

Contact Information:

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Research Interests: Tensor categories, higher categories and their applications in topological phases of matter, conformal field theory, and operator algebras.

Employment/Education:

- 2020- Present **North Carolina State University**, Assistant Professor.
- 2018-2020 **The Ohio State University**, Zassenhaus Assistant Professor (Postdoc).
Faculty mentor: [David Penneys](#)
- 2016-2018 **Australian National University**, Postdoctoral fellow.
Faculty mentor: [Scott Morrison](#)
- 2011-16 **Vanderbilt University**, Ph.D. in Mathematics (May 2016).
Advisor: [Vaughan F.R. Jones](#)
Dissertation: “Annular representation theory with applications to approximation and rigidity properties for rigid C^* -tensor categories”
- 2007-11 **The University of North Carolina Asheville**, B.A. in Mathematics (May 2011).

Funding:

- PI, [NSF Standard Grant DMS 1901082](#), “Applications of Tensor Categories in Operator Algebras,” 07/01/2019-06/30/2022.
- Co-PI with Henri Moscovici and David Penneys, [NSF Standard Grant DMS 1936283](#), (Conference) “2019 East Coast Operator Algebra Symposium,” 09/01/2019-8/31/2020.

Publications:

1. *Rank-finiteness for G -crossed braided fusion categories* (with Scott Morrison, Eric C. Rowell, and Dmitri Nikshych). To appear in **Transform. Groups**. [arXiv:1902.06165](#).
2. *Fusion rules for $\mathbb{Z}/2\mathbb{Z}$ permutation gauging* (with Cain Edie-Michell and Julia Plavnik). **J. Math. Phys.** 60 (2019). [DOI:10.1063/1.5117843](#), [arXiv:1804.01657](#).
3. *Realizations of algebra objects and discrete subfactors* (with David Penneys). **Adv. Math.** 350 (2019), 588–661, [DOI:10.1016/j.aim.2019.04.039](#), [arXiv:1704.02035](#).
4. *Spontaneous symmetry breaking from anyon condensation* (with Marcel Bischoff, Yuan-Ming Lu, and David Penneys). **J. High Energy Phys.** (2019). [DOI:10.1007/JHEP02\(2019\)062](#), [arXiv:1811.00434](#).
5. *Fusing Binary Interface Defects in Topological Phases: The $\text{Vec}(\mathbb{Z}/p\mathbb{Z})$ case* (with Daniel Barter and Jacob C. Bridgeman). To appear in **J. Math. Phys.** [arXiv:1810.09469](#).
6. *Domain walls in topological phases and the Brauer-Picard ring for $\text{Vec}(\mathbb{Z}/p\mathbb{Z})$* (with Daniel Barter and Jacob C. Bridgeman). **Comm. Math. Phys.** (2019). [DOI:10.1007/s00220-019-03338-2](#), [arXiv:1806.01279](#).

7. *Vanishing of categorical obstructions for permutation orbifolds* (with Terry Gannon). **Comm. Math. Phys.** (2019). DOI:10.1007/s00220-019-03288-9, arXiv:1804.08343.
8. *Annular representations of free product categories* (with Shamindra Kumar Ghosh and Madhav B Reddy). To appear in **J. Noncomm. Geom.** arXiv:1803.06817.
9. *Free oriented extensions of subfactor planar algebras* (with Shamindra Kumar Ghosh and Madhav B Reddy). **Internat. J. Math.** 29 (2018), no. 13, 33 pp. DOI:10.1142/S0129167X18500933, arXiv:1805.08971.
10. *Eigenvalues of rotations and braids in spherical fusion categories* (with Daniel Barter and Henry Tucker). **J. Algebra**, 515 (2018), pp. 52-76. DOI:10.1016/j.jalgebra.2018.08.011, arXiv:1611.00071.
11. *Classification of Thurston-relation subfactor planar algebras* (with Zhengwei Liu and Yunxiang Ren). **Quantum Topol.** 10 (2019), no. 3, 481–480. arXiv:1606.00779.
12. *Operator algebras in rigid C^* -tensor categories* (with David Penneys). **Comm. Math. Phys.** 355 (2017), no. 3, 1121–1188, arXiv:1611.04620.
13. *Quantum G_2 categories have property (T)*. **Internat. J. Math.** 27 (2016), no. 2, 1650015, 23 pp. MR3464395, arXiv:1504.08338.
14. *Annular representation theory for rigid C^* -tensor categories* (with Shamindra Kumar Ghosh). **J. Funct. Anal.** 270 (2016), no. 4, 1537–1584, arXiv:1502.06543.
15. *Q -systems and compact W^* -algebra objects* (with David Penneys). To appear in **Contemporary Mathematics Series** (Peer reviewed conference proceedings). arXiv:1707.02155.
16. *Discrete homotopy theory and critical values of metric space* (with Jim Conant, Victoria Curnutte, Conrad Plaut, Kristen Pueschel, Maria Lusby, and Jay Wilkins). **Fund. Math.** 227 (2014), no.2, 97–128, arXiv:1205.2925.

Preprints:

1. *Triangle presentations and tilting modules for SL_{2k+1}* . arXiv:2005.07172.
2. *Extension theory for braided-enriched fusion categories* (with Scott Morrison, David Penneys, and Julia Plavnik). arXiv:1910.03178.
3. *Computing fusion rules for spherical G -extensions of fusion categories* (with Marcel Bischoff). arXiv:1909.02816.

Organizational Activities:

- (With Thomas Kerler and David Penneys) [Quantum Algebra and Quantum Topology Seminar](#), Ohio State University, Autumn 2018-Present.
- (With David Penneys) [OSU Summer Research Program on Quantum Symmetries](#), 3 -14 June, 2019.
- (With David Penneys and Henri Moscovici) [East Coast Operator Algebras Symposium](#), 12-13 October 2019.

Invited Talks:

- *Triangle presentations and tilting modules for SL_{2k+1}* . Lie Theory Seminar, Universidad Nacional de Cordoba. 13 July, 2020.

- *Rank finiteness for braided fusion categories.* Subfactor Seminar, Vanderbilt University, 24 April, 2020.
- *Vanishing of categorical obstructions for permutation orbifolds.* AMS Special Session on Mathematical Aspects of Conformal Field Theory, Joint Mathematics Meetings Denver, CO. 18 January 2020.
- *Braided tensor categories from finite von Neumann algebras.* AMS Special Session on Advances in Operator Algebras, Joint Mathematics Meetings Denver, CO. 17 January 2020.
- *Fusion categories and their applications in mathematical physics.* Special seminar, North Carolina State University. 10 January, 2020.
- *The higher dimensional algebra of matrix product operators and quantum spin chains.* Mathematical Physics and Operator Algebras Seminar, Michigan State University. 26 September, 2019.
- *Vanishing categorical obstructions for permutation orbifolds.* Algebra and Combinatorics Seminar, North Carolina State University. 9 Septmeber, 2019.
- *A survey of G -crossed braided fusion categories.* Operator Algebras and Applications, Simons Center for Geometry and Physics. 17-21 June, 2019.
- *Spontaneous symmetry breaking from anyon condensation.* Noncommutative Geometry and Operator Algebras Spring Institute 2019, Vanderbilt University. 6 May 2019.
- *Generalized crossed products and discrete subfactors.* Linear Anlalysis Seminar, Texas A & M. 22 February, 2019.
- *Spontaneous symmetry breaking from anyon condensation.* Fusion categories and Subfactors, Banff International Research Station. 16 October, 2018.
- *Generalized crossed products and discrete subfactors.* East Coast Operator Algebra Symposium, Texas Christian University. 13 October, 2018.
- *Vanishing categorical obstructions for permutation orbifolds.* Subfactor seminar, Vanderbilt University. 12 October, 2018.
- *Braided tensor categories associated to von Neumann algebras.* Subfactors in Maui. 21 May, 2018.
- *$\mathbb{Z}/2\mathbb{Z}$ permutation gauging of modular tensor categories.* Algebra seminar, University of Sydney. 20 October, 2017.
- *Operator algebras in rigid C^* -tensor categories.* Differential geometry seminar, University of Adelaide. 6 October, 2017.
- *A categorical approach to discrete subfactors.* Quantum symmetries: Subfactors and planar algebras, Maui. 19 July, 2017.
- *Subfactors and quantum symmetry.* Mathematical Sciences Institute Colloquium, Australian National University. 27 April, 2017.
- *Discrete subfactors as generalized crossed products.* Operator algebra and noncommutative geometry seminar, University of Wollongong. 20 April, 2017.
- *Operator algebras in rigid C^* -tensor categories.* Structure of operators algebras: subfactors and fusion categories, Isaac Newton Institute, Cambridge. 23 January, 2017.
- *Operator algebras in rigid C^* -tensor categories.* Analysis seminar, University of Glasgow. 17 January, 2017.
- *Classification of planar algebras by skein theory.* Noncommutative geometry seminar, The Ohio State University. 8 September, 2016.
- *Frobenius-Schur indicators and rotation eigenvalues for pivotal tensor categories.* Quantum Mathematics Meeting, Australian National University. 5 August, 2016.
- *Annular representation theory and analytic properties for rigid C^* -tensor categories.* NCGOA 2016, Hausdorff Institute for Mathematics, Bonn. 20 May, 2016.

- *Rigid C^* -tensor category and their analytic properties.* Seminar in Operator Theory and Operator Algebras, University of Virginia. 19 April, 2016.
- *Quantum G_2 categories have property (T).* Functional Analysis Seminar, University of California, Los Angeles. 24 February, 2016.
- *Planar algebras and tensor categories.* Invited lectures, Indian Statistical Institute, Kolkata. January, 2016.
- *Analytical properties for tensor categories.* AMS Southeastern Sectional Meeting, Memphis TN. 17 October, 2015.
- *Quantum G_2 categories have property (T).* Subfactor Seminar, Vanderbilt University. 25 September, 2015.
- *The tube algebra and representation theory of categories.* Subfactors and Conformal Field Theory, Oberwolfach Institute. March, 2015.
- *Representations and Universal Norm for the Tube Algebra of Rigid C^* -tensor categories.* Subfactor Seminar, Vanderbilt University. 23 January, 2015.
- *Representations and Universal Norm for the Tube Algebra of Rigid C^* -tensor categories, II.* Subfactor Seminar, Vanderbilt University. 30 January, 2015.
- *The Drinfeld center and affine annular representations of a planar algebra.* Subfactors in Maui. July, 2013.

Visiting Scholar:

- **Isaac Newton Institute for the Mathematical Sciences**, Cambridge, England, January 2017, [Programme on Operator Algebras: Subfactors and their Applications](#).
- **Indian Statistical Institute**, (ISI), Kolkatta, India, January 2016, Host researcher: Shamindra Kumar Ghosh.

Academic Awards:

1. [B.F. Bryant Prize for Excellence in Teaching](#), Vanderbilt University, 2016.
2. [Bjarni Jonsson Prize for Research](#), Vanderbilt University, 2016.

Teaching:

2018-2020: Ohio State University.

- Instructor, Linear Algebra (Math 2568).
- Instructor, Discrete Mathematics (Math 2366).
- Instructor, Mathematical Topics for Engineers (2177).

2016-2018: Australian National University.

- Instructor, reading course on Hopf algebras and tensor categories.

2011-2016: Vanderbilt University.

- Instructor, Calculus II (Math 1301).
- Teaching assistant, Calculus I (Math 1200, 1300).
- Teaching assistant, Calculus II (Math 1301).
- Teaching assistant, Differential Equations and Linear Algebra.

Academic Service:

- Practice and Pedagogy Leader, Teaching Assistant Orientation, Vanderbilt University, 2014-2015.

- Honors Thesis Supervisor for An Ran Chen, Australian National University, 2017.
- Teaching assistant for MSRI Program [Summer graduate school: planar algebras, quantum symmetries, and random matrices](#), June 2017.
- Teaching assistant for MRC program [Quantum Symmetries: Subfactors and Fusion Categories](#), June 2018.
- REU Project Mentor, Ohio State University, Summer 2018-Present.
- Refereed articles for: International Mathematics Research Notices, Journal of the Australian Mathematical Society, Analysis and PDE, Quantum Topology, Compositio Mathematica, Quantum, Advances in Mathematics.