Qingzhong Liang

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EDUCATION

Duke University **Durham, NC**
PhD in Mathematics *Expected Graduation: May 2023*
Topic: Quantum Error Correction
Advisor: Professor Robert Calderbank

Georgia Institute of Technology **Atlanta, GA**
Algorithms, Combinatorics, and Optimization *Aug 2017 - May 2018*

University of Michigan **Ann Arbor, MI**
BSc. in Mathematics (High Honors), With Distinction *Aug 2014 - Apr 2017*

EXPERIENCE

Duke University **Durham, NC**
Research Assistant *Sep 2019 - Now*

- Characterized and constructed quantum stabilizer codes that are oblivious to coherent noise, which improved the performance of the trapped ions platform
- Developed the generator coefficient framework for diagonal gates acting on stabilizer codes; Applied this framework to characterize codes that are preserved by any diagonal gate and introduced a method of synthesizing CSS codes that realize a target logical diagonal gate at some level l in the Clifford hierarchy

Duke University **Durham, NC**
Student Officer of the Society for Industrial and Applied Mathematics (SIAM) *Aug 2019 - Now*

- Organized regular activities to help the undergraduate students to get familiar with Matlab and LaTeX
- Helped the Math Department to organize the 2021 Triangle Area Graduate Mathematics Conference (TAGMac), which was held at Duke University in November 2021

Duke University **Durham, NC**
Course Instructor *Fall 2019, Fall 2020*

- Served as the main instructor for two undergraduate calculus courses (Math 105L and Math 111L)
- Gave three 50-min lectures each week for 12 weeks, developed course materials, wrote exams, graded exams and assignments, held office hours, assigned works to TAs, and accommodated students' special requests

PUBLICATIONS

Quantum Error Correction

- **Climbing the Diagonal Clifford Hierarchy**, arXiv 2110.11923. (with Jingzhen Hu* and Robert Calderbank)
- **Quantum Channels Induced by Diagonal Gates**, arXiv 2109.13481. (with Jingzhen Hu* and Robert Calderbank)
- **Mitigating Coherent Noise by Balancing Weight-2 Z-Stabilizers**, *IEEE Transactions on Information Theory*, Early Access, ISSN 0018-9448. (with Jingzhen Hu*, Narayanan Rengaswamy, and Robert Calderbank)
- **CSS Codes that are Oblivious to Coherent Noise**, *2021 IEEE International Symposium on Information Theory (ISIT)*, 2021, pp. 1481-1486. (with Jingzhen Hu*, Narayanan Rengaswamy, and Robert Calderbank)

∗ This author and I are co-first authors

Algebraic Geometry and Combinatorics

- **Algebraic Model Selection and Experimental Design in Biological Data Science**, *Advances in Applied Mathematics*, Volume 133, 2022, 102282, ISSN 0196-8858. (with Anyu Zhang, Jingzhen Hu, Elena S Dimitrova, and Brandilyn Stigler)
- **Enumerating Parking Completions Using Join and Split**, *Electronic Journal of Combinatorics*,

Volume 27, Issue 2 (2020), Paper #P2.44. (with Ayomikun Adeniran, Steve Butler, Galen Dorpalen-Barry, Pamela E. Harris, Cyrus Hettle, Jeremy L. Martin, and Hayan Nam)

- **Gröbner bases of convex neural code ideals**, *Association for Women in Mathematics Series*, vol 21. Springer, Cham, 2020. pp 127-138. (with Kaitlyn Phillipson, Elena S. Dimitrova, Molly Honecker, and Jingzhen Hu)
- **Cyclic Sieving of Matchings**, Ars Combinatoria, Accepted in November 2019. (with Grant Bowling)
- **On the genus of a quotient of a numerical semigroup**, *Semigroup Forum* 98 (2019), no. 3, 690-700. (with Ayomikun Adeniran, Steve Butler, Colin Defant, Yibo Gao, Pamela E. Harris, Cyrus Hettle, Hayan Nam, and Adam Volk)

SKILLS

- Relevant Coursework: Quantum Information Science, Coding Theory with Application in Data Science, Data Structures and Algorithms, Statistics and Data Analysis, Bayesian Statistical Modeling, Time Series and Dynamic System, Probability, Graph Theory, Advanced Combinatorial Optimization, Abstract Algebra
- Programming Languages: C++, Python, R, Matlab, HTML/CSS
- Languages: Cantonese (native), English (fluent), Mandarin (fluent), and Swedish (elementary)

HONORS & AWARDS

The 37th Virginia Tech Regional Mathematics Contest *Oct 2015*

- Ranked 15th nationwide, ranked 1st in UM Math Department

The 75th William Lowell Putnam Mathematical Competition *Dec 2014*

- Ranked 260.5th nationwide, ranked 3rd in UM Math Department, received department award

2013 Mathematical Contest in Modeling (MCM) *Feb 2013*

- Honorable Mention

PROJECTS

Algorithms for Data Storage *Jan - May 2020*

- Studied the q-ary asymmetric lexicographically-ordered constrained (QA-LOCO) codes
- Developed an encoding-decoding algorithm for QA-LOCO codes, which reduces the required storage space as well as the data encoding complexity from linear to logarithm

CONFERENCE TALKS & WORKSHOPS

- *CSS Codes that are Oblivious to Coherent Noise*, 2021 IEEE International Symposium on Information Theory (ISIT), Melbourne, Victoria, Australia. (Remote, July 12-20 2021)
- *Stabilizer Codes Oblivious to Coherent Noise*, Kavli Quantum Coffee Hour Talk, Duke University, Durham, NC. (Remote, Nov 6 2020, presented together with Jingzhen Hu)
- Graduate Research Workshop in Combinatorics (GRWC 2018), Iowa State University, Ames, Iowa. (May 21 - June 1, 2018)
- *On a Problem of Sarnak Related to Constructing Efficient Universal Subsets of 1-Qubit Gates*, 2015 Young Mathematicians Conference, The Ohio State University, Columbus, Ohio. (August 2015)