

# Jason D. Chadwick

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## Summary

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Ph.D. Candidate in Computer Science with a proven track record of research and industry experience in quantum computer systems and architecture. Specialized in developing and implementing low-level software optimizations for large-scale, fault-tolerant quantum computation, with direct experience in implementing and decoding error correction codes, compiling quantum programs, and optimizing control pulses. Proven ability to make impactful contributions to industrial software, including integrating novel pulse-level optimizations and crosstalk modeling into Intel's core C++ compiler and Python hardware interface.

## Education

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**Ph.D. Candidate, Computer Science**, University of Chicago 2022–present

Studying quantum computer systems and architecture, advised by Fred Chong.

My research focuses on co-design optimizations that narrow the gap between existing hardware and fault-tolerant quantum computation. I have worked on research in the areas of hardware implementation of LDPC codes, low-latency surface code decoding, mitigating burst errors, control pulse engineering, device calibration, circuit compilation, and high-radix computation.

**B.S. Physics**, Carnegie Mellon University 2018–2022

Minor in Computer Science

GPA 3.95

## Professional Experience

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**Quantum Computing Intern**, Intel Summer 2025

Implemented accurate simulation of capacitive crosstalk in quantum dots into the company's C++ compilation and simulation infrastructure. Implemented and explored several novel ideas for more efficient crosstalk mitigation. My analysis of hardware cost versus compensation effectiveness directly informed the design of next-generation hardware, leading to insights projected to reduce crosstalk compensation hardware complexity by more than 50%.

**Quantum Computing Intern**, Intel Summer 2024

Discovered new pulse schedules for two-qubit operations in silicon spin qubits, resulting in up to 54% reduction in errors and spurring the exploration of novel chip designs to take advantage of these gains. Incorporated this work into existing Python hardware interface and C++ compiler stack, creating an internal pulse library interface that is now a core part of Intel's software stack. Created compilation and simulation software for hardware-informed exploration of the QEC code design space, providing guidance for Intel's quantum roadmap. First-author paper published in *Physical Review A* based on this work.

**Undergraduate Researcher**, University of Chicago Spring 2021–Summer 2022

Optimized short-duration control pulses for high-radix quantum logic gates, motivating a new compiler design that takes advantage of mixed-radix operations. Presented research at QCE 2022 and contributed key results to papers at ASPLOS 2023 and ISCA 2023.

**Undergraduate Intern**, Princeton Plasma Physics Laboratory Summer 2020

As part of the Department of Energy SULI program, designed a neural network to predict fusion plasma cross-sectional density and pressure using only data available in real time during plasma operation, for use in real-time feedback control systems. Work published in *Nuclear Fusion*.

## Skills

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**QEC concepts:** Low-latency/windowed decoding, syndrome extraction circuits, injection, distillation & compilation, circuit-level simulation, noise modeling, qLDPC codes

**Programming languages:** Python, Julia, C/C++

**Python libraries:** Stim/Sinter, Qiskit, Cirq, QuTiP, ldpc

## Awards and Honors

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| <b>Best Poster, Honorable Mention</b> , QEC25   | 2025      |
| <b>QSYS Best Paper 1st place</b> , IEEE QCE 2024  | 2024      |
| <b>QTEM Best Paper 3rd place</b> , IEEE QCE 2023  | 2023      |
| <b>Crerar Fellowship</b> , University of Chicago  | 2022      |
| <b>University Honors</b> , Carnegie Mellon University                                   | 2022      |
| <b>College Honors</b> , Mellon College of Science, Carnegie Mellon University           | 2022      |
| <b>Dean's List, High Honors</b> , Mellon College of Science, Carnegie Mellon University | 2018–2022 |

## Service

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|---|--------------|
| <b>Teaching Assistant</b> , CMSC 22200 Computer Architecture  | Jan–Mar 2025 |
| Developed autograder and taught lab sessions.   |              |
| <b>Workshop organizer</b> , QCE 2024  | Sept 2024    |
| Organized second edition of "Novel Applications of Optimal Control and Calibration for Quantum Technology" at QCE 2024, featuring invited talks and guided discussions. |              |
| <b>Workshop organizer</b> , QCE 2023  | Sept 2023    |
| Organized a day-long workshop "Advances in Numerical Quantum Optimal Control and Characterization Methods" at QCE 2023, featuring invited talks and guided discussions. |              |
| <b>Physics Steering Committee</b> , CMU Physics Department  | 2019–2021    |
| Collaborated with physics department leadership to guide programs and policy.   |              |

## Publications

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† indicates equal contribution

| Year | Title and Authors  | Publisher   | Category                  |
|------|--|---|---------------------------|
| 2025 | Erasure Minesweeper: exploring hybrid-erasure surface code architectures for efficient quantum error correction<br><b>J. D. Chadwick</b> †, M. H. Teo†, J. Viszlai†, W. Yang†, and F. T. Chong<br><a href="https://arxiv.org/abs/2505.00066">arxiv.org/abs/2505.00066</a>  | 2025 IEEE International Conference on Quantum Computing and Engineering (QCE) | Refereed conference paper |
| 2025 | Short two-qubit pulse sequences for exchange-only spin qubits in 2D<br><b>J. D. Chadwick</b> , G. G. Guerreschi, F. Luthi, M. T. Mądzik, F. A. Mohiyaddin, P. Prabhu, A. T. Schmitz, A. Litteken, S. Premaratne, N. C. Bishop, A. Y. Matsuura, and J. S. Clarke<br><a href="https://doi.org/10.1103/PhysRevA.111.052616">doi.org/10.1103/PhysRevA.111.052616</a> | <i>Physical Review A</i> <b>111</b> , 052616                                  | Journal article           |
| 2025 | SWIPER: Minimizing Fault-Tolerant Quantum Program Latency via Speculative Window Decoding<br>J. Viszai†, <b>J. D. Chadwick</b> †, S. Joshi, G. S. Ravi, Y. Li, and F. T. Chong<br><a href="https://doi.org/10.1145/3695053.3731022">doi.org/10.1145/3695053.3731022</a>  | 52nd International Symposium on Computer Architecture (ISCA)                  | Refereed conference paper |
| 2024 | Averting multi-qubit burst errors in surface code magic state factories<br><b>J. D. Chadwick</b> , C. Kang, J. Viszlai, S. F. Lin, and F. T. Chong<br><a href="https://doi.org/10.1109/QCE60285.2024.00128">doi.org/10.1109/QCE60285.2024.00128</a>  | 2024 IEEE International Conference on Quantum Computing and Engineering (QCE) | Refereed conference paper |

### QSYS Best Paper 1st place

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|------|--|---|---------------------------|
| 2023 | Efficient control pulses for continuous quantum gate families through coordinated re-optimization<br><b>J. D. Chadwick</b> and F. T. Chong<br><a href="https://doi.org/10.1109/QCE57702.2023.00145">doi.org/10.1109/QCE57702.2023.00145</a><br><u>QTEM Best Paper 3rd place</u>                                    | 2023 IEEE International Conference on Quantum Computing and Engineering (QCE)                                       | Refereed conference paper |
| 2023 | Dancing the Quantum Waltz: Compiling Three-Qubit Gates on Four Level Architectures<br>A. Litteken, L. M. Seifert, <b>J. D. Chadwick</b> , N. Nottingham, J. M. Baker, and F. T. Chong<br><a href="https://doi.org/10.1145/3579371.3589106">doi.org/10.1145/3579371.3589106</a>                                     | 50th International Symposium on Computer Architecture (ISCA)  | Refereed conference paper |
| 2023 | Qompress: Efficient Compilation for Ququarts Exploiting Partial and Mixed Radix Operations for Communication Reduction<br>A. Litteken, L. M. Seifert, <b>J. D. Chadwick</b> , N. Nottingham, J. M. Baker, and F. T. Chong<br><a href="https://doi.org/10.1145/3575693.3575726">doi.org/10.1145/3575693.3575726</a> | 28th ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS) | Refereed conference paper |
| 2022 | Time-Efficient Qudit Gates through Incremental Pulse Re-seeding<br>L. M. Seifert <sup>†</sup> , <b>J. D. Chadwick</b> <sup>†</sup> , A. Litteken, F. T. Chong, and J. M. Baker<br><a href="https://doi.org/10.1109/QCE53715.2022.00051">doi.org/10.1109/QCE53715.2022.00051</a>                                    | 2022 IEEE International Conference on Quantum Computing and Engineering (QCE)                                       | Refereed conference paper |
| 2021 | Prediction of electron density and pressure profile shapes on NSTX-U using neural networks<br>M. D. Boyer and <b>J. D. Chadwick</b><br><a href="https://doi.org/10.1088/1741-4326/abe08b">doi.org/10.1088/1741-4326/abe08b</a>   | <i>Nuclear Fusion</i> 61 046024   | Journal article           |

### Under Review

| Year | Title and Authors   | Publisher    | Category        |
|------|---|--------------|-----------------|
| 2025 | Operating two exchange-only qubits in parallel<br>M. T. Mądzik, F. Luthi, G. G. Guerreschi, F. A. Mohiyaddin, F. Borjans, <b>J. D. Chadwick</b> , M. J. Curry, J. Ziegler, S. Atanasov, P. L. Bavadz, E. J. Connors, J. Corrigan, H. Ekmel Ercan, R. Flory, H. C. George, B. Harpt, E. Henry, M. M. Islam, N. Khammassi, D. Keith, L. F. Lampert, T. M. Mladenov, R. W. Morris, A. Nethewewala, S. Neyens, R. Otten, L. P. O. Ibarra, B. Patra, R. Pillarisetty, S. Premaratne, M. Ramsey, A. Risinger, J. Rooney, R. Savytskyy, T. F. Watson, O. K. Zietz, A. Y. Matsuura, S. Pellerano, N. C. Bishop, J. Roberts, and J. S. Clarke<br><a href="https://arxiv.org/abs/2504.01191">arxiv.org/abs/2504.01191</a> | Under review | Journal article |

## Talks

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| Year | Title   | Venue   | Category              |
|------|---|---|-----------------------|
| 2025 | Erasure Minesweeper: exploring hybrid-erasure surface code architectures for efficient quantum error correction | 2025 IEEE International Conference on Quantum Computing and Engineering (QCE) | Conference talk       |
| 2025 | Short two-qubit pulse sequences for exchange-only spin qubits in 2D   | APS March Meeting 2025  | Conference talk       |
| 2024 | Averting multi-qubit burst errors in surface code magic state factories   | 2024 IEEE International Conference on Quantum Computing and Engineering (QCE) | Conference paper talk |
| 2024 | Dynamic mitigation of time-varying noise in surface code magic state factories                                  | APS March Meeting 2024  | Conference talk       |
| 2023 | Efficient control pulses for continuous quantum gate families through coordinated re-optimization               | 2023 IEEE International Conference on Quantum Computing and Engineering (QCE) | Conference paper talk |

## Patents

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| Year | Title   | Description  |
|------|---|--|
| 2023 | SYSTEMS AND METHODS FOR OPTIMIZED PULSES FOR CONTINUOUS QUANTUM GATE FAMILIES THROUGH PARAMETER SPACE INTERPOLATION | Methods related to those described in "Efficient control pulses for continuous quantum gate families through coordinated re-optimization", QCE 2023. |