

# SAMANTHA ALLEN

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## Research Interests

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Geometric 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

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### Assistant Professor

August 2022 – present

Department of Mathematics and Computer Science  
Duquesne University

### Limited Term Assistant Professor

August 2021 – July 2021

Department of Mathematics  
University of Georgia

### John Wesley Young Research Instructor

July 2018 – July 2021

Department of Mathematics  
Dartmouth College

## Education

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### 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

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4. *Do Link Polynomials Detect Causality In Globally Hyperbolic Spacetimes?* Joint with Jacob H. Swenberg. J. Math. Phys. 62 (2021), no. 3, 032503. arXiv version: [arxiv.org/abs/2011.09415](https://arxiv.org/abs/2011.09415)
3. *Unknotting with a single twist.* Joint with Charles Livingston. Enseign. Math. 66 (2020), no. 3-4, 541-589. arXiv version: [arxiv.org/abs/2005.10717](https://arxiv.org/abs/2005.10717)
2. *Concordances from differences of torus knots to  $L$ -space knots.* Proc. Amer. Math. Soc. 148 (2020), no.4, 1815-1827. arXiv version: [arxiv.org/abs/1710.10664](https://arxiv.org/abs/1710.10664)
1. *Using secondary Upsilon invariants to rule out stable equivalence of knot complexes.* Algebr. Geom. Topol. 20 (2020), no. 1, 29-48. arXiv version: [arxiv.org/abs/1706.07108](https://arxiv.org/abs/1706.07108)

## Preprints

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3. *Unknotting via null-homologous twists and multi-twists.* Joint with Kenan İnce, Seungwon Kim, Benjamin Matthias Ruppik, and Hannah Turner. Submitted for publication. Preprint: [arxiv.org/abs/2211.04621](https://arxiv.org/abs/2211.04621)
2. *An Upsilon torsion function for knot Floer homology.* Joint with Charles Livingston. Submitted for publication. Preprint: [arxiv.org/abs/2208.04768](https://arxiv.org/abs/2208.04768)
1. *Nonorientable surfaces bounded by knots: a geography problem.* Accepted for publication at NYJM. Preprint: [arxiv.org/abs/2007.14332](https://arxiv.org/abs/2007.14332)

## Invited Talks

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Barbara T. Faires Allegheny Mountain Colloquium	October 2023
AWM 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

## Professional Development

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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 in Oaxaca, Mexico	July 2017

## Awards and Grants

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AIM SQuaRE	Summer 2023
Wimmer Award	Fall 2022
MSRI 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
Best in Undergraduate Research, Mid-Southeast ACM Conference	November 2011

## Teaching Experience

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

### **Instructor**, Duquesne University

Math 215 Calculus III	Falls 2022, 2023; Spring 2023 (ongoing)
Math 311 Number Theory	Falls 2022, 2023 (ongoing)
Math 350 History of Mathematics	Spring 2023

### **Instructor**, University of Georgia

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

### **Instructor**, Dartmouth College

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

### **Instructor**, Indiana University

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

\*Part of the Groups Scholars program.

(Established to address low college attendance rates among underrepresented students at IU. Eligible students are the first in their family to attend college with limited financial resources from all racial backgrounds.)

## Mentorship

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- Co-advisor** of undergraduate research project for student Jacob Swenberg Spring & Summer 2020  
Along with Vladimir Chernov and Ina Petkova, advised undergraduate student in research on link polynomials and causality in spacetimes. Culminating in a co-authored paper, listed above.
- Mentor** in the Directed Reading Program at IU Fall 2017  
Advised an advanced undergraduate student in a Graph Theory independent reading project, culminating in a short, seminar-style presentation to his peers.

## Programming and Other Skills

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Proficient in  $\text{\LaTeX}$ , Mathematica, C++  
Familiar with MATLAB, Python  
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).

## Outreach, Service, and Other Activities

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- Committee member** for the School of Science and Engineering Diversity, Equity, and Inclusion Committee Ongoing
- Committee member** for the Department Awards Committee Ongoing
- Referee** for journals *Topology and its Applications* and *Pacific Journal of Mathematics* Ongoing
- Co-organizer** of an MSRI Special Session at the Joint Mathematics Meeting Winter 2023
- Co-organizer** of the Dartmouth College Topology Seminar Winter 2021
- Co-host** of the Math 8 Sessions of the Undergraduate Open House September 2020  
Served the department by co-hosting two question-and-answer sessions about Math 8 (a part of the calculus sequence) for incoming freshmen.
- Presenter** at The Governor's Institute of Vermont in Mathematical Sciences June 2019, 2020  
Taught an interactive class to high school students.  
2019 topic: introduction to knot theory.  
2020 topic: platonic solids, Euler, and induction.
- Member of selection committee** for the "Biographies of Contemporary Women in Mathematics" essay contest Winters 2019, 2020  
This essay contest (sponsored by the Dartmouth Mathematics Department) asks middle school, high school, and undergraduate students to interview and write a biography about a contemporary woman working in a field related to mathematics.
- Judge** for the Dartmouth Math Department's Undergraduate Poster Session Spring 2019
- Co-organizer** of Sonia Kovalesky Math Day at Dartmouth College Spring 2019  
Co-organized and ran a cryptography workshop for middle and high school girls and their teachers. Participated in the panel discussion as the postdoc representative.
- 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  
Tutored students living in the Women in STEM dormitory (all women majoring in STEM fields) in various math, physics, and computer science courses.

## Memberships

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Member of the American Mathematical Society  
Member of the Association for Women in Mathematics