James Tener **Curriculum Vitae**

Contact information

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Research interests

My work is motivated by conformal field theory (CFT), and my research program seeks to build a unified mathematical framework for the study of CFT, as well as to study new mathematical connections which arise as a result. Mathematical objects which arise include operator algebras, subfactors, functorial field theories, vertex operator algebras, quantum algebra and tensor categories, vector-valued modular forms, and complex function theory.

Employment

Australian National University
Lecturer (March 2019 - present)
Mathematical Sciences Institute Research Fellow (July 2018 - March 2019)

University of California, Santa Barbara
Visiting Assistant Professor (September 2015 - April 2016, September 2016 - June 2018)

Max Planck Institute for Mathematics, Bonn
Postdoctoral Researcher (August 2014 - August 2015, June 2016 - August 2016)

Visiting positions

Research Member, MSRI Program on Quantum Symmetries (January 2020 - May 2020)

Education

University of California, Berkeley
PhD, Mathematics (September 2008 - May 2014)
Advisor: Vaughan F. R. Jones

Pomona College
BA, Mathematics (September 2004 - May 2008)
Magna cum laude, Phi Beta Kappa, math department award, and thesis award

External funding

1. ARC Discovery Project DP200100067 "Physical realisation of enriched quantum symmetries," 2020 - 2022, co-Chief Investigator
2. AMSI Scientific Workshop Funding 2020, "The Mathematics of Conformal Field Theory II"
3. AMSI Scientific Workshop Funding 2019, "Subfactors in Sydney"
4. AMS-Simons Travel Grant 2017-2019
5. NSF Graduate Research Fellowship 2010-2012

Published articles and preprints

1. *Fusion and positivity in chiral conformal field theory*
   submitted. arXiv:1910.08257.
2. *Classification of extremal vertex operator algebras with two simple modules*
   submitted. arXiv:1811.02180 (with J. Connor Grady)
3. *Representation theory in chiral conformal field theory: from fields to observables*
   Selecta Math.. to appear. arXiv:1810.08168
4. *Positivity and fusion of unitary modules for unitary vertex operator algebras*
   RIMS Kôkyûroku (2018), no. 2086, 6-13.

5. *Singular values of weighted composition operators and second quantization*
   Int. Math. Res. Not. IMRN (2018), no. 20, 6426-6441. arXiv:1612.03970 (with Mihai Putinar)
6. *On classification of extremal non-holomorphic conformal field theories*
   J. Phys. A: Math. Theor., 50 (2017), 115204. arXiv:1611.04071 (with Zhenghan Wang)
7. *Geometric realization of algebraic conformal field theories*
   Adv. Math., 349 (2019), 488-563. arXiv:1611.01176
8. *Construction of the unitary free fermion Segal CFT*
   Commun. Math. Phys. 355 (2017), no. 2, 463-518. arXiv:1608.02095
9. *Planar algebras in braided tensor categories*
   Mem. Amer. Math. Soc, to appear. arXiv:1607.06041 (with André Henriques and David Penneys)
10. *Internal trace for module tensor categories over braided tensor categories*
    Documenta Math., 21 (2016) 1089-1149. arXiv:1509.02937 (with André Henriques and David Penneys)
11. *Subfactors of index less than 5, part 4: vines*
    Int. J. Math., 23 (2012), no. 3, 1250017. arXiv:1010.3797 (with David Penneys)
12. *Unitary equivalence to a complex symmetric matrix: low dimensions*
    Lin. Alg. Appl., 437 (2012), no. 1, 271-284. arXiv:1104.4960 (with Stephan R. Garcia and Daniel Poore)
13. *Unitary equivalence of a matrix to its transpose*
    J. Operator Theory, 68:1 (2012), 179-203. arXiv:0908.2107 (with Stephan R. Garcia)
14. *Projections and idempotents with fixed diagonal and the homotopy problem for unit tight frames*
    Oper. Matrices, 5 (2011) 139-155. arXiv:0906.0139 (with J. Giol, L.V. Kovalev, D. Larson and N. Nguyen)
15. *Unitary equivalence to a complex symmetric matrix: an algorithm*
    J. Math. Anal. Appl., 341 (2008) 640-648. arXiv:0908.2201

Selected recent international research conference presentations (since June 2016)

1. Workshop on Subfactors and Applications
   Mathematisches Forschungsinstitut Oberwolfach, October 2019
2. Workshop on Operator Algebras and Quantum Physics
   Simons Center for Geometry and Physics, June 2019
3. NCGOA/Shanks conference on Algebra and Geometry Quantized and Quantified
   Vanderbilt University, May 2019
4. Workshop on Subfactors and Fusion Categories
   Banff International Research Station, October 2018
5. Workshop on Geometric and Categorical Aspects of CFTs
   Casa Matemática Oaxaca, September 2018
6. Algebraic Methods in Mathematical Physics
   CRM Montreal, July 2018
7. (Sub)Factors in Maui, May 2018
8. Workshop on algebraic combinatorics and representation theory of finite groups and vertex operator algebras
   Kyoto RIMS, December 2017
9. Shanks workshop on subfactors and applications
   Vanderbilt University, October 2017
10. Workshop on Subfactors, higher geometry, higher twists and almost Calabi-Yau algebras
    Isaac Newton Institute for Mathematical Sciences, Cambridge, March 2017
11. Southeastern Analysis Meeting 2017

UT Knoxville, March 2017

12. Berkeley-Tokyo Autumn School on Quantum Field Theory and Subfactors
    UC Berkeley, November 2016
13. Modular Categories–Their Representations, Classification, and Applications
    Casa Matemática Oaxaca, August 2016
14. Workshop on Von Neumann Algebras
    Hausdorff Institute for Mathematics, Bonn, July 2016
15. Mathematics and Physics at the Crossroads trimester program seminar
    National Institute for Nuclear Physics, Frascati, June 2016

Recent invited seminar and colloquium talks (since April 2017)

1. University of Rome Tor Vergata Operator Algebras Seminar, July 2019
2. University of Melbourne Pure Mathematics Seminar, March 2019
3. Perimeter Institute for Theoretical Physics, April 2018
4. University of Arizona Mathematics Colloquium, February 2018
5. UC Davis Seminar on Algebra & Discrete Mathematics, November 2017
6. OSU Seminar on Quantum Algebra & Quantum Topology, September 2017
7. OSU Seminar on Non-commutative Geometry & Operator Algebras, September 2017
8. Claremont Colleges Mathematics Colloquium, April 2017

Research supervision

- I am a supervisory panel member for PhD student Amelia Han.
- I supervised the undergraduate honors thesis of J. Connor Grady (UCSB '18) entitled *The Classification of Extremal Vertex Operator Algebras of Rank 2*). He is now a PhD student at the University of Illinois.

Conferences co-organised

1. The Mathematics of Conformal Field Theory II, July 2020. Funded by AMSI, AustMS, IAMP, PIMS, and the MSI.
2. Subfactors in Sydney, February 2019. Funded by AMSI, AustMS, and the ARC.
3. Workshop on Quantum Symmetries, February 2019. Funded by the ARC.
4. Subfactors in Maui series, July 2019, 2017, 2013, and 2012. Funded by the NSF and DARPA.
5. Subfactor Theory in Mathematics and Physics, July 2014. Funded by DARPA.
6. QFTahoe Workshop, March 2013. Funded by the NSF.
7. Subfactors in Tahoe, February 2012. Funded by the NSF.

Service and organization

- Co-organiser for the MSI Special Year 2020 in Mathematical Physics
- Convenor for the quantum mathematics group seminar, July 2019 to present.
- Started the UC Santa Barbara seminar on quantum topology and quantum algebra, a research and learning seminar with significant interdisciplinary participation by graduate students from the mathematics, physics, and computer science departments.
- Served as a referee for 16 journals, including Journal of the AMS, Duke Mathematical Journal, Advances in Mathematics, Annales Henri Poincaré, International Mathematics Research Notices, Proceedings of the National Academy of Sciences, Proceedings of the AMS, and Transactions of the AMS.

Teaching experience and awards

- I am the convenor for MATH3228/6213 Advanced Complex Analysis (2018-present). I was nominated by students for the Joint Colleges of Science Award for Teaching Excellence in 2018 (ineligible to win; the award requires at least three years of prior employment at ANU).
- I co-taught MATH3351/6211 Advanced Topics in Mathematical Physics in S1 of 2019, on the subject of Vertex Operator Algebras.

- I taught MATH3349/4349 Special Topics in Mathematics in S2 of 2019, on the subject of Operator Algebras.
- At UC Santa Barbara, I was the instructor of record for 11 courses, including Calculus II (5 times), Transition to Higher Mathematics (4 times), and upper division Linear Algebra (2 times). Course sizes range from 150-350 for calculus and 35-60 for proof-based courses. On a scale of 1=excellent to 5=poor, my average course rating by students was 1.2.
- As a graduate student at UC Berkeley, I was the instructor of record for Matrix Theory and Differential Equations, and a teaching assistant for Calculus II, Precalculus, Matrix Theory, and Linear Algebra. I received an Outstanding Graduate Student Instructor award.