# SAMANTHA ALLEN

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## Research Interests

Low-dimensional topology, knot theory in dimensions three and four. In particular, the interplay between classical knot invariants and those arising from Heegaard Floer, and what it can tell us about classical knot-theoretic problems, the knot concordance group, and 3-manifolds.

## Academic Appointments

**Assistant Professor**                                                                                        August 2022 – present
Department of Mathematics and Computer Science
Duquesne University

**Limited Term Assistant Professor**                                                               August 2021 – July 2022
Department of Mathematics
University of Georgia

**John Wesley Young Research Instructor**                                                       July 2018 – July 2021
Department of Mathematics
Dartmouth College

## Education

**PhD in Mathematics** – Indiana University, Bloomington, IN                                            June 2018
**Thesis:** Relationships between the nonorientable genus and the normal Euler number of nonorientable surfaces whose boundary is a knot
**Advisor:** Charles Livingston

**BS in Mathematics** – High Point University, High Point, NC                                           May 2012
**BS in Computer Science** – High Point University, High Point, NC                                 May 2012

## Publications (preprints on following page)

7. S. Allen and C. Livingston, An Upsilon torsion function for knot Floer homology. Math. Res. Lett. **32** (2025), no. 3, 679–705.

6. S. Allen, K. İnce, S. Kim, B.M. Ruppik and H. Turner, Unknotting via null-homologous twists and multi-twists. Pacific J. Math. **330** (2024), no. 1, 25–41.

5. S. Allen, Nonorientable surfaces bounded by knots: a geography problem.
   New York J. Math. **29** (2023), 1038–1059.

4. S. Allen and J.H. Swenberg, Do Link Polynomials Detect Causality In Globally Hyperbolic Spacetimes? J. Math. Phys. **62** (2021), no. 3, 032503.

3. S. Allen and C. Livingston, Unknotting with a single twist. Enseign. Math. **66** (2020), no. 3-4, 541-589.

2. S. Allen, Concordances from differences of torus knots to $L$–space knots. Proc. Amer. Math. Soc. **148** (2020), no. 4, 1815–1827.

1. S. Allen, Using secondary Upsilon invariants to rule out stable equivalence of knot complexes. Algebr. Geom. Topol. **20** (2020), no. 1, 29–48.

## Preprints

2. S. Allen and C. Livingston, Knot primality: knot Floer homology, metacyclic representations and twisted homology. Preprint: arxiv.org/abs/2508.08102

1. S. Allen, C. Livingston, M. Temkin and C.-M. M. Wong, Using knot Floer invariants to detect prime knots. Submitted for publication. Preprint: arxiv.org/abs/2311.110898

## Awards and Grants

| | |
|---|---|
| NSF LEAPS-MPS Award DMS-2532488 | 2025–2027 |
| DU Faculty Development Fund (joint with Robert Muth) | 2025–2027 |
| AIM SQuaRE | Summers 2023, 2024 |
| Wimmer Family Foundation summer stipend | Summer 2023 |
| Wimmer Family Foundation award | Fall 2022 |
| MSRI (now SLMSI) 2022 Summer Research in Mathematics | Summer 2022 |
| NSF-AWM Travel Grant | Fall 2019 |
| Joseph & Francis Morgan Swain Fellowship, Indiana University | Spring 2018 |
| IUB Provost's Travel Award for Women in Science, Indiana University | Fall 2017 |
| Rothrock Teaching Award (for excellence in teaching), Indiana University | Spring 2015 |
| Muriel Adams Stahl Fellowship, Indiana University | Fall 2012 |

## Invited Talks

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|---|---|
| University of Pittsburgh Algebra, Combinatorics, & Geometry Seminar | February 2024 |
| Barbara T. Faires Allegheny Mountain Colloquium (MAA section) | October 2023 |
| Special Session on Progress in low-dimensional topology Association for Women in Mathematics Research Symposium | October 2023 |
| Virginia Commonwealth University Geometry Seminar | October 2022 |
| PATCH Seminar at Temple University        September 2022 Georgia Topology Conference | May 2022 |
| Georgia Tech Topology Seminar | April 2022 |
| AMS Special Session on Knots, Links, 3-manifolds, and 4-manifolds (JMM) | April 2022 |
| UGA Graduate Student Topology Seminar | November 2021 |
| University of Georgia Topology Seminar | September 2021 |
| UC Davis Geometry & Topology Seminar | May 2021 |
| Rutgers Topology Seminar | April 2021 |
| Michigan State University Geometry & Topology Seminar | March 2021 |
| AMS Special Session on Low Dimensional Topology (JMM) | January 2021 |
| Boston College Geometry/Topology/Dynamics Virtual Seminar | November 2020 |
| University of Nevada, Reno Algebraic and Geometric Topology Seminar | November 2020 |
| CKVK* Virtual Seminar | October 2020 |
| Topic group on Knots, surfaces, and 4-manifolds (NCNGT conference) | June 2020 |
| Dartmouth Mathematics Society (undergraduate club) | March 2020 |
| AMS-AWM Special Session on Women in Topology (JMM) | January 2020 |
| Special Session on Invariants of Knots, Links, and Low-dimensional Manifolds (AMS Sectional) | October 2019 |
| Knot concordance and low-dimensional manifolds, Le Croisic, France | June 2019 |
| Special Session on Invariants of Knots, Links, and Low-dimensional Manifolds (AMS Sectional) | April 2019 |
| Special Session on Algebraic, Combinatoric, and Quantum Invariants of Knots and Manifolds (AMS Sectional) | March 2018 |
| University of Virginia Geometry Seminar | February 2018 |
| University of Oregon Topology Seminar | January 2018 |

## Teaching Experience

For each of the following, I was the **instructor of record**.

**Instructor**, Duquesne University

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| Math 116 Calculus II | Spring 2024 |
| Math 215 Calculus III | Falls 2022, 2023; Spring 2023 |
| Math 311 Number Theory | Falls 2022, 2023 |
| Math 250 Foundations of Higher Mathematics | Fall 2025 |
| Math 350W History of Mathematics | Springs 2023-2025 |
| Math 411W Abstract Algebra I | Falls 2024, 2025 |
| Math 423W Topology | Spring 2025 |

**Instructor**, University of Georgia

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|---|---:|
| Math 2250 Calculus I for Science and Engineering | Fall 2021 |
| Math 2260 Calculus II for Science and Engineering | Spring 2022 |

**Instructor**, Dartmouth College

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| Math 8 Calculus of Functions of One and Several Variables | Fall 2018; Spring 2019, 2021 |
| Math 17 Intro to Math Beyond Calculus (*taught remotely*) | Spring 2020 |
| Math 22 Linear Algebra with Applications | Fall 2018 |
| Math 25 Number Theory | Fall 2019 |
| Math 31 Topics in Algebra (*taught remotely in Fall 2020*) | Fall 2019, 2020 |

**Instructor**, Indiana University

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| Math D116 Introduction to Finite Mathematics I | Fall 2017 |
| Math D117 Introduction to Finite Mathematics II | Fall 2015, 2016; Spring 2015 |
| Math J010 Introduction to Algebra | Summer 2013, 2014, 2016 |
| Math J110 Introductory Problem Solving | Summer 2015 |
| Math J111 Introduction to College Math I | Fall 2013, 2014 |
| Math M014 Basic Algebra | Spring 2014 |
| Math T101 Mathematics for Elementary Teachers | Spring 2017 |

## Mentorship

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| **Co-advisor** for three students participating in DU's Undergraduate Research Program | Summer 2025 |

Along with Robert Muth, advised research on the use of machine learning for understanding the relationship between Kleshchev multipartitions and MV-polytopes

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|---|---:|
| **Advisor** for two students participating in DU's Undergraduate Research Program | Summer 2024 |

One student designed and implemented an algorithm for finding a Seifert matrix for a knot given its PD notation. Another related determinants of spiral knots to integer sequences.

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| **Advisor** of undergraduate research project on properties of twisted torus knots. | Spring 2024 |
| **Co-advisor** of undergraduate research project for student Jacob Swenberg | Spring 2020 |

Along with Vladimir Chernov and Ina Petkova, advised research on link polynomials and causality in spacetimes. Resulted in a co-authored paper, listed above.

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| **Mentor** in the Directed Reading Program at Indiana University | Fall 2017 |

## Outreach, Service, and Other Activities

**Secretary** for the Allegheny Mountain section of the Mathematical Association of America — Ongoing

**Committee member** for the School of Science and Engineering DEI Committee — Ongoing

**Committee member** for the Department Awards Committee — Ongoing

**Referee** for journals *Topology and its Applications*, *Pacific Journal of Mathematics* and *Selecta Mathematica* — Ongoing

**Panelist** for a grant review panel at the National Science Foundation — Spring 2023

**Organizer** of Pi Day even hosted by the department and open to the university — March 2023, 2024

**Organizer** of departmental game nights for faculty and students — Springs 2023, 2024

**Panelist** at Pittsburgh Women in Mathematics and Computing Symposium (WMCS) — February 2023

**Co-organizer** of an MSRI Special Session at the Joint Mathematics Meeting — Winter 2023

**Organizer** of topic group at Nearly Carbon Neautral Geometric Topology Conference — September 2022

**Co-organizer** of the Dartmouth College Topology Seminar — Winter 2021

**Co-host** of the Math 8 Sessions of the Undergraduate Open House — September 2020

**Presenter** at The Governor's Institute of Vermont in Mathematical Sciences — June 2019, 2020
2019 topic: introduction to knot theory. 2020 topic: platonic solids, Euler, and induction.

**Member of selection committee** for the "Biographies of Contemporary Women — Winters 2019, 2020
in Mathematics" essay contest sponsored by the Dartmouth Mathematics Department

**Judge** for the Dartmouth Math Department's Undergraduate Poster Session — Spring 2019

**Co-organizer** of Sonia Kovalesky Math Day at Dartmouth College — Spring 2019

**Volunteer** at IU Science Fest — Falls 2015, 2017

**Volunteer** at Math and Science Night at McCormick's Creek Elementary School — Spring 2017

**Tutor** in the Women in STEM Living-Learning Center — Spring 2014 – Spring 2015

## Professional Development

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| Participant in Research Experience for Undergraduate Teachers at ICERM | June 2025 |
| Participant in CTE's Inspired Teaching Retreat | May 2025 |
| Participant in online Philadelphia Area (Contact) Topology Seminar | AY 2024-2025 |
| Attended MAA Allegheny Mountain Section Meeting | March 2025 |
| Participant in Braids Reunion Workshop at ICERM | July 2024 |
| Attended conference on Combinatorial and Gauge theoretical methods in low dimensional topology and geometry at Centro di Ricerca de Matematica in Pisa, Italy | June 2024 |
| Attended MAA Allegheny Mountain Section Meeting | April 2024 |
| Participant in CTE discussion on "Mentoring Underrepresented Students in STEMM" | March 2024 |
| Attended CTE Micro-Workshop on Transparent Assignment Design | October 2023 |
| Attended Allegheny Mountain Section NExT Workshop | September 2023 |
| Participant in the CTE book study on Inclusive Teaching | Spring 2023 |
| Attended CTE Micro-Workshop on Cultivating Student Feedback | February 2023 |
| Certificate in Diversity and Inclusion at UGA (completed) | Spring 2022 |
| Attended the Georgia Topology Conference | June 2021 |
| Participant in the AIM 4-dimensional Topology virtual research community | Spring 2021 |
| Attended the Simons Center workshop on Floer homology in low-dimensional topology | January 2021 |
| Attended the Joint Mathematics Meetings of the AMS and MAA | January 2021 |
| Attended the Tech Topology Conference (Georgia Tech) | December 2020 |
| Attended the ICERM workshop Perspectives on Dehn Surgery | July 2019 |
| Attended the Workshop in Geometric Topology (Calvin College) | June 2018 |
| Attended the Joint Mathematics Meetings of the AMS and MAA | January 2018 |
| Attended the UCLA Topology Conference 2018 | January 2018 |
| Attended the Banff workshop on Thirty Years of Floer Theory for 3-Manifolds | July 2017 |

## Programming and Other Skills

Proficient in LaTeX, Mathematica, Python

Familiar with MATLAB, C++

Teaching experience in the use of:

Canvas and Brightspace (LMS),

Zoom (for teaching & collaboration),

TechSmith Relay and Kaltura (for video capture and editing),

WeBWorK and WebAssign (online homework systems), and

Gradescope (for grading in the remote setting).