

**Contact Information:**

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**Employment/Education:**

2016–Present **The Ohio State University**, Ohio, USA. Assistant professor  
 2014-16 **University of California, Los Angeles**, California, USA. Assistant adjunct professor  
 2012-14 **University of Toronto**, Ontario, Canada. Mathematics postdoctoral fellow  
 Postdoctoral supervisors: [Dror Bar-Natan](#) and [George Elliott](#)  
 2005-12 **University of California, Berkeley**, California, USA. Mathematics Ph.D.  
 Advisor: [Vaughan F.R. Jones](#)  
 Dissertation: “Planar structure for inclusions of finite von Neumann algebras”  
 2001-5 **The George Washington University**, Washington, D.C., USA,  
 Mathematics, B.A., Ruggles Prize 2003 and 2005  
 Physics, B.S., Howard Hughes Fellow in Bioinformatics 2004  
 Chemistry, B.S., George Gamow Fellow 2003  
 Columbian School Distinguished Scholar, Summa Cum Laude, Phi Beta Kappa.

**Scientific/Academic Honors and Grants:**

- NSF CAREER grant DMS 1654159 2017-2022 “Representing and classifying enriched quantum symmetry”
- NSF DMS grant 1500387 2015-16 “Classifying subfactors and fusion categories”, transferred to OSU as NSF DMS grant 1655912 2016-18
- AMS-Simons travel grant 2014-15
- Summer support for Summers 2013 and 2014 through DARPA grant HR0011-12-1-0009
- NSF East Asia and Pacific Summer Institute grant 1015571 Summer 2010
- Conference grants:
  - Contact organizer for a BIRS workshop 2018/10/14-19 on Subfactors and Fusion Categories (with Gannon, Morrison, and Plavnik)
  - Contact organizer for an AMS MRC workshop 2018/6/10-16 on [Quantum symmetries: subfactors and fusion categories](#)
  - Coauthored successful grant NSF DMS-1665434 for [Quantum Symmetries: Subfactors and Planar Algebras](#) Conference 2017 (with Brothier, Jones, Snyder, and Tener)
  - Contact organizer for [AIM SQuaREs](#) workshop 2016/9/12-16 and 2017/11/27 - 12/1 on Classifying fusion categories (with Grossman, Izumi, Morrison, Peters, and Snyder)
  - US Junior Oberwolfach Fellow for 2015 workshop [Subfactors and Conformal Field Theory](#)
  - Coauthored proposal for 2015 Oberwolfach workshop [Subfactors and Conformal Field Theory](#) (with official organizers Bisch, Gannon, Jones, and Kawahigashi)
  - Coauthored successful grant NSF DMS-1400275 for [Subfactor Theory in Mathematics and Physics](#) Conference 2014 (with Bisch, Brothier, Jones, Morrison, and Snyder)
  - Contact organizer for a BIRS workshop 2014/4/13-18 on [Classifying Subfactors and Fusion Categories](#) (with Jones, Morrison, Peters, and Snyder)

**Peer reviewed journal articles:**

1. *The classification of subfactors with index at most  $5\frac{1}{4}$*  (with Narjess Afzaly and Scott Morrison). To appear **Mem. Amer. Math. Soc.** [arXiv:1509.00038](#)

2. *Monoidal categories enriched in braided monoidal categories* (with Scott Morrison). 2017. To appear **Int. Math. Res. Not.** [arXiv:1701.00567](#)
3. *Operator algebras in rigid  $C^*$ -tensor categories* (with Corey Jones). **Comm. Math. Phys.** 355 (2017), no. 3, 1121–1188, [MR3687214](#), [arXiv:1611.04620](#)
4. *Bicommutant categories from fusion categories* (with André Henriques). **Selecta Math. (N.S.)** 23 (2017), no. 3, 1669–1708, [MR3663592](#), [arXiv:1511.05226](#).
5.  *$C^*$ -algebras from planar algebras I: canonical  $C^*$ -algebras associated to a planar algebra* (with Michael Hartglass). **Trans. Amer. Math. Soc.** 369 (2017), no. 6, 3977–4019, [MR3624399](#), [arXiv:1401.2485](#).
6. *Categorified trace for module tensor categories over braided tensor categories* (with André Henriques and James Tener). **Documenta Math.** 21 (2016) 1089–1149 [arXiv:1509.02937](#)
7. *Quotients of  $A_2 * T_2$*  (with Masaki Izumi and Scott Morrison). **Canad. J. Math.** 68 (2016), no. 5, 999–1022. [MR3536926](#) (abbreviated version of *Fusion categories between  $C \boxtimes D$  and  $C * D$* , [arXiv:1308.5723](#)).
8. *Calculating two-strand jellyfish relations* (with Emily Peters). **Pacific J. Math.** 277 (2015), no. 2, 463–510. [MR3402358](#), [arXiv:1308.5197](#).
9. *2-supertransitive subfactors at index  $3 + \sqrt{5}$*  (with Scott Morrison). **J. Funct. Anal.** 269 (2015), no. 9, 2845–2870. [MR3394622](#), [arXiv:1406.3401](#)
10. *Infinite index subfactors and the GICAR categories* (with Vaughan F. R. Jones). **Comm. Math. Phys.** 339 (2015), no. 2, 729–768. [MR3370617](#), [arXiv:1410.0856](#)
11. *Subfactors of index exactly 5* (with Masaki Izumi, Scott Morrison, Emily Peters, and Noah Snyder). **B. Lond. Math. Soc.** (2015) 47 (2): 257–269. [MR3335120](#), [arXiv:1406.2389](#).
12. *Constructing spoke subfactors using the jellyfish algorithm* (with Scott Morrison). **Trans. Amer. Math. Soc.**, 367 (2015), no. 5, 3257–3298. [MR3314808](#), [arXiv:1208.3637](#)
13. *Chirality and principal graph obstructions*. **Adv. Math.** 273 (2015), no. 19, 32–55. [MR3311757](#), [arXiv:1307.5890](#)
14. *1-supertransitive subfactors with index at most  $6\frac{1}{5}$*  (with Zhengwei Liu and Scott Morrison). **Comm. Math. Phys.** 334 (2015), no. 2, 889–922. [MR3306607](#), [arXiv:1310.8566](#)
15.  *$C^*$ -algebras from planar algebras II: the Guionnet-Jones-Shlyakhtenko  $C^*$ -algebras* (with Michael Hartglass). **J. Funct. Anal.** 267 (2014), no. 10, 3859–3893. [MR3266249](#), [arXiv:1401.2486](#)
16. *Principal graph stability and the jellyfish algorithm* (with Stephen Bigelow). **Math. Ann.** 358 (2014), no. 1-2, 1–24. [MR3157990](#), [arXiv:1208.1564](#)
17. *A planar calculus for infinite index subfactors*. **Comm. Math. Phys.** 319 (2013), no. 3, 595–648, [MR3040370](#), [arXiv:1110.3504](#)
18. *Rigid  $C^*$ -tensor categories of bimodules over interpolated free group factors* (with Arnaud Brothier and Michael Hartglass). **J. Math. Phys.** 53 (2012), no. 12, 123525 (43 pages), [arXiv:1208.5505](#), [DOI:10.1063/1.4769178](#)
19. *A cyclic approach to the annular Temperley-Lieb category*. **J. Knot Theory Ramifications** 21 (2012), no. 6, 1250049, 40 pp. [MR2903179](#), [arXiv:0912.1320](#).
20. *Subfactors of index less than 5, Part 4: Vines* (with James Tener). **Internat. J. Math.** 23 (2012), no. 3, 1250017, 18 pp. [MR2902286](#), [arXiv:1010.3797](#)
21. *Subfactors of index less than 5, Part 2: Triple points* (with Scott Morrison, Emily Peters, and Noah Snyder). **Internat. J. Math.** 23 (2012), no. 3, 1250016, 33 pp. [MR2902285](#), [arXiv:1007.2240](#).
22. *The embedding theorem for finite depth subfactor planar algebras* (with Vaughan F. R. Jones). **Quantum Topol.** 2 (2011), no. 3, 301337. [MR2812459](#), [arXiv:1007.3173](#)

Peer reviewed conference proceedings:

1. *Q-systems and compact  $W^*$ -algebra objects* (with Corey Jones). To appear **Contemp. Math.** [arXiv:1707.02155](#)
2. *Lifting shadings on symmetrically self-dual subfactor planar algebras* (with Zhengwei Liu and Scott Morrison). To appear **Contemp. Math.** [arXiv:1709.05023](#)
3. *The generator conjecture for  $3^G$  subfactor planar algebras* (with Zhengwei Liu). **Proceedings of the 2014 Maui and 2015 Qinhuangdao conferences in honour of Vaughan F. R. Jones' 60th birthday**, 344–366, Proc. Centre Math. Appl. Austral. Nat. Univ., 46, Austral. Nat. Univ., Canberra, 2017. [MR3635674](#), [arXiv:1507.04794](#)

**Conference proceedings:**

1. *Planar algebras in modular tensor categories*. (joint work with André Henriques and James Tener). 2015. **Oberwolfach Reports** [DOI:10.4171/OWR/2015/16](#)

**arXiv preprints:**

1. *Planar algebras in braided tensor categories* (with André Henriques and James Tener). [arXiv:1607.06041](#)
2. *Realizations of algebra objects and discrete subfactors* (with Corey Jones). [arXiv:1704.02035](#)

**Computing packages:**

1. **FusionAtlas**, a package for *Mathematica* and *Scala* (with Scott Morrison, Emily Peters, Noah Snyder, and James Tener), available at [http://tqft.net/wiki/Atlas\\_of\\_subfactors](http://tqft.net/wiki/Atlas_of_subfactors).

**Research Interests:**

Subfactors, planar algebras, tensor and fusion categories, conformal and topological field theories, diagrammatic algebras, von Neumann algebras,  $C^*$ -algebras,  $K$ -theory, noncommutative geometry, Hochschild and cyclic homology, knot theory

**Visiting scholar positions:**

- **The Australian National University**, Canberra, Australia, March 2017, March 2014, and Jan-Feb 2013, host researcher [Scott Morrison](#)
- **Isaac Newton Institute for the Mathematical Sciences**, Cambridge, England, January 2017, [Programme on Operator Algebras: Subfactors and their Applications](#)
- **Hausdorff Research Institute for Mathematics**, Bonn, Germany, May-June 2016, [Trimester on von Neumann algebras](#)
- **Institut Henri Poincaré**, Paris, France, May-June 2011, Trimester on von Neumann algebras and ergodic theory of groups actions
- **Vanderbilt University**, Nashville, USA Jan-Feb 2011, host researcher [Jesse Peterson](#)
- **University of Tokyo**, Japan, Summer 2010, NSF East Asia and Pacific Summer Institute, host researcher [Yasuyuki Kawahigashi](#)
- **Institute for the Mathematical Sciences (IMSc)**, Chennai, India, Feb 2009, host researcher [V.S. Sunder](#)

**Academic service:**

- Conferences and seminars organized:
  - International conferences/workshops co-organized:
    1. 2018 BIRS workshop on Subfactors and Fusion Categories
    2. 2018 AMS MRC workshop on [Quantum symmetries: subfactors and fusion categories](#)

3. 2017 Mathematical Congress of the Americas Special Session on von Neumann algebras
  4. 2016 AIM SQuaRE on Classifying Fusion Categories
  5. 2015 Oberwolfach workshop on Subfactors and Conformal Field Theory (coauthored proposal as unofficial organizer)
  6. 2014 Subfactor Theory in Mathematics and Physics
  7. 2014 BIRS workshop on Classifying Subfactors and Fusion Categories
- National conferences co-organized:
    1. 2019 East Coast Operator Algebra Symposium at The Ohio State University
    2. 2018 AMS Special Session at the Central Spring Sectional Meeting on Quantum Symmetries
    3. 2017 Quantum Symmetries: Subfactors and Planar Algebras
    4. 2017 AMS JMM Special Session [Advances in Operator Algebras](#)
    5. 2015 AMS Special Session at Memphis sectional meeting on [von Neumann algebras](#)
    6. 2015 AMS JMM Special Session [Classification Problems in Operator Algebras](#)
    7. 2014 AMS JMM Special Session [Classification Problems in Operator Algebras](#)
    8. 2011 Subfactors in Maui
    9. 2011 Subfactors in Tahoe
    10. 2010 Subfactors in Tahoe
  - Micro-conferences co-organized:
    1. 2017 and 2018 [Operators on Hilbert spaces In Ohio](#) Conference at The Ohio State University
    2. 2016 [Bodega Bay Subfactor Microconference](#)
    3. 2015 UC Subfactor retreat at UC Santa Barbara
    4. 2015 [Bodega Bay Subfactor Microconference](#)
  - Organized many weekly seminars at UC Berkeley, the Fields institute, UCLA, and OSU:
    1. Fall 2016 - Present - OSU Non-Commutative Geometry and Operator Algebras seminar
    2. Fall 2016 - Present - OSU Quantum Algebra/Quantum Topology seminar
    3. Spring 2015 - Spring 2016 - UCLA Subfactor reading course
    4. Fall 2013 - Spring 2014 - [Quantum Algebra Seminar](#) at the Fields Institute
    5. Fall 2009 - Spring 2012 - UC Berkeley Subfactor seminar
    6. Spring 2008 - Fall 2009 - UC Berkeley Student subfactor seminar
  - Co-editor for conference proceedings for 2014 and 2015 Subfactor Conferences on Mathematics and Physics, Maui and Qinhuangdao, in honor of Vaughan F. R. Jones' 60th birthday (with Scott Morrison)
  - Reviewed articles for Adv. Math., Algebr. Geom. Top., B. Lond. Math. Soc., Contemp. Math., Comm. Math. Phys., Documenta Math., Int. Math. Res. Not., J. Algebra Appl., J. Math. Phys., Math. Reports, Proc. Amer. Math. Soc., Trans. Amer. Math. Soc.
  - Reviewed articles for Mathematical Reviews, and Zentralblatt MATH.

**Teaching:**

2016-Present: Assistant Professor at The Ohio State University

- Functional Analysis (7211, 7212, grad course)
- Foundations of higher mathematics (3345)

2014-16 Assistant Adjunct Professor at UCLA

- Operator algebras (259A, grad course)

- Real analysis (131A, 131B)
- Linear algebra and applications (33A)
- Differential equations (33B)
- Calculus for Life Sciences Students (3B)
- Probability for Life Sciences Students (3C)

2012-14 Postdoctoral Fellow at University of Toronto

- Complex variables (MAT334H1)
- Linear algebra (MAT223F)
- Engineering Sciences enriched Calculus I (MAT194H1)
- Calculus 1A (MAT135H1)

2005-11 UC Berkeley Graduate Student Instructor (instructor and teaching assistant)

Instructor:

- Graduate Prelim workshop (Analysis)
- Undergraduate research seminar (191)
- Complex analysis (185)
- Linear algebra (110)
- Introduction to proof writing (74)
- Matrix theory/differential equations (54)
- Calculus (16B)

Teaching Assistant:

- Topology and analysis (202B, grad course)
- Complex analysis (185)
- Linear algebra (110)
- Discrete mathematics (55)
- Matrix theory/differential equations (54)
- Multivariable calculus (53)
- Calculus (1A, 16A, 16B)

Additional training and awards:

- Unofficially co-mentored 3 Stanford undergraduates on computing Turaev-Viro invariants over 5 weeks during Summer 2015 [SURIM program](#)
- 2014 F. V. Atkinson Teaching Award at the University of Toronto (postdoctoral teaching award)
- 3 courses (2 hours each) at the University of Toronto's Centre for Teaching Support and Innovation
- Attended Spring 2011 UC Berkeley program on How Students Learn: <http://gsi.berkeley.edu/howstudentslearn/schedule.html>
- 2008-9 Outstanding GSI Award at UC Berkeley (can only receive once)