Jacob C. Bridgeman

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arXiv, Scholar profile, orcid

November 2025

Employment

2025–Present • **Staff Quantum Architect**, PsiQuantum.

2024–2025 • **Senior Quantum Architect, Fault Tolerance**, PsiQuantum.

2022–2024 • **Senior Postdoctoral Fellow**, Research Foundation–Flanders, hosted by Ghent University. Grant number 12E9223N.

2021–2022 • **Postdoctoral Researcher**, Ghent University.

2018–2021 • **Postdoctoral Researcher**, Perimeter Institute for Theoretical Physics.

2018 • **Research Associate**, University of Technology Sydney.

2017 • **Postdoctoral Fellow**, University of Sydney.

2013–2017 • **Casual Tutor**, University of Sydney. Assist in experimental and computational labs. Marking of assignments and exams.
• **Postgraduate Student**, University of Sydney.

Education

2014–2017 • **Doctor of Philosophy in Physics**, University of Sydney.
• **Thesis**, Tensor Network Methods for Quantum Phases, Supervised by Prof. Stephen D. Bartlett, with auxiliary supervisors Prof. Andrew C. Doherty and A/Prof. Steven T. Flammia.

2013–2014 • **Perimeter Scholars International**
• **Master of Science in Physics**, University of Waterloo and the Perimeter Institute for Theoretical Physics. Master of Science in theoretical physics undertaken at the Perimeter Institute for Theoretical Physics.
• **Master's Thesis**, Effective Edge States of Symmetry Protected Topological Systems. Supervised by Dr Luiz H. Santos and Juven C. Wang.

2009–2012 • **Bachelor of Science (Advanced Mathematics)** Honours class I and the University Medal, University of Sydney. Double majors in physics and pure mathematics. Completed with First Class Honours and the University Medal.
• **Honours Thesis**, Critical Quantum Lattice Models using the Multiscale Entanglement Renormalisation Ansatz. Supervised by Prof. Stephen D. Bartlett and A/Prof. Andrew C. Doherty.
• **Senior special project**, Scaling dimensions and local primary fields of critical quantum Ashkin-Teller spin chain using MERA. Supervised by A/Prof. Stephen D. Bartlett and A/Prof. Andrew C. Doherty.
• **The School of Physics Summer Vacation Project**, Symmetries in tensor networks. Supervised by A/Prof. Stephen D. Bartlett and A/Prof. Andrew C. Doherty.
• **The School of Physics Summer Vacation Project**, Quantum state and measurement tomography using convex optimisation. Supervised by A/Prof. Stephen D. Bartlett and Andrew C. Doherty.

Scholarships and Awards

2013
- **Perimeter Scholars International Scholarship**. Full scholarship to support students undertaking the Perimeter Scholars International programme and MSc at the University of Waterloo.

2012
- **The University Medal**.
- **Australian Postgraduate Award**, awarded to enable students to pursue a higher research degree.
- **University of Sydney Merit Award**, offered to the most highly ranked APA applicants.
- **The School of Physics Summer Vacation Scholarship 2012-2013**.

2011
- **The University of Sydney Honours Scholarship 2012**.
- **The Science Foundation for Physics Scholarship for Third Year**.
- **The School of Physics Summer Vacation Scholarship 2011-2012**.

2010
- **The Science Foundation for Physics Scholarship for Second Year**.
- **The School of Physics Summer Vacation Scholarship 2010-2011**.

2008
- **School Dux**, first in school.

Publications

2024
- J. Bridgeman, A. Kubica, and M. Vasmer, "Lifting topological codes: Three-dimensional subsystem codes from two-dimensional anyon models," *PRX Quantum* **5**, 020310, arXiv:2305.06365, 2024

2023
- B. V.-D. Cuiper, J. C. Bridgeman, N. Dewolf, J. Haegeman, and F. Verstraete, "One-dimensional symmetric phases protected by frieze symmetries," *Physical Review B* **107**, 115123, arXiv:2202.12880, 2023
- J. Bridgeman, L. Lootens, and F. Verstraete, "Invertible bimodule categories and generalized Schur orthogonality," *Communications in Mathematical Physics* **402**, 2691–2714, arXiv:2211.01947, 2023

2022
- J. Bridgeman, B. Brown, and S. Elman, "Boundary topological entanglement entropy in two and three dimensions," *Communications in Mathematical Physics* **389**, 1241–1276, arXiv:2012.05244, 2022
- D. Barter, J. Bridgeman, and R. Wolf, "Computing associators of endomorphism fusion categories," *SciPost Physics* **13**, 029, arXiv:2110.03644, 2022

2020
- J. Bridgeman, A. Hahn, T. Osborne, and R. Wolf, "Gauging defects in quantum spin systems: A case study," *Physical Review B* **101**, 134111, arXiv:1910.10619, 2020
- J. Bridgeman and D. Barter, "Computing Defects Associated to Bounded Domain Wall Structures: The Vec($\mathbb{Z}/p\mathbb{Z}$) case," *Journal of Physics A: Mathematical and Theoretical* **53**, 235206, arXiv:1901.08069, 2020
- J. Bridgeman and D. Barter, "Computing data for Levin-Wen with defects," *Quantum* **4**, 277, arXiv:1907.06692, 2020

2019
- D. Barter, J. Bridgeman, and C. Jones, "Domain walls in topological phases and the Brauer-Picard ring for Vec($\mathbb{Z}/p\mathbb{Z}$)," *Communications in Mathematical Physics* **369**, 1167–1185, arXiv:1806.01279, 2019
- J. Bridgeman, D. Barter, and C. Jones, "Fusing Binary Interface Defects in Topological Phases: The Vec($\mathbb{Z}/p\mathbb{Z}$) case," *Journal of Mathematical Physics* **60**, 121701, arXiv:1810.09469, 2019

2017
- J. Bridgeman and D. Williamson, "Anomalies and entanglement renormalization," *Physical Review B* **96**, 125104, arXiv:1703.07782, 2017
- J. Bridgeman, S. Bartlett, and A. Doherty, "Tensor Networks with a Twist: Anyon-permuting domain walls and defects in PEPS," *Physical Review B* **96**, 245122, arXiv:1708.08930, 2017

2016
- J. Bridgeman, S. Flammia, and D. Poulin, "Detecting Topological Order with Ribbon Operators," *Physical Review B* **94**, 205123, arXiv:1603.02275, 2016
- J. Bridgeman and C. Chubb, "Hand-waving and Interpretive Dance: An Introductory Course on Tensor Networks," *Journal of Physics A: Mathematical and Theoretical* **50**, 223001, arXiv:1603.03039, 2017. Selected for inclusion in the *Journal of Physics A Highlights of 2017 collection.* Informal 7 lecture course at the University of Sydney

2015
- J. Bridgeman, A. O'Brien, S. Bartlett, and A. Doherty, "Multiscale entanglement renormalization ansatz for spin chains with continuously varying criticality," *Physical Review B* **91**, 165129, arXiv:1501.02817, 2015

Invited Talks

2024
- J. Bridgeman, L. Lootens, and F. Verstraete, "Invertible bimodule categories and generalized Schur orthogonality." Presented (virtually) to the European Quantum Algebra Lectures (EQuAL), Slides available

2023
- J. Bridgeman, A. Kubica, and M. Vasmer, "Lifting topological codes: Three-dimensional subsystem codes from two-dimensional anyon models." Presented at Freie Universität Berlin, EQUS seminar (Sydney University), Slides available

2022
- D. Barter, J. Bridgeman, and R. Wolf, "Computing data for endomorphism fusion categories." Presented (virtually) to the Indiana University Quantum Topology seminar

2021
- D. Barter, J. Bridgeman, and C. Jones, "Computing with tube categories." Presented at North Carolina State University, University Quantum Symmetries Lectures, Slides available
- D. Barter, J. Bridgeman, C. Jones, and R. Wolf, "Enriched topological codes." Presented (virtually) to the Mathematical Physics-Physical Mathematics seminar

2020
- D. Barter, J. Bridgeman, and C. Jones, "Defects in topological phases." Presented at Ghent University, Slides available

2019
- J. Bridgeman, "An introduction to many body models." Presented at OSU Summer research program on quantum symmetries
- D. Barter, J. Bridgeman, and C. Jones, "Enriching topological codes: computing with defects." Presented at OSU Summer research program on quantum symmetries, Slides available

2017
- J. Bridgeman and D. Williamson, "Anomalies and Entanglement Renormalization." Presented at Freie Universität Berlin, Ghent University, Max Planck Institute of Quantum Optics, Leibniz Universität Hannover, Perimeter Institute, Université de Sherbrooke, Caltech, University of New Mexico, Australian National University, The Ohio State University, Can be viewed at PIRSA:17100064, Slides available

2015
- J. Bridgeman, S. Flammia, and D. Poulin, "Ribbon Operators in 2D Topologically Ordered Spin Systems." Presented at the Royal Melbourne Institute of Technology, Massachusetts Institute of Technology, Slides available

2013
- J. Bridgeman, A. O'Brien, S. Bartlett, and A. Doherty, "MERA for spin chains with critical lines." Presented at the 2013 Sydney Quantum Information Theory Workshop (Coogee workshop), Sydney, Australia. Slides available

2012
- J. Bridgeman, A. O'Brien, S. Bartlett, and A. Doherty, "MERA for lattice models with critical lines." Presented at the 2012 Symposium on Tensor Networks for Engineered Quantum Systems, Brisbane, Australia

Teaching Experience

Demonstrating
- During my PhD, I worked as a lab demonstrator for first, second and third year experimental and computational labs.

School Tutoring
- During my second year of undergraduate, I participated in a volunteer tutoring programme run by the student union to enable high school students to have access to free tutoring.

Lecturing
- J. Bridgeman and C. Chubb, "Hand-waving and Interpretive Dance: An Introductory Course on Tensor Networks," *Journal of Physics A: Mathematical and Theoretical* **50**, 223001, arXiv:1603.03039, 2017
- Guest lecture 'Quantum error correction' in the UGent Masters Quantum Computing course (2022).
- Co-lecturer for UGent Masters Quantum Computing course (2024).

Students Supervised/Mentored

Undergraduate
- **Eric Huang**, (**USyd**) Auxiliary supervisor — Talented Students Programme project

Masters
- **Kevin Vervoort**, (**UGent**, 2021–2022) Supervisor — 'Topological Wormholes in Tensor Networks'
- **Louis Lammertyn**, (**UGent**, 2023–2024) Promotor — 'Towards a $\frac{1}{2}E_6$ phase diagram'
- **Jonas Vanhauwe**, (**UGent**, 2023–2024) Promotor — 'Universal topological quantum computation using nonuniversal resources'
- **Joachim Slembrouck**, (**UGent** Literature study, 2023–2024) Promotor — An introduction to tensor categories and their skeletal data

Service to the Community

Conferences

2023
- Quantum Information Processing 2023, Ghent: Co-chair and primary local organizer.
- Quantum Information Processing 2024, Taiwan: Program committee.

2022
- American Institute of Mathematics Workshop: Higher categories and topological order, with Tobias Osborne, David Penneys, and Julia Plavnik.
- 28th Solvay Conference on Physics: Scientific secretary.

2021
- American Institute of Mathematics Workshop: Fusion categories and tensor networks, with Tobias Osborne, David Penneys, and Julia Plavnik.

Refereeing

Journals
- Physica A: Statistical Mechanics and its Applications, Physical Review {A, B, X, Letters}, Quantum, SciPost Physics

Conferences
- QIP {2018, 2021, 2022, 2024}, TQC {2018, 2020}, QTurn2020

Books
- Oxford University Press

Grants
- NSERC (Canada)

Referees

Prof. Stephen D. Bartlett
- School of Physics, The University of Sydney, NSW 2006, Australia
- stephen.bartlett@sydney.edu.au

Prof. Andrew C. Doherty
- School of Physics, The University of Sydney, NSW 2006, Australia
- andrew.doherty@sydney.edu.au

Prof. Steven T. Flammia
- AWS Center for Quantum Computing, Pasadena, CA 91125, USA
- sflammi@amazon.com

Asst. Prof. Corey Jones
- Department of Mathematics, North Carolina State University, NC, USA

	• cmjones6@ncsu.edu
Prof. Tobias J. Osborne	• Institüt für Theoretische Physik, Leibniz Universität Hannover • tobias.j.osborne@gmail.com
Prof. Frank Verstraete	• DAMTP, University of Cambridge, UK & Ghent University, Belgium • Frank.Verstraete@UGent.be