

# Jacob C. Bridgeman

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[arXiv](#), [Scholar profile](#), [orcid](#)

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## Employment

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|--------------|--|
| 2022–Current | • <b>Senior postdoctoral fellow</b> , Research Foundation–Flanders, hosted by Ghent University. Grant number 12E9223N.   |
| 2021–2022    | • <b>Postdoctoral Researcher</b> , Ghent University.   |
| 2018–2021    | • <b>Postdoctoral Researcher</b> , Perimeter Institute for Theoretical Physics.  |
| 2018         | • <b>Research Associate</b> , University of Technology Sydney.   |
| 2017         | • <b>Postdoctoral Fellow</b> , University of Sydney.   |
| 2013–2017    | • <b>Casual Tutor</b> , University of Sydney.<br>• Assist in experimental and computational labs. Marking of assignments and exams.<br>• <b>Postgraduate Student</b> , University of Sydney. |

## Education

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| 2014–2017 | • <b>Doctor of Philosophy in Physics</b> , University of Sydney.<br>• <b>Thesis</b> , 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 | • <b>Perimeter Scholars International</b><br><br>• <b>Master of Science in Physics</b> , University of Waterloo and the Perimeter Institute for Theoretical Physics. Master of Science in theoretical physics undertaken at the Perimeter Institute for Theoretical Physics.<br>• <b>Master's Thesis</b> , Effective Edge States of Symmetry Protected Topological Systems. Supervised by Dr Luiz H. Santos and Juven C. Wang.  |
| 2009–2012 | • <b>Bachelor of Science (Advanced Mathematics)</b> 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.<br>• <b>Honours Thesis</b> , Critical Quantum Lattice Models using the Multiscale Entanglement Renormalisation Ansatz. Supervised by Prof. Stephen D. Bartlett and A/Prof. Andrew C. Doherty.<br>• <b>Senior special project</b> , 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.<br>• <b>The School of Physics Summer Vacation Project</b> , Symmetries in tensor networks. Supervised by A/Prof. Stephen D. Bartlett and A/Prof. Andrew C. Doherty.<br>• <b>The School of Physics Summer Vacation Project</b> , Quantum state and measurement tomography using convex optimisation. Supervised by A/Prof. Stephen D. Bartlett and Andrew C. Doherty. |

## Scholarships and Awards

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| 2013 | • <b>Perimeter Scholars International Scholarship</b> . Full scholarship to support students undertaking the Perimeter Scholars International programme and MSc at the University of Waterloo. |
| 2012 | • <b>The University Medal</b> .  |

- **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.

## Preprints

- 2023 • J. Bridgeman, A. Kubica, and M. Vasmer, “Lifting topological codes: Three-dimensional sub-system codes from two-dimensional anyon models,” [arXiv:2305.06365](#), 2023

## Publications

- 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  $\text{Vec}(\mathbb{Z}/p\mathbb{Z})$  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  $\text{Vec}(\mathbb{Z}/p\mathbb{Z})$ ,” *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  $\text{Vec}(\mathbb{Z}/p\mathbb{Z})$  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

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|------|--|
| 2023 | • J. Bridgeman, A. Kubica, and M. Vasmer, “Lifting topological codes: Three-dimensional subsystem codes from two-dimensional anyon models.” Presented at <a href="#">Freie Universität Berlin</a> , <a href="#">EQUS seminar (Sydney University)</a> , <a href="#">Slides available</a> .  |
| 2022 | • D. Barter, J. Bridgeman, and R. Wolf, “Computing data for endomorphism fusion categories.” Presented (virtually) to the <a href="#">Indiana University Quantum Topology seminar</a>  |
| 2021 | • D. Barter, J. Bridgeman, and C. Jones, “Computing with tube categories.” Presented at North Carolina State University, <a href="#">University Quantum Symmetries Lectures</a> , <a href="#">Slides available</a> .<br>• D. Barter, J. Bridgeman, C. Jones, and R. Wolf, “Enriched topological codes.” Presented (virtually) to the <a href="#">Mathematical Physics-Physical Mathematics seminar</a>   |
| 2020 | • D. Barter, J. Bridgeman, and C. Jones, “Defects in topological phases.” Presented at Ghent University, <a href="#">Slides available</a> .  |
| 2019 | • J. Bridgeman, “An introduction to many body models.” Presented at <a href="#">OSU Summer research program on quantum symmetries</a><br>• D. Barter, J. Bridgeman, and C. Jones, “Enriching topological codes: computing with defects.” Presented at <a href="#">OSU Summer research program on quantum symmetries</a> , <a href="#">Slides available</a> .   |
| 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, <a href="#">Can be viewed at PIRSA:17100064</a> , <a href="#">Slides available</a> . |
| 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, <a href="#">Slides available</a> .  |
| 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. <a href="#">Slides available</a> .   |
| 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

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| 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,” <i>Journal of Physics A: Mathematical and Theoretical</i> <b>50</b> , 223001, <a href="#">arXiv:1603.03039</a> , 2017<br>• Guest lecture ‘Quantum error correction’ in the <a href="#">UGent Masters Quantum Computing course (2022)</a> . |

## Students Supervised/Mentored

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| Undergraduate | • <b>Eric Huang</b> , (USyd) Auxiliary supervisor for Talented Students Programme project.  |
| Masters       | • <b>Kevin Vervoort</b> , (UGent) Supervisor ‘ <a href="#">Topological Wormholes in Tensor Networks</a> ’.<br>• <b>Louis Lammertyn</b> , (UGent) Promoter ‘ <a href="#">A Haagerup phase diagram</a> ’. |

## Service to the community

### Conferences

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| 2023 | • <a href="#">Quantum Information Processing 2023, Ghent</a> : Co-chair and primary local organizer.<br>• <a href="#">Quantum Information Processing 2024, Taiwan</a> : Program committee. |
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2022	<ul style="list-style-type: none"> <li>• <a href="#">American Institute of Mathematics Workshop</a>: Higher categories and topological order, with Tobias Osborne, David Penneys, and Julia Plavnik.</li> <li>• <a href="#">28th Solvay Conference on Physics</a>: Scientific secretary.</li> </ul>
2021	<ul style="list-style-type: none"> <li>• <a href="#">American Institute of Mathematics Workshop</a>: Fusion categories and tensor networks, with Tobias Osborne, David Penneys, and Julia Plavnik.</li> </ul>

## Refereeing

Journals	<ul style="list-style-type: none"> <li>• Physica A: Statistical Mechanics and its Applications, Physical Review {A, B, X, Letters}, Quantum, SciPost Physics</li> </ul>
Conferences	<ul style="list-style-type: none"> <li>• QIP {2018, 2021, 2022, 2024}, TQC {2018, 2020}, QTurn2020</li> </ul>
Books	<ul style="list-style-type: none"> <li>• Oxford University Press</li> </ul>
Grants	<ul style="list-style-type: none"> <li>• NSERC (Canada)</li> </ul>

## Referees

Prof. Stephen D. Bartlett	<ul style="list-style-type: none"> <li>• School of Physics, The University of Sydney, NSW 2006, Australia</li> <li>• <a href="mailto:stephen.bartlett@sydney.edu.au">stephen.bartlett@sydney.edu.au</a></li> </ul>
Prof. Andrew C. Doherty	<ul style="list-style-type: none"> <li>• School of Physics, The University of Sydney, NSW 2006, Australia</li> <li>• <a href="mailto:andrew.doherty@sydney.edu.au">andrew.doherty@sydney.edu.au</a></li> </ul>
Prof. Steven T. Flammia	<ul style="list-style-type: none"> <li>• AWS Center for Quantum Computing, Pasadena, CA 91125, USA</li> <li>• <a href="mailto:sflammi@amazon.com">sflammi@amazon.com</a></li> </ul>
Asst. Prof. Corey Jones	<ul style="list-style-type: none"> <li>• Department of Mathematics, North Carolina State University, NC, USA</li> <li>• <a href="mailto:cmjones6@ncsu.edu">cmjones6@ncsu.edu</a></li> </ul>
Prof. Tobias J. Osborne	<ul style="list-style-type: none"> <li>• Institut für Theoretische Physik, Leibniz Universität Hannover</li> <li>• <a href="mailto:tobias.j.osborne@gmail.com">tobias.j.osborne@gmail.com</a></li> </ul>
Prof. Frank Verstraete	<ul style="list-style-type: none"> <li>• DAMTP, University of Cambridge, UK &amp; Ghent University, Belgium</li> <li>• <a href="mailto:Frank.Verstraete@UGent.be">Frank.Verstraete@UGent.be</a></li> </ul>