

Colin M. Burdine

Curriculum Vitae

Baylor University

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📄 <https://cburdine.github.io>

Education

- 2021–Present **Ph.D. in Electrical and Computer Engineering**, *Baylor University*, Waco, TX.
GPA: 4.0 (Expected Spring 2026)
- 2017–2021 **B.S. in Computing (with secondary major in Mathematics)**, *Baylor University*, Waco, TX.
GPA: 3.96, *Summa Cum Laude*

Research Interests

- Quantum Computing / Algorithms and Applications on NISQ Hardware
- Scientific Machine Learning / Symmetry-Aware Deep Learning
- Quantum Simulation of Open Quantum Systems
- Computational Solid State Physics

Dissertation *Non-Classical Methods for the Simulation and Design of Quantum Materials*
(Expected defense: Spring 2026)

Research Experience

- 2021–Present **Baylor University**, Waco, TX, Graduate PhD Research.
- *Current Work*: Developing a symmetry-aware and quantum-informed deep learning framework for calculating the electronic structure of materials and devices with an order-of-magnitude speed-up over density functional theory methods.
 - Proposed a new algorithm for efficiently simulating certain classes of open quantum systems on NISQ quantum devices. Applied this algorithm to simulate the decoherence of bosonic systems on trapped ion quantum hardware with custom error mitigation techniques.
 - Developed graph neural network models to identify potential conventional and unconventional superconductors from atomic structures obtained via high-throughput density functional theory calculations.
- Summer 2021 **Argonne National Laboratory**, Lemont, IL, Research Internship.
- Contributed to the Waggle/SAGE Project, developing self-supervised and self-calibrating convolutional autoencoder models for identification of wildlife, vehicles, and adverse weather events on power- and memory-limited edge computing devices.
- Summer 2020 **Sandia National Laboratory**, Livermore, CA, Research Internship.
- Applied geometric spectral learning techniques and recurrent neural networks to predict the parameters of chaotic dynamical systems from time-series data.

Teaching and Instruction

- Summers **Baylor University, Materials + ML Workshop**, Waco, TX.
- 2023–2025
- Independently developed and taught an interdisciplinary two-week summer course on machine learning applications in materials science. Published original course content in a free and open-source interactive online book (see project website).
- 2022–Present **Baylor University, Graduate Teaching Assistant**, Waco, TX.
- Assisted faculty in developing course materials and programming assignments for various engineering courses, including computational intelligence, signal processing, solid state physics, introductory quantum mechanics, and quantum computing.
 - Assisted with grading, mentoring students during office hours, and occasional lectures.

- 2018–2022 **Baylor University, Success Center Tutoring and Leadership Team**, Waco, TX.
- o Tutored computer science courses, calculus, real analysis, and other proof-based courses in mathematics. Also taught supplemental instruction sessions in computer programming, linear algebra, calculus, and precalculus.

Relevant Professional Experience

- Summer 2019 **Red Ventures, Data Platform Engineering / Data Scientist**, Fort Mill, SC.
- o Developed and deployed a non-convex optimization software package in C++/Go to optimize a dynamic portfolio of monetary bids for placement of search engine results under finite budget constraints, raising activated search engine volume by 14%.

Computer Skills

- Programming o Experienced in **Python, C/C++**, Go, Java SE, and LaTeX. Also familiar with SQL, HTML/CSS, and JavaScript.
- Software Systems o Very experienced with various Python frameworks, including **PyTorch, JAX, Tensorflow, Numpy/Scipy**, and **Qiskit**.
- o Experienced with *ab initio* computational chemistry suites like **QuantumESPRESSO**.
 - o Also experienced with Docker and **high-performance computing systems**. Somewhat familiar with the **CUDA development stack** and Amazon Web Services (AWS).
 - o Experienced with Linux, UNIX, and Windows operating systems.

Presentations and Talks

- o **C. Burdine**. “Quantum-Informed Machine Learning for Rapid Material Design and Quantum Device Engineering”. In: Texas Quantum Summit (College Station, TX, Sept. 19–21, 2025). Poster Presentation. 2025
- o **C. Burdine**. “Discovery of novel superconducting materials with deep learning”. In: IEEE International Conference on Quantum Computing and Engineering (QCE) (Bellevue, WA, Sept. 16–21, 2023). 2023
- o **C. Burdine**. “Predicting the Critical Temperature of Doped and Alloyed Superconductors”. In: Southwest Data Science Conference (Waco, TX, Mar. 24, 2023). 2023

List of Publications

- o **C. Burdine**, E. P. Blair. “Quantum-Informed E(3)-Equivariant Neural Networks for Material Design and Quantum Device Engineering”. In: (Manuscript in Preparation)
- o **C. Burdine**, N. Bauer, G. Siopsis, E. P. Blair. “Efficient Simulation of Open Quantum Systems on NISQ Trapped-Ion Hardware”. In: *Advanced Quantum Technologies* (2025), p. 2400606
- o **C. Burdine**, E. P. Blair. “Trotterless simulation of open quantum systems for NISQ quantum devices”. In: *Advanced Quantum Technologies* 8.1 (2025), p. 2400240
- o **C. Burdine**, E. P. Blair. “Discovery of novel superconducting materials with deep learning”. In: *2023 IEEE International Conference on Quantum Computing and Engineering (QCE)*. vol. 1. IEEE. 2023, pp. 1335–1341

References

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