Current Position

- Reader, School of Mathematics, University of Edinburgh, Aug 2017–present.
- Lecturer and Chancellor's Fellow, School of Mathematics, University of Edinburgh, Sep 2013–Aug 2017.

Visiting positions

- Research member, MSRI Berkeley. Programs: Quantum Symmetries and Higher categories and categorification, Jan-May 2019
- Participant, HIM Bonn. Program: Symplectic Geometry and Representation Theory, Oct-Dec 2017.
- Research member, MSRI Berkeley. Program: Geometric Representation Theory, Sep-Dec 2014.

Previous Employment

NSF Postdoctoral Fellow (MSPRF) and Bing Instructor, University of Texas, Jul 2011-Aug 2013.

Education

- Ph.D. Mathematics, Massachusetts Institute of Technology, June 2011.
- B.S. Mathematics (minor: Physics), University of Oregon, June 2006. *Summa Cum Laude*, Phi Beta Kappa.

Research

Research Summary

With my co-authors I have pioneered the construction of a four-dimensional fully extended **topo**logical field theory (TFT), which we have called the "quantum character theory". This field theory draws together a number of constructions at the frontiers of: algebraic topology (via the factorization homology of braided tensor categories), the geometric Langlands program, the representation theory/Morita theory of tensor categories, various quantum algebras such as reflection equation algebras, double affine Hecke algebras, and q-difference operators more generally, and finally to the framework of classical geometric representation theory, such as the theory of D-modules and Springer theory.

In recent years, these methods unlocked resolutions to a number of high profile open questions in mathematics and physics alike. Specifically, we resolved a conjecture of Fields Medalist and mathematical physicist Edward Witten concerning the finite-dimensionality of skein module invariants of 3-manifolds, we proved an old conjecture of Freed and Teleman characterizing invertible topological quantum field theories via modular tensor categories, and we refined and resolved a question of Bonahon and Wong concerning the invertibility ("Azumaya property") of skein algebras at roots of unity.

Grants

• June 2021: \$10,000,000 Simons Foundation collaborative grant "Global categorical symmetries". The grant has 16 PI's, and will employ 16 postdoctoral researchers on these topics, as well as organize approximately 20 workshops and conferences. Edinburgh's take is \$500,000.

- June 2019: £20,000 from EPSRC for ICMS conference 'Geometric representation theory and topological field theory'.
- May-July 2019: £8000 from EPSRC for ICMS Research in Groups activity 'Quantum Springer Theory'.
- 2015-2020: ERC Starting Grant 2014, "The quantum geometric Langlands topological field theory", €1,100,948.00.
- 2014-present: LMS Scheme 3 grant for ARTIN network, £2000 annually.
- 2014-present: Glasgow Mathematical Journal Trust grant for ARTIN network, £3000 annually.
- 2011-2014: NSF Mathematical Sciences Postdoctoral Research Fellowship, \$135,000.

Postdocs supervised

- Brian Williams, Whitaker Fellow. Oct 2020–present.
- Andrea Appel. May 2017–May 2019. Currently tenure-track Assistant Professor at University of Parma.
- Peter Samuelson. Jun 2016–Jun 2018. Currently tenure-track Assistant Professor at UC Riverside.
- Alexander Shapiro. July 2018–July 2019. Tenure track Assistant Professor at Notre Dame (on leave), and PI on ERC Starting grant and Royal Society URF, at the University of Edinburgh.
- Sam Gunningham. September 2018–September 2019. Currently tenure-track Assistant Professor at University of Montana.

Ph.D. students supervised

- Alisa Sheinkman. Primary supervisor (September 2020-present).
- Patrick Kinnear. Co-supervisor with Pavel Safronov (September 2020-present).
- Tim Weelinck. Primary supervisor (2015-2019). Ph.D. thesis: "Quantum Symmetric Pairs in Topological Field Theory."
- Juliet Cooke. Primary Supervisor (2016-Present). Ph.D. thesis: "Excision of Skein Categories and Factorisation Homology."
- Anna Mrktchyan. Primary Supervisor (2016-Present).

Departmental Colloquia

I have given invited colloquia at:

- Harvard University, October 2021.
- Western Hemisphere Colloquium in Geometry and Physics, September 2020.
- UCLA, April 2020 (postponed due to covid).
- University of Iowa, April 2020.
- ZMP (Center for Mathematical Physics) Hamburg, June 2016.
- Max Planck Institute for Mathematics in Bonn, October 2015.
- UNSW-Sydney Joint Colloquium in Pure Mathematics, June 2014.
- The Australian National University, June 2014.

Lecture series

I delivered week-long lecture series on my work at:

- Advanced Winter School 'Quantum Geometry and Representation Theory', Osaka Advanced Mathematical Institute (this was moved online due to the covid crisis), in March 2021.
- Summer School 'Algebraic Structures in Quantum Field Theory', The University of Hamburg, in September 2019.
- Summer School 'Quantum groups and their analysis', The University of Oslo, in August 2019.
- The Erwin Schrödinger Institute in Vienna, November 2017.
- The University of Montpellier, in July 2015.

International Conferences

I have been an invited speaker at 30 international week-long conferences and workshops in: Oberwolfach, Nottingham, Brussels, IHES, Vienna, Sanya, AIM (x2), Oaxaca (x2), Cargese, Geneva, Glasgow, Aberdeen, Paris, Warwick, Maui (x3), Banff (x3), Fields Institute, ETH Zurich, USC, AIM, Kentucky, Baylor, New Orleans, Minneapolis. Some representative recent conferences titles:

- Workshop on Subfactors and Fusion Categories
- Workshop on Factorizable Structures
- Higher Structures in Geometry and Physics
- Geometric Representation Theory
- Field Theories and Higher Structures in Mathematics and Physics
- Geometric and Categorical Aspects of CFTs
- Categorified Hecke Algebras, Link Homology and Hilbert Schemes.

Research seminars

I have given 32 invited research seminars at Cambridge, Oxford, UCLA, UC Davis, Perimeter Institute (x2), University of Manchester, Columbia, UC Berkeley, MSRI, UCL, Oregon, Montpelier (x2), Newcastle, Toronto (x2), IPFL Lausanne, Glasgow (x2), York (x2), Northwestern, Texas A & M, Rutgers, UC Riverside, Lyon 1, University of Paris 7, IRMA Strasbourg, Northwestern, UIUC.

Conferences organized

- I organized, together with Constantin Teleman and Michele Del Zotto, a three-day kick-off even for the Simons Collaboration "Global categorical symmetries in quantum field theory", held as a twinned event between the Simons Center for Geometry and Physics and the International Centre for Mathematical Sciences (ICMS) in Edinburgh.
- I was lead organizer, with Dan Freed, Peter Samuelson, and Olivier Schiffmann, of a two-week long summer school and conference, "Geometric representation theory and low-dimensional topology" at the ICMS in Edinburgh, in June 2019.
- I organized, with David Ben-Zvi, the week-long residential workshop Workshop on Yangians and Quantum Loop Algebras, in Austin in May 2014.
- Since 2013, I am the network organizer for the LMS network Algebra and Representation Theory in the North; we organize four conferences annually – over twenty since I have taken over. I manage the funding applications, appoint local organizers, and maintain the mailing

list.

Teaching

Teaching Experience

The University of Edinburgh, School of Mathematics

- Course Organizer/Instructor: MATH08059 Proofs and Problem Solving (Spring 2015, 2016, 2017).
- Organizer: Honours algebra Skills lab (Fall 2020, Spring 2022).
- Organizer: Combinatorics and Graph Theory (Fall 2021).
- **Organizer**: SMSTC working seminar on topological field theory (Spring 2016), SMSTC working seminar on homological algebra (Fall 2016).
- **Tutor**: Proofs and Problem Solving; Probability; Fundamentals of Pure Mathematics; Jewels of Algebra; Honours Differential Equations (Fall 2013 Spring 2014).
- Supervisor: 3 MMath/MSc. dissertations: Sam Moore (Maths, Spring 2014), Aaron Conlon (Physics, Spring 2016), Zoë Schroot (Physics, Spring 2016).

The University of Texas at Austin, Department of Mathematics

- Instructor: Introduction to Quantum Groups and Geometric Representation Theory M392C (Spring 2013).
- Course Organizer/Instructor: Advanced Calculus with Applications M427L (Fall 2012).
- Course Organizer/Instructor: Introduction to Linear Algebra w/ Proofs M341 (Fall 2012).

Massachusetts Institute of Technology, Department of Mathematics

- **Instructor**: Multivariable Calculus. Interphase summer program for incoming freshmen, Office of Minority Education (Summer 2009, 2010).
- **Teaching Assistant**: 18.03 Differential Equations (Spring 2010); 18.02 Multivariable Calculus (Fall 2009); 18.821 Project Lab in Mathematics (Fall 2008).
- Research Mentor:
 - Undergraduate Research Opportunities Program (Fall 2009 Spring 2011).
 - Summer Program for Undergraduate Research (Summer 2009).
 - Research Science Institute (Summer 2007, 2008).
- Instructor: Harvard Math Circle (for 6-10 yr. olds) (Spring 2010, Fall 2010).

Teaching Awards

- Charles and Holly Housman Award for Excellence in Undergraduate Teaching, MIT Dept. of Math, 2010.
- Hartley Rogers Prize for mentoring undergraduate research, MIT Dept. of Math 2009.

Academic Leadership and Citizenship

• I am the Director of Sustainability for the School of Mathematics, and am responsible for the design and implementation of the School's four-pillar sustainability plan.

- I serve on the ICMS Management committee, and am charged with overhauling their conference space for organization of hybrid in-person/cyberspace and also twinned (dual location) conferences.
- I am an American Mathematical Society (MathSciNet) Reviewer, and referee for Mathematische Annalen, Journal of Algebra, Selecta Mathematica, International Math Research Notices, Transformation Groups, SIGMA, Communications in Mathematical Physics, Transactions of the American Mathematical Society, Quarterly Journal of Mathematics, Algebra and Representation Theory, Annales Scientifiques de l'ENS.
- I have reviewed grants for the US National Science Foundation (NSF), the Swiss National Science Foundation (SNF), and the French Agence National de Recherche (ANR), and the Banff International Research station (BIRS).
- I was the external examiner for Oxford Ph.D. students Nicholas Cooney and Josephine French, for Central European University Ph.D. student Szabolcs Meszaros, and for Glagow Ph.D. student Tomasz Przezdziecki.
- I was the internal examiner for Edinburgh Ph.D. students Carmen Rovi, Chris Campbell, Simon Crawford, and Martti Karvonen, and Edinburgh MSc. student Aaron Greenspan.
- At UT Austin, I assisted in the supervision of Ph.D. students Iordan Ganev and Hendrik Orem, posing them their first published research questions, and mentoring them during its solution.
- At MIT, I supervised ten successful undergraduate research projects in the years 2008-2012, in the programs RSI, SPUR, and UROP, at MIT, leading to seven publications in leading specialist journals.
 - My first RSI student, Sana Raoof won first prize at the International Science and Engineering Fair in 2008, and is studying in an MD/PhD. program at Harvard.
 - My RSI student Eric Larson won second place nationally at the Siemens competition, and first place in the Intel Science Talent Search; Eric is now a postdoc at Stanford.
 - My RSI student Noah Arbesfeld placed sixth nationally in the STS, and is currently a postdoc at Imperial University.
 - My UROP student Asilata Bapat and I were jointly awarded the Hartley Rogers prize for undergraduate research at MIT; Asilata is currently a postdoc at Australian National University.

List of Publications

Open access versions of all of my publications can be found at http://arxiv.org/a/jordan_d_1.

- D. Jordan, I. Le, G. Schrader, A. Shapiro. *Quantum decorated character stacks*. Submitted to Publ. IHES, June 2021.
- A. Brochier, D. Jordan, P. Safronov, N. Snyder. Invertible braided tensor categories. Algebraic Geometric Topology 21 (2021) 2107–2140
- S. Gunningham, D. Jordan, P. Safronov, *The finiteness conjecture for skein modules*. Submitted to Inventiones Mathematica, Oct 2019.
- 4. I. Ganev, D. Jordan, P. Safronov, *The quantum Frobenius for character varieties and multi*plicative quiver varieties. Submitted to JEMS, October 2021.

- A. Brochier, D. Jordan, N. Snyder, *Dualizable braided tensor categories*, Compositio Mathematica 157 (2021) 435-483.
- D. Jordan, N. White, The center of the reflection equation algebra via quantum minors, Journal of Algebra 542.
- D. Jordan, M. Vazirani, The Rectangular Representation of the Double Affine Hecke Algebra via Elliptic Schur-Weyl Duality, Int. Math. Res. Not. 2019, https://doi.org/10.1093/imrn/rnz030
- M. Balagovic, D. Jordan, The Harish-Chandra isomorphism for quantum GL₂, Journal of Noncommutative geometry, Volume 12, Issue 3, 2018, pp. 1161–1197.
- D. Ben-Zvi, A. Brochier, D. Jordan, *Integrating quantum groups over surfaces*, Journal of Topology, Volume 11, No. 4, p. 873-916.
- D. Ben-Zvi, A. Brochier, D. Jordan, Quantum character varieties and braided module categories, Selecta Mathematica, 2018.
- A. Brochier, D. Jordan, Fourier transform for quantum D-modules via the punctured torus mapping class group, arXiv:1403.1841, Quantum Topology, Volume 8, Issue 2, 2017, pp. 361–379.
- D. Jordan, Quantized multiplicative quiver varieties, Adv. Math, Volume 250, 15 January 2014, Pages 420-466.
- D. Jordan, Quantum D-modules, elliptic braid groups, and double affine Hecke algebras, Int. Math. Res. Notices, Vol 2009, 24 pages.
- 14. D. Jordan and X. Ma, Quantum symmetric pairs and representations of the double affine Hecke algebras of type $C^{\vee}C_n$, Selecta Math. (N.S.) 17 (2011), no. 1, 139–181.
- 15. D. Jordan and H. Orem, An algebro-geometric construction of lower central series of associative algebras, Int. Math. Res. Notices 2014.
- P. Grossman, D. Jordan, and N. Snyder, Cyclic extensions of fusion categories via the Brauer-Picard groupoid, Quantum Topology, Vol. 6, No. 2, 2015, p. 313-331.
- D. Jordan and E. Larson, On the classification of certain fusion categories, J. Noncommut. Geom. 3 (2009), no. 3, 481–499.
- A. Bapat and D. Jordan, Lower central series in symmetric tensor categories, J. Algebra 373 (2013), 299–311. arxiv:1001.1375.
- N. Arbesfeld and D. Jordan, New results on the lower central series quotients of a free associative algebra, J. Algebra, Volume 323, Issue 6, 15 March 2010, Pages 1813-1825. arxiv:0902.4899.
- B. Bond and D. Jordan, The lower central series of the symplectic quotient of a free associative algebra, J. Pure Appl. Algebra 217 (2013), no. 4, 689–699. <u>arxiv:1111.2316</u>.
- S. Bhupatiraju, P. Etingof, D. Jordan, W. Kuszmaul and J.Li, Lower central series of a free associative algebra over the integers and finite fields, J. Algebra 372 (2012), 251–274. arXiv:1203.1893.

Contact information

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