

Curriculum Vitae

David Feder

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Citizen of Canada and the U.K.

Education

Ph.D. (physics) McMaster University, Hamilton, Ontario (August, 1997). Advisor: Prof. C. Kallin.
Thesis title: Inhomogeneous d-wave Superconductors.

M.Sc. (physics) McMaster University, Hamilton, Ontario (August, 1994). Advisor: Prof. C. Kallin.
Thesis title: Superfluidity of Lattice Anyons.

B.Sc. (physics) Science College (Concordia University), Montreal, Quebec (July, 1992).

Professional Employment

08/2007 - present: Associate Professor, Department of Physics and Astronomy, University of Calgary.

07/2002 - 07/2007: Assistant Professor, Department of Physics and Astronomy, University of Calgary.

12/2000 - 06/2002: Research Associate, Institute for Physical Science and Technology, University of Maryland at College Park, and the National Institute of Standards and Technology (NIST, Gaithersburg).

09/1997 - 11/2000: Visiting scholar from the University of Oxford, Clarendon Laboratory, at NIST, Gaithersburg.

09/1996 - 12/1996: Visiting Scholar at Stanford University, Department of Physics.

09/1992 - 08/1997: Graduate teaching assistant in the Department of Physics and Astronomy at McMaster University.

09/1991 - 08/1992: Undergraduate research in the Department of Physics at Concordia University, supervised by Prof. C. S. Kalman.

05/1991 - 08/1991: Undergraduate research in the Department of Computer Science at Concordia University, supervised by Prof. C. Lam.

09/1990 - 08/1991: Undergraduate research in the Department of Chemistry at Concordia University, supervised by Prof. G. Dénès.

Publications and Presentations

(A) Refereed journal publications:

1. A. G. D'Souza, J. Briët, and D. L. Feder, *Testing Equivalence of Pure Quantum States and Graph States under SLOCC*, International Journal of Quantum Information **8** (April, 2010).
2. J. Joo and D. L. Feder, *Error-correcting one-way quantum computation with global entangling gates*, Physical Review A **80**, 032312 (2009).
3. A. G. Morris and D. L. Feder, *Topological entropy of quantum Hall states in rotating Bose gases*, Physical Review A **79**, 013619 (2009).
4. D. L. Feder, *Cooling ultracold bosons in optical lattices by spectral transform*, Physical Review A **79**, 013604 (2009).
5. T. P. Friesen and D. L. Feder, *One-way quantum computing in optical lattices with many atom addressing*, Physical Review A **78**, 032312 (2008).
6. M. C. Garrett and D. L. Feder, *Cluster states from imperfect global entanglement*, New Journal of Physics **10**, 033009 (2008).
7. A. G. Morris and D. L. Feder, *Gaussian potentials facilitate access to quantum Hall states in rotating Bose gases*, Physical Review Letters **99**, 240401 (2007).
8. D. L. Feder, *Perfect quantum state transfer with spinor bosons on weighted graphs*, Physical Review Letters **97**, 180502 (2006).
9. A. G. Morris and D. L. Feder, *Validity of the lowest-Landau-level approximation for rotating Bose gases*, Physical Review A **74**, 033605 (2006).
10. S. B. McKagan, D. L. Feder, and W. P. Reinhardt, *Mean-field effects may mimic number squeezing in Bose-Einstein condensates in optical lattices*, Physical Review A **74**, 013612 (2006).
11. D. L. Feder, *Vortex arrays in a rotating superfluid Fermi gas*, Physical Review Letters **93**, 200406 (2004).
12. N. Nygaard, G. M. Bruun, B. I. Schneider, C. W. Clark, and D. L. Feder, *Vortex line in a neutral finite-temperature superfluid Fermi gas*, Physical Review A **69**, 053622 (2004).
13. N. Nygaard, G. M. Bruun, C. W. Clark, and D. L. Feder, *Microscopic structure of a vortex line in a dilute superfluid Fermi gas*, Physical Review Letters **90**, 210402 (2003).
14. D. L. Feder and C. W. Clark, *Superfluid-to-solid crossover in a rotating Bose-Einstein condensate*, Physical Review Letters **87**, 190401 (2001).

- 15.* B. P. Anderson, P. C. Haljan, C. A. Regal, D. L. Feder, L. A. Collins, C. W. Clark, and E. A. Cornell, *Watching dark solitons decay into vortex rings in a Bose-Einstein condensate*, Physical Review Letters **86**, 2926 (2001).
16. D. L. Feder, A. A. Svidzinsky, A. L. Fetter, and C. W. Clark, *Anomalous modes drive vortex dynamics in confined Bose-Einstein condensates*, Physical Review Letters **86**, 564 (2001).
17. D. L. Feder, *Solitons in a Bose-Einstein condensate*, 'Optics in 2000', Optics and Photonics News **11**, 38 (2000).
18. D. L. Feder, M. S. Pindzola, L. A. Collins, B. I. Schneider, and C. W. Clark, *Dark-soliton states of Bose-Einstein condensates in anisotropic traps*, Physical Review A **62**, 053606 (2000).
19. T. Bergeman, D. L. Feder, N. L. Balasz, and B. I. Schneider, *Bose-Einstein condensates in a harmonic trap near the critical temperature*, Physical Review A **61**, 063605 (2000).
- 20.* J. Denschlag, J. Simsarian, D. L. Feder, C. W. Clark, L. A. Collins, J. Cubizolles, L. Deng, E. W. Hagley, K. Helmerson, W. P. Reinhardt, S. L. Rolston, B. I. Schneider, and W. D. Phillips, *Generating solitons by phase engineering of a Bose-Einstein condensate*, Science **287**, 97 (2000).
21. D. L. Feder, C. W. Clark, and B. I. Schneider, *Nucleation of vortex arrays in rotating anisotropic Bose-Einstein condensates*, Physical Review A (Rapid Communications) **61**, 011601 (2000).
22. D. L. Feder, C. W. Clark, and B. I. Schneider, *Vortex stability of interacting Bose-Einstein condensates confined in rotating harmonic traps*, Physical Review Letters **82**, 4956 (1999).
23. B. I. Schneider and D. L. Feder, *Numerical approach to the ground and excited states of a Bose-Einstein condensed gas confined in a completely anisotropic trap*, Physical Review A **59**, 2232 (1999).
24. A. L. Fetter and D. L. Feder, *Beyond the Thomas-Fermi approximation for a trapped condensed Bose-Einstein Gas*, Physical Review A **58**, 3185 (1998).
25. D. L. Feder, A. Beardsall, A. J. Berlinsky, and C. Kallin, *Twin boundaries in d-wave superconductors*, Physical Review B (Rapid Communications) **56**, 5751 (1997).
26. D. L. Feder and C. Kallin, *Microscopic derivation of the Ginzburg-Landau equations for a d-wave superconductor*, Physical Review B **55**, 559 (1997).
27. D. L. Feder and C. Kallin, *Statistics and Superfluidity*, Physical Review B **52**, 9197 (1995).
28. D. L. Feder and C. Kallin, *Superfluidity of Lattice Semions*, Physical Review B **51**, 11 555 (1995).

*Experimental-theoretical collaboration with myself as primary theorist.

(B) Non-refereed journal publications:

1. P. M. Ketcham and D. L. Feder, *Visualizing Bose-Einstein condensates*, Computing in Science and Engineering **5**, 86 (2003) (invited).
2. P. M. Ketcham, D. L. Feder, C. W. Clark, S. G. Satterfield, T. J. Griffin, W. L. George, B. I. Schneider, and W. P. Reinhardt, *Volume Visualization of Bose-Einstein Condensates*, NIST Interagency Report (NISTIR), number 6739 (2001).

(C) Publications featuring my work:

1. Virtual Journal of Quantum Information, November, 2006: featured article [3] in reference list above (Perfect Quantum State Transfer with Spinor Bosons on Weighted Graphs).
2. Virtual Journal of Nanoscale Science and Technology, November 20, 2006: featured article [3] in reference list above (Perfect Quantum State Transfer with Spinor Bosons on Weighted Graphs).
3. D. W. Rogers, *Einstein's Other Theory: The Planck-Bose-Einstein Theory of Heat Capacity* (Princeton University Press, 2005): cover illustration (vortices in a Bose-Einstein condensate).
4. Businessweek Magazine, Science and Technology Section, *Physics: "Putting The Weirdness To Work"*, March 15, 2004: Included figure (vortices in a Bose-Einstein condensate).
5. Nature **416**, 211 (2002): Included figure (visualization of vortex lines in a trapped condensate), J. Anglin and W. Ketterle, "Bose-Einstein condensation of atomic gases."
6. Optics and Photonics News "Optics in 2000," December, 2000: Cover illustration (concentric vortex rings from snake instability of a dark soliton).
7. Scientific American, December, 2000: Included figure ("Quantum whirlpools"), G. P. Collins, "The Coolest Gas in the Universe."
8. Science **289**, 893 (2000): Included figure (dynamic generation of vortices in a Bose-Einstein condensate), D. Kleppner and R. Jackiw, "One hundred years of quantum physics."
9. Physics Today, December, 1999: Cover illustration and included figure (vortices in a Bose-Einstein condensate), K. Burnett, M. Edwards, C. W. Clark, "The theory of Bose-Einstein condensation of dilute gases."

(D) Academic book reviews:

1. Review of *Computational Physics* by J. M. Thijssen (Cambridge University Press, 1999), Scientific Computing World (December, 1999).
2. Review of *Stochastic Simulation in Physics* by P. K. MacKeown (Springer-Verlag, 1997), Scientific Computing World (October, 1998).

3. Review of *Fractional Statistics and Anyon Superconductivity* by Frank Wilczek (World Scientific, 1990), *Physics in Canada* **50**, 273 (1994).

(E) Selected Invited Presentations:

1. "Cooling ultracold bosons in optical lattices by quantum walks," Institute for Quantum, Atom, and Neutron Physics, Gutenberg University, Mainz, Germany, April 24, 2009.
2. "Cooling ultracold bosons in optical lattices by quantum walks," Institute for Quantum Optics, University of Hannover, Hannover, Germany, April 22, 2009.
3. "Cooling ultracold bosons in optical lattices by quantum walks," Department of Physics and Astronomy, Aarhus University, Aarhus, Denmark, April 17, 2009.
4. "Cooling ultracold bosons in optical lattices by quantum walks," Institute for Laser Physics, University of Hamburg, Hamburg, Germany, April 15, 2009.
5. "Can the ground states of low-dimensional many-body systems be useful for quantum computation?" Laboratoire de Physique Théorique et Modèles Statistiques, Université Paris-Sud, Orsay, France, April 7, 2009.
6. "Cooling ultracold bosons in optical lattices by quantum walks," Institut D'Optique, Palaiseau, France, March 4, 2009.
7. "Implementing a Spectral Transform with Atoms in 1D Optical Lattices," CIFAR Ultracold Matter Meeting, Banff, April 18, 2008.
8. "One-way Quantum Computing with Ultracold Atoms in Optical Lattices," University of Edmonton, November 22, 2007.
9. "Quantum Algorithms with Quantum Walks," Theory Canada III, Theoretical Physics Institute, Edmonton, June 14, 2007.
10. "Quantum Hall States in Rotating Bose Gases," Meeting of the Division of Atomic, Molecular, and Optical Physics meeting of the American Physical Society, Calgary, June 8, 2007.
11. "One-Way Quantum Computing with Imperfect Clusters and Measurements," CIFAR Quantum Information Processing Meeting, St. John's, May 3, 2007.
12. "Marches Quantiques avec les Atomes Ultrafroids," Laboratoire d'Informatique Théorique et Quantique, Université de Montréal, April 4, 2007.
13. "Prospects for Quantum Information Processing with Ultracold Atoms," Cifar Quantum Simulation Meeting, Vancouver, February 22, 2007.
14. "Many Particle Quantum Walks," Insitute for Quantum Computing, Waterloo, August 14, 2006.
15. "Graphs in Quantum Information Theory," Sixth Canadian Summer School on Quantum Information Processing, University of Calgary, August 11, 2006.
16. "Many Particle Quantum Walks," Computations in Quantum Many-Body Physics, Santa Fe, June 29, 2006.
17. "Bose-Einstein Condensates: A New Phase for Research," Lunchbox Lecture Series of the Pacific Institute for the Mathematical Sciences, Calgary, Alberta, April 16, 2004.
18. "Ultracold Atomic Gases: New Phases for Research," Colloquium at the University of Alberta, Edmonton, November 26, 2004.

19. "Superfluid Fermi Gases Under Rotation," Condensed Matter Physics Seminar at the University of Alberta, Edmonton, November 25, 2004.
20. "Superfluid-to-solid transition in a rotating Bose-Einstein gas," Division of Atomic, Molecular, and Optical Physics meeting of the American Physical Society, Williamsburg, June 1, 2002.
21. "Superfluid-to-solid crossover in a rotating Bose-Einstein condensed gas," Division of Condensed Matter Physics symposium on Bose-Einstein Condensation and Maria Goeppert-Mayer Award, March 2002 meeting of the American Physical Society, Indianapolis, March 20, 2002.
22. "Vortex arrays in confined Bose-Einstein condensates," Annual meeting of the American Association for the Advancement of Science, Boston, February 17, 2002.
23. "Superfluid to solid crossover in a rotating Bose-Einstein condensate," International Conference on the Theory of Quantum Gases and Quantum Coherence, Salerno, Italy, June 3, 2001.
24. "Vortices in trapped Bose-Einstein condensates," MIT-Harvard Center for Ultracold Atoms, Harvard University, March 20, 2001.
25. "Solitons and vortex rings in trapped Bose-Einstein condensates," 31st Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah, January 9, 2001.
26. "Solitons, vortices, and rings in trapped Bose-Einstein condensates," Workshop on Computational Methods for Few-Body Dynamical Systems, Gaithersburg, Maryland, November 17, 2000.
27. "Vortices in Trapped Bose-Einstein Condensates," Quantum Optics and Condensed Matter seminar, University of Toronto, October 30, 2000.
28. "Optical generation of solitons and vortices in Bose-Einstein condensates," Division of Condensed Matter Physics symposium on Degenerate Quantum Gases, March 2000 meeting of the American Physical Society, Minneapolis, March 20, 2000.
29. "Dynamics of vortices and dark solitons in trapped Bose-Einstein condensates," Nonlinear Science Festival II, Risø National Laboratory, Roskilde, Denmark, December 3, 1999.
30. "Vortex generation in rotating Bose-Einstein condensates," Atomic and Laser seminar, University of Oxford, June 14, 1999.
31. "The search for vortices in trapped Bose-condensed gases," seminar at the Winnipeg Institute for Theoretical Physics, May 28, 1999.
32. "Vortices in trapped Bose-condensed gases," joint AMO-condensed matter seminar in the Department of Physics and Astronomy, University of New York at Stony Brook, April 5, 1999.
33. "The search for vortices in trapped Bose-condensed gases," condensed matter seminar in the Department of Physics and Astronomy, University of Delaware, November 10, 1998.
34. "Twin boundaries in d-wave Superconductors," presentation at the meeting of the Canadian Institute for Advanced Research, Toronto, January, 1997.

Awards

MITACS Network Centres of Excellence Award, 2008.

Natural Sciences and Engineering Research Council Discovery Grant, 2008.

“Supervisor of the Year,” Graduate Students Association of the University of Calgary, 2005.

University of Calgary Young Innovator Award, 2003.

Canada Foundation for Innovation New Opportunities Award, 2003.

Natural Sciences and Engineering Research Council Discovery Grant, 2003.

Director’s Fellowship at Los Alamos National Laboratory, 2000-2002 (declined);

Ontario Graduate Scholarship, 1995-1997;

Bourse de maîtrise du Fonds pour la Formation de Chercheurs et l’Aide à la Recherche (Government of Québec), 1992-1994;

Science College Prize, 1991.

Professional Duties and Outreach:

1. Organizer (with Alexander Lvovsky (principal organizer), Gilad Gour, Peter Høyer, Christopher Healey, Peter Marzlin, Barry Sanders, Robert Thompson, and Wolfgang Tittel, University of Calgary, and Jeffrey Shapiro (ex-officio), MIT), Ninth International Conference on Quantum Communication, Measurement and Computing (QCMC 2008), University of Calgary, 19-24 August, 2008.
2. Organizer (with Robert Raussendorf, Perimeter Institute; Peter Høyer, Institute for Quantum Information Science, University of Calgary; Michele Mosca and Simone Severini, Institute for Quantum Computing, University of Waterloo), “Quantum Information and Graph Theory,” held at the Perimeter Institute, Waterloo, April 28 - May 2 (2008).
3. Co-Organizer, 2007 DAMOP/DAMP Meeting of the American Physical Society, 2007.
4. Organizer, Focus Session of the 2006 March Meeting of the American Physical Society, “Vortices and Vortex Lattices in Fermi and Bose Superfluid Gases.”
5. Organizer (with Allan Griffin, University of Toronto), Banff Cold Atom Meeting (2005).
6. Advisory Board Member, Program Committee for the 2004 DAMOP/DAMP Meeting of the American Physical Society.
7. Organizer (with Robert Thompson, University of Calgary), Banff Cold Atom Meeting (2004).
8. Founding member, Institute for Quantum Information Science, University of Calgary.