Bryson G. Kagy — Curriculum Vitae

BgKagy@ncsu.edu — North Carolina State University

Education

2019-Present **North Carolina State University** — Raleigh, NC
PhD Advisor: Seth Sullivant
Master's in Mathematics, May 2021.
Qualifying exams in Combinatorics, Algebra, and Linear algebra/Lie Theory.

2015-2019 **Georgia Institute of Technology** — Atlanta, GA
B.S. Mathematics with Pure Mathematics concentration, May 2019.
B.S. Physics, May 2019.
Science and Math Research Training (SMaRT) Program

Research Interests

algebraic statistics, algebraic combinatorics, algebraic geometry, graph theory, cluster algebras, coexter groups dimension reduction, discrete harmonic analysis, fair division, and knot theory.

Computer Languages

Java, LaTeX, Polymake, Macaulay2, Maple, Python.

Current Research Projects

Started Fall 2022 **North Carolina State University** — Raleigh, NC
Advisor: Seth Sullivant
Investigating Phylogentic Circular networks. Specifically looking at characterizing inequality/polytope for equidistant Circular networks with the ultimate goal of exploring a tropical Network Space.

Started Spring 2022 **North Carolina State University** — Raleigh, NC
Advisor: Seth Sullivant
Generalized a characterization of idenitifibilty of phylogentic mixture mixtures models. Specifically, characterizing when the underlying model is JC, K2P, K3P, SSM instead of an underlying General Markov model.

Started Fall 2022 **North Carolina State University** — Raleigh, NC
In collaboration with Spencer Daughtery
Looking at bijections on trees between stable matchings of vertices and set partitions of edges. Ultimate goal of working towards Stanely's conjecture about the complete invariance of the chromatic polynomial of trees.

Workshops

Summer 2022 Banff International Research Station (BIRS) — Kelowna, Canada
Joint MSRI-BIRS Graduate Summer School - Sums of Squares Method in Geometry, Combinatorics and Optimization

Awards & Honors

Spring 2019 North Carolina State University — Raleigh, NC
NC State Provost Fellowship

Spring 2018 Georgia Institute of Technology — Atlanta, GA
2017-2018 School of Mathematics Outstanding Math Major Award.

Past Research Projects

Summer 2018 **Carnegie Mellon University** Pittsburgh PA
Advisor: Dr. David Offner and Dr. Jessica De Silva
Summer Undergraduate Applied Mathematics Institute (SUAMI)
Analyzed a protocol by Zeph Landau and Francis Su that ensured fair legislative districting through concepts of fair division. We proved their protocol must return a result to a party that is within 2 districts of their geometric target, a measure of fairness. Preprint at arxiv.org/abs/1811.05705.

Summer 2017 **Georgia Institute of Technology** Atlanta, GA
Advisor: Dr. Michael Lacey
Georgia Institute of Technology Impact Math REU
Created a one-bit Johnson-Lindenstrauss Lemma where just the sign of each part of the measurements is taken. We found bounds for how many one-bit measurements are required to maintain the structure between points, showing it is not more than in the linear case. Preprint at arxiv.org/abs/1903.02123.

Fall 2018 - Spring 2019 **Georgia Institute of Technology** Atlanta, GA
Advisor: Dr. Michael Lacey
Reading Course and Designing Data Analysis Course
Worked through Guth's book on Polynomial Methods and their applications to combinatorics, algebra, and incidence geometry. Planned out and complied notes to create a new course about the math of data analysis.

Conference Presentations

2019 Joint Mathematics Meeting, Poster "Fair Division for Drawing Legislative Districts"
2019 National Conference on Undergraduate Research, Talk: "Fair Division for Drawing Legislative Districts"
2018 SIAM LA-TX conference, Talk: "Fair Division for Drawing Legislative Districts"
2018 Joint Mathematics Meeting, Poster: "One-Bit Johnson-Lindenstrauss Lemma"
2017 Young Mathematicians Conference, Poster: "One-Bit Johnson-Lindenstrauss Lemma"

Teaching Experience

Summer 2020-Present **Instructor of record** Raleigh, NC
North Carolina State University
Instructor of Record for MA 111 Pre-Calculus, MA 141 Calculus 1, MA 241 Calculus 2, MA 103 Intro to Contemporary Math. Wrote and gave lectures, held office hours, wrote tests. For MA 103, chose what topics were taught which were were Voting Theory, Graph theory, Fair division, and Cryptography.

Outreach

Fall 2018-Spring 2019 **Mathapalooza Exhibit** Atlanta, GA
Event at Atlanta Science Festival 2019
Advisor: Dr. Evans Harrell
Designed a new exhibit for the Atlanta Science Festival. Mathapalooza was an immersive public event with math puzzles, stage shows and art installations aimed to foster math appreciation in Atlanta students.

Fall 2018 **Seven Bridges of Königsberg Show** Atlanta, GA
Math in Motion Exhibition
Advisor: Dr. Evans Harrell
Created and presented interactive exhibits explaining foundational concepts in graph theory. These demonstrations accompanied original composition and dance performances at public venues around Atlanta.