

Cristopher Moore

Computer Science Department and Department of Physics and Astronomy
University of New Mexico, Albuquerque NM 87131 moore@cs.unm.edu

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1 Education

Born March 12, 1968 in New Brunswick, New Jersey.

Northwestern University, B.A. in Physics, Mathematics, and the Integrated Science Program, with departmental honors in all three departments, 1986.

Cornell University, Ph.D. in Physics, 1991. Philip Holmes, advisor. Thesis: “Undecidability and Unpredictability in Dynamical Systems.”

2 Employment

Professor, Computer Science Department with a joint appointment in the Department of Physics and Astronomy, University of New Mexico, Albuquerque	2008–present
Research Professor, Santa Fe Institute	Fall 2007
Associate Professor, University of New Mexico	2005–2008
Assistant Professor, University of New Mexico	2000–2005
Research Professor, Santa Fe Institute	1998–1999
City Councilor, District 2, Santa Fe	1994–2002
Postdoctoral Fellow, Santa Fe Institute	1992–1998
Lecturer, Cornell University	Spring 1991
Graduate Intern, Niels Bohr Institute/NORDITA, Copenhagen	Summers 1988 and 1989
Teaching Assistant, Cornell University Physics Department	Fall 1986–Spring 1990
Computer programmer, Bio-Imaging Research, Lincolnshire, Illinois	Summers 1984–1986

3 Appointments

Visiting Professor, University of Michigan, Ann Arbor	September–October 2005
Visiting Professor, École Normale Supérieure du Lyon	June 2004
Visiting Professor, Institut Universitaire de France	June 2003
Visiting Professor, Université Paris 7 (Denis Diderot)	June 2001 and 2002
External Faculty, Santa Fe Institute	2000–present
Visiting Professor, École Polytechnique	September 1999

4 Honors and awards

Honorary Member, Laboratorio de Ciencias de la Computación, Mexico City, Mexico
University of New Mexico School of Engineering Outstanding Senior Faculty Award for Excellence in Research, 2007
University of New Mexico School of Engineering Outstanding Junior Faculty Award for Excellence in Teaching, 2002
University of New Mexico School of Engineering Outstanding Junior Faculty Award for Excellence in Research, 2002
National Science Foundation Graduate Fellowship, 1986-1989
Clark Award for Best Teaching Assistant, 1987
Marcy Award for Undergraduate Independent Study, 1986
Richter Fellowship for Undergraduate Independent Study, 1985
Phi Beta Kappa, 1985

5 Publications

5.1 Books and book chapters

C. Moore and S. Mertens, *The Nature of Computation*. Oxford University Press, 2011.
A. Percus, G. Istrate, and C. Moore, Eds., *Computational Complexity and Statistical Physics*. Oxford University Press, 2005.
D. Griffeath and C. Moore, Eds., *New Constructions in Cellular Automata*. Oxford University Press, 2003.
“Limiting the Computational Power of Recurrent Neural Networks: VC Dimension and Noise.” In J. Kolen and S. Kremer, Eds., *A Field Guide to Dynamical Recurrent Networks*. IEEE Press, 2001.

5.2 Journal articles

Please note that author order in theoretical computer science is almost always alphabetical.
C. Moore and A. Russell, “Approximate representations, approximate homomorphisms, and low-dimensional embeddings of groups.” Submitted.
C. Moore and A. Russell, “Approximating the permanent via nonabelian determinants.” Submitted.
S. Mertens and C. Moore, “The complexity of the fermionant, and immanants of constant width.” Submitted.
A. Decelle, F. Krzakala, C. Moore, and L. Zdeborová, “Asymptotic analysis of the stochastic block model for modular networks and its algorithmic applications.” *Physical Review E* **84** (2011) 066106.
H. Bauke, C. Moore, J.-B. Rouquier, and D. Sherrington, “Topological phase transition in a network model with preferential attachment and node removal.” *European Physical Journal B* **83** (2011) 519–524.
A. Decelle, F. Krzakala, C. Moore, and L. Zdeborová, “Phase transition in the detection of modules in sparse networks.” *Physical Review Letters* **107** (2011) 065701.
J. Machta, S. DeDeo, S. Mertens, and C. Moore, “Parallel complexity of random Boolean circuits.” *J. Stat. Mech.* P04015 (2011).

- C. Moore and A. Russell, “A graph integral formulation of the circuit partition polynomial.” *Combinatorics, Probability, and Computing* **20** (2011) 911–920.
- S. Hallgren, C. Moore, M. Rötteler, A. Russell, and P. Sen, “Limitations of quantum coset states for Graph Isomorphism.” *Journal of the ACM* **57** (6) (2010).
- C. Moore, A. Russell, and P. Śniady, “On the impossibility of a quantum sieve algorithm for Graph Isomorphism.” *SIAM J. Computing* **39**(6) (2010) 2377–2396.
- A. Denney, C. Moore, and A. Russell, “Finding conjugate stabilizer subgroups in $\text{PSL}(2, q)$ and related groups.” *Quantum Information and Computation* **10**(3–4) (2010) 282–291.
- Y. Park, C. Moore, and J.S. Bader, “Dynamic networks from hierarchical Bayesian graph clustering.” *PLoS One* **5**(1) (2010).
- G. Alagic, C. Moore, and A. Russell, “Quantum algorithms for Simon’s problem over general groups.” *ACM Transactions on Algorithms* **6** (2009) 331–345.
- D. Achlioptas, A. Clauset, D. Kempe, and C. Moore, “On the bias of traceroute sampling: or, power-law degree distributions in regular graphs.” *Journal of the ACM* **56**(4) (2009) 1–28.
- V. Kalapala and C. Moore, “The phase transition in Exact Cover.” *Chicago Journal of Theoretical Computer Science*, article 5 (2008).
- A. Clauset, C. Moore, and M. E. J. Newman, “Hierarchical structure and the prediction of missing links in networks.” *Nature* **453** (2008) 98–101.
- C. Moore, A. Russell, and L.J. Schulman, “The symmetric group defies strong Fourier sampling.” *SIAM Journal on Computing* **37** (2008) 1842–1864. Invited paper in special issue for FOCS 2005.
- R.M. D’Souza, P.L. Krapivsky, and C. Moore, “The power of choice in growing trees.” *European Journal of Physics B* **59** 535–543 (2007).
- C. Moore and A. Russell, “For distinguishing conjugate hidden subgroups, the Pretty Good Measurement is as good as it gets.” *Quantum Information and Computation* **7** (2007) 752–765.
- C. Moore, D. Rockmore, A. Russell, and L.J. Schulman, “The value of strong Fourier sampling: quantum algorithms for affine groups and hidden shifts.” *SIAM Journal on Computing* **37** (2007) 938–958.
- C. Moore, G. Istrate, D. Demopoulos, and M.Y. Vardi, “A continuous-discontinuous second-order transition in the satisfiability of random Horn-SAT formulas.” *Random Structures and Algorithms* **31** (2007) 173–185.
- H. Jia, C. Moore, and D. Strain, “Generating hard satisfiable formulas by hiding solutions deceptively.” *Journal of Artificial Intelligence Research* **28** (2007) 107–118.
- T. Berger-Wolfe, C. Moore, and J. Saia, “A computational approach to animal breeding.” *Journal of Theoretical Biology* **244** (2007) 433–439.
- C. Moore, D. Rockmore, and A. Russell, “Generic quantum Fourier transforms.” *ACM Transactions on Algorithms* **2** (2006) 707–723. Invited paper in special issue for SODA 2004.
- D. Achlioptas and C. Moore, “Two moments suffice to cross a sharp threshold.” *SIAM Journal on Computing* **36** (2006) 740–762.
- C. Moore and M. Nauenberg, “New periodic orbits for the n -body problem.” *Journal of Computational and Nonlinear Dynamics* **1** (2006) 271–367. Special issue for Philip Holmes’ 60th birthday.
- A. Coja-Oghlan, C. Moore, and V. Sanwalani, “Counting connected graphs and hypergraphs via the probabilistic method.” *Random Structures and Algorithms* **28** (2006) 289–322.
- C. Moore, G. Ghoshal, and M. E. J. Newman, “Exact solutions for models of evolving networks with addition and deletion of nodes.” *Physical Review E* **74** (2006) 036121.

- C. R. Shalizi, R. Haslinger, J.-B. Rouquier, K. L. Klinkner, and C. Moore, “Automatic filters for the detection of coherent structure in spatiotemporal systems.” *Physical Review E* **73** (2006) 036104.
- A. Coja-Oghlan, C. Moore, and V. Sanwalani, “MAX k -CUT and approximating the chromatic number of random graphs.” *Random Structures and Algorithms* **28** (2006) 289–322.
- V. Kalapala, V. Sanwalani, A. Clauset, and C. Moore, “Scale invariance in road networks.” *Physical Review E* **73** (2006) 026130.
- D. Achlioptas, M. Molloy, C. Moore, and F. Van Bussel, “Rapid mixing for lattice colorings with fewer colors.” *Journal of Statistical Mechanics* (2005) P10012.
- F. Ablyayev, A. Gainutdinova, M. Karpinski, C. Moore, and C. Pollett, “On the computational power of probabilistic and quantum branching programs.” *Information and Computation* **203** (2005) 145–162.
- P. Beame, J. Culberson, D. Mitchell, and C. Moore, “The resolution complexity of random graph k -colorability.” *Discrete Applied Mathematics* **153** (2005) 25–47.
- D. Achlioptas, H. Jia, and C. Moore, “Hiding satisfying assignments: two are better than one.” *Journal of Artificial Intelligence Research* **24** (2005) 623–639.
- A. Clauset and C. Moore, “Accuracy and scaling phenomena in Internet mapping.” *Physical Review Letters* **94** (2005) 018701.
- A. Clauset, M.E.J. Newman, and C. Moore, “Finding community structure in very large networks.” *Physical Review E* **70** (2004) 066111.
- J. Kari and C. Moore, “Rectangles and squares recognized by two-dimensional automata.” In *Theory Is Forever, Essays Dedicated to Arto Salomaa on the Occasion of His 70th Birthday*. J. Karhumäki, H. Maurer, G. Paun, and G. Rozenberg, Eds. *Lecture Notes in Computer Science* **3113** (2004) 134–144.
- M. Lachmann, M.E.J. Newman, and C. Moore, “The Physical Limits of Communication, or why any sufficiently advanced technology is indistinguishable from noise.” *American Journal of Physics* **72** (2004) 1290–1293.
- D. Achlioptas and C. Moore, “Almost all graphs of degree 4 are 3-colorable.” *Journal of Computer and System Sciences*, **67** (2003) 441–471. Invited paper in special issue for STOC 2002.
- M. Campagnolo, C. Moore, and J. F. Costa, “An analog characterization of the Grzegorzcyk hierarchy.” *Journal of Complexity*. **18** (2002) 977–1000.
- C. Moore and I. Pak, “Ribbon tile invariants from signed area.” *Journal of Combinatorial Theory Ser. A*. **98** (2002) 1–16.
- F. Green, S. Homer, C. Moore, and C. Pollett, “Counting, fanout, and the complexity of quantum ACC.” *Quantum Information and Computation* **2(1)** (2002) 35–65.
- C. Moore and M. Nilsson, “Parallel quantum computation and quantum codes.” *SIAM Journal on Computing* **31(3)** (2001) 799–815.
- F. Lemieux, C. Moore, and D. Thérien, “Subtree-counting loops.” *Quasigroups and Related Systems* **8** (2001) 45–65.
- C. Moore and J.M. Robson, “Hard tiling problems with simple tiles.” *Discrete and Computational Geometry* **26(4)** (2001) 573–590.
- F. Lemieux, C. Moore, and D. Thérien, “Polyabelian loops and Boolean-completeness.” *Commentationes Mathematicae Universitatis Carolinae* **41** (2000) 671–686.
- M. Campagnolo, C. Moore, and J. F. Costa, “Iteration, inequalities, and differentiability in analog computers.” *Journal of Complexity* **16** (2000) 642–660.

- C. Moore and J. Machta, “Internal diffusion-limited aggregation: parallel algorithms and complexity.” *Journal of Statistical Physics* **99** (2000) 661–690.
- C. Moore and M. E. J. Newman, “Height representation, critical exponents, and ergodicity in the four-state triangular Potts antiferromagnet.” *Journal of Statistical Physics* **99** (2000) 629–660.
- C. Moore and J.P. Crutchfield, “Quantum automata and quantum grammars.” *Theoretical Computer Science* **237** (2000) 275–306.
- C. Moore, D. Thérien, F. Lemieux, J. Berman, and A. Drisko, “Circuits and expressions with non-associative gates.” *Journal of Computer and System Sciences* **60** (2000) 368–394.
- C. Moore and M.E.J. Newman, “Exact solution of site and bond percolation on small-world networks.” *Physical Review E* **62** (2000) 7059–7064.
- C. Moore and M.E.J. Newman, “Epidemics and percolation in small-world networks.” *Physical Review E* **61** (2000) 5678–5682.
- M.E.J. Newman, C. Moore, and D.J. Watts, “Mean-field solution of the small-world network model.” *Physical Review Letters* **84** (2000) 3201–3204.
- C. Moore and P. Lakdawala, “Queues, stacks, and transcendentalities at the transition to chaos.” *Physica D* **135** (2000) 24–40.
- M.E.J. Newman and C. Moore, “Glassy dynamics in an exactly solvable spin model.” *Physical Review E* **60** (1999) 5068–5072.
- C. Moore, M.G. Nordahl, N. Minar, and C. Shalizi, “Vortex dynamics and entropic forces in antiferromagnets and antiferromagnetic Potts models.” *Physical Review E* **60** (1999) 5344–5351.
- C. Moore and M. Nilsson, “The computational complexity of sandpiles.” *Journal of Statistical Physics* **96** (1999) 205–224.
- P. Koiran and C. Moore, “Closed-form analytic maps in one and two dimensions can simulate universal Turing Machines.” *Theoretical Computer Science* **210(1)** (1999) 217–223, Special Issue on Real Numbers.
- C. Moore, “Predicting non-linear cellular automata quickly by decomposing them into linear ones.” *Physica D* **111** (1998) 27–41.
- K. Lindgren, C. Moore, and M.G. Nordahl, “Complexity of two-dimensional patterns.” *Journal of Statistical Physics* **91** (1998) 909–951.
- C. Moore, “Dynamical recognizers: real-time language recognition by analog computers.” *Theoretical Computer Science* **201** (1998) 99–136.
- C. Moore, “Majority-vote cellular automata, Ising dynamics, and P-completeness.” *Journal of Statistical Physics* **88** (1997) 795–805.
- C. Moore, “Quasi-linear cellular automata.” *Physica D* **103** (1997) 100–132.
- C. Moore and T. Boykett, “Commuting cellular automata.” *Complex Systems* **11** (1997) 55–64.
- D. Griffeath and C. Moore, “Life without death is P-complete.” *Complex Systems* **10** (1996) 437–447.
- C. Moore, “Recursion theory on the reals and continuous-time computation.” *Theoretical Computer Science* **162** (1996) 23–44.
- C. Moore and A. Drisko, “Algebraic properties of the block transformation on cellular automata.” *Complex Systems* **10(3)** (1996) 185–194.
- C. Moore, “Braids in classical dynamics.” *Physical Review Letters* **70** (1993) 3675–3679.
- C. Moore, “Generalized one-sided shifts and maps of the interval.” *Nonlinearity* **4** (1991) 727–745.

- C. Moore, “Generalized shifts: undecidability and unpredictability in dynamical systems.” *Non-linearity* **4** (1991) 199–230.
- C. Moore, “Undecidability and unpredictability in dynamical systems.” *Physical Review Letters* **64** (1990) 2354–2357.
- C. Moore, “Comment on ‘Space-time as a causal set’.” *Physical Review Letters* **60** (1988) 655.

5.3 Refereed conference proceedings

- V. Dani and C. Moore, “Independent sets in random graphs from the weighted second moment method.” *Proc. RANDOM ’11* 472–482.
- C. Moore, X. Yan, Y. Zhu, J.-B. Rouquier, and T. Lane, “Active learning for node classification in assortative and disassortative networks.” *Proc. 17th Int. Conf. on Knowledge Discovery and Data Mining* (KDD ’11) 841–849.
- H. Dinh, C. Moore, and A. Russell, “McEliece and Niederreiter cryptosystems that resist quantum Fourier sampling attacks.” *Proc. CRYPTO ’11* 761–779.
- S. Kasiviswanathan, C. Moore, and L. Theran, “The rigidity transition in random graphs.” *Proc. 22nd Symp. on Discrete Algorithms* (SODA ’11) 1237–1252.
- D. Kempe, M. Salek, and C. Moore, “Frugal and truthful auctions for vertex covers, flows, and cuts.” *Proc. 51st. Foundations of Computer Science* (FOCS ’10) 745–754.
- S. Bravyi, C. Moore, and A. Russell, “Bounds on the quantum satisfiability threshold.” *Proc. 1st Symp. on Innovations in Computer Science* (ICS ’10) 482–489.
- C. Moore, A. Russell, and P. Śniady, “On the impossibility of a quantum sieve algorithm for Graph Isomorphism.” *Proc. 39th Symp. on Theory of Computing* (STOC ’07), 536–545.
- G. Alagic, C. Moore, and A. Russell, “Quantum algorithms for Simon’s problem over general groups.” *Proc. 18th Symp. on Discrete Algorithms* (SODA ’07), 1217–1224.
- S. Hallgren, C. Moore, M. Rötteler, A. Russell, and P. Sen, “Limitations of quantum coset states for Graph Isomorphism.” *Proc. 38th Symp. on Theory of Computing* (STOC ’06), 604–617.
- R. D’Souza, D. Galvin, C. Moore, and D. Randall, “Global connectivity from local geometric constraints for sensor networks with various wireless footprints.” *Proc. 6th Intl. Conf. on Information Processing in Sensor Networks* (IPSN ’06), 19–26.
- A. Clauset, C. Moore, and M. E. J. Newman, “Structural inference of hierarchies in networks.” *Proc. Workshop on Statistical Network Analysis, International Conference on Machine Learning* (ICML ’06). E. M. Airoldi et al., Eds., *Lecture Notes in Computer Science* **4503**, 1–13.
- C. Moore, A. Russell, and L.J. Schulman, “The symmetric group defies strong Fourier sampling.” *Proc. 46th Foundations of Computer Science* (FOCS ’05), 479–490.
- D. Achlioptas, A. Clauset, D. Kempe, and C. Moore, “On the bias of traceroute sampling, or: why almost every network looks like it has a power law.” *Proc. 37th Symp. on Theory of Computing* (STOC ’05), 694–703.
- H. Jia, C. Moore, and D. Strain, “Generating hard satisfiable formulas by hiding solutions deceptively.” *Proc. 20th Natl. Conf. on Artificial Intelligence* (AAAI ’05), 384–389.
- C. Moore, G. Istrate, D. Demopoulos and M. Vardi, “A continuous-discontinuous second-order transition in the satisfiability of random Horn-SAT formulas.” *Proc. 9th Intl. Workshop on Randomization and Computation* (RANDOM ’05), 414–425.
- C. Moore, D. Rockmore, and A. Russell, “Generic quantum Fourier transforms.” *Proc. 15th Symp. on Discrete Algorithms* (SODA ’04), 778–787.

- C. Moore, D. Rockmore, A. Russell, and L.J. Schulman, “The value of basis selection in Fourier sampling: hidden subgroup problems for affine groups.” *Proc. 15th Symp. on Discrete Algorithms* (SODA ’04), 1113–1122.
- D. Achlioptas, H. Jia, and C. Moore, “Hiding satisfying assignments: two are better than one.” *Proc. 19th Natl. Conf. on Artificial Intelligence* (AAAI ’04), 131–136.
- D. Achlioptas and C. Moore, “The chromatic number of random regular graphs.” *Proc. 8th Intl. Workshop on Randomization and Computation* (RANDOM ’04), 219–228.
- A. Coja-Oghlan, C. Moore, and V. Sanwalani, “Counting connected graphs and hypergraphs via the probabilistic method.” *Proc. 8th Intl. Workshop on Randomization and Computation* (RANDOM ’04), 322–333.
- H. Jia and C. Moore, “How much backtracking does it take to color random graphs? Rigorous results on heavy tails.” *Proc. 10th Intl. Conference on Principles and Practice of Constraint Programming* (CP ’04). *Lecture Notes in Computer Science* **3258** (2004), 742–746.
- H. Jia, C. Moore, and B. Selman, “From spin glasses to hard satisfiable formulas.” *Proc. 7th Intl. Conf. on Theory and Applications of Satisfiability Testing* (SAT ’04), 12–19.
- D. Achlioptas, F. von Bussel, M. Molloy, and C. Moore, “Sampling grid colorings with fewer colors.” *Proc. Latin American Theoretical Informatics Symposium* (LATIN ’04) 80–89.
- C. Morgan, D. Stefanovic, C. Moore, and M. N. Stojanovic, “Building the components for a biomolecular computer.” *Proc. 10th Intl. Meeting on DNA Computing* (DNA 10, ’04).
- A. Coja-Oghlan, C. Moore, and V. Sanwalani, “MAX k -CUT and approximating the chromatic number of random graphs.” *Proc. Intl. Colloquium on Automata, Languages and Programming* (ICALP ’03) 200–211.
- D. Achlioptas and C. Moore, “The asymptotic order of the k -SAT threshold.” *Proc. 43rd Foundations of Computer Science* (FOCS ’02) 779–788.
- D. Achlioptas and C. Moore, “Almost all graphs of average degree 4 are three-colorable.” *Proc. 34th Symp. on Theory of Computing* (STOC ’02) 199–208.
- F. Ablyayev, C. Moore, and C. Pollett, “Quantum branching programs of bounded width.” *Proc. 29th Intl. Colloquium on Automata, Languages and Programming* (ICALP ’02) 343–354.
- C. Moore, I. Rapaport, and E. Rémila, “Tiling groups for Wang tiles.” *Proc. 13th Symp. on Discrete Algorithms* (SODA ’02) 402–211.
- C. Moore and A. Russell, “Quantum walks on the hypercube.” *Proc. 6th Intl. Workshop on Randomization and Approximation Techniques in Computer Science* (RANDOM ’02) 164–178.
- D. Achlioptas and C. Moore, “On the two-colorability of random hypergraphs.” *Proc. 6th Intl. Workshop on Randomization and Approximation Techniques in Computer Science* (RANDOM ’02) 78–90.
- E. Allender, S. Arora, M. Kearns, C. Moore, and A. Russell, “A Note on the Representational Incompatibility of Function Approximation and Factored Dynamics.” *Proc. 16th Ann. Conf. on Neural Information Processing Systems* (NIPS ’02)
- C. Moore, P. Tesson, and D. Thérien, “Satisfiability of systems of equations over finite monoids.” *Proc. 26th Intl. Symp. on Mathematical Foundations of Computer Science* (MFCS ’01) 537–547.
- J. Linde, C. Moore, and M.G. Nordahl, “An n -dimensional generalization of the rhombus tiling.”
- M. Morvan, R. Cori, J. Mazoyer and R. Mosseri, Eds., *Proc. 1st Intl. conference on Discrete Models: Combinatorics, Computation, and Geometry* (DM-CCG’01) 23–42.

- J. Kari and C. Moore, “New results on alternating and non-deterministic two-dimensional finite-state automata.” *Proc. Symp. on Theoretical Aspects of Computer Science* (STACS ’01) 396–406.
- D. Achlioptas, A. Chtcherba, G. Istrate, and C. Moore, “The phase transition in 1-in- k SAT and NAE 3-SAT.” *Proc. 12th Symp. on Discrete Algorithms* (SODA ’01) 721–722.
- M.L. Campagnolo and C. Moore, “Upper and lower bounds on continuous-time computation.” *Proc. 2nd Intl. Conf. on Unconventional Models of Computation* (UMC ’00) 135–153.
- M. Lachmann, C. Moore, and I. Rapaport, “Who wins Domineering on rectangular boards?” In R.J. Nowakowski, Ed., *More Games of No Chance* (MSRI Workshop on Combinatorial Games, 2000) 307–315.
- C. Moore and D. Eppstein, “One-dimensional peg solitaire, and duotaire.” In R.J. Nowakowski, Ed., *More Games of No Chance* (MSRI Workshop on Combinatorial Games, 2000) 341–350.
- D.M. Barrington, P. McKenzie, C. Moore, P. Tesson, and D. Thérien, “Equation satisfiability and program satisfiability for finite monoids.” *Proc. 25th Intl. Symp. on Mathematical Foundations of Computer Science* (MFCS ’00) 172–181.
- M. Campagnolo and C. Moore, “An analog characterization of the subrecursive functions.” *Proc. 4th Real Numbers and Computers* (RNC ’00) 91–110.
- C. Moore, “Finite-dimensional analog computers: flows, maps, and recurrent neural networks.” *Proc. 1st Intl. Conf. on Unconventional Models of Computation* (UMC ’98).
- J. Berman, A. Drisko, C. Moore, F. Lemieux, and D. Thérien, “Circuits and expressions with non-associative gates.” *Proc. 12th Ann. IEEE Conf. on Computational Complexity* (1997) 193–203.
- C. Moore, “Dynamical recognizers: Real-time language recognition by analog computers.” In F. Cucker and M. Shub, Eds., *Foundations of Computational Mathematics*. Springer-Verlag (1997).

6 Funding (Principal Investigator)

- NSF CISE with Alex Russell, “Representation-theoretic Techniques for Pseudorandomness and Lower Bounds.” \$240,979, 2011–2014.
- McDonnell Foundation with Aaron Clauset and Mark Newman, “Statistical Inference and Machine Learning for Complex Networks.” \$417,576, 2008–2011.
- NSF EMT (Emerging Models and Technologies for Computation) with Alex Russell, “The Quantum Complexity of Algebraic Problems.” \$180,000, 2005–2008.
- ARO with Wim van Dam and Alex Russell, “Quantum Algorithms for Algebraic Problems.” \$600,000, 2005–2008.
- NSF Medium ITR with Darko Stefanovic and Milan Stojanovic, “Solution-Phase Computation with Enzymatic Networks.” \$3M, 2003–2008.
- NSF Small ITR with Alex Russell and Daniel Rockmore, “Complexity-Theoretic Applications of non-Abelian Fourier Analysis.” \$195,000, 2002–2005.
- NSF QuBIC (Quantum and Biologically Inspired Computation) with Alex Russell, “Quantum Monte Carlo Algorithms.” \$175,000, 2002–2005.
- NSF Physics, “Phase Transitions and Critical Phenomena in NP-complete Problems.” \$166,000, 2002–2006.
- NSF Physics, “Computational Complexity in Statistical and Quantum Physics.” \$80,000, 2000–2002.
- Los Alamos National Laboratory, “Phase Transitions in NP-complete Problems.” \$25,000, 2002.

Sandia University Research Program (SURP), “Phase Transitions in NP-complete Problems.” \$35,000, 2001–2002.

Sandia University Research Program (SURP), “Tilings and self-assembly.” \$35,000, 2000–2001.

7 Invited talks at conferences and selected seminars

IPAM Workshop on Mathematical Challenges in Graphical Models and Message-Passing Algorithms, January 2012

NASA Quantum Future Technologies Conference, January 2012

Dagstuhl Seminar on Quantum Cryptanalysis, September 2011

Santa Fe Institute Community Lecture, April 2011

Institute for Quantum Computing/Center for Applied Cryptographic Research Seminar, University of Waterloo, April 2011

Tutte Combinatorics Seminar, University of Waterloo, April 2011

UCLA Combinatorics Colloquium, November 2010.

Invited Address at the AMS Western Sectional Meeting, UCLA, October 2010.

CMU Statistics Seminar, July 2010.

SIAM Annual Meeting, Session on Probabilistic Combinatorics and Algorithms, July 2010.

Computability in Europe (CiE) Session on Computability of the Physical, June 2010.

Cornell Applied Mathematics Colloquium, April 2010.

Invited plenary speaker, Latin American Theoretical Informatics Symposium (LATIN) 2010.

International Symposium on Complex Systems Science. Paris, September 2009.

Los Alamos Workshop on Physics of Algorithms. Santa Fe, September 2009.

UC Berkeley Computer Science Theory Seminar, April 2009.

Aspen Center for Physics colloquium, June 2008.

CNLS conference on Classical and Quantum Information Theory, April 2008.

MIT Quantum Information Science seminar. MIT, October 2007.

Workshop on Advances in Quantum Algorithms, University of Waterloo, June 2007.

CNLS symposium on Algorithms, Inference, and Statistical Physics, May 2007.

Syracuse University Physics Colloquium and Condensed Matter Seminar, April 2007.

DIMACS/Georgia Tech Workshop on Complex Networks and their Applications, January 2007.

Invited talk, “A Tale of Two Cultures: Phase Transitions in Physics and Computer Science.”

European Conference on Complex Systems, Oxford, September 2006.

SIAM Conference on Discrete Mathematics, minisymposium on Random Constraint Satisfaction Problems: from Physics to Algorithms. Victoria, June 2006.

MIT Quantum Information Seminar seminar. MIT, April 2006.

Invited talk, “Fourier Sampling, Representations, and the Hunt for a Quantum Algorithm for Graph Isomorphism.” Quantum Information Processing (QIP), Paris, 2006.

UC Berkeley Theory Lunch, November 2005.

Lectures on Networks, Epidemics, Phase Transitions, and Constraints. University of Michigan, Ann Arbor, 2005.

Invited talk, “Fearful Symmetries: Factoring, Graph Isomorphism, and Quantum Computing.” ALGO/ESA, Palma de Mallorca, 2005.

Institute for Quantum Information seminar. Caltech, 2005.
 Quantum Institute Theory Workshop. Los Alamos National Laboratory, 2005.
 Optimization Algorithms and Quantum Disordered Systems. Institut Henri Poincaré, Paris, 2004.
 AMS Session on Probability and Applications in Combinatorics and Algorithms. Phoenix, 2004.
 International Conference on Discrete Models for Complex Systems. Lyon, 2003.
 Conference on Typical-Case Complexity, Randomness and Analysis of Search Algorithms. Abdus Salam International Center for Theoretical Physics, Trieste, 2002.
 MIT Combinatorics Seminar, 2002.
 IPAM Workshop on Phase Transitions and Algorithmic Complexity, 2002.
 Mini-Symposium on Quantum Computing. Texas A&M University, 2001.
 Intl. Conference on Discrete Models, Combinatorics, Computation, and Geometry. Paris, 2001.
 NATO Advanced Study Institute on Complexity from Microscopic to Macroscopic Scales: Coherence and Large Deviations. Geilo, Norway 2001.
 AMS Session on Quasigroups and Loops. Notre Dame, 2000.
 Intl. Conference on the Conceptual Foundations of Statistical Mechanics. Jerusalem, 2000.
 INRIA Algorithms Seminar. Versailles, 1999.
 MIT Physics of Computation Seminar, 1998.
 Second Intl. Conf. on Complex Systems. New England Complex Systems Institute, 1998.
 First International Conference on Unconventional Models of Computation. Auckland, 1998.
 McGill University Workshop on Computational Complexity. Bellairs Research Institute, 1997.
 Neural Information Processing Systems (NIPS) Workshop on Dynamic Recurrent Neural Networks.
 Altenberg Workshop on Theoretical Biology. Altenberg, Austria, 1996.
 Workshop on Logic and Dynamics for Higher Level Formations in Biology. Hayama, Japan, 1996.

8 Teaching

8.1 Courses taught at UNM

Introduction to the Theory of Computation (grad)	Spring '04, '07-'12
Data Structures and Algorithms	Spring and Fall '02, Fall '03, '04, '06
Physics and Computation	Spring '00, Spring '01, Spring and Fall '02, Spring '04, Fall '10
Introduction to Quantum Computation	Fall '04, Spring '08, Fall '11
Combinatorics, Probability, and Computation	Fall '06
Introduction to the Theory of Computation (undergrad)	Spring '03
Theoretical Foundations of Computer Science	Fall '03
Intermediate Object-Oriented Programming	Fall '00, Fall '01

8.2 Courses taught elsewhere

Summer 2005–2012: Santa Fe Institute Complex Systems Summer School, Santa Fe.
 August 2007: ISC-PIF Complexity Summer School, Paris.
 January 2003: Complex Systems Summer School. Valparaiso, Chile.
 Summer 2001, 2002: Santa Fe Institute Complex Systems Summer School, Budapest.

Spring 2001: Short Course on Computational Complexity for the NSF Physics Graduate Student Fellowship program at the Santa Fe Institute.

Spring 1991: Cornell University, “Components, Systems, and Society: Science and Engineering in a Social Context” (with Zellman Warhaft, Mechanical and Aerospace Engineering).

8.3 Students supervised

Current students: Aaron Denney (Ph.D., Physics), Xiaoran Yan (Ph.D., Computer Science), Yaojia Zhu (Ph.D., Computer Science), Munik Shrestha (Ph.D., Physics), Satomi Sugaya (Ph.D., Physics).
Tiffany Pierce: M.S., Computer Science, 2008. Thesis: “Inference of Large-Scale Structure in Networks.”

Haixia Jia, Ph.D. 2007 with distinction. Thesis: “Hard Problems with Hidden Solutions.”

Aaron Clauset, Ph.D. 2006 with distinction. Thesis: “Structural Inference and the Statistics of Networks.” Now a postdoc at the Santa Fe Institute

Vishal Sanwalani, Ph.D. 2005 with distinction. Thesis: “Applications of the Probabilistic Method to Random Graphs.” Postdocs at the University of Waterloo and at Microsoft Research.

Vamsi Kalapala, M.S. 2005. Thesis: “Results on Phase Transitions and Scale Invariance.”

Douglas Strain, M.S. 2005.

Qian Liang, M.S. 2003. Thesis: “The Evolution of Mulan: Some Studies in Game-Tree Pruning and Evaluation Functions in the Game of Amazons.” Now at Microsoft.

Manuel Campagnolo. Ph.D. 2002 from the Lisbon University of Technology (co-advised with José Felix Costa). Thesis: “Computational Complexity of Real-valued Recursive Functions and Analog Circuits.” Now an Associate Professor of Mathematics at the Lisbon University of Technology.

9 Professional activities

9.1 Editorial

Associate Editor, *SIAM Journal on Discrete Mathematics*, 2010–

Editorial Board, *Journal of Statistical Mechanics: Theory and Experiment*, 2004–2007.

9.2 Organizing and program committees

Jury, Turing Centenary Research Fellowship and Scholar Competition

Program Committee, Workshop on Complex and Communication Networks, GLOBECOM 2011.

Program Committee, Intl. Conf. on Theory and Applications of Satisfiability Testing (SAT) 2011.

Program Committee, Workshop on Complex and Communication Networks, GLOBECOM 2010.

Program Committee, Symposium on Discrete Algorithms (SODA) 2010.

Steering Committee, Quantum Information Processing (QIP) 2008, 2009 (Chair), 2010.

Program Committee, Workshop on Analysis of Dynamic Networks, December 2008.

Co-organizer (with Sue Coppersmith, Jon Machta, Alan Middleton, and Lenka Zdeborová), Workshop on Disorder, Algorithms, and Complexity. Aspen Center for Physics, Summer 2012.

Co-organizer (with Misha Chertkov, Raissa D’Souza, and Paul Hines), Power Grids as Complex Networks. Santa Fe Institute, 2012.

Co-organizer (with Aaron Clauset), Statistical Inference in Networks. Santa Fe Institute, 2008.

Co-organizer (with Sue Coppersmith, Jon Machta, and Alan Middleton), Workshop on Complexity, Disorder, and Algorithms. Aspen Center for Physics, Summer 2008.

Program Committee, Intl. Workshop on Randomization and Computation (RANDOM) 2007.

Co-organizer (with Paul Bourguine and Michel Morvan), Scaling in Biological and Social Networks. Santa Fe, 2007.

Co-organizer (with Persi Diaconis, Daniel Fisher, and Charles Radin), Phase Transitions in Physics, Computer Science, Combinatorics and Probability. American Institute of Mathematics, 2006.

Program Committee, Intl. Conf. on Theory and Applications of Satisfiability Testing (SAT) 2006.

Co-organizer (with Michel Morvan), New Perspectives on Complex Systems. Santa Fe, 2005.

Program Committee, Intl. Colloquium on Automata, Languages and Programming (ICALP) 2004.

Co-organizer (with Rajarshi Das, Irina Rish, and Gerry Tesauro) of the Workshop on Robust Communication Dynamics in Complex Networks. NIPS, Whistler, Canada, 2003.

Program Committee, Discrete Models for Complex Systems. Lyon, June 2003.

Co-organizer (with Dana Randall), special session of the joint AMS/MAA national meeting on Discrete Models. Baltimore, January 2003.

Program Committee, Symposium on Theoretical Aspects of Computer Science (STACS) 2002.

Co-organizer (with Allon Percus and Gabriel Istrate), workshop on “Computational Complexity and Statistical Physics.” Santa Fe, 2001.

9.3 Reviewing

(Computer Science) *Journal of the ACM, SIAM Journal of Computing, Theory of Computing, Journal of Computer and System Sciences, Information and Computation, Theoretical Computer Science, Information Processing Letters, Random Structures and Algorithms, Quantum Information and Computation, Theory of Computing Systems, Discrete and Computational Geometry, IEEE Trans. on Computers, IEEE Trans. on Networks, ACM Trans. on Modeling and Computer Simulation, Foundations of Computer Science (FOCS), Symposium on Theory of Computing (STOC), Symposium on Discrete Algorithms (SODA), Randomization and Approximation Techniques in Computer Science (RANDOM), Intl. Colloquium on Automata, Languages, and Programming (ICALP), Symposium on Theoretical Aspects of Computer Science (STACS), Mathematical Foundations of Computer Science (MFCS), Computing and Combinatorics Conference (COCOON)*

(Physics) *Physical Review Letters, Nature Physics, Physical Review A, Physical Review E, Physics Letters A, Physica D, Europhysics Letters, Communications in Mathematical Physics, Intl. J. Modern Physics C, Computers in Physics*

(Other) *Nature, Science, Proceedings of the National Academy of Sciences, Proceedings of the Royal Society, Nature Physics, PLoS One, Annals of Applied Probability, Journal of Theoretical Biology, Applied Artificial Intelligence, IEEE Trans. Evolutionary Computation, Fluctuation and Noise Letters, Advances in Complex Systems, Chaos, Journal of Complexity*