Christopher Kang

ctkang@uchicago.edu | christopherkang.me | US Citizen | Updated July 22, 2023

EDUCATION

University of Chicago, Chicago, IL — 9/2022-present
PhD in Computer Science
Advised by Fred Chong

University of Washington, Seattle, WA — 9/2018-6/2022
Bachelor of Science in Computer Science — GPA: 3.95/4.0
Bachelor of Science in Economics
Phi Beta Kappa member

RESEARCH INTERESTS

Quantum architectures for Hamiltonian simulation

PUBLICATIONS & PREPRINTS

[1] Christopher Kang, Micheline B Soley, Eleanor Crane, SM Girvin, and Nathan Wiebe. "Leveraging Hamiltonian Simulation Techniques to Compile Operations on Bosonic Devices". In: *arXiv preprint arXiv:2303.15542* (2023).

[2] Christopher Kang, Nicholas P. Bauman, Sriram Krishnamoorthy, and Karol Kowalski. "Optimized Quantum Phase Estimation for Simulating Electronic States in Various Energy Regimes". In: *Journal of Chemical Theory and Computation* 18.11 (2022). PMID: 36201845, pp. 6567–6576. DOI: 10.1021/acs.jctc.2c00577. eprint: https://doi.org/10.1021/acs.jctc.2c00577. URL: https://doi.org/10.1021/acs.jctc.2c00577.

[3] Timothy J Stavenger, Eleanor Crane, Kevin Smith, Christopher Kang, Steven M Girvin, and Nathan Wiebe. "Bosonic Qiskit". In: *arXiv preprint arXiv:2209.11153* (2022).

TALKS

Leveraging Hamiltonian Simulation Techniques to Compile Higher Order Block-Encodings on Bosonic Devices — *3/2023*
QIP 2023, APS March Meeting 2023, UMD RQS Institute

Quantum-Inspired Classical Hamiltonian Simulation — *9/2020*
Northwest Quantum Nexus / UW Workshop

Building a Variational Quantum Eigensolver in Q# — *3/2019*
Northwest Quantum Nexus

RECOGNITION

Crerar Fellowship, UChicago *9/2022*
Awarded to select incoming PhD students ($5000)

Outstanding Scholar in Economics, UW Economics *6/2022*
Awarded to a senior in Economics based on academic merit

Hellmut Golde Endowed Scholarship, UW CSE *9/2021*
Awarded to a student in Computer Science based on academic merit ($1750)

George and Pearl Corkery Scholarship, UW Economics *5/2021*
Awarded to an exceptional junior in Economics based on academic merit ($2500)

Campus Nomination for Goldwater Scholarship, UW *12/2020*
Campus nomination for the national Goldwater scholarship

Microsoft Endowed Scholarship, UW CSE *9/2019*
Awarded to a student in Computer Science based on academic merit ($500)

Honors Calculus Award, UW Department of Mathematics *6/2019*
Top student in the 1st year Honors Calculus Class ($200)

Honors Undergraduate Scholars Award, UW Honors Program *9/2018*
Awarded a four-year merit-based tuition waiver ($47000)

UNDERGRAD RESEARCH EXPERIENCE

Product Formulas to Control Boson-Qubit Devices *9/2020-12/2022*
Advised by Nathan Wiebe *UToronto, C2QA*

- Used matrix product formulas (Trotter, Baker-Campbell-Hausdorff) to design new control schemes for hybrid boson-qubit quantum devices
- Characterized asymptotic error performance of product formulas
- Collaborated with physicists and computer scientists to explore potential near-term applications of hybrid boson-qubit devices
- Publication currently being prepared for submission [1]

Quantum-Inspired Classical Hamiltonian Simulation [2] *6/2020-12/2022*
Advised by Sriram Krishnamoorthy and Karol Kowalski *PNNL*

- Co-led the design/creation of a quantum-inspired algorithm for *ab initio* molecular simulations based on Trotterization/phase estimation
- Presents a new framework to effectively emulate Hamiltonian simulation algorithms with superpolynomially less memory
- Received campus nomination for Goldwater scholarship with this project. This work is also being included as a key deliverable in an upcoming grant review to the Department of Energy

Device-Aware Quantum Circuit Compilation *6/2019-9/2019*
Advised by Sriram Krishnamoorthy *PNNL*

- Implemented a software pipeline in Q# to reduce the circuit depth necessary for phase-estimation based Hamiltonian simulation.
- Took Broombridge Hamiltonians as input and produced low-level circuits that used fermionic swaps to minimize depth on non-all-to-all devices.

Reinforcement Learning *1/2019-9/2019*
Advised by Willie Agnew and Pedro Domingos *UW*
Supported grad student with evaluating models in different environments.

Graph-Based Semi-Supervised Learning *6/2018-9/2018*
Advised by Mahantesh Halappanavar *PNNL*
Investigated the use of graph-based semi-supervised neural networks to classify the severity of computer vulnerabilities.

TEACHING

TA: Intro to Quantum Computing, UChicago CS *Winter 2023*
Teaching an Intro to Quantum Computing course intended for a general undergraduate CS audience.

TA: Graduate Quantum Computing, UW CSE *Winter 2022*
Taught a special topics grad class on quantum computing and quantum algorithms.
Graded homework assignments and held office hours.
Received highest TA rating from faculty instructor, "*Truly Exceptional*"

TA: Undergraduate Quantum Computing, UW CSE *Fall 2020*
Taught a special topics class on quantum computing and quantum algorithms.
Wrote and presented three lectures on Hamiltonian simulation.
Received highest TA rating from faculty instructor, "*Truly Exceptional*"

TA: Freshman Introductory Seminar, UW CSE *Summer, Fall 2019*
Taught an introductory class for freshmen on inclusive leadership

SERVICE

Co-organizer, Theory Lunch UChicago *9/2022-present*
Organize a weekly Theory Lunch to bring together members of the TCS community.

Member, ACM's US Tech Policy Council (USTPC) *2/2021-present*
Principal author for USTPC's Statement on Remote Test Administration

Organizer, Theory Lunch UW *6/2022-9/2022*
Organize a weekly Theory Lunch to bring together members of the TCS community.

Special Assistant for Undergraduate Research, UW CSE *9/2021-6/2022*
Year-long appointment to improve the undergraduate research experience

Board Member, Q++ (LGBTQ+ @ UW CSE) *9/2018-6/2022*
Built an LGBTQ+ community in UW CSE and supported LGBTQ+ peers

Co-Chair, CSE Student Advisory Council *Spring 2019-Summer 2021*
Served as head undergraduate representative to faculty and staff in the department

Representative, CSE Student Advisory Council *Fall 2018-Spring 2019*
Represented undergraduates in the CSE School

WORK EXPERIENCE

Special Assistant, UW CSE *Summer 2022*
Consulted Director of External Outreach on digital transformation efforts and pricing models for affiliate engagement.

Summer Scholar, Deloitte Consulting, LLP *Summer 2021*
Supported a large public sector healthcare client with an enterprise-level digital transformation effort

Outreach Ambassador, UW CSE *Winter 2019-Fall 2020*
Supported CSE outreach efforts to diverse K-12 students across the Puget Sound

Student Assistant, UW CSE *Fall 2018-Fall 2020*
Assistant to Director of External Outreach