Kirsten Morris

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Research Interests

Quantum Error Correction, Graph-based Codes, Iterative Decoding, Algebraic Coding Theory, Applied Discrete Math

Education

Ph.D. **University of Nebraska-Lincoln**, Mathematics   August 2025
- Graduate Minor in Electrical Engineering
- Advisors: Dr. Christine Kelley & Dr. Tefjol Pllaha

M.S. **University of Nebraska-Lincoln**, Mathematics   August 2022

M.A. **University of Georgia**, Mathematics   December 2018

B.S. **Georgia College & State University**, Mathematics   May 2016

Positions Held

Postdoctoral Associate Virginia Tech   August 2025-Present

Graduate Research and Teaching Assistant University of Nebraska-Lincoln   August 2021-July 2025

NSF Mathematical Sciences Graduate Internship Fermi National Accelerator Lab   June 2022-August 2022

Program Analyst (Data), AmeriCorps   November 2020-July 2021

Quality Assurance and Data AmeriCorps VISTA, AmeriCorps   Sept 2019-August 2020

Honors and Awards

Graduate Fellowship for STEM Diversity National Fellowship, provides funding for up to 6 years. August 2021-May 2025

Othmer Scholarship University of Nebraska-Lincoln. August 2021-August 2025

Emeritus Faculty Fellowship (awarded based on scholarship) University of Nebraska-Lincoln. November 2024

Steven Haataja Award for Outstanding Exposition by a Graduate Student University of Nebraska-Lincoln. May 2024

NSF Research Training Grant University of Georgia. Aug. 2016-May 2017, Summer 2017-19

Publications

6. K. D. Morris, T. Pllaha, C.A. Kelley, "Absorbing Sets in Quantum LDPC Codes," *Submitted*.

5. K. D. Morris, T. Pllaha, C.A. Kelley, "Effect of redundancy on syndrome-based decoding for QLDPC codes," to appear in *Proc. of IEEE International Symposium on Topics in Coding*, 2025.

4. O. Ogunkoya, K. Morris, D. Kurkcuoglu, "Investigating Parameter Trainability in the SNAP-Displacement Protocol of a Qudit System," to appear in *Physica Scripta*, 2025.

3. J.F. Chhoa, L. Huang, A. Little, A. Maurais, K. D. Morris, M.D. van der Walt, G. Verma, and Rongrong Wang, "Supervised Dimension Reduction via Local Gradient Elongation," WiSDM 2023 Springer Proceedings *Advances in Data Science*.

2. K. D. Morris, T. Pllaha, C.A. Kelley, "Analysis of syndrome-based iterative decoder failure of QLDPC codes," in *Proc. of IEEE International Symposium on Topics in Coding*, Brest, France, 5 pages, September 2023.
arXiv:2307.14532 ↗

1. G. Buhl, E. Cronk, R. Moreno, K. Morris, D. Pedroza, and J. Ryan. Matrix Completions for Linear Matrix Equations. *Involve, a Journal of Mathematics*, 10(5):781–799, 2017.
10.2140/involve.2017.10.781 ↗

Select Presentations

International Symposium on Topics in Coding (ISTC) — August 2025

UCLA
- Presentation (Invited): Effect of redundancy on syndrome-based decoding for QLDPC codes 20 min

Applied Algebra Days — June 2025

University of South Florida
- Presentation (Invited): Analysis and Improvement of QLDPC Decoding Performance, 35 min

2025 AWM Research Symposium — May 2025

University of Wisconsin-Madison
- Presentation (Invited): Quantum Error Correction using QLDPC Codes, 25 minutes

Error-Correcting Codes and Combinatorial Structures Workshop — March 2025

Eindhoven University of Technology, the Netherlands
- Presentation (Invited): Quantum LDPC Code Graphs & Decoding Challenges, 25 minutes

AMS Fall Central Sectional Meeting — September 2024

University of Texas at San Antonio
- Presentation (Invited): Failure inducing sets in Quantum LDPC Codes, 25 minutes

ISIT Quantum Information Knowledge Workshop — July 2024

Athens, Greece
- Poster (Invited): Absorbing Sets in QLDPC Codes

Virginia Tech-Swiss Coding Theory and Cryptography Workshop and Summer School — July 2024

VT Stegar Center, Switzerland
- Presentation: Absorbing Sets and Quantum LDPC Codes (5 minutes)

Department of Mathematics Seminar — April 2024

Creighton University
- Presentation (Invited): The Art of Error: An Introduction to Coding Theory, 50 minutes

AMS Spring Eastern Sectional Meeting — April 2024

Howard University
- Presentation (Invited): Absorbing Sets and Decoding Failures of QLDPC Codes, 20 minutes

Postgraduate International Coding Seminar — March 2024
- Presentation (Invited): Exploring the role of absorbing sets in syndrome decoding, 50 minutes

SIAM Texas-Louisiana Annual Meeting — November 2023

University of Louisiana at Lafayette
- Presentation (Invited): Graphical Characterization of Decoding Failures for Quantum LDPC Codes (25 minutes)

Discrete and Coding Theory Seminar — October 2023

University of Nebraska-Lincoln
- Presentation: Analysis of Graph-Based Iterative Decoders for Quantum Low Density Parity Check Codes (50 minutes)

SIAM Southeastern Atlantic Section Annual Meeting — March 2023

Virginia Tech
- Presentation (Invited): Analysis of syndrome-based iterative decoder failure of QLDPC codes (25 minutes)

Commutative Algebra Reading Seminar   March 2023

University of Nebraska-Lincoln
- Presentation: An Introduction to Algebraic Geometry Codes (30 minutes)

Math for All   February 2023

University of Colorado-Boulder
- Presentation: Absorbing Set Analysis of QLDPC Codes (20 minutes)

Graduate Student Seminar   April 2022
                                                                               August 2022
University of Nebraska-Lincoln   September 2023
- Presentation: An Introduction to Quantum Error Correction (50 minutes)
- Presentation: Quantum Computing and the Barren Plateau Phenomenon (50 minutes)
- Presentation: An Introduction to QR Codes (50 minutes)

Coding Theory Research Group   Feb 2022

University of Nebraska-Lincoln
- Presentation: An Introduction to Quantum Error Correction (50 minutes)

Graduate Student Summer Conference   July 2018
                                                                                  July 209
University of Georgia
- Presentation: An Introduction to Topological Data Analysis (15 minutes)
- Fractional Coloring (15 minutes)

Teaching Experience

Instructor of Record   August 2017-May 2019
- Courses taught: Fall 2022, Fall 2025

    - Linear Algebra (Virginia Tech)
    - Math 100A: Intermediate Algebra (UNL)
    - Calculus I (3x) (UGA)
    - Precalculus (1x) (UGA)

- Received year long classroom training in mathematics pedagogy, including theories of learning,
  DEI considerations in the classroom, and active learning

STEM CONNECT Tutor   August 2023-May 2024

University of Nebraska-Lincoln
- STEM CONNECT awards scholarships to and provides curricular and co-curricular support to
  academically talented, low-income students with interest in careers that require strong skills in
  mathematics or computer science
- Courses Served:

    - Linear Algebra (3 students)
    - Differential Equations (4 students)

Teaching Assistant   June 2023, January 2025

University of Nebraska-Lincoln
- Math 814T: Linear Algebra for High School Teachers
- ECEN 498: Quantum Programming for STEM

Co-Organizer: Graduate Teaching Assistant Orientation   August 2023

University of Nebraska-Lincoln
- Assisted in creating the schedule, selecting speakers, designing programming, and providing lo-
  gistical support for the Math Department GTA Orientation

Professional Development

VT-Swiss Coding Theory & Cryptography Summer School and Collaboration Workshop   July 2024

Virginia Tech Steger Center, Riva San Vitale, Switzerland
- Researched the construction of good quantum MDS codes.

Women in the Science of Data and Machine Learning (WiSDM) Research Workshop   August 2023

Institute for Pure and Applied Mathematics (IPAM)
- Investigated the efficacy of a certain distance metric for prediction of unlabeled data.

Rethinking Number Theory   June 2023

AIM Research Community
- Investigated using group algebras to construct linear codes with desirable properties.

EDGE Summer Program Participant   June 2016

The Enhancing Diversity in Graduate Education (EDGE) Program

Research Experience for Undergraduates (REU)   Summer 2015

California State University Channel Islands

Leadership & Service

Nebraska Conference for Undergraduate Women in Mathematics (NCUWM)   August 2023-May 2025

Organizing Committee Member and Volunteer

Postgraduate International Coding Theory Seminar (PICS) Co-Organizer   August 2024-Present

Co-organize this online seminar for graduate students and early career postdocs

Graduate Student Assembly   August 2023-May 2025

University of Nebraska-Lincoln
- Vice President of Finance, August 2024-May 2025
- Math Department Representative, August 2023-May 2024

Math Department Graduate Mentoring Program Coordinator   August 2024-May 2025

University of Nebraska-Lincoln

Discrete & Coding Theory (DISCO) Seminar Co-Organizer   August 2023-May 2024

University of Nebraska-Lincoln

Graduate Student Mentor   August 2023-May 2024

University of Nebraska-Lincoln
- Mentor for a first-year math graduate student. Meet weekly and on an as-needed basis to help support a successful transition to graduate school.
- Mentor for an undergraduate student interested in graduate school. Meet quarterly to discuss goals and career plans.

Panelist   Oct 2022
March 2022
October 2021

University of Nebraska-Lincoln
- Math Club-"Getting into Graduate School: Applications"
- Admitted Student Weekend- "Being a Math Grad Student at UNL"
- Graduate School Workshop- "Getting into Graduate School and Applying for Fellowships"

President, Vice-President, Treasurer   March 2014-May 2019

GCSU & University of Georgia
Association for Women in Mathematics Chapters

Mathematics Active Learning Team (MALT) Member   Fall 2018-Spring 2019

University of Georgia

Community Outreach

Girls Inc. Math Instructor   July 2023

University of Nebraska-Lincoln

- Designed and facilitated week-long programming for middle school girls. Led the campers through interactive mathematics activities.

AGAM: Discover Cryptography Workshop Leader   June 2023

University of Nebraska-Lincoln

- Designed and facilitated a workshop for high school students on "The Mathematics of QR Codes" as part of a week long math camp.

EvenQuads: Notable Women in Mathematics-Data Collector   February 2022

Association for Women in Mathematics

- Collected data on five notable mathematicians in pursuit of the assembly of Deck Two of Evenquads, a card game featuring woman mathematicians from the global mathematics community who have made significant contributions to the field

Athens Area Girls Math Team Coach   August 2016-April 2017

STEM Pump

- Led weekly meetings with girls in grades 1-4. Used workbooks, logic games, and puzzles to introduce new mathematical concepts, develop logic and critical thinking skills, and increase the mathematical abilities and confidence of the participants

Technology

SageMath, Python, Matlab