

Mark M. Wilde

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Education

University of Southern California,
Ph.D., Electrical Engineering,
Los Angeles, California, August 2008.

Tulane University,
M.S., Electrical Engineering,
New Orleans, Louisiana, August 2004.

Texas A&M University,
B.S., Computer Engineering,
College Station, Texas, May 2002.

Research Experience

Postdoctoral Fellow October 2009—present
Patrick Hayden, McGill University Montreal, Quebec
Research in quantum error correction, quantum Shannon theory, quantum biology.

Visitor October 2008—December 2008
Andreas Winter, Centre for Quantum Singapore
Technology, National University of Singapore
Proved trade-off capacity theorems for the transmission of classical and quantum information over an entanglement-assisted quantum channel.

Visitor September 2008
Martin Rötteler, NEC Laboratories America Princeton, New Jersey
Investigated the simulation of entanglement-assisted quantum codes under the assumption that entanglement may not be ideal. Investigated improving performance of the algorithm for encoding general quantum convolutional codes.

Research Assistant September 2006—August 2008
Todd A. Brun, University of Southern California Los Angeles, California
Developed several methods for error correction of quantum information including entanglement-assisted quantum convolutional coding, convolutional entanglement distillation, and entanglement-assisted operator error correction for continuous-variable systems. Derived several formulae that determine the number of entangled qubits that several variations of an entanglement-assisted quantum code require. Developed the continuous-variable coherent channel.

Research Assistant Summer 2005, 2006
Jonathon P. Dowling, Louisiana State University Baton Rouge, Louisiana
Developed a linear-optical implementation of a controlled-phase gate. Discovered a method to implement the coherent channel experimentally in a linear-optical system.

Research Assistant
Bart Kosko, University of Southern California
September 2005–September 2006
Los Angeles, California
Developed a model for stochastic resonance in a quantum-optical system. Highlighted the applications of this model in quantum key distribution. Also constructed models for stochastic resonance in quantum teleportation and continuous-variable superdense coding.

Research Assistant
Andrew Martinez, Tulane University
September 2002–September 2004
New Orleans, Louisiana
Developed a voice conversion system with the ability to transform one persons voice features to that of another person.

Work Experience

Quantum Information Scientist
Science Applications International Corporation
January–October 2009
Arlington, Virginia
Developed the theory of a quantum shift register. Such a device may be useful in the implementation of a quantum error correction code for quantum communication. Proved the ultimate capability of a noisy quantum channel for consuming or generating noiseless quantum communication, noiseless classical communication, and noiseless entanglement. Proved the ultimate capability of a noisy quantum channel and a secret key to generate noiseless public communication and noiseless private communication. Developed a Leggett-Garg test for “quantumness” in a biomolecule.

Summer Intern
Jet Propulsion Laboratory
Summer 2005
Pasadena, California
Developed a low complexity, lossless image software in the C language that compresses hyperspectral images obtained from the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). Wrote a specialized tool to select specific regions of a hyperspectral image for output to a new image.

Summer Intern
Hewlett-Packard
Summer 2002
Houston, Texas
Wrote tools in C (Linux environment) to stress test the capacities of the Storage Area Network devices for Compaqs Networked Attached Storage group. Wrote a test suite in TCL to test the NFS protocol for Linux, UNIX, and Microsofts Services for UNIX.

Summer Intern
Compaq Computer Corporation
Summer 2001
Houston, Texas
Used hardware debugging skills with logic analyzer and oscilloscope to troubleshoot design of Compaq DL360 server in the server new product lab. Provided architecture feedback to engineers. Ran memory qualification tests on the DL 360 server and improved software toolset.

Summer Intern
Compaq Computer Corporation
Summer 2000
Dallas, Texas
Wrote an ASP web application that allows software developers to fill out a retrospective questionnaire regarding the quality of their project. Displayed results of the questionnaire in a statistical graphic format. Transferred data from a legacy database located on a WAN to a new database using SQL action queries. Maintained the SQA (Software Quality Assurance) web site.

Mark M. Wilde

Teaching Experience

- Guest Lecturer, Quantum Computation,
“Reversible Computation,”
McGill University, Winter 2010
- Teaching Assistant, Quantum Computation,
McGill University, Winter 2010
- Guest Lecturer, “Mysteries of the Quantum World,”
“Introduction to Quantum Error Correction,”
Tulane University, Fall 2008
- Guest Lecturer, Linear Algebra,
“Introduction to Quantum Information Processing,”
University of Southern California, Spring 2007
- Teaching Assistant, Linear Signals and Systems,
University of Southern California, Fall 2005–Spring 2007

Peer-reviewed Articles

- [25] Min-Hsiu Hsieh and Mark M. Wilde, “Trading classical communication, quantum communication, and entanglement in quantum Shannon theory,” arXiv:0901.3038, Accepted for publication in the *IEEE Transactions on Information Theory*, May 2010.
- [24] Kamil Bradler, Patrick Hayden, Dave Touchette, Mark M. Wilde, “Trade-off capacities of the quantum Hadamard channels,” arXiv:1001.1732, Accepted for publication in *Physical Review A*, April 2010.
- [23] Min-Hsiu Hsieh and Mark M. Wilde, “Entanglement-assisted communication of classical and quantum information,” arXiv:0811.4227, Accepted for publication in *IEEE Transactions on Information Theory*, April 2010.
- [22] Mark M. Wilde and Todd A. Brun, “Quantum convolutional coding with shared entanglement: general structure,” arXiv:0807.3803, Accepted for publication in *Quantum Information Processing*, April 2010.
- [21] Mark M. Wilde and Todd A. Brun, “Entanglement-assisted quantum convolutional coding,” *Physical Review A* vol. 81, 042333, April 2010.
- [20] Mark M. Wilde and Min-Hsiu Hsieh, “Entanglement generation with a quantum channel and a shared state,” *Proceedings of the 2010 IEEE International Symposium on Information Theory*, (arXiv:0904.1175), Austin, Texas, USA, June 2010.
- [19] Mark M. Wilde, Hari Krovi, and Todd A. Brun, “Convolutional entanglement distillation,” *Proceedings of the 2010 IEEE International Symposium on Information Theory*, (arXiv:0708.3699), Austin, Texas, USA, June 2010.
- [18] Mark M. Wilde and David Fattal, “Nonlocal quantum information in bipartite quantum error correction,” *Quantum Information Processing*, Online First, arXiv:0912.2150, 2010.
- [17] Mark M. Wilde, James M. McCracken, and Ari Mizel, “Could light harvesting complexes exhibit non-classical effects at room temperature?”, *Proceedings of the Royal Society A* vol. 466, no. 2117, pp. 1347-1363, May 2010.

- [16] Mark M. Wilde and Bart Kosko, “Quantum forbidden-interval theorems for stochastic resonance,” *Journal of Physics A: Mathematical and Theoretical* vol. 42, 465309, November 2009.
- [15] Min-Hsiu Hsieh and Mark M. Wilde, “Public and private communication with a quantum channel and a secret key,” *Physical Review A*, vol. 80, 022306, August 2009.
- [14] Mark M. Wilde, “Can classical noise enhance quantum transmission?” *Journal of Physics A: Mathematical and Theoretical* vol. 42, 325301, July 2009.
- [13] Mark M. Wilde, “Quantum shift register circuits,” *Physical Review A*, vol. 79, 062325, June 2009.
- [12] Mark M. Wilde, “Logical operators of quantum codes,” *Physical Review A*, vol. 79, 062322, June 2009.
- [11] Mark M. Wilde and Todd A. Brun, “Protecting quantum information with entanglement and noisy optical modes,” *Quantum Information Processing* vol. 8, 401-413, October 2009.
- [10] Todd A. Brun, Jim Harrington, and Mark M. Wilde, “Localized closed timelike curves enable perfect state distinguishability,” *Physical Review Letters*, vol. 102, 210402, May 2009.
- [9] Mark M. Wilde and Todd A. Brun, “Extra shared entanglement reduces memory demand in quantum convolutional coding,” *Physical Review A*, vol. 79, 032313, March 2009.
- [8] Mark M. Wilde and Dmitry B. Uskov, “Linear-optical hyperentanglement-assisted quantum error-correcting code,” *Physical Review A*, vol. 79, 022305, February 2009.
- [7] Bilal Shaw, Mark M. Wilde, Ognyan Oreshkov, Isaac Kremsky, Daniel A. Lidar, “Encoding one logical qubit into six physical qubits,” *Physical Review A*, vol. 78, 012337, July 2008.
- [6] Mark M. Wilde and Todd A. Brun, “Unified quantum convolutional coding,” *Proceedings of the 2008 IEEE International Symposium on Information Theory*, 359-363, (arXiv:0801.0821), Toronto, Ontario, Canada, July 2008.
- [5] Mark M. Wilde and Todd A. Brun, “Optimal entanglement formulas for entanglement-assisted quantum coding,” *Physical Review A*, vol. 77, 064302, June 2008.
- [4] Mark M. Wilde, Todd A. Brun, Jonathan P. Dowling, and Hwang Lee, “Coherent communication with linear optics,” *Physical Review A*, vol. 77, 022321, February 2008.
- [3] Mark M. Wilde, Hari Krovi, and Todd A. Brun, “Entanglement-assisted quantum error correction with linear optics,” *Physical Review A*, vol. 76, 052308, November 2007.
- [2] Mark M. Wilde, Federico Spedalieri, Jonathan P. Dowling, and Hwang Lee, “Alternate scheme for optical cluster-state generation without number-resolving photon detectors,” *International Journal of Quantum Information*, vol. 5, no. 4, August 2007.
- [1] Mark M. Wilde, Hari Krovi, and Todd A. Brun, “Coherent communication with continuous quantum variables,” *Physical Review A*, vol. 75, 060303(R), June 2007.

Pre-print Articles

- [5] Monireh Houshmand, Saied Hosseini-Khayat, and Mark M. Wilde, “Minimal memory require-

ments for pearl necklace encoders of quantum convolutional codes,” arXiv:1004.5179, April 2010.

[4] David Avis, Patrick Hayden, and Mark M. Wilde, “Leggett-Garg inequalities and the geometry of the cut polytope,” arXiv:1004.3818, April 2010.

[3] Mark M. Wilde and Min-Hsiu Hsieh, “The quantum dynamic capacity formula of a quantum channel,” arXiv:1004.0458, April 2010.

[2] Mark M. Wilde and Ari Mizel, “Addressing the clumsiness loophole in a Leggett-Garg test of macrorealism,” arXiv:1001.1777, January 2010.

[1] Kamil Bradler, Mark M. Wilde, Sai Vinjanampathy, Dmitry B. Uskov, “Identifying the quantum correlations in light-harvesting complexes,” arXiv:0912.5112, 2009.

Conferences

[15] Kamil Bradler, Patrick Hayden, Dave Touchette, Mark M. Wilde, “Trade-off capacities of the quantum Hadamard channels,” Rump session presentation at *The Thirteenth Workshop on Quantum Information Processing* in Zurich, Switzerland (January 2010).

[14] Mark M. Wilde, “Quantum shift-register circuits,” Poster presentation at *The Thirteenth Workshop on Quantum Information Processing* in Zurich, Switzerland (January 2010).

[13] Min-Hsiu Hsieh and Mark M. Wilde, “Optimal trading of classical communication, quantum communication, and entanglement,” Oral presentation at *4th Workshop on Theory of Quantum Computation, Communication and Cryptography* in Waterloo, Ontario, Canada (May 2009).

[12] Jim Harrington, Mark M. Wilde and Todd A. Brun, “Closed timelike curves enable perfect state distinguishability,” Poster presentation at *The Twelfth Workshop on Quantum Information Processing* in Santa Fe, New Mexico (January 2009).

[11] Min-Hsiu Hsieh and Mark M. Wilde, “The Classically-Enhanced Father Protocol,” Poster presentation at *The Twelfth Workshop on Quantum Information Processing* in Santa Fe, New Mexico (January 2009).

[10] Mark M. Wilde and Dmitry B. Uskov, “Linear-Optical Hyperentanglement-Assisted Quantum Code,” Poster presentation at the *Quantum Computing Program Review* in Atlanta, Georgia (August 2008).

[9] Mark M. Wilde and Todd A. Brun, “Unified Quantum Convolutional Coding,” Oral presentation at the *International Symposium on Information Theory* in Toronto, Ontario, Canada (July 2008).

[8] Mark M. Wilde and Todd A. Brun, “Quantum Convolutional Coding with Entanglement Assistance,” Oral presentation at the *American Physical Society March Meeting* in New Orleans, Louisiana (March 2008).

[7] Mark M. Wilde and Todd A. Brun, “Quantum Convolutional Coding with Entanglement Assistance,” Oral presentation at the University of New Mexico for the *10th Annual Southwest Quantum Information and Technology Network Workshop* in Albuquerque, New Mexico (February 2008).

[6] Mark M. Wilde, Hari Krovi, and Todd A. Brun, “Convolutional Entanglement Distillation,” Oral presentation at the University of Southern California for the *First International Conference on Quantum Error Correction* in Los Angeles, California (December 2007).

[5] Mark M. Wilde, Todd A. Brun, Hwang Lee, and Jonathan P. Dowling, “Coherent Communication with Linear Optics,” Poster presentation at the *Quantum Computing Program Review* in Minneapolis (August 2007).

[4] Mark M. Wilde, Hari Krovi, Jonathan P. Dowling, and Todd A. Brun, “Coherent Communication of Continuous Quantum Variables with Linear Optics,” Oral presentation at the University of Rochester for the *International Conference of Quantum Information* (June 2007).

[3] Mark M. Wilde, Hari Krovi and Todd A. Brun, “Coherent Communication with Continuous Variables,” Oral presentation at Caltech for the *Southwest Quantum Information and Technology Network Workshop* (February 2007).

[2] Mark M. Wilde and Bart Kosko, “Quantum forbidden-interval theorems for stochastic resonance with squeezed light,” in *Proceedings of the 8th International Conference on Quantum Communication, Measurement, and Computing*, pp. 553–556, December 2006.

[1] Mark M. Wilde, Federico Spedalieri, Jonathan P. Dowling, and Hwang Lee, “Optical Cluster-State Generation without Number-Resolving Photon Detectors,” Poster presentation at *Frontiers in Optics* in Rochester, NY (October 2006).

Book Chapters

[2] Mark M. Wilde, “Error Correction in Quantum Communication,” Chapter in *Quantum Error Correction*, Cambridge University Press, coming soon.

[1] Bart Kosko, Ian Lee, Sanya Mitaim, Ashok Patel and Mark M. Wilde, “Applications of Forbidden Interval Theorems in Stochastic Resonance,” Chapter in *Applications of Nonlinear Dynamics*, Springer Berlin / Heidelberg, February 2009.

Seminars

[15] “Additivity in quantum Shannon theory,” Tutorial presentation at the 2010 International Workshop on Quantum Information Science, Tokyo, Japan (March 2010).

[14] “Trade-off capacities of the quantum Hadamard channels,” ERATO-SORST Project of the Japan Science and Technology Agency, Tokyo, Japan (February 2010).

[13] “Non-classical Behavior of Biological Systems at Room Temperature,” Department of Chemistry and Chemical Biology at Harvard University and Department of Physics and Astronomy at Louisiana State University (October 2009).

[12] “Claude Shannon Meets Quantum Mechanics: An Introduction to Quantum Shannon Theory,” Department of Electrical Engineering and Department of Mathematics at the George Washington University (August 2009).

[11] “Optimal Trading of Classical Communication, Quantum Communication, and Entanglement,” School of Computer Science at McGill University and Naval Research Laboratory in Washington, DC (July 2009).

[10] “Quantum Shift Register Circuits,” Laser Cooled and Trapped Atoms Group of the Atomic Physics Division of the National Institute of Standards and Technology in Gaithersburg, Maryland (June 2009).

- [9] “The Classically-Enhanced Father Protocol,” Northrop Grumman Space Technology Research Laboratory and Department of Electrical Engineering, University of Southern California (December 2008).
- [8] “Entanglement-Assisted Quantum Error Correction,” Centre for Quantum Technologies at the National University of Singapore (November 2008).
- [7] “Closed Timelike Curves Enable Perfect State Distinguishability,” Centre for Quantum Technologies at the National University of Singapore (October 2008).
- [6] “Entanglement-Assisted Quantum Convolutional Coding,” Quantum Group at NEC Laboratories America (September 2008).
- [5] “Quantum Coding with Entanglement,” Quantum Lunch Seminar for the Quantum Institute at Los Alamos National Laboratory (April 2008).
- [4] “Quantum Convolutional Coding Techniques,” Information Processing Group at the Jet Propulsion Laboratory (December 2007).
- [3] “Quantum Convolutional Coding with Shared Entanglement for Distillation and Error Correction,” Hearne Institute for Theoretical Physics at Louisiana State University (November 2007).
- [2] “Quantum Communication, Quantum Entanglement, and All That Jazz,” Tulane University (November 2007).
- [1] “Entanglement-Assisted Quantum Error Correction,” Hearne Institute for Theoretical Physics at Louisiana State University (July 2007).

Other Documents

- [1] Mark M. Wilde, “Quantum coding with entanglement,” Ph.D. Thesis, University of Southern California, *arXiv:0806.4214*, August 2008.

Service

Reviewer—*Journal of Physics A: Mathematical and Theoretical*, *Journal of Physics B: Atomic, Molecular, and Optical Physics*, *Quantum Information Processing*, *Optics Communications*, *Physical Review Letters*, *Physical Review A*, *IEEE Transactions on Information Theory*, *IEEE Communication Letters*, *IEEE International Symposium on Information Theory*

Graduate Representative, Catholic Center at University of Southern California

Honors and Awards

Best Teaching Assistant Award, Department of Electrical Engineering, University of Southern California, 2007

School of Engineering Fellowship, University of Southern California, 2004

Teaching Assistantship, Tulane University, 2002

Thomas Barton Scholarship, Texas A&M University, 1998