

# THOMAS STECKMANN

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## EDUCATION

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### North Carolina State University

4.0 GPA - Physics B.S. | Mathematics B.S.

Raleigh, NC

Aug. 2018 – May 2022

University Honors Program; Physics Honors; Math Honors; Park Scholar

## WORK EXPERIENCE

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### Quantum Information Science Intern

Oak Ridge National Labs and NC State

Summer 2020, Summer 2021 - Present

Oak Ridge, TN

- Investigated the application of Lie Group Decomposition to produce an efficient circuit for matrix exponentials, which has benefits in long-time simulation of quantum systems on quantum computers
- Work lead directly to an in-review publication: [Fixed Depth Hamiltonian Simulation via Cartan Decomposition](#)
- Developed and published a python package to make the work in the publication simple to adapt to new application areas beyond the original expertise of the authors: [Cartan Quantum Synthesizer](#)
- Following work on Cartan Decomposition on application to studying the dynamics of the Hubbard model for electrons using current quantum computing hardware. Using a variety of optimization tools centered around Cartan Decomposition, our non-Trotter based approach succeeds where previous simulations on superconducting hardware failed

### Undergraduate Research Assistant

North Carolina State University

June 2018 – June 2020

Raleigh, NC

- Work revealed a relationship between a material efficient and sustainable fabrication method and charge transport properties in organic semiconducting polymer transistors
- Experience using Atomic Force Microscopy, transport characterization, spectroscopy, and X-ray scattering analysis
- Mentored other undergraduate students in developing new projects in the research group
- Reviewed related literature on the morphology charge-transport relationship for the materials in the study

## QUANTUM COMPUTING EXPERIENCE

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### Undergraduate School on Experimental Quantum Information Processing

Summer 2021

- Virtual summer program featuring lectures from faculty of IQC on the theory and implementation of quantum algorithms, qubit architectures, and quantum communication protocols

### Quantum Ideas Summer School | Hosted by Duke University STAQ collaboration

Summer 2019

- Introduction to quantum computing hardware approaches including superconducting and trapped ion systems
- Exploration of advanced variational algorithms and error correcting codes

### Quantum Information Club at NC State | Co-founder, Current President

March 2020 – Present

- Developing approachable programming in quantum computing for undergraduate students with a range of math, science, and engineering backgrounds by working closely with community partners such as the NC State Q Hub, IBM Qiskit, and qBraid, and university groups at UNC Chapel-Hill, Duke, Georgetown, and Georgia Tech
- Primary organizer for the [2020 North Carolina IBM Summer Jam Hackathon](#) with over 60 participants, and a workshop co-organized with IBM Qiskit with over 40 participants

### Quantum Computing Hackathons with Qiskit

Summer 2019

- [Qiskit Hackathon Global](#) With a team of five students, developed a function to evaluate the Quantum Volume of IBM hardware during this 24 hour invite only event
- [NC IBM Q Summer Jam](#) Implemented an algorithm for quantum PageRank using Quantum Random Walk

## TECHNICAL SKILLS AND RELEVANT COURSEWORK

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**Programming Languages:** Python, Java, Mathematica

**Libraries:** Qiskit, NumPy, Scipy, Matplotlib

**Featured Course Work:** (Graduate Level) Mathematical Foundations of Quantum Computation | Linear Algebra | Computational Physics | Complex Variables | (Undergraduate Level) Quantum Mechanics I/II | Modern Algebra | Cryptography | Programming Concepts - Java | Real Analysis I/II

## PUBLICATIONS AND PRESENTATIONS

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### **Publications:**

Efehan Kokcu, Thomas Steckmann, JK Freericks, Eugene F Dumitrescu, and Alexander F Kemper, "Fixed depth hamiltonian simulation via cartan decomposition," (2021) [arXiv preprint arXiv:2104.00728](#)

### **Presentations:**

- 2nd place, "Efficient Quantum Simulation on a Quantum Computer," McCormick virtual Symposium | 2021
- "Constant Depth Exact Time Evolution of Spin Systems Based on Cartan Decomposition," National Council For Undergraduate Research | 2021
- "Scalable Fabrication of High Mobility Monolayer OFETs Using Floating Film Transfer" Virtual poster, Material Research Society | 2020
- Honorable Mention, "High Efficiency Semiconducting Polymer Self-Assembly in Organic Transistors" Poster, McCormick virtual symposium | 2020
- 3rd place, "Aggregation Mechanisms in Low Temperature Ultrathin Water-Floated Films Future" Future of Materials IV Workshop | 2020