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Research Interests

Quantum information and quantum computation. Primarily fault-tolerance, computer architectures, error-correction, algorithms, control theory, and solid-state implementations.

Educational History

- 1996–2002 **PhD in Physics, California Institute of Technology**
MS in Physics, California Institute of Technology
Advisor: Prof. John Preskill
Thesis: *Controlling quantum information*
- 1992–1996 **BS in Physics, Virginia Tech (Summa cum laude, Φ BK, in Honors)**
BS in Mathematics, Virginia Tech (Summa cum laude, Φ BK)
Advisor: Prof. Lay-Nam Chang
Thesis: *Solving a two-person perfect information game with a quantum computer*
- 1988–1992 **Diploma, Thomas Jefferson High School for Science and Technology**
Advisor: Mr. Donald Hyatt
Thesis: *Natural selection in cellular automata*

Employment History

- 2009–present **Sandia National Laboratories**
Senior Member of the Technical Staff
Quantum Information Science and Technology
- 2009–present **University of New Mexico**
Adjunct Associate National Laboratory Professor (paperwork in progress)
Department of Physics and Astronomy
- 2005–2009 **University of New Mexico**
Research Assistant Professor
Department of Physics and Astronomy
- 2002–2005 **Massachusetts Institute of Technology**
Hewlett-Packard/MIT Postdoctoral Fellow
Center for Theoretical Physics & Center for Bits and Atoms
- 1996–2002 **California Institute of Technology**
Graduate Research Assistant
Department of Physics
- 1995 **University of Illinois**
NSF Research Experience for Undergraduates (REU) researcher

- Department of Physics
- 1992–1994 **Hughes Aircraft Company**
Systems Engineering Researcher
- 1991 **Kay-Bee Toy Company**
Salesperson

Research Grants (Total currently active: \$790,026.)

- 2008–2009 \$111,000. **Sandia National Laboratories**
Quantum error correction in double-quantum-dot qubits.
PI: Andrew Landahl.
- 2008–2011 \$180,000. **National Science Foundation**
Continuous-time quantum computation.
PI: Andrew Landahl.
- 2008 \$67,000. **Sandia National Laboratories**
Quantum error correction in double-quantum-dot qubits.
PI: Andrew Landahl.
- 2007–2010 \$300,000. **National Science Foundation**
Quantum-classical tradeoffs for information-processing tasks.
PIs: Carlton Caves, Andrew Landahl.
- 2006–2009 \$199,026. **National Science Foundation**
High-fidelity gates and qubit addressing in an optical lattice quantum processor.
PIs: Ivan Deutsch, Andrew Landahl.
- 1994 \$2,000. **Society of Physics Students**
Nonlinear optical limiting in Buckminsterfullerene.
Undergraduate Research Award
Advisor: Prof. Randy Heflin.

Classroom teaching

- Fall 2007 **University of New Mexico**
Instructor, Physics 452/581: *Introduction to quantum information*
Instructor, Physics 501: *Information physics seminar*
- Fall 2006 **University of New Mexico**
Instructor, Physics 262: *Optics, relativity, and quantum mechanics*
Instructor, Physics 501: *Information physics seminar*
- Fall 2005 **Sandia National Laboratories**
Guest Lecturer, *A short course on quantum information*
(For Prof. Ivan Deutsch)
- Fall 2005 **Southwest Quantum Information and Technology Summer School**
Instructor, *Quantum error correction*
- Fall 2002 **Harvard University**
Guest Lecturer, Physics 287: *Topics in the physics of quantum information*
(For Prof. Mikhail Lukin)

1996–2002 **California Institute of Technology**
 Head TA, Physics 229: *Quantum information and quantum computation*
 Head TA, Physics 135: *Quantum optics*
 Recitation Leader, Physics 12: *Waves, quantum mechanics, statistical physics*
 Recitation Leader, Math 1: *Calculus and probability*

Research mentoring

PhD Advisor

Patrick Rice, 2008–present
 Jonas Anderson, 2008–present
 Brad Chase, 2006–2009

Masters Advisor

Devon Hjelm, 2007–2008

Undergraduate Mentor

Nathan Wozny, Summer 2001
 Project: *Error tolerance in quantum storage of information*
 Eric Dennis, Summer 1999
 Project: *Fault tolerant recovery of toric codes*

High School Mentor

Alexei Dunaway, Summer 2006
 Project: *Implementing the Solovay-Kitaev algorithm*
 Brian Jacokes, Summer 2003
 Project: *An improved quantum algorithm for searching an ordered list*
 Regional winner, Siemens-Westinghouse National Science Competition

Professional Service and Outreach

2006–2009 Chair, Local Organizing Committee for International QIP 2009 Conference
 2008–present Member, Program Committee for International QIP 2009 Conference
 2007–2008 Member, Steering Committee for Southwest Quantum Information and Technology (SQuInT) Workshop
 2007 Grand Awards Judge, Intel International Science and Engineering Fair
 2006 Creator/developer, info.phys.unm.edu (UNM Information Physics Group website)
 2006–present Member, UNM Center for Advanced Studies Seminar Series Committee
 2004–2005 Co-leader, MIT Quantum Reading Group
 2003–2004 Mentor, Siemens Westinghouse Competition (Brian Jacokes)
 2002–2005 Member, MIT Quantum Information Processing Seminar Committee
 2002 Creator/developer, qis.mit.edu (MIT Quantum Information Science website)
 2000 Creator/developer, www.iqi.caltech.edu (Caltech Institute for Quantum Information website)

1999	Physics demonstrator, Rolling Valley Elementary, Alexandria, VA
1998–2002	Judge, Caltech Summer Undergraduate Research Fellowship Speaking Competition
1997–2002	Member, Caltech Physics Graduate Students Issues Committee
1992–1996	Physics demonstrator, Blacksburg Middle School, Blacksburg, VA
Journal/Grant Referee	<i>IEEE Transactions on Computers, International Journal of Quantum Information, Journal of Mathematical Physics, Journal of Physics B, NSF Division of Mathematical Sciences, Physical Review A, Physical Review Letters, Quantum Information and Computation, Quantum Information Processing</i>

Computer skills

Proficient in C/C++, Fortran, Matlab, Mathematica. Experience with MPI-based parallel programming and real-time network programming. Familiar with numerous other programming languages and able to pick up new ones quickly.

Prizes and Awards

1995–1996	Barry M. Goldwater Scholar
1996	Rhodes Scholarship Nominee, Virginia
1995–1996	Phi Beta Kappa Scholar
1995–1996	Society of Physics Students Scholar
1995–1996	Phi Kappa Phi Scholar
1994	Leinhardt Scholarship for Departmental Service (Virginia Tech)
1994–1995	Hatcher Scholarship in Mathematics (Virginia Tech)
1994–1995	Mortar Board National Honor Society (Fundraising Chair)
1994	Hamilton Prize in Physics (Virginia Tech)
1994	Sigma Pi Sigma National Physics Honor Society
1994	Pi Mu Epsilon National Mathematics Honor Society
1993–1994	Gamma Beta Phi National Honor Society
1992–1996	Virginia Scholar
1992–1996	National Merit Scholar

Publication Citations (From Google Scholar and Web of Science, 4/2009.)

197	Christandl, Datta, Ekert, and Landahl, PRL 92 , 187902 (2004)
92	Dennis, Kitaev, Landahl, and Preskill, JMP 43 , 4452 (2002)
81	Christandl, Datta, Dorlas, Ekert, Kay, and Landahl, PRA 71 , 032312 (2005)
47	Ahn, Doherty, and Landahl, PRA 65 , 042301 (2002)

- 10 Childs, Deotto, Farhi, Goldstone, Gutmann, and Landahl, PRA **66**, 032314 (2002)
- 10 Lloyd, Landahl, and Slotine, PRA **69**, 012305 (2004)
- 6 Childs, Landahl, Parrilo, PRA **75**, 032335 (2007)
- 3 Chase and Landahl, arXiv:0802.1207 (2008)
- 2 Chase, Landahl, and Geremia, PRA **77**, 032304 (2008)

Preprints/In Press

- [1] *The impact of classical electronics constraints on a solid-state logical qubit memory*
J. E. Levy, A. Ganti, C. A. Phillips, B. R. Hamlet,
A. J. Landahl, T. M. Gurrieri, R. D. Carr, and M. S. Carroll
[arXiv:0904.0003](https://arxiv.org/abs/0904.0003)
Accepted by the 21st ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2009).
- [2] *Engineering giant nonlinearities in quantum nano-systems*
K. Jacobs and A. J. Landahl
[arxiv:0809.2993](https://arxiv.org/abs/0809.2993)
Submitted to Phys. Rev. Lett.
- [3] *Universal quantum walks and adiabatic algorithms by 1D Hamiltonians*
B. A. Chase and A. J. Landahl
[arXiv:0802.1207](https://arxiv.org/abs/0802.1207)
Submitted to Quantum Information & Computation

Publications

Theses

- [3] *Controlling quantum information*
PhD Thesis, California Institute of Technology (2002).
- [2] *Solving a two-person perfect information game with a quantum computer*
Honors Thesis, Virginia Tech (1996).
- [1] *Natural selection in cellular automata*
Senior Thesis, Thomas Jefferson High School for Science & Technology (1992).

Technical articles in refereed journals

- [8] *Efficient feedback controllers for continuous-time quantum error correction*
B. A. Chase, A. J. Landahl, and JM Geremia
[arXiv:0711.0689](https://arxiv.org/abs/0711.0689)
Phys. Rev. A **77**, 032304 (2008).
- [7] *Quantum algorithms for the ordered search problem via semidefinite programming*
A. M. Childs, A. J. Landahl, and P. A. Parrilo
[quant-ph/0608161](https://arxiv.org/abs/quant-ph/0608161)
Phys. Rev. A **75**, 032335 (2007).
- [6] *Perfect transfer of arbitrary states in quantum spin networks*

- M. Christandl, N. Datta, T. C. Dorlas, A. Ekert, A. Kay, and A. J. Landahl
[quant-ph/0411020](#)
Phys. Rev. A **71**, 032312 (2005).
- [5] *Perfect state transfer in quantum spin networks*
M. Christandl, N. Datta, A. Ekert, and A. J. Landahl
[quant-ph/0309131](#)
Phys. Rev. Lett. **92**, 187902 (2004).
- [4] *Universal quantum interfaces*
S. Lloyd, A. J. Landahl, and J.-J. E. Slotine
[quant-ph/0303048](#)
Phys. Rev. A **69**, 012305 (2004).
- [3] *Quantum search by measurement*
A. M. Childs, E. Deotto, E. Farhi, J. Goldstone, S. Gutmann, and A. J. Landahl
[quant-ph/0204013](#)
Phys. Rev. A **66**, 032314 (2002).
- [2] *Continuous quantum error correction via quantum feedback control*
C. Ahn, A. C. Doherty, and A. J. Landahl
[quant-ph/0110111](#)
Phys. Rev. A **65**, 042301 (2002).
- [1] *Topological quantum memory*
E. Dennis, A. Kitaev, A. Landahl, J. Preskill
[quant-ph/0110143](#)
J. Math. Phys. **43**, 4452–4505 (2002).

Technical articles in conference proceedings

- [3] *Information processing in quantum spin systems*
A. J. Landahl, M. Christandl, N. Datta, and A. Ekert
[Proceedings of the 7th International Conference on Quantum Communication, Measurement and Computing](#), 215–218 (AIP Press, 2004).
- [2] *Universal single-qubit quantum controller-observers*
S. Lloyd, A. J. Landahl, and J.-J. E. Slotine
[Proceedings of the 2003 International Conference on Physics and Control](#), 829–833 (IEEE Press, 2003).
- [1] *Highlights of quantum search by measurement*
A. M. Childs, E. Deotto, E. Farhi, J. Goldstone, S. Gutmann, and A. J. Landahl
[Proceedings of the 6th International Conference on Quantum Communication, Measurement, and Computing](#), 426–429 (Rinton Press, 2003).

Other technical articles

- [2] *Determining global asymptotic behavior of differential equations from renormalization group theoretic structural stability analysis*
A. J. Landahl
National Science Foundation Research Experience for Undergraduates
Research Reports (1995).

- [1] *Transformation of a graphics demonstration into a networked parallel processing visual system*
A. J. Landahl
George Washington University Science and Engineering
Research Reports (1992).

Book reviews

- [1] *Breaking barriers to quantum computing*
A. J. Landahl
Science **300** 1509 (2003).

Unpublished Manuscripts

Technical articles

- [1] *An improved quantum algorithm for searching an ordered list*
M. B. JACOBS, A. J. Landahl, and E. Brookes
[Superseded by my improved results in PRA **75**, 032335 (2007).] (2004).

Conferences and Seminars

- Mar. 2009 **Center for Advanced Studies Seminar**
Talk: *Fault-tolerant quantum computation with color codes*
University of New Mexico, Albuquerque, NM
- Feb. 2009 **Southwest Quantum Information and Technology Workshop (SQInT 2009)**
Poster (by Jonas Anderson): *Fault-tolerant quantum computation with color codes*
Seattle, WA
- Jan. 2009 **Workshop on Quantum Information Processing (QIP 2009)**
Talk: *Welcoming remarks*
Santa Fe, NM
- Aug. 2008 **Quantum Information Science and Technology Workshop (QIST 2008)**
Albuquerque, NM
- Jul. 2008 **QInf Seminar**
Talk: *Universal quantum walks and adiabatic algorithms by 1D Hamiltonians*
University of Toronto, Toronto, ON
- Apr. 2008 **Quantum Information and Graph Theory: Emerging Connections**
Talk: *Universal quantum walks on graphs*
Waterloo, ON
- Mar. 2008 **EECS Seminar**
Talk: *How to make quantum computers work: Models, algorithms, and error correction*
University of Southern California, Los Angeles, CA
- Mar. 2008 **American Physical Society March Meeting**
Talk: *Efficient feedback controllers for continuous-time quantum error correction*
New Orleans, LA
- Feb. 2008 **Southwest Quantum Information and Technology Workshop (SQInT 2008)**
Tutorial: *Positivity in quantum information*

- Santa Fe, NM
- Dec. 2007 **First International Conference on Quantum Error Correction (QEC 2007)**
Los Angeles, CA
- Dec. 2007 **Quantum Institute Workshop**
Los Alamos, NM
- Aug. 2007 **Quantum Lunch Seminar**
Talk: *One-dimensional nearest-neighbor time-independent Hamiltonians are universal for quantum computation*
Los Alamos National Laboratory, Los Alamos, NM
- Aug. 2007 **Hannigan Meadows Research Retreat**
Talk: *Quantum walks and quantum computing*
Hannigan Meadows, AZ
- Jul. 2007 **Quantum Enabled Science and Technology Workshop (QUEST 2007)**
Talk: *Implementing quantum circuits without using dynamical control fields*
Santa Fe, NM
- Jun. 2007 **Computer Science Research Institute Seminar**
Talk: *So you've got a quantum computer, Now What?*
Sandia National Laboratories, Albuquerque, NM
- May 2007 **Quantum Computational Methods for Differential Equations and Physics Problems**
Talk: *Ballistic quantum computation: Improving the Feynman computer*
Los Alamos, NM
- Mar. 2007 **American Physical Society March Meeting**
Denver, CO
- Feb. 2007 **Southwest Quantum Information and Technology Workshop (SQInT 2007)**
Talk: *Printed quantum circuits*
Pasadena, CA
- May 2006 **KITP Workshop on Topological Phases and Quantum Computation (QUBIT 2006)**
Talk: *Quantum control and quantum computing*
Santa Barbara, CA
- Feb. 2006 **Southwest Quantum Information and Technology Workshop (SQInT 2006)**
Talk: *An improved quantum algorithm for the ordered search problem*
Albuquerque, NM
- Jan. 2006 **Workshop on Quantum Information Processing (QIP 2006)**
Paris, FR
- Dec. 2005 **Quantum Institute Workshop**
Talk: *Quantum wires made out of quantum spins*
Los Alamos, NM
- Jul. 2005 **Center for Advanced Studies Seminar**
Talk: *Blueprints from a quantum information mechanic: Designs for wires, codes, and algorithms*
University of New Mexico, Albuquerque, NM

- Jul. 2005 **Southwest Quantum Information and Technology Student Summer School**
Tutorial: *Quantum error correction*
Los Angeles, CA
- Apr. 2005 **Physics and Astronomy Department General Seminar**
Talk: *How to build a fault-tolerant quantum computer*
Louisiana State University, Baton Rouge, LA
- Mar. 2005 **Center for Theoretical Physics Seminar**
Talk: *Automating the search for new quantum algorithms*
MIT, Cambridge, MA
- Jan. 2005 **Physics and Astronomy Seminar**
Talk: *How to print a quantum computer*
University of Leeds, Leeds, UK
- Jan. 2005 **Workshop on Quantum Information Processing (QIP 2005)**
Cambridge, MA
- Nov. 2004 **Atomic, Molecular, and Optical Physics Seminar**
Talk: *How to "print" a quantum computer out of spin chains*
Georgia Tech, Atlanta, GA
- Nov. 2004 **Quantum Information Processing Seminar**
Talk: *How to build a quantum computer out of spin chains*
MIT, Cambridge, MA
- Oct. 2004 **Quantum/Nanophysics Seminar**
Talk: *How to build a quantum computer out of spin chains and spin networks*
Dartmouth College, Hanover, NH
- Aug. 2004 **Newton Institute Workshop on Quantum Information Theory**
Cambridge, UK
- Jul. 2004 **International Conference on Quantum Communication, Measurement, and Computing (QCMC 2004)**
Talk: *Quantum Computing with Spin Networks*
Glasgow, UK
- Jul. 2004 **Quantum Information and Quantum Control Conference (QIQC 2004)**
Poster: *Quantum Computing with Spin Networks*
Toronto, ON
- Apr. 2004 **Awards Day Seminar**
Keynote Talk: *The quantum information revolution*
Virginia Tech, Blacksburg, VA
- Feb. 2004 **Center for Theoretical Physics Seminar**
Talk: *Why fundamental physics needs quantum information*
MIT, Cambridge, MA
- Feb. 2004 **Particle and Nuclear Physics Seminar**
Talk: *Why fundamental physics needs quantum information*
University of New Hampshire, Durham, NH

- Jan. 2004 **Workshop on Quantum Information Processing (QIP 2004)**
Poster (by Charlene Ahn): *Quantum error correction for continuously detected errors*
Waterloo, Canada
- Oct. 2003 **Foundations of Computer Science Conference (FOCS 2003)**
Cambridge, MA
- Oct. 2003 **Center for Bits and Atoms Seminar**
Talk: *Quantum adiabatic algorithms*
MIT, Cambridge, MA
- Oct. 2003 **Sidney-Pacific Seminar**
Talk: *Quantum information science: putting quantum weirdness to work*
MIT, Cambridge, MA
- Oct. 2003 **Quantum Reading Group Seminar**
Talk: *Quantum communication in spin networks*
MIT, Cambridge, MA
- Oct. 2003 **Cambridge-MIT Institute Workshop**
Cambridge, MA
- Sep. 2003 **Center for Bits and Atoms Seminar**
Talk: *Quantum fault-tolerance*
MIT, Cambridge, MA
- Sep. 2003 **HP Labs Seminar**
Talk: *Computer games for quantum computers: Are they harder or easier?*
Palo Alto, CA
- Aug. 2003 **International Conference on Physics and Control (PhysCon 2003)**
Talk: *Universal quantum interfaces*
St. Petersburg, Russia
- Aug. 2003 **HP/MIT Quantum Information Workshop**
Talk: *Universal quantum interfaces and recursive quantum algorithms*
Corvallis, OR
- Jun. 2003 **Cambridge-MIT Institute Workshop**
Cambridge, UK
- May 2003 **Simons Conference on Quantum and Reversible Computation**
Talk: *Universal quantum interfaces, or, the power of one (qubit)*
Stony Brook, NY
- May 2003 **Quantum Reading Group Seminar**
Talk: *Quantum sparse graph codes*
MIT, Cambridge, MA
- Mar. 2003 **Quantum Reading Group Seminar**
Talk: *Ordered search*
MIT, Cambridge, MA
- Nov. 2002 **Quantum Reading Group Seminar**
Talk: *Lower bounds by polynomials*

- MIT, Cambridge, MA
- Oct. 2002 **Center for Bits and Atoms Seminar**
Talk: *Quantum information science: algorithms, error-correction, and control*
MIT, Cambridge, MA
- Oct. 2002 **Quantum Feedback Control Workshop**
Talk: *Continuous-time quantum error correction*
MIT, Cambridge, MA
- Oct. 2002 **Eastern Section Meeting of the American Mathematical Society**
Talk: *Continuous-time quantum error correction*
Boston, MA
- Jul. 2002 **International Conference on Quantum Communication, Measurement, and Computing (QCMC 2002)**
Talk: *Quantum search by measurement*
Cambridge, MA
- Jul. 2002 **HP/MIT Quantum Information Summer School**
Palo Alto, CA
- Apr. 2002 **Institute for Quantum Information Seminar**
Talk: *Quantum search by measurement*
Caltech, Pasadena, CA
- Mar. 2002 **Southwest Quantum Information and Technology Workshop (SQInT 2002)**
Talk: *Continuous-time quantum error correction*
Boulder, CO
- Feb. 2002 **T-8 Division Seminar**
Talk: *Continuous-time quantum error correction*
Los Alamos, NM
- Feb. 2002 **Quantum Computing Seminar**
Talk: *Continuous-time quantum error correction*
UC Berkeley, Berkeley, CA
- Jan. 2002 **Information Science Seminar**
Talk: *Continuous quantum error correction via quantum feedback control*
Bell Labs, Murray Hill, NJ
- Jan. 2002 **Quantum Information Processing Seminar**
Talk: *Continuous quantum error correction via quantum feedback control*
MIT, Cambridge, MA
- Jan. 2002 **Cambridge-MIT Institute Workshop**
Cambridge, MA
- Jan. 2002 **Workshop on Quantum Information Processing (QIP 2002)**
Poster: *Continuous quantum error correction via quantum feedback control*
Yorktown Heights, NY
- Dec. 2001 **Institute of Theoretical Physics (ITP) Conference on Quantum Information: Entanglement, Decoherence, and Chaos**

- Santa Barbara, CA
- Aug. 2001 **Quantum Enabled Science and Technology Workshop (QUEST 2001)**
Talk: *Quantum control: continuous QEC via QFC*
Santa Fe, NM
- Jun. 2001 **International Conference on Quantum Information (ICQI 2001)**
Rochester, NY
- Apr. 2001 **Quantum Electromechanics Workshop**
Pasadena, CA
- Mar. 2001 **Southwest Quantum Information and Technology Workshop (SQuInT 2001)**
Pasadena, CA
- Jul. 1998 **Workshop on Quantum Computation**
Torino, Italy
- Feb. 1998 **First NASA International Conference on Quantum Computing and Quantum Communications (QCQC 1998)**
Palm Springs, CA
- Jul. 1997 **Workshop on Quantum Computation**
Torino, Italy
- Dec. 1996 **Institute for Theoretical Physics (ITP) Conference on Quantum Coherence and Decoherence**
Santa Barbara, CA
- Nov. 1996 **Quantum Information and Computation Workshop (QUIC 1996)**
Pasadena, CA
- Oct. 1996 **Mathematics Graduate Student Seminar**
Quantum error correction from the ground up: From quantum bits to stabilizer codes with nontrivial homologies
Caltech, Pasadena, CA