



Steven T. Flammia

Highlights

- 60+ published articles in peer-reviewed journals since first publishing in 2005, including 13 papers in Physical Review Letters and 10 highly cited papers (100+ citations).
- 4000+ total citations, with more than 2800+ citations in the last 5 years, and an h-index of 30, increasing +2 per year on average (source: [Google Scholar](#)).
- Several theoretical results leading to breakthrough experimental progress, such as experiments performed [here](#), [here](#) and [here](#), with additional experiments in progress.
- Principal Investigator or co-PI on grant allotments totaling US \$4.5M since starting at Sydney. The grants comprise both theoretical and experimental efforts.
- Coverage in the popular press such as [The Australian](#), including research highlights in [Nature](#) and [Science](#), and professional broad-interest press like [Physics Viewpoint](#) (twice).

Education

May '02 **B.S. Physics**, *Pennsylvania State University*.

May '02 **B.S. Mathematics**, *Pennsylvania State University*.

May '07 **Ph.D. Physics**, *University of New Mexico*.

with Distinction

Thesis *Informationally Complete Quantum Measurements and Entanglement Bounds*

Advisor Carlton M. Caves

GPA 4.0 (= A)

Research Experience and Employment

Jan '19–present **Professor**, *University of Sydney*, Sydney, New South Wales, Australia.

Jan '16–Dec '18 **Associate Professor**, *University of Sydney*, Sydney, New South Wales, Australia.

Oct '12–Dec '15 **Senior Lecturer**, *University of Sydney*, Sydney, New South Wales, Australia.

Aug '11–Sep '12 **Principal Research Scientist**, *University of Washington*, Seattle, USA.

Oct '10–Aug '11 **Postdoctoral Researcher**, *California Institute of Technology*, Pasadena, USA.

Oct '07–Sep '10 **Postdoctoral Researcher**, *Perimeter Institute for Theoretical Physics*, Waterloo, Canada.

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Prizes & Fellowships

- 2005 **National Science Foundation EAPSI fellowship.**
2014–2017 **Australian Research Council Future Fellowship.**
2019 **Pawsey Medal of the Australian Academy of Science.**

Teaching Experience

- Feb ‘19–Apr ‘19 **Quantum Mechanics.**
3rd year advanced quantum mechanics course.
- Jul ‘13–Apr ‘19 **Statistical Mechanics, a Computational Approach.**
3rd year core-subject course. Taught each year since July 2013.
- Apr ‘15–Jun ‘15 **Quantum Information Theory.**
Postgraduate course covering quantum error correction and quantum Shannon theory

Invited tutorials

- Jul ‘18 **Quantum Noise Estimation.**
Invited summer school lectures at Tsinghua University, Beijing, China.
- Jan ‘17 **Quantum Noise Estimation.**
Invited tutorial lectures at Quantum Information Processing 2017 in Seattle, USA.
- Apr ‘10–May ‘10 **Topological Quantum Order.**
Informal class taught at Perimeter Institute jointly with Alioscia Hamma
- Mar ‘10 **Quantum Data Compression.**
Invited tutorial lectures at the University of Maryland RIT seminar series “Quantum Information and Computation”
- Jun ‘06–Jul ‘06 **Topological Quantum Computing.**
Invited Lecturer for a short introductory course consisting of several lectures at the University of Queensland

Refereed Publications

61. C. H. Yang, K. W. Chan, R. Harper, W. Huang, T. Evans, J. C. C. Hwang, B. Hensen, A. Laucht, T. Tanttu, F. E. Hudson, S. T. Flammia, K. M. Itoh, A. Morello, S. D. Bartlett, A. S. Dzurak, *Silicon qubit fidelities approaching stochastic noise limits via pulse optimisation*, accepted at Nature Electronics [arXiv:1807.09500](#).
60. S. Krastanov, S. Zhou, S. T. Flammia, and L. Jiang, *Stochastic Estimation of Dynamical Variables*, accepted at Quantum Science and Technology, [arXiv:1812.05120](#).
59. R. Harper and S. Flammia, *Fault-tolerant logical gates in the IBM Quantum Experience*, Phys. Rev. Lett. **122**, 080504 (2019), [arXiv:1806.02359](#).
58. E. Huang, A. C. Doherty, S. Flammia, *Performance of quantum error correction with coherent errors*, Phys. Rev. A **99** 022313 (2019), [arXiv:1805.08227](#).
57. A. Hashagen, S. Flammia, D. Gross and J. Wallman, *Real Randomized Benchmarking*, Quantum **2**, 85 (2018), [arXiv:1801.06121](#).
56. M. Appleby, S. T. Flammia, T.-Y. Chien and S. Waldron, *Constructing exact symmetric informationally complete measurements from numerical solutions*, J. Phys. A **51**, 165302 (2018), [arXiv:1703.05981](#).

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55. D. K. Tuckett, S. D. Bartlett and S. T. Flammia, *Ultrahigh error threshold for surface codes with biased noise*, Phys. Rev. Lett. **120**, 050505 (2018), [arXiv:1708.08474](#).
54. R. J. Chapman, A. Karim, Z. Huang, S. T. Flammia, M. Tomamichel and A. Peruzzo, *Beating the classical limits of information transmission using a quantum decoder*, Phys. Rev. A **97**, 012315 (2018), [arXiv:1704.07036](#).
53. M. Appleby, I. Bengtsson, I. Dumitru and S. Flammia, *Dimension towers of SICs I: Aligned SICs and embedded tight frames*, J. Math. Phys. **58** 112201 (2017), [arXiv:1707.09911](#).
52. A. Robertson, C. Granade, S. D. Bartlett and S. T. Flammia, *Tailored codes for small quantum memories*, Phys. Rev. Applied **8** 064004 (2017), [arXiv:1703.08179](#).
51. C. Granade, C. Ferrie and S. T. Flammia, *Practical adaptive quantum tomography*, New J. Phys. **19** 113017 (2017), [arXiv:1605.05039](#).
50. Y.-C. Lee, C. Brell and S. T. Flammia, *Topological quantum error correction in the Kitaev honeycomb model*, J. Stat. Mech. **2017** 083106 (2017), [arXiv:1705.01563](#).
49. C. T. Chubb and S. T. Flammia, *Approximate symmetries of Hamiltonians*, J. Math. Phys. **58** 082202 (2017), [arXiv:1608.02600](#).
48. M. Appleby, S. Flammia, G. McConnell and J. Yard, *SICs and Algebraic Number Theory*, Foundations of Physics **47** 1042 (2017), [arXiv:1701.05200](#).
47. C. Riofrio, D. Gross, S. T. Flammia, T. Monz, D. Nigg, R. Blatt, and J. Eisert, *Experimental quantum compressed sensing for a seven-qubit system*, Nature Comm. **8** 15305 (2017), [arXiv:1608.02263](#).
46. S. T. Flammia, J. Haah, M. J. Kastoryano, I. H. Kim, *Limits on the storage of quantum information in a volume of space*, Quantum **1**, 4 (2017), [arXiv:1610.06169](#).
45. R. Harper, R. J. Chapman, C. Ferrie, C. Granade, R. Kueng, D. Naoumenko, S. T. Flammia, A. Peruzzo, *Explaining quantum correlations through evolution of causal models*, Phys. Rev. A **95** 042120 (2017), [arXiv:1608.03281](#).
44. R. Harper and S. T. Flammia, *Estimating the fidelity of T gates using standard interleaved randomized benchmarking*, Quantum Sci. Technol. **2** 015008 (2017), [arXiv:1608.02943](#).
43. D. Bacon, S. T. Flammia, A. W. Harrow and J. Shi, *Sparse Quantum Codes from Quantum Circuits*, IEEE Trans. Info. Theory **63**, (4) 2464–2479 (2017), [arXiv:1411.3334](#).
42. S. Burton, C. G. Brell and S. T. Flammia, *Classical Simulation of Quantum Error Correction in a Fibonacci Anyon Code*, Phys. Rev. A **95** 022309 (2017), [arXiv:1506.03815](#).
41. J. Bridgeman, S. T. Flammia and D. Poulin, *Detecting Topological Order with Ribbon Operators*, Phys. Rev. B **94** 205123 (2016), [arXiv:1603.02275](#).
40. R. Kueng, D. M. Long, A. C. Doherty and S. T. Flammia, *Comparing Experiments to the Fault-Tolerance Threshold*, Phys. Rev. Lett. **117** 170502 (2016), [arXiv:1510.05653](#).
39. C. T. Chubb and S. T. Flammia, *Computing the Degenerate Ground Space of Gapped Spin Chains in Polynomial Time*, Chicago J. Theor. Comp. Sci., **2016** (9), 1–35 (2016). [arXiv:1502.06967](#).
38. H. Ball, T. M. Stace, S. T. Flammia and M. J. Biercuk, *The Effect of Noise Correlations on Randomized Benchmarking*, Phys. Rev. A **93** 022303 (2016), [arXiv:1504.05307](#).

37. E. Mount, C. Kabytayev, S. Crain, R. Harper, S.-Y. Baek, G. Vrijsen, S. Flammia, K. R. Brown, P. Maunz, J. Kim, *Error Compensation of Single-Qubit Gates in a Surface Electrode Ion Trap Using Composite Pulses*, Phys. Rev. A **92** 060301(R) (2015), [arXiv:1504.01440](#).
36. J. Wallman, C. Granade, R. Harper, and S. T. Flammia, *Estimating the Coherence of Noise*, New J. Phys. **17**, 113020 (2015), [arXiv:1503.07865](#).
35. A. O'Brien, S. D. Bartlett, A. C. Doherty, S. T. Flammia, *Symmetry-respecting real-space renormalization for the quantum Ashkin-Teller model*, Phys. Rev. E **92** 042163 (2015), [arXiv:1507.00038](#).
34. M. A. Fogarty, M. Veldhorst, R. Harper, H. Yang, S. D. Bartlett, S. T. Flammia and A. S. Dzurak, *Non-exponential Fidelity Decay in Randomized Benchmarking with Low-Frequency Noise*, Phys. Rev. A **92** 022326 (2015), [arXiv:1502.05119](#).
33. C. Cesare, A. J. Landahl, D. Bacon, S. T. Flammia and A. Neels, *Adiabatic Topological Quantum Computing*, Phys. Rev. A **92** 012336 (2015), [arXiv:1406.2690](#).
32. J. J. Wallman and S. T. Flammia, *Randomized Benchmarking with Confidence*, New J. Phys. **14** 103032 (2014), [arXiv:1404.6025](#)
31. C. G. Brell, S. Burton, G. Dauphinais, S. T. Flammia, and D. Poulin, *Thermalization, Error-Correction, and Memory Lifetime for Ising Anyon Systems*, Phys. Rev. X, **4** 031058 (2014), [arXiv:1311.0019](#)
30. D. Hayes, S. T. Flammia, and M. Biercuk, *Programmable quantum simulation by dynamic Hamiltonian engineering*, New J. Phys., **16** 083027 (2014), [arXiv:1309.6736](#)
29. Y.-C. Lee, M.-H. Hsieh, S. T. Flammia, and R.-K. Lee, *Local PT symmetry violates the no-signaling principle*, Phys. Rev. Lett., **106** 230501 (2014), [arXiv:1312.3395](#)
28. D. Bacon, S. T. Flammia and G. M. Crosswhite, *Adiabatic Quantum Transistors*, Phys. Rev. X **3** 021015 (2013), [arXiv:1207.2769](#)
27. S. T. Flammia and A. W. Harrow, *Counterexamples to Kalai's Conjecture C*, Quant. Info. Comp. **13** 1 (2013), [arXiv:1204.3404](#)
26. S. T. Flammia, D. Gross, Y.-K. Liu and J. Eisert, *Quantum Tomography via Compressed Sensing: Error Bounds, Sample Complexity, and Efficient Estimators*, New J. Phys. **14** 095022 (2012), [arXiv:1205.2300](#)
25. B. Brown, S. T. Flammia and N. Schuch, *Computational Difficulty of Computing the Density of States*, Phys. Rev. Lett. **107** 040501 (2011), [arXiv:1010.3060](#)
24. S. T. Flammia and Y.-K. Liu, *Direct Fidelity Estimation from Few Pauli Measurements*, Phys. Rev. Lett. **106** 230501 (2011), [arXiv:1104.4695](#)
23. C. G. Brell, S. T. Flammia, S. D. Bartlett and A. C. Doherty, *Toric Codes and Quantum Doubles from Two-body Hamiltonians*, New J. Phys. **13** 053039 (2011), [arXiv:1011.1942](#)
22. N. C. Menicucci, S. T. Flammia, P. van Loock, *Graphical calculus for Gaussian pure states*, Phys. Rev. A **83**, 042335 (2011), [arXiv:1007.0725](#)
21. D. M. Appleby, S. T. Flammia and C. A. Fuchs, *The Lie Algebraic Significance of Symmetric Informationally Complete Measurements*, J. Math. Phys. **52** 022202 (2011), [arXiv:1001.0004](#)

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20. M. Cramer, M. B. Plenio, S. T. Flammia, R. Somma, D. Gross, S. D. Bartlett, O. Landon-Cardinal, D. Poulin, and Y.-K. Liu, *Efficient quantum state tomography*, Nat. Commun. **1**(9), 2010. [arXiv:1101.4366](#)
19. D. Gross, Y.-K. Liu, S. T. Flammia, S. Becker and J. Eisert, *Quantum state tomography via compressed sensing*, Phys. Rev. Lett. **105** 150401 (2010). [arXiv:0909.3304](#)
18. D. Bacon and S. T. Flammia, *Adiabatic Cluster State Quantum Computing*, Phys. Rev. A **82** 030303(R) (2010), [arXiv:0912.2098](#)
17. S. T. Merkel, C. A. Riofrío, S. T. Flammia and I. H. Deutsch, *Random unitary maps for quantum state reconstruction*, Phys. Rev. A **81** 032126 (2010). [arXiv:0912.2101](#)
16. S. T. Flammia, A. Hamma, T. L. Hughes and X.-G. Wen, *Topological entanglement Rényi entropy and reduced density matrix structure*, Phys. Rev. Lett. **103** 261601 (2009). [arXiv:0909.3305](#)
15. D. Bacon and S. T. Flammia, *Adiabatic Gate Teleportation*, Phys. Rev. Lett. **103** 120504 (2009). [arXiv:0905.0901](#)
14. S. T. Flammia, N. C. Menicucci and O. Pfister, *The Optical Frequency Comb as a One-Way Quantum Computer*, J. Phys. B **42** 114009, (2009). [arXiv:0811.2799](#)
13. D. Gross, S. T. Flammia and J. Eisert, *Most Quantum States Are Too Entangled To Be Useful As Computational Resources*, Phys. Rev. Lett. **102** 190501 (2009). [arXiv:0810.4331](#)
12. S. T. Flammia and S. Severini, *Weighing matrices and optical quantum computing*, J. Phys. A: Math. Theor. **42** 065302, (2009). [arXiv:0808.2057](#)
11. N. C. Menicucci, S. T. Flammia and O. Pfister, *One-way quantum computing in the optical frequency comb*, Phys. Rev. Lett. **101** 130501, (2008). [arXiv:0804.4468](#)
10. S. Boixo, A. Datta, M. J. Davis, S. T. Flammia, A. Shaji and C. M. Caves, *Quantum Metrology: Dynamics vs. Entanglement*, Phys. Rev. Lett. **101** 040403, 2008. [arXiv:0805.2180](#)
9. H. Zaidi, N. C. Menicucci, S. T. Flammia, R. Bloomer, M. Pysher and O. Pfister, *Entangling the optical frequency comb: simultaneous generation of multiple 2×2 and 2×3 continuous-variable cluster states in a single optical parametric oscillator*, Laser Phys. **18** 659, 2008. [arXiv:0710.4980](#)
8. D. E. Browne, M. B. Elliott, S. T. Flammia, S. T. Merkel, A. Miyake, and A. J. Short, *Phase transition of computational power in the resource states for one-way quantum computation*, New J. Phys. **10**, 023010 (2008). [arXiv:0709.1729](#)
7. S. Boixo, A. Datta, S. T. Flammia, A. Shaji, E. Bagan, and C. M. Caves, *Quantum-limited metrology with product states*, Phys. Rev. A **77** 012317, (2007). [arXiv:0710.0285](#)
6. N. C. Menicucci, S. T. Flammia, H. Zaidi, and O. Pfister, *Ultracompact generation of continuous-variable cluster states*, Phys. Rev. A **76** 010302, 2007. [arXiv:quant-ph/0703096](#)
5. A. Datta, S. T. Flammia, A. Shaji, and C. M. Caves, *Constrained bounds on measures of entanglement*, Phys. Rev. A **75** 062117, 2007. [arXiv:quant-ph/0612049](#)
4. S. Boixo, S. T. Flammia, C. M. Caves, and J. Geremia, *Generalized limits for single-parameter quantum estimation*, Phys. Rev. Lett. **98** 090401, 2007. [arXiv:quant-ph/0609179](#)

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3. S. T. Flammia, *On SIC-POVMs in prime dimensions*, J. Phys. A: Math. Gen. **39** 13483, 2006. [arXiv:quant-ph/0605050](https://arxiv.org/abs/quant-ph/0605050)
2. S. T. Flammia, A. Silberfarb, and C. M. Caves, *Minimal informationally complete measurements for pure states*, Found. Phys. **35** 1985, 2005. [arXiv:quant-ph/0404137](https://arxiv.org/abs/quant-ph/0404137)
1. A. Datta, S. T. Flammia, and C. M. Caves, *Entanglement and the power of one qubit*, Phys. Rev. A **72** 042316, 2005. [arXiv:quant-ph/0505213](https://arxiv.org/abs/quant-ph/0505213)

Refereed Conference Proceedings

4. D. Bacon, S. T. Flammia, A. W. Harrow and J. Shi, *Sparse Quantum Codes from Quantum Circuits*, Proceedings of the 47th ACM Symposium on Theory of Computing (STOC 2015), [arXiv:1411.3334](https://arxiv.org/abs/1411.3334).
3. O. Pfister, N. C. Menicucci, S. T. Flammia, H. Zaidi, R. Bloomer, and M. Pysher, *Playing the quantum harp: multipartite squeezing and entanglement of harmonic oscillators* in Quantum Electronics Metrology, A. E. Craig and S. M. Shahriar eds., (SPIE, San Jose, CA, USA), **6906**(1) 690603+, (2008).
2. S. Boixo, A. Datta, M. J. Davis, S. T. Flammia, A. Shaji, A. B. Tacla and C. M. Caves, *Quantum metrology with Bose-Einstein condensates*, in Quantum Communication, Measurement And Computing (QCMC): Ninth International Conference on QCMC, A. Lvovsky, ed., (AIP, Calgary, Canada), **1110**(1) 423–426, (2009).
1. S. Boixo, A. Datta, M. J. Davis, S. T. Flammia, A. Shaji, A. B. Tacla and C. M. Caves, *Quantum metrology from an information theory perspective*, in Quantum Communication, Measurement And Computing (QCMC): Ninth International Conference on QCMC, A. Lvovsky, ed., (AIP, Calgary, Canada), **1110**(1) 427–432, (2009).

Preprints Submitted to Peer-Reviewed Journals

7. M. Appleby, I. Bengtsson, S. Flammia and D. Goyeneche, *Tight Frames, Hadamard Matrices and Zauner's Conjecture*, submitted, [arXiv:1903.06721](https://arxiv.org/abs/1903.06721).
6. R. Harper, I. Hincks, C. Ferrie, S. T. Flammia and J. J. Wallman, *Statistical analysis of randomized benchmarking*, submitted, [arXiv:1901.00535](https://arxiv.org/abs/1901.00535).
5. D. K. Tuckett, C. T. Chubb, S. Bravyi, S. D. Bartlett, and S. T. Flammia, *Tailoring surface codes for highly biased noise*, submitted, [arXiv:1812.08186](https://arxiv.org/abs/1812.08186).
4. C. T. Chubb and S. T. Flammia, *Statistical mechanical models for quantum codes with correlated noise*, submitted, [arXiv:1809.10704](https://arxiv.org/abs/1809.10704).
3. J. Combes, C. Granade, C. Ferrie and S. T. Flammia, *Logical Randomized Benchmarking*, submitted, [arXiv:1702.03688](https://arxiv.org/abs/1702.03688).
2. J. Helsen, J. J. Wallman, S. T. Flammia, S. Wehner, *Multi-qubit Randomized Benchmarking Using Few Samples*, submitted, [arXiv:1701.04299](https://arxiv.org/abs/1701.04299).
1. M. Appleby, S. Flammia, G. McConnell and J. Yard, *Generating Ray Class Fields of Real Quadratic Fields via Complex Equiangular Lines*, submitted, [arXiv:1604.06098](https://arxiv.org/abs/1604.06098).

Edited Volumes

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1. 9th Conference on the Theory of Quantum Computation, Communication, and Cryptography (TQC 2014), Steven T. Flammia and Aram W. Harrow, Eds., (Schloss Dagstuhl 2014), <http://www.dagstuhl.de/dagpub/978-3-939897-73-6>.

Invited Book Reviews

1. B. Schumacher and M. Westmoreland, “Quantum Processes, Systems, and Information” (Oxford U. Press 2010). Amer. J. Phys. **79** 239 (2011), doi:[10.1119/1.3531951](https://doi.org/10.1119/1.3531951).

Invited Talks & Selected Contributed Talks

(* = competitive refereeing process for talk acceptance)

Learning Pauli channels.

- Mar ‘19 University of Technology, Sydney (UTS), Sydney, Australia.
- Feb ‘19 Yale University, New Haven, USA.
- Jan ‘19 Quantum Information Processing 2019 (QIP 2019), Boulder, USA.
- Apr ‘18 American Mathematical Society NE (invited), Northeastern University, Boston.
- Apr ‘18 Canadian Institute For Advanced Research (CIFAR) annual meeting, Quebec City.
- Mar ‘18 American Physical Society March Meeting (invited) .
- Mar ‘18 American Mathematical Society MW (invited), Ohio State University, Columbus.

Limits on Information Storage in a Volume of Space.

- Dec ‘17 Quantum Seminar, Stony Brook.
- Oct ‘17 Frontiers of Quantum Information Physics, KITP, Santa Barbara.
- Sep ‘17 Quantum Error Correction 2017, University of Maryland.

Ribbon Operators for Topological Order.

- Jun ‘17 Theory of Quantum Computation, Communication and Cryptography 2017, Paris, France.
- May ‘17 Quantum Seminar, IBM, Yorktown Heights, USA.
- Jun ‘16 Last Frontier of Quantum Information Science, Juneau, USA.
- Jun ‘15 Seminar, Massachusetts Institute of Technology, Cambridge, USA.
- Jun ‘15 JQI/QuICS Seminar, University of Maryland, College Park, USA.
- May ‘15 Topological Phases and Quantum Computation Workshop, Mo’orea, French Polynesia.

Sparse Quantum Codes from Quantum Circuits.

- Sep ‘15 Frontiers of Quantum Computer Science, University of Maryland, College Park, USA.
- Jun ‘15 Seminar, National Institute of Standards and Technology (NIST), Gaithersburg, USA.
- Jun ‘15 *STOC 2015: Symposium on on Theory of Computing, Portland, USA.
- May ‘15 Quantum Information Seminar, Macquarie University, Sydney, Australia.
- Apr ‘15 Colloquium, University of Queensland, Brisbane, Australia.
- Dec ‘14 Quantum Error Correction 2014, ETH, Zürich, Switzerland.

Randomized Benchmarking with Confidence.

- Apr ‘17 Quantum Information & Measurement, Paris, France.
- Mar ‘17 IQuISE Seminar, MIT, Cambridge, USA.
- Aug ‘16 Fault Tolerance Workshop, Benasque, Spain.
- Jul ‘16 Quantum Communication, Measurement, and Control (QCMC 2016), Singapore.
- Mar ‘16 Yale Quantum Institute Colloquium, Yale University, USA.

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- Mar '16 APS March Meeting 2016, Baltimore, USA.
Oct '15 IPDF Collaboration Meeting 2015, Sydney, Australia.
Aug '15 Workshop on Designs and Systems of Lines, Worcester Polytechnic Institute, Worcester, USA.
Jan '15 *Quantum Information Processing 2015, Sydney, Australia.

Thermalization, Error Correction, and Memory Lifetime for Ising Anyons.

- Jul '14 Quantum LDPC Codes Workshop, Perimeter Institute, Waterloo, Canada.
Jul '14 Seminar, Max Planck Institute for Quantum Optics, Garching, Germany.
Jul '14 Quantum Information Workshop, Seefeld, Austria.
May '14 Seminar, Sandia National Laboratories, Albuquerque, USA.
Jul '13 Online Seminar, Q+ Hangout. Broadcast worldwide and posted on YouTube.

The sample complexity of tomography.

- Mar '13 Research Seminar, Duke University, Durham, USA.
Mar '13 American Physical Society March Meeting, Baltimore, USA.
Feb '13 Mathematical Methods of Quantum Tomography, Fields Institute, Toronto, Canada.
Jan '13 MCQO Workshop, San Diego, USA.

Direct fidelity estimation from few Pauli measurements.

- Aug '12 Discovery 2020 Workshop, Santa Fe, USA.
Jul '12 Seminar, Free University of Berlin, Berlin, Germany.
Mar '12 Seminar, University of Sherbrooke, Sherbrooke, Canada.
Feb '12 Seminar, Massachusetts Institute of Technology, Cambridge, USA.
Feb '12 *SQuInT Workshop 2012, Albuquerque, USA.
Jan '12 PIQuDos Seminar, Perimeter Institute for Theoretical Physics, Waterloo, Canada.
Oct '11 Colloquium, University of Sydney, Sydney, Australia.
Jun '11 Seminar, University of New Mexico, Albuquerque, USA.
Jun '11 Seminar, Sandia National Labs, Albuquerque, USA.
Jun '11 Seminar, University of Washington, Seattle, USA.
May '11 Seminar, Massachusetts Institute of Technology, Cambridge, USA.
May '11 Seminar, Lincoln Labs, Cambridge, USA.
May '11 Seminar, HRL Labs, Malibu, USA.
Apr '11 Seminar, University of Queensland, Brisbane, Australia.

Quantum Doubles from two-body Hamiltonians.

- Jan '12 Institute for Quantum Computing Colloquium, IQC, Waterloo, Canada.
Feb '11 Quantum Information Seminar, University of Southern California, Los Angeles, USA.
Nov '10 CoQuIT Workshop, Hanover, Germany.

Lie algebras and symmetric informationally complete measurements.

- Mar '11 American Physical Society March Meeting, Dallas, USA.

Adiabatic Quantum Transistors.

- Jan '11 Workshop on Hamiltonians and Quantum Information, Coogee, Australia.
Sep '10 Workshop on Hamiltonians and Gaps, Cambridge, UK.
Jul '10 Workshop on Quantum Algorithms, Computational Models and Foundations of Quantum Mechanics, Vancouver, Canada.

Adiabatic Gate Teleportation.

- Jan '10 *Quantum Information Processing, Zürich, Switzerland.

Ultra fast quantum state tomography.

- May '11 Seminar, Massachusetts Institute of Technology, Cambridge, USA.
Feb '11 *SQuInT Workshop 2011, Boulder, USA.
Dec '10 *Workshop on Low-rank Methods for Large-Scale Machine Learning, NIPS 2010, Whistler, Canada.
Jun '10 Seminar, University of Innsbruck, Innsbruck, Austria.
Apr '10 CQIQC Seminar, University of Toronto, Toronto, Canada.
Mar '10 JQI Seminar, University of Maryland, Maryland, USA.
Feb '10 Quantum Measurement and Control Workshop, Coogee, Australia.
Jan '10 *Quantum Information Processing, Zürich, Switzerland.
Nov '09 CQIC Seminar, University of New Mexico, Albuquerque, USA.
Nov '09 CQIL Seminar, McGill University, Montreal, Canada.
Nov '09 IQIS Seminar, University of Calgary, Calgary, Canada.
Aug '09 *Conference on Quantum Information and Quantum Control III, Toronto, Canada.
May '09 *Theory of Quantum Computing, Waterloo, Canada.
Apr '09 IQI Seminar, California Institute of Technology, Pasadena, California, USA.
Feb '09 Sydney Quantum Information Theory Workshop, Coogee, Australia.

Most quantum states are too entangled for measurement-based computation.

- Jan '09 *Quantum Information Processing, Santa Fe, NM, USA.

One-way quantum computing in the optical frequency comb.

- Nov '08 Laurier Seminar Series in Computational Science and Applied Statistical Modeling, Wilfrid Laurier University, Waterloo, ON, Canada.
Sep '08 Institute for Quantum Computing Colloquium, IQC, Waterloo, ON, Canada.
Aug '08 Quantum Lunch, Los Alamos National Laboratory, USA.
May '08 Quantum Information and Graph Theory: Emerging Connections, Perimeter Institute, Waterloo, Ontario, Canada.
Feb '08 *SQuInT Workshop 2008, Santa Fe, New Mexico, USA.

Generalized Limits for Quantum Single-Parameter Estimation.

- Feb '07 *SQuInT Workshop 2007, Pasadena, California, USA.

What's Entanglement Good For?.

- Jan '07 Seminar, University of Innsbruck, Innsbruck, Austria.
Nov '06 IQI Seminar, California Institute of Technology, Pasadena, California, USA.
Sep '06 PIQuDos Seminar, Perimeter Institute for Theoretical Physics, Waterloo, Canada.

Entanglement and the Power of One Qubit.

- Apr '05 Emmy Nother Research Group Seminar, University of Erlangen-Nurnberg, Erlangen, Germany.
Feb '05 *SQuInT Workshop 2005, Tucson, Arizona, USA.

Funding

All funding amounts are in equivalent US dollars (as of 2017/10) and represent my personal allotment, excluding the budgets of any other co-PIs.

Total funding amount since beginning at Sydney is approximately \$4.5 million.

- Jan '18–Dec '24 **ARC Centre of Excellence for Engineered Quantum Systems (EQUS)**, \$1,120,000, co-PI.

Long-term funding to establish a center for quantum information science research in Australia.

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- Jan '16–Dec '17 **Structured Measurements for Quantum and Classical Compressed Sensing**, \$14,100, PI.
Small travel and collaboration grant for work on compressed sensing and quantum tomography. Funded by the Australia–Germany Joint Research Cooperation.
- Aug '15–Jan '16 **IARPA MQCO Capstone**, \$105,000, co-PI.
Capstone grant that bridges funding until the successor program of the MQCO program by IARPA. Activities followed on from the MUSIQC grant.
- May '15–May '16 **Topology and Algebra in Quantum Nanoscience**, \$58,600, co-PI.
Proposal for jumpstarting an effort in the mathematics and physics of strongly correlated 2D systems with topological order.
- Jan '14–Dec '17 **ARC Future Fellowship**, \$489,000.
Prize fellowship for outstanding researchers; sponsored by the Australian government.
- Feb '14–Jan '19 **Robust and Device-Independent Benchmarking for Fault-Tolerant Quantum Computation**, \$1,022,600, PI.
This theoretical proposal investigates new protocols for testing and certifying meso-scale quantum devices.
- Feb '14–Jan '19 **Certified Topological Quantum Computation**, \$1,115,400, co-PI.
Part of an experimental collaboration with the Blatt group in Innsbruck, this effort seeks to implement a small-scale topological quantum error-correcting code in an ion trap.
- Oct '12–Aug '15 **Modular Universal Scalable Ion-trap Quantum Computer (MUSIQC)**, US\$558,000, co-PI.
The goal is to build a hierarchical design for an ion trap quantum computer that can entangle both nearby and nonlocal trapped ion qubits on dozens of ions simultaneously and with high fidelity.

Press

My work on frequency comb quantum computers was featured as a [Physics Viewpoint](#), and as a research highlight in [Nature](#). My work showing that most states are too entangled to be useful was also featured as a [Physics Viewpoint](#), and in popular articles appearing in [Phys Org](#), [Science News](#), [American Scientist](#), [Physics World](#), and [Science](#). Two of my papers have been featured as an [Editor's Suggestion](#), and one as a [Physics Synopsis](#). My work on biased noise models was featured in [The Australian](#), [Gizmodo](#), [Cosmos](#), and [Phys Org](#).

Programs

- QT1 Written together with S. Becker. QT1 is a Matlab program for implementing quantum state and process tomography via trace-norm minimization. QT1 is still in development and is currently only available by request.
- Qcircuit Written together with B. Eastin; maintained by T. Scholten. Qcircuit is a macro package for \LaTeX for typesetting quantum circuit diagrams quickly and efficiently. Available at CTAN (www.ctan.org/pkg/qcircuit) and on GitHub (github.com/CQuIC-GitHub/qcircuit).

Students Supervised

Current PhD students

- Feb '17–present *Tim Evans*, PhD student
 Jul '16–present *Prahlad Warszawski*, PhD student.
 Feb '16–present *David Tuckett*, PhD student.

Graduated PhD students

- Feb '15–Apr '19 *Christopher Chubb*, postdoc at University of Sherbrooke.

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Oct '12–Jan '17 *Simon Burton*, postdoc at University College London.
Jul '14–Sep '17 *Robin Harper*, postdoc at the University of Sydney.

Honours students

Feb '18–Dec '18 *Eric Huang*, honours student
Feb '17–Dec '17 *Campbell McLaughlin*, honours student, university medalist
Feb '17–Dec '17 *David Long*, honours student, university medalist
Feb '15–Dec '15 *Alan Robertson*, honours student.
Feb '15–Dec '15 *Henry Stoke*, honours student.
Feb '14–Dec '14 *Christopher Chubb*, honours student; university medalist.
Feb '14–Dec '14 *Nic Funai*, honours student; university medalist.
Feb '14–Dec '14 *Ishraq Uddin*, honours student.

undergraduate students

Jun '11–Aug '11 *Adrian Chapman*, undergraduate summer student, went on to graduate school at U. of New Mexico.
May '10–Aug '10 *Brielin Brown*, undergraduate summer student, went on to graduate school at UC Berkeley.
May '08–Jul '08 *Sreraman Muralidharan*, undergraduate summer student, went on to graduate school at Yale.

senior project students

Feb '16–Jun '16 *Campbell McLaughlin*
Feb '16–Jun '16 *David Long*
Feb '16–Jun '16 *Eric Huang*
Jul '14–Dec '14 *Alex Murray, Tim Shen*
Feb '14–Jun '14 *Sean Carnaffan*
Jul '13–Dec '13 *Robin Harper, Henry Stoke*
Feb '13–Jun '13 *Layton Manuel*

talented students program students

Feb '16–Jun '16 *Edric Wang*, 2nd year TSP student.
Feb '15–Jun '15 *David Merrick Long*, 1st year TSP student.
Feb '14–Jun '15 *Eric Huang*, 1st year TSP student.
Feb '14–Jun '14 *Paul Webster*, 2nd year TSP student.

Professional Activities, Service, and Outreach

Editorial.

- Coordinating Editor for *Quantum*

Refereeing and Reviewing.

- Referee for the following journals: Nature, Science, Physical Review Letters, Reviews of Modern Physics, Nature Photonics, Nature Communications, Communications in Mathematical Physics, Physical Review A, Physical Review B, Physical Review X, IEEE Transactions on Information Theory, Proceedings of the National Academy of Science, Journal of Mathematical Physics, Journal of Physics A, Journal of Physics B, New Journal of Physics, European Physical Journal D, European Physical Journal Quantum Technology, Scientific Reports, Physica Scripta, Cryptography and Communications, Quantum Information and Computation, International Journal of Quantum Information, Entropy, Optics Express.

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- Reviewer for competitive grant funding for the following agencies: US National Science Foundation (NSF), Australian Research Council (ARC), Natural Sciences and Engineering Research Council of Canada (NSERC), Netherlands Organization for Scientific Research (NWO), US-Israel Binational Science Foundation (BSF), Agence Nationale de la Recherche France (ANR), Swiss National Science Foundation (SNSF).

Conference Program Committees.

- Co-Chair of Program Committee, Theory of Quantum Computation (TQC), 2014.
- Program Committee member, Theory of Quantum Computation (TQC), 2011, 2017, 2018.
- Program Committee member, Quantum Information Processing (QIP), 2015, 2018.
- Program Committee member, Quantum Communication, Measurement and Computing (QCMC), 2016.
- Program Committee member, Asian Quantum Information Science (AQIS), 2015.

University Service and Conference Organizing.

- Talented Students Program Coordinator (jointly with Helen Johnston), at the University of Sydney, Oct'12–present.
- Local Organizer for Quantum Information Processing (QIP) 2015.
- Organizer for the Sydney Quantum Information Theory Workshop 2014.
- Organizer (2013 till present) for the annual Coogee Quantum Information conference.
- Organizer for the conference *Seeking SICs: An Intense Workshop on Quantum Frames and Designs* at Perimeter Institute, 2008.
- PIQuDos Seminar Series coordinator, Fall 2008.

Outreach and Community.

- Co-author of the popular blog “[The Quantum Pontiff](#)” which is a source of news, information, commentary, and outreach for the quantum information science community.
- Moderator, administrator, and co-developer for the website [Scirate](#), where users vote and comment on papers of interest to the quantum information science community.

Intellectual Property

- US Patent #8,513,647: *Quantum computational device employing multi-qubit structures and associated systems and methods*, DM Bacon, GM Crosswhite, ST Flammia

Professional References

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Professors Blatt and Kim are experimentalists and can testify to the impact of my work toward current experimental efforts, while the others are theorists who can additionally comment on my theoretical achievements and abilities. Professors Bartlett and Doherty can additionally comment on my teaching.

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