

## Employment

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### Assistant Professor

THE UNIVERSITY OF KENTUCKY, DEPARTMENT OF MATHEMATICS

2024 – present

### Golomb Visiting Assistant Professor

PURDUE UNIVERSITY, DEPARTMENT OF MATHEMATICS

2021 – 2024

## Education

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### The University of Texas at Austin

Ph.D. IN MATHEMATICS

2021

Thesis: “Taking topological field theory at phase value,” advised by Daniel Freed.

### Stanford University

B.S. IN MATHEMATICS WITH HONORS

2015

Thesis: “Modular Representation Theory and the CDE Triangle,” advised by Akshay Venkatesh.

## Publications and Preprints

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### Published

1. (with Sam Gunningham) The Arf-Brown TQFT of Pin<sup>-</sup> Surfaces. In *Topology and Quantum Theory in Interaction*, Contemp. Math. volume 718, pp. 49–87. 2018. ([arXiv:1803.11183](https://arxiv.org/abs/1803.11183)).
2. The low-energy TQFT of the generalized double semion model. Comm. Math. Phys. volume 375, issue 2, pp. 1079–1115. 2020. ([arXiv:1811.03583](https://arxiv.org/abs/1811.03583)).
3. Stable diffeomorphism classification of some unorientable 4-manifolds. Bull. London Math. Soc. volume 54, issue 6, pp. 2219–2231. 2022. ([arXiv:2102.03965](https://arxiv.org/abs/2102.03965)).
4. (with Markus Dierigl, Jonathan J. Heckman, and Miguel Montero) The anomaly that was not meant IIB. Fortschr. Phys. volume 70, issue 1. 2022. ([arXiv:2107.14227](https://arxiv.org/abs/2107.14227)).
5. (with Yu Leon Liu and Christoph Weis) Constructing the Virasoro groups using differential cohomology. Int. Math. Res. Not. IMRN, volume 2023, number 21, pp. 18537–18574. 2023. ([arXiv:2112.10837](https://arxiv.org/abs/2112.10837)).
6. (with Ivano Basile, Matilda Delgado, and Miguel Montero) Global anomalies & bordism of non-supersymmetric strings. J. High Energy Physics volume 2024, number 92, 2024 ([arXiv:2310.06895](https://arxiv.org/abs/2310.06895)).
7. (with Matthew Yu) What bordism-theoretic anomaly cancellation can do for U. Comm. Math. Phys. volume 405, issue 7. 2024. ([arXiv:2210.04911](https://arxiv.org/abs/2210.04911)).
8. Bordism for the 2-group symmetries of the heterotic and CHL strings. In *Higher Structures in Geometry, Topology and Physics*, Contemp. Math. volume 802, pp. 227–297, 2024. ([arXiv:2304.14764](https://arxiv.org/abs/2304.14764)).
9. (with Markus Dierigl, Jonathan J. Heckman, and Miguel Montero) The Chronicles of IIBordia: Dualities, Bordisms, and the Swampland. Adv. Theor. Math. Phys. volume 28, number 3, pp. 805–1025. 2024. ([arXiv:2302.00007](https://arxiv.org/abs/2302.00007)).
10. (with Cameron Krulewski) Smith homomorphisms and Spin<sup>h</sup> structures. Proc. Amer. Math. Soc. volume 152, number 2, pp. 897–912. 2025. ([arXiv:2406.08237](https://arxiv.org/abs/2406.08237)).
11. (with Sanath K. Devalapurkar, Cameron Krulewski, Yu Leon Liu, Natalia Pacheco-Tallaj, and Ryan Thorngren) A Long Exact Sequence in Symmetry Breaking: order parameter constraints, defect anomaly-matching, and higher Berry phases. J. High Energy Physics, volume 2025, number 7, 2025 ([arXiv:2309.16749](https://arxiv.org/abs/2309.16749)).
12. (with Weicheng Ye and Matthew Yu) Bosonization and Anomaly Indicators of (2+1)-D Fermionic Topological Orders. Comm. Math. Phys. volume 406, number 178. 2025 ([arXiv:2312.13341](https://arxiv.org/abs/2312.13341)).

### Accepted

13. (with Sanath K. Devalapurkar, Cameron Krulewski, Yu Leon Liu, Natalia Pacheco-Tallaj, and Ryan Thorngren) The Smith Fiber Sequence of Invertible Field Theories. Accepted for publication, Comm. Math. Phys. 2024. ([arXiv:2405.04649](https://arxiv.org/abs/2405.04649)).

14. (with Noah Braeger, Markus Dierigl, Jonathan J. Heckman, and Miguel Montero) Cobordism Utopia: U-Dualities, Bordisms, and the Swampland. Accepted for publication, Adv. Theor. Math. Phys. 2025 ([arXiv:2505.15885](https://arxiv.org/abs/2505.15885)).

## Submitted

15. Invertible phases for mixed spatial symmetries and the fermionic crystalline equivalence principle, 2021 ([arXiv:2102.02941](https://arxiv.org/abs/2102.02941)).
16. (with Matthew Yu) Adams spectral sequences for non-vector-bundle Thom spectra, 2023 ([arXiv:2305.01678](https://arxiv.org/abs/2305.01678)).
17. (with Omar Antolín Camarena, Cameron Krulewski, Natalia Pacheco-Tallaj, Daniel Sheinbaum, and Luuk Stehouwer) Weak topological phases in the presence of interactions, 2024 ([arXiv:2410.10031](https://arxiv.org/abs/2410.10031)).
18. (with Matthew Yu) Type IIA string theory and  $tmf$  with level structure, 2024 ([arXiv:2411.07299](https://arxiv.org/abs/2411.07299)).
19. (with Weicheng Ye and Matthew Yu) Global Structure in the Presence of a Topological Defect, 2025 ([arXiv:2501.18399](https://arxiv.org/abs/2501.18399)).
20. (with Vivek Chakrabhavi, Markus Dierigl, and Jonathan J. Heckman) Exploring Pintopia: Reflection Branes, Bordisms, and U-Dualities, 2025 ([arXiv:2509.03573](https://arxiv.org/abs/2509.03573)).

## Preprints (will be submitted)

21. (with Weicheng Ye and Matthew Yu) How to Build Anomalous (3+1)d Topological Quantum Field Theories, 2025 ([arXiv:2510.24834](https://arxiv.org/abs/2510.24834)).

## OTHER WORKS

- Appendix to “Topological Superconductors on Superstring Worldsheets” by Justin Kaidi, Julio Parra-Martinez, and Yuji Tachikawa. SciPost Phys. volume 9, issue 1, 2020 ([arXiv:1911.11780](https://arxiv.org/abs/1911.11780)).
- (with Søren Galatius and Martin Palmer) Appendix to “Lectures on Invertible Field Theories” by Søren Galatius. In *Quantum field theory and manifold invariants*, edited by Daniel S. Freed, Sergei Gukov, Ciprian Manolescu, Constantin Teleman and Ulrike Tillmann. IAS/Park City Mathematics Series volume 28, 2021 ([arXiv:1912.08706](https://arxiv.org/abs/1912.08706)).
- Appendix to “Toric 2-group anomalies via cobordism” by Joe Davighi and Nakarin Lohitsiri. J. High Energ. Phys. volume 2023, issue 19. 2023. ([arXiv:2302.12853](https://arxiv.org/abs/2302.12853)).

## Books

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1. (edited jointly with Araminta Amabel and Peter Haine) *Differential Cohomology: Categories, Characteristic Classes, and Connections*, 2021 ([arXiv:2109.12250](https://arxiv.org/abs/2109.12250)). Under contract with Cambridge University Press.

## Encyclopedia Articles

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1. Differential cohomology, *Encyclopedia of Mathematical Physics* 2nd ed., Ed. Richard Szabo and Martin Bojowald, Academic Press, 2025. ([arXiv:2312.14338](https://arxiv.org/abs/2312.14338)).

## Talks

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October 2025	<b>The hastened Adams spectral sequence for supercohomology</b> , AMS Fall Central Sectional Meeting, Special Session on Homotopy Theory
September 2025	<b>The hastened Adams spectral sequence for supercohomology</b> , Electronic Computational Homotopy Theory research seminar (Zoom)
April 2025	<b>The Diaconescu-Moore-Witten anomaly and topological modular forms with level structure</b> , ZMP Physics Colloquium, Hamburg (Zoom)
October 2024	<b>String<sup>h</sup> structures and Diaconescu-Moore-Witten anomalies</b> , Anomalyology seminar (Zoom)
June 2024	<b>Anomaly cancellation in string theory using homotopy theory</b> , String Math 2024, ICTP
March 2024	<b>Bosonization and anomalies of 3d fermionic topological orders</b> , Conference on Higher Categorical Tools for Quantum Phases of Matter, Perimeter
January 2024	<b>Anomalies and generalized cohomology</b> , The University of Kentucky
December 2023	<b>Anomaly indicators for symmetries of 3d spin TFTs</b> , Perimeter Institute (online)
October 2023	<b>Constructing the Virasoro groups with differential cohomology</b> , Wichita State/Texas Tech Topology and Geometry Seminar (online)
July 2023	<b>The twisted Wu formula</b> , Young Faculty Speaker, Graduate Student Topology and Geometry Conference (online)
June 2023	<b>From Borel-equivariant bordism to the fermionic crystalline equivalence principle</b> , Equivariant Bordism Theory and Applications, Casa Matemática Oaxaca
May 2023	<b>IIBordia</b> , (joint with Jonathan J. Heckman), Swampland Seminar (online)
May 2023	<b>Spectral sequences (5-lecture series)</b> , Atlantic TQFT Spring School

April 2023	<b>The twisted Wu formula and Adams spectral sequences for non-vector-bundle Thom spectra</b> , Midwest Topology Seminar
April 2023	<b>Non-vector-bundle Thom spectra and applications to anomalies</b> , Perimeter Institute Mathematical Physics Seminar
March 2023	<b>Twisted string bordism and a potential anomaly in <math>E_8 \times E_8</math> heterotic string theory</b> , Geometric/Topological Quantum Field Theories and Cobordisms 2023, NYU Abu Dhabi
January 2023	<b>Algebraic topology and the Swampland</b> , UT Austin Geometry Seminar
January 2023	<b>Review of anomalies and invertible field theories</b> , (joint with Matthew Yu), Global Categorical Symmetries Postdoc and Graduate Student Colloquium (online)
October 2022	<b>Computing anomalies of theories of supergravity using bordism</b> , Higher Structures & Field Theory Seminar (online)
June 2022	<b>Anti-unitary symmetries of 3d finite abelian spin gauge theories</b> , Perimeter Institute Conference on Global Categorical Symmetries Gong Show
May 2022	<b>Introduction to cobordism theory (3-lecture series)</b> , Geometric Aspects of the Swampland conference, Madrid
November 2021	<b>The anomaly of the duality symmetry in type IIB string theory</b> , Perimeter Institute Math Physics Seminar (online)
July 2021	<b>Invertible phases for mixed spatial symmetries</b> , Higher Structures in QFT and String Theory Gong Show (online)
July 2021	<b>Modeling invertible topological phases of matter using homotopy theory</b> , Harvard Center of Mathematical Sciences and Applications Interdisciplinary Science Seminar (online)
June 2021	<b>From bordism groups to crystalline SPT phases</b> , TopFlavours (online)
June 2021	<b>Stable diffeomorphism classification of some unorientable 4-manifolds</b> , (Online) Workshop in Geometric Topology
March 2021	<b>Stable diffeomorphism classification of some unorientable 4-manifolds</b> , MIT Topology Seminar (online)
November 2020	<b>Two Physics Applications of Invertible Field Theories</b> , Harvard Center of Mathematical Sciences and Applications Special Seminar (online)
August 2020	<b>From Crystalline Topological Phases of Matter to Bordism</b> , Graduates Reminisce Online On Topology Summer Seminar
April 2020	<b>What: Bordism groups. Why: Condensed-matter physics. How: The Adams spectral sequence.</b> , Graduate Online Anything Topology Series
April 2020	<b>Topological Phases and Topological Field Theories</b> , Mathematical Sciences Research Institute Grad Student Seminar (online)
March 2020	<b>Topological Phases and Topological Field Theories</b> , Johns Hopkins Topology Seminar
July 2019	<b>The low-energy TQFT of the generalized double semion model</b> , Park City Mathematics Institute Research Program 2019
August 2018	<b>The low-energy TQFT of the generalized double semion model</b> , Conference on Higher Algebra and Mathematical Physics, Perimeter Institute
November 2017	<b>The low-energy TQFT of the generalized double semion model</b> , Contributed talk, Texas Analysis and Mathematical Physics Symposium
January 2017	<b>Lattice models and TQFTs</b> , AT&T Foundry Palo Alto weekly seminar series

## Service

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### Committee work, University of Kentucky

2024–present

Member of the Access, Community, and Engagement and Topology Prelim committees.

### Purdue Topology Seminar

2022–24

Organizer.

### Co-organizer: UT summer mini-courses

2020, 2021

Co-organized a program of several week-long online math mini-courses run by and for graduate students.

### Teacher: UT summer mini-courses

2017, 2018, 2019, 2020, 2021

Taught week-long mini-courses on subjects including characteristic classes, topological field theory, and spectral sequences for grad students.

## **UT Math Club**

Spoke at UT Austin's undergraduate math club on SET and maximal caps; cohomology; and Frobenius algebras and TQFTs.

Fall 2015, Spring 2016, Fall 2016,

Fall 2019, Spring 2021

## **Teaching assistant: Park City Mathematics Institute**

TA for Søren Galatius' course on invertible field theories for grad students.

Summer 2019

## **10/8 theorem learning seminar**

Co-organized a learning seminar at UT Austin on Furuta's proof of the 10/8 theorem.

Spring 2019

## **Homotopy theory learning seminar**

Co-organized a learning seminar at UT Austin on the Adams-Novikov spectral sequence.

Fall 2018

## **Saturday Morning Math Group**

Gave a talk to high schoolers about the mathematics of SET.

Fall 2018

## **Gromov-Witten theory learning seminar**

Co-organized a learning seminar at UT Austin on Gromov-Witten theory.

Spring 2018

## **Quantum topology and categorification learning seminar**

Co-organized a learning seminar at UT Austin on Chern-Simons theory, the Jones polynomial, and Khovanov homology.

Spring 2017

## **Student geometry seminar, UT Austin**

Organizer.

Fall 2016, Fall 2017

## **A-Star Math Tournament**

Head proctor and co-organizer.

2015

## **Berkeley Math Tournament**

Proctor and grader.

2012, 2015

## **Stanford Math Tournament**

Head proctor, proctor, and problem writer.

2012, 2013, 2014

## **American Regions Math League (ARML)**

Coached the San Francisco-Bay Area A2 team.

2012

## **Teaching experience**

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### **Instructor of Record**

THE UNIVERSITY OF KENTUCKY

2024–25

MA114 (Calculus II), MA214 (Calculus IV), MA322 (Matrix algebra, honors section), MA351 (Undergraduate topology I), MA551 (Graduate topology I)

### **Instructor of Record**

PURDUE UNIVERSITY

2021–24

MA265 and MA351 (linear algebra) as well as MA266 (differential equations).

### **Wolverine Pathways Summer Institute**

THE UNIVERSITY OF MICHIGAN, ANN ARBOR

Summer 2023

Wolverine Pathways is a college preparatory program for students from under-served communities in the southeast Michigan area. In my role as a teacher for the Summer Institute, I helped develop the curriculum of the Summer Institute and worked with rising high school seniors on topics including modular arithmetic, trigonometry, and an introduction to topology and geometry.

### **Teaching Assistant**

THE UNIVERSITY OF TEXAS AT AUSTIN

Fall 2020, Spring 2021

TAed UT's grad algebraic topology and differential topology courses, including grading problem sets.

### **Supplemental Instruction (SI) Teaching Assistant**

THE UNIVERSITY OF TEXAS AT AUSTIN

Fall 2016, Fall 2017, Fall 2018

- M408N: Differential Calculus for Science
- M408L: Integral Calculus
- Taught in a “flipped classroom,” teaching sections, holding office hours, and participating in the Sanger Learning Center SI Program.

**Directed Reading Program Mentor**

THE UNIVERSITY OF TEXAS AT AUSTIN

*Spring 2016 – Spring 2021*

- Mentored undergraduates on projects including lattice-based cryptography, point-set topology, symplectic geometry, and cobordism.

**Math 50 Series Tutor**

STANFORD UNIVERSITY

*Winter 2013 – Spring 2015*

- Tutored linear algebra, multivariable calculus, and differential equations.