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 breakingabstractions",*Proceeding of the IEEE* (**PIEEE**), June, 2020.
- **Y. Shi**, C. Chamberland, A.W. Cross, "Fault-tolerant Preparation of Approximated GKP states", *New Journal of Physics*, 21(9), 093007. (**NJP**). September, 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)**. April, 2019.

- 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.

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", *submitting to CAV 2021.*
- **Y. Shi**, R. Tao, X. Li, J. Lin, F.T. Chong, R. Gu, "Gleipnir: Bounding Errors in Quantum Programs via Tensor Networks", *submitting to PLDI 2021.*
- 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", *submitted to MICRO 2021*
- 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", *submitting to ISCAS 2021.*
- G. Li, **Y. Shi**, A. Javadi-Abhari, "Software-Hardware Co-optimization for Computational Chemistry on Superconducting Quantum Processors", *submitting to ISCAS 2021.*

SELECTED PRESENTATIONS

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