on Superconducting Quantum Processors", *International Symposium on Computer Architecture* **ISCA 2021**.
- G. Li, A. Wu, **Y. Shi**, A. Javadi-Abhari, Y. Ding, Y. Xie, "On the Co-Design of Quantum Software and Hardware", *International Conference on Nanoscale Computing and Communication*, **NanoCom 2021**.
- P. Gokhale, Y. Ding, T. Propson, C. Winkler, N Leung, **Y. Shi**, D.I. Schuster, H. Hoffmann, F.T. Chong, "Partial Compilation of Variational Algorithms for Noisy Intermediate-Scale Quantum Machines", *International Symposium on Microarchitecture* **MICRO**. October, 2019.
- P. Gokhale, A. Javadi-Abhari, N. Earnest, **Y. Shi**, F.T Chong, "Quantum Compilation for NISQ Algorithms with Pulse-Backed Augmented Basis Gates", *International Symposium on Microarchitecture* **MICRO**. October, 2020.
- M.R. Jokar, R.Rines, G. Pasandi, H. Cong, A Holmes, **Y. Shi**, M. Pedram, F.T. Chong "DigiQ: A Digital Controller for QuantumComputers Using SFQ Logic", *International Symposium on High-Performance Computer Architecture* **HPCA 2022**.
- T. Tomesh, K. Gui, P. Gokhale, **Y. Shi**, F.T. Chong, M. Martonosi, M. Suchara, "Optimized Quantum Program Execution Ordering to Mitigate Errors in Simulations of Quantum Systems", *International Conference on Rebooting Computing* **ICRC 2022**

MANUSCRIPTS

- **Y. Shi**, X. Li, R. Tao, A. Javadi-Abhari, A. Cross, F.T. Chong, R. Gu, "CertiQ: Mostly-automated Verification of a Realistic Quantum Compiler"
- K Gui, T Tomesh, P Gokhale, **Y. Shi**, F.T. Chong, M Martonosi, M Suchara, "Optimized Quantum Program Execution Ordering to Mitigate Errors in Simulations of Quantum Systems"

SELECTED PRESENTATIONS

Braket the Quantum Computing Cloud Service

- UCLA, CA — June, 2022

Breaking Abstractions of the Quantum Computing Stack

- UW Madison, WI — January, 2020
- UCLA, CA — Feb, 2020
- UCSD, CA — March, 2020

Optimized Compilation of Aggregated Instructions

- EPiQC, IL — January, 2019
- ASPLOS, RI — April, 2019
- Columbia University, NY — April, 2019

Fault-tolerant Preparation of Approximate GKP states

- IBM T.J Watson Center, NY — June, 2019
- ATPESC, IL — July, 2019

CertiQ: Mostly-automated Verification of a Realistic Quantum Compiler

- IBM T.J Watson Center, NY — September, 2019
- IQWC, CO — November, 2019

- EPiQC, IL November, 2019

TEACHING EXPERIENCE General physics, Mechanics, Wave Heat Optics, Intro to spacetime and GR, Computational physics, Experimental physics, E & M, Electronics, Intro to Programming, System programming