

Curriculum Vitae

Matthew B. Hastings

Senior Research Scientist

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RESEARCH INTERESTS:

- Quantum Information Theory, Correlated Electron Systems, and Topological Order.
- Soft Matter Physics: Granular Matter and Vortex Dynamics
- Non-Equilibrium Statistical Physics: Network Dynamics, Diffusion-Limited Aggregation, and Fractal Growth Models

EDUCATION AND EMPLOYMENT:

- Senior Research Scientist, Microsoft Research Station Q, Santa Barbara, CA, April 2009-present.
- Technical Staff Member, Los Alamos National Laboratory, January 2001-March 2009 (1/2001-12/2003 as Richard P. Feynman Fellow, 1/2006-end as Full Term Technical Staff Member).
- General Member, KITP, Santa Barbara, 2007-2008.
- Visiting Professor, Universite Paris 7, February 2003.
- Director's Fellowship, Los Alamos National Laboratory, 2000.
- R. H. Dicke Fellow, Princeton University, 1997-2000.
- PhD in Physics September 1997. Massachusetts Institute of Technology, Thesis: "A Renormalization Approach to Diffusion Limited Aggregation", advisor Leonid Levitov.
- BS in Mathematics and Physics June 1994. Yale University, New Haven, CT, *Magna cum laude* with distinction in the major.

PRIZES AND AWARDS:

- LANL Achievement Award, 2004.
- LANL Postdoctoral Distinguished Performance Team Award, 2003.
- Lockett Award, MIT, 1997.
- National Science Foundation Graduate Fellowship, 1994-1997.
- Compton Graduate Fellowship, MIT, 1994-1996.
- De Forest Senior Prize in Mathematics, Yale, 1994.
- Howard L. Schultz Prize in Physics, Yale, 1994.
- Anthony D. Stanley Prize in Mathematics, Yale, 1993.

LECTURE SERIES AND SUMMER SCHOOLS:

1. Fields Institute Distinguished Lecture Series, in the thematic program on quantum information theory, August, 2009, Fields Institute, Toronto.
2. Les Houches Summer School lectures in the program on quantum theory from large to small scales, August, 2010, to be given.

CONFERENCE INVITED TALKS:

1. Symposium on DLA, 1997 APS March Meeting, “A Renormalization Approach to Diffusion Limited Aggregation”.
2. EU School on Multifractals - Mathematics and Applications, 1999, “Renormalization of Diffusion Limited Aggregation”.
3. Conference on Scaling and Universality in Strongly Nonlinear Systems, Cuernavaca, Mexico, 2000, “High-Dimensional Diffusive Growth”.
4. Workshop on Pattern Formation and Diffusion Limited Growth, Michigan Center for Theoretical Physics, August 6-10, 2001, “Growth Exponents with 3.99 Walkers”.
5. CNLS Annual Conference, Santa Fe, NM, 2003, “Mean-Field and Anomalous Behavior on a Small-World Network”.
6. Workshop on Geometry and Statistics of Random Growth, Institut Henri Poincare, Paris, France, 2003, “Dielectric Breakdown Model and Conformal Mapping”.
7. ICTP, Trieste, Italy, 2004, “Exact Multifractal Spectra for Arbitrary Laplacian Random Walks Using Iterated Conformal Mappings”.

8. Dynamics Days 2005 Invited Talk, Long Beach, CA, 2005, “Diffusion-Limited Aggregation and Conformal Maps”.
9. Conference on Topological Phases and Quantum Computation, KITP, Santa Barbara, CA, 2006, “The Stability of Topologically Ordered States: Real Time and Quasi-Adiabatic Evolution”.
10. CNLS Workshop on Optimization in Complex Networks, Los Alamos, NM, 2006, “Community Detection as an Inference Problem”.
11. Workshop on Stochastic Geometry and Field Theory, KITP, Santa Barbara, CA, 2006, “A Review of Diffusion-Limited Aggregation”.
12. 96th Statistical Mechanics Conference, Rutgers University, New Brunswick, NJ, 2006, “Entropy and Entanglement in Quantum Ground States”.
13. Workshop on Algorithms, Inference, and Statistical Physics, Santa Fe, NM, 2007, “Community Detection as an Inference Problem”.
14. Workshop on Lieb-Robinson Bounds and Applications, Erwin Schrodinger Institute, Vienna, Austria, 2007, “Entropy and Entanglement in Quantum Ground States”.
15. Workshop on Computational Complexity of Quantum Hamiltonian Systems, Lorentz Center, Leiden, The Netherlands, 2007, “An Area Law for One Dimensional Quantum Systems”.
16. Workshop on Integrable Quantum Systems and Solvable Statistical Mechanics Models, Centre de Recherches Mathématiques, Montreal, Canada, 2008, “Time Dynamics in XXZ Spin Chains Far From Equilibrium”.
17. Gordon Research Conference on Quantum Information Science QIS 2008, Big Sky, Montana, 2008, “Entanglement and Dynamics in Quantum Systems Far From Equilibrium”.
18. Workshop on Tensor Network States, Madrid, Spain, 2008, “A Counterexample to Additivity of Minimum Output Entropy”.
19. Canadian Institute for Advanced Research Workshop on Quantum Information Processing, Kelowna, BC, Canada, 2008, “A Counterexample to Additivity of Minimum Output Entropy”.
20. 2008 LANL Quantum Workshop, Los Alamos, NM, “A Counter-example to Additivity: Using Entanglement to Boost Communication Capacity”.
21. QIP 2009, 12th Workshop on Quantum Information Processing, Santa Fe, New Mexico, “Area Laws for Quantum Many-Body Systems: Gapped One-Dimensional Systems are in NP”.

22. QIP 2009, 12th Workshop on Quantum Information Processing, Santa Fe, New Mexico, “A Counterexample to Additivity”. Note: 21 and 22 are both invited talks at QIP 2009.
23. QIPC 2009, Rome, Italy, “A Counterexample to Additivity”.

OTHER INVITED TALKS:

1. James Franck Institute, University of Chicago, 1997, “A Renormalization Approach to Diffusion-Limited Aggregation”.
2. Lucent Technologies, Murray Hill, NJ, 1997, “A Renormalization Approach to Diffusion-Limited Aggregation”.
3. Institute for Theoretical Physics, University of California, Santa Barbara 1997, “A Renormalization Approach to Diffusion-Limited Aggregation”.
4. Harvard University 1997, “A Renormalization Approach to Diffusion-Limited Aggregation”.
5. Yale University, 1997, “A Renormalization Approach to Diffusion-Limited Aggregation”.
6. Lucent Technologies, 1999, “Phase Transitions in Dirty Bosonic Systems”.
7. Brookhaven National Laboratory, 1999, “Phase Transitions in Dirty Bosonic Systems”.
8. University of Catania, Italy, 1999, “Phase Transitions in Dirty Bosonic Systems”.
9. James Franck Institute, University of Chicago, 1999, “Phase Transitions in Dirty Bosonic Systems”.
10. Lucent Technologies, Murray Hill, NJ, 2000, “Kagome Lattice Antiferromagnet”.
11. NEC Research Institute, Princeton, NJ, 2000, “Kagome Lattice Antiferromagnet”.
12. Yale University, 2000. “Kagome Lattice Antiferromagnet”.
13. ExxonMobil Research and Engineering, Annandale, NJ, 2000, “Diffusion-Limited Aggregation, Viscous Fingering, and Conformal Maps”.
14. Brown University, Providence, RI, 2001, “Kagome Lattice Antiferromagnet”.
15. Princeton University, Princeton, NJ, 2001, “Dielectric Breakdown Models, Fractal Growth, and Conformal Maps”.
16. Emory University, Atlanta, GA, 2001, “Dielectric Breakdown Models, Fractal Growth, and Conformal Maps”.
17. James Franck Institute, University of Chicago, 2001, “Tightening of Knots and Dynamics of Topological Constraints in Granular Chains”.

18. Cornell University, Ithaca, NY, 2002, “Dielectric Breakdown Models, Fractal Growth, and Conformal Maps”.
19. Centro Internacional de Ciencias, Cuernavaca, Mexico, 2002, “Dielectric Breakdown Models, Fractal Growth, and Conformal Maps”.
20. University of Arizona, Tucson, AZ, 2003, “Mean-field and Anomalous Behavior on a Small-World Network”.
21. Rensselaer Polytechnic Institute, Troy, NY, 2003, “Mean-field and Anomalous Behavior on a Small-World Network”.
22. MIT, Cambridge, MA, 2003, “Lieb-Schultz-Mattis in Higher Dimensions”.
23. Harvard University, Cambridge, MA, 2003, “Lieb-Schultz-Mattis in Higher Dimensions”.
24. University of Arizona, Tucson, AZ, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
25. MIT, Cambridge, MA, 2004, “Mean-field and Anomalous Behavior on a Small-World Network”.
26. University of California Davis, Davis, CA, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
27. Princeton University, Princeton, NJ, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
28. Brown University, Providence, RI, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
29. Boston University, Boston, MA, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
30. ETH Zurich, Switzerland, 2004, “Do Vortices Entangle?”
31. Paul Scherrer Institute, Switzerland, 2004, “Lieb-Schultz-Mattis in Higher Dimensions”.
32. UC Santa Barbara Physics Colloquium, Santa Barbara, CA, 2005, “Lieb-Schultz-Mattis in Higher Dimensions”.
33. ICTP, Trieste, Italy, 2005, “Slow Polaron Dynamics via Non-Equilibrium Born-Oppenheimer”.
34. Yale University, New Haven, CT, 2005, “Lieb-Schultz-Mattis in Higher Dimensions”.
35. Caltech, Pasadena, CA, 2006, “Lieb-Schultz-Mattis in Higher Dimensions”.
36. Syracuse University, 2007, “Community Detection as an Inference Problem”.
37. PCTP at Princeton University, 2007, “How Hard is Quantum Many-Body Theory?”.
38. KITP at UCSB, 2007, “How Hard is Quantum Many-Body Theory?”.

39. Microsoft Station Q, 2007, “How Hard is Quantum Many-Body Theory?”.
40. USC Physics Colloquium, 2007, “How Hard is Quantum Many-Body Theory?”.
41. Caltech, 2007, “Classical and Quantum Expanders”.
42. Perimeter Institute Colloquium, 2008, “How Hard is Quantum Many-Body Theory?”.
43. University of Wisconsin, Madison, 2008, “How Hard is Quantum Many-Body Theory?”.
44. UC Berkeley, Berkeley, CA, 2008, “How Hard is Quantum Many-Body Theory?”.
45. Stanford University, Stanford, CA, 2008, “How Hard is Quantum Many-Body Theory?”.
46. UCSD, La Jolla, CA, 2008, “How Hard is Quantum Many-Body Theory?”.
47. Duke University, Durham, NC, 2008, “How Hard is Quantum Many-Body Theory?”.
48. Duke University, Durham, NC, 2008, “Lieb-Schultz-Mattis in Higher Dimensions”.
49. UCSB Physics Colloquium, Santa Barbara, CA, 2008, “Entropy in Quantum Information Theory and Condensed Matter Physics”.
50. UNM Mathematics Colloquium, Albuquerque, NM, 2008, “Making Almost Commuting Matrices Commute: A Quantitative Version of Lin’s Theorem”.
51. IBM Yorktown Heights, Yorktown Heights, NY, 2009, “A Review of Quantum Expanders”.
52. MIT Applied Mathematics Colloquium, Cambridge, MA, 2009, “A Counterexample to Additivity”.
53. Max Planck Institute for Quantum Optics, Garching, Germany, 2009, “Area Laws for Quantum Systems”.
54. Max Planck Institute for Quantum Optics, Garching, Germany, 2009, “A Counter-Example to Additivity”.
55. UC Berkeley, Berkeley, CA, 2009, “Entropy in Quantum Information Theory and Condensed Matter Physics”.
56. University of Virginia Physics Colloquium, Charlottesville, VA, 2009, “Entropy in Quantum Information Theory and Condensed Matter Physics”.
57. UC Davis Mathematics Colloquium, Davis, CA, 2009, “Communicating Over Quantum Channels”.

PROFESSIONAL ACTIVITIES:

- Member, IPAM Science Advisory Board, 2009-present.
- Organizer, ICTP Workshop on Quantum Computing and Statistical Mechanics, with E. Farhi, M. Mueller, G. Mussardo, A. Scardicchio, and S. Sondhi.
- Organizer, 2010 Boulder Condensed Matter Summer School, with S. Trebst, B. Terhal, M. Troyer, and S. White.
- Organizer, Workshop on Classical and Quantum Information Theory, Santa Fe, March 2008.
- Member, CNLS Director Search Committee.
- Member, T-13 Group Leader Search Committee.
- Member, LANL LDRD ER Grant Review Committee, 2005 and 2007.
- Organizer, Statistical Physics of Complex Systems Summer Workshop at Los Alamos, Summer 2002, 2003, and 2004.
- Organizer, Statistical Mechanics Seminar at Los Alamos.
- Reviewer for Mathematical Reviews.
- Reviewer for Physical Review Letters, B, and E, Europhysics letters, JSTAT, Physics Letters A, JSTAT, and Journal of Physics.
- Grant reviewer for NSF, Israeli-US Binational Science Foundation.

POSTDOCS MENTORED:

- S. Michalakis, August 2008-present.
- J. Yard, January 2009-present (with Howard Barnum).

STUDENTS MENTORED:

- C. Mack, Summer 2007, Statistical Physics of Clustering.
- B. Kozma, Summer 2004, Impurity Averaged Perturbation Theory of Small-World Networks.
- J. A. Drocco, Summer 2003, “Multiscaling at the Jamming Transition”, co-mentors C. J. Olson Reichhardt and C. Reichhardt.

PUBLICITY:

- Work on “Superadditivity of Communication Capacity”, featured in Nature Physics News and Views, P. W. Shor, Nature Physics **5**, 247 (2009).
- Work on “Ratchet Cellular Automata” featured in Physical Review Focus, June 20, 2003; Technology Research News, July 16/23, 2003; LANL Director’s Highlights, July 25, 2003; LANL Theoretical Division Research Highlights, 2003.
- Work on “Do Vortices Entangle?” featured in Nature News and Views, D. R. Nelson, Nature **430**, 839 (2004); ScienceWeek, 9/24/2004.
- Work on Large N Spin Glass featured in Bell Labs Condensed Matter Journal Club, November 2003.

REFERENCES:

- Leonid S. Levitov, Professor of Physics at MIT, levitov@mit.edu, (617) 253-6817.
- J. Preskill, John D. MacArthur Professor of Theoretical Physics at Caltech, preskill@theory.caltech.edu, (626)-395-6691.
- F. Verstraete, Professor of Physics at the University of Vienna, Frank.Verstraete@univie.ac.at, +43-4277-51219.
- G. Korniss, Associate Professor of Physics at Rensselaer Polytechnic Institute, korniss@rpi.edu.
- Shivaji L. Sondhi, Professor of Physics at Princeton University, sondhi@feynman.princeton.edu, (609) 258-4326
- Itamar Procaccia, Levinson Professorial Chair in Chemical Physics, Weizmann Institute of Science, Itamar.Procaccia@weizmann.ac.il
- Thomas C. Halsey, ExxonMobil Research and Engineering, thomas.c.halsey@exxonmobil.com.

GRANTS:

- 2001: LANL ER, “Statistical Properties of Granular Chains”, with E. Ben-Naim (PI).
- 2002: LANL Start-up Grant, \$50K, with M. Chertkov and Z. Toroczkai
- 2003: LANL Start-up Grant, \$100K, with M. Chertkov and Z. Toroczkai
- 2004: LANL ER, “Quantum Devices for Electronic Circuitry and Advanced Detection”, with I. Martin (PI).
- 2004: LANL DR, “Statistical Physics of Infrastructure Networks”, \$1.2M (FY 2004), \$1.24M (FY 2005), \$1.3M (FY 2006), co-PI.
- 2007: LANL DR, “The Physics of Algorithms”, \$1.22M (FY 2007), \$1.28M (FY 2008), \$1.35M (FY 2009), with M. Chertkov (PI).
- 2008: LANL ER, “Entanglement in Quantum Ground States”, \$328K (FY 2008), \$344K (FY 2009), \$361K (FY 2010), PI.
- 2008: NSF Focused Research Group, “Quantum Spins Systems, Theory and Applications in Quantum Computing”. Bruno Nachtergaele, PI.

PUBLICATIONS:

75. “Random tensor theory: extending random matrix theory to mixtures of random product states”, A. Ambainis, A. W. Harrow and M. B. Hastings, arXiv:0910.0472, Commun. Math. Phys., submitted.
74. A. B. Kallin, I. González, M. B. Hastings, and R. G. Melko, “Valence Bond and von Neumann Entanglement Entropy in Heisenberg Ladders”, arXiv:0905.4286, Phys. Rev. Lett. **103**, 117203 (2009).
73. M. C. Bañuls, M. B. Hastings, F. Verstraete, and J. I. Cirac, “Matrix Product States for dynamical simulation of infinite chains”, arXiv:0904.1926, Phys. Rev. Lett., in press.
72. M. B. Hastings, “Light Cone Matrix Product”, arXiv:0903.3253, J. Math. Phys, in press.
71. M. B. Hastings, “Quantum Adiabatic Computation With a Constant Gap is Not Useful in One Dimension”, arXiv:0902.2960, Phys. Rev. Lett. **103**, 050502 (2009).
70. D. Gottesman and M. B. Hastings, “Entanglement vs. gap for one-dimensional spin systems”, arXiv:0901.1108, New Journal of Physics, submitted.
69. M. B. Hastings, “Superadditivity of communication capacity using entangled inputs”, arXiv:0809.3972, Nature Physics **5**, 255 (2009).
68. M. B. Hastings, “Making Almost Commuting Matrices Commute”, arXiv:0808.2474, Commun. Math. Phys. **291**, 321 (2009).
67. M. B. Hastings, “Inference from Matrix Products: A Heuristic Spin Glass Algorithm”, arXiv:0807.3008, Phys. Rev. Lett. **101**, 167206 (2008).
66. M. B. Hastings and L. S. Levitov, “Synchronization and Dephasing of Many-Body States in Optical Lattices”, arXiv:0806.4283, Phys. Rev. Lett., submitted
65. M. B. Hastings and A. W. Harrow, “Classical and Quantum Tensor Product Expanders”, preprint arxiv:0804.0011, QIC **9**, 336 (2009).
64. M. B. Hastings, “Observations Outside the Light-Cone: Algorithms for Non-Equilibrium and Thermal States”, preprint arxiv:0801.2161, Phys. Rev. B **77**, 144302 (2008).
63. M. B. Hastings, “Topology and Phases in Fermionic Systems”, preprint arxiv:0710.3324, JSTAT, L01001 (2008).
62. E. Ben-Naim, M. B. Hastings, and D. Izraelevitz, “Statistics of Partial Minima”, preprint arxiv:0709.3117, J. Phys. A, **40**, F1021 (2007).

61. M. B. Hastings, “Quantum Belief Propagation”, preprint arxiv: 0706.4094, Phys. Rev. B Rapids **76**, 201102 (2007).
60. M. B. Hastings, “Random Unitaries Give Quantum Expanders”, preprint arxiv:0706.0556, Phys. Rev. A **76**, 032315 (2007).
59. M. B. Hastings, “An Area Law for One Dimensional Quantum Systems”, preprint arxiv:0705.2024, JSTAT, P08024 (2007).
58. M. M. Wolf, F. Verstraete, M. B. Hastings, and J. I. Cirac, “Area Laws in Quantum Systems: Mutual Information and Correlations”, preprint arxiv:0704.3907, Physical Review Letters, **100**, 070502 (2008).
57. B. Kozma, M. B. Hastings, and G. Korniss, “Diffusion Processes on Small-World Networks with Distance-Dependent Random Links”, preprint arxiv:0704.2564, JSTAT, P08014 (2007).
56. M. B. Hastings, “Entropy and Entanglement in Quantum Ground States”, preprint cond-mat/0701055, Phys. Rev. B **76**, 035114 (2007).
55. M. B. Hastings, “Quasi-Adiabatic Continuation in Gapped Spin and Fermion Systems: Goldstone’s Theorem and Flux Periodicity”, preprint cond-mat/0612538, JSTAT, P05010 (2007).
54. A. Praz, C. Mudry, and M. B. Hastings, “Scaling Relations in Quasi-two-dimensional Heisenberg Antiferromagnet”, preprint cond-mat/0606032, Phys. Rev. B **74**, 184407 (2006).
53. M. B. Hastings, “Community Detection as an Inference Problem”, preprint cond-mat/0604429, Phys. Rev. E **74**, 035102 (2006).
52. S. Bravyi, M. B. Hastings, and F. Verstraete, “Lieb-Robinson Bounds and the Generation of Correlations and Topological Quantum Order”, preprint quant-ph/0603121, Phys. Rev. Lett. **97**, 050401 (2006).
51. C. Amoruso, A. K. Hartmann, M. B. Hastings, M. A. Moore, “Conformal Invariance and SLE in Two-Dimensional Ising Spin Glasses”, preprint cond-mat/0601711, Phys. Rev. Lett. **97**, 267202 (2006).
50. M. B. Hastings, “Systematic Series Expansions for Processes on Networks”, preprint cond-mat/0511129, Phys. Rev. Lett. **96**, 148701 (2006).
49. M. B. Hastings, “Solving Gapped Hamiltonians Locally”, preprint cond-mat/0508554, Phys. Rev. B **73**, 085115 (2006).
48. M. B. Hastings and T. Koma, “Spectral Gap and Exponential Decay of Correlations”, preprint math-ph/0507008, Commun. Math. Phys. **265**, 781 (2006).

47. M. B. Hastings and C. Mudry, “Universal Scaling Relations in Strongly Anisotropic Materials”, preprint cond-mat/0506294, Phys. Rev. Lett. **96**, 027215 (2006).
46. M. B. Hastings and Xiao-Gang Wen, “Quasi-adiabatic Continuation of Quantum States: The Stability of Topological Ground State Degeneracy and Emergent Gauge Invariance”, preprint cond-mat/0503554, Phys. Rev. B **72**, 045141 (2005).
45. B. Kozma, M. B. Hastings, and G. Korniss, “Diffusion Processes on Power-Law Small-World Networks”, preprint cond-mat/0501509, Phys. Rev. Lett. **95**, 018701 (2005).
44. M. B. Hastings, “Sufficient Conditions for Topological Order in Insulators”, preprint cond-mat/0411094, Europhys. Lett. **70**, 824 (2005).
43. D. Mozyrsky, M. B. Hastings, and I. Martin, “Intermittent polaron dynamics: Born-Oppenheimer out of equilibrium”, preprint cond-mat/0410721, Phys. Rev. B **73**, 35104 (2006).
42. M. B. Hastings, “Statistical Mechanics of Interfering Links”, preprint cond-mat/0410038, Phys. Rev. E Rapids **72**, 015102 (2005).
41. M. B. Hastings, “An ϵ -expansion for Small-World Networks”, preprint cond-mat/0407374, Eur. Phys. Jour. B. **42**, 297 (2004).
40. M. B. Hastings, “Decay of Correlations in Fermi Systems at Non-zero Temperature”, preprint cond-mat/0406348, Phys. Rev. Lett. **93**, 126402 (2004).
39. M. B. Hastings, “Locality in Quantum and Markov Dynamics on Lattices and Networks”, preprint cond-mat/0405587, Phys. Rev. Lett. **93**, 140402 (2004).
38. M. B. Hastings, “Spin-Orbit Scattering and Time-Reversal Symmetry: Detection of a Spin by Tunneling”, preprint cond-mat/0401151, Phys. Rev. B Rapids **70**, 161301 (2004).
37. C. Reichhardt, C.J. Olson Reichhardt, and M.B. Hastings, “Nonlinear dynamics, rectification, and phase locking for particles on symmetrical two-dimensional periodic substrates with dc and circular ac drives”, preprint cond-mat/0312620, Phys. Rev. E **69**, 056115 (2004).
36. D. Mozyrsky, I. Martin, A. Shnirman, and M. B. Hastings, “Renormalization of resonant tunneling in MOSFETs”, preprint cond-mat/0312503, J. Comp. and Theor. Nanoscience **4**, 772 (2007).
35. J. A. Drocco, M. B. Hastings, C. J. Olson Reichhardt, and C. Reichhardt, “Multiscaling at Point J : Jamming is a Critical Phenomenon”, preprint cond-mat/0310291, Phys. Rev. Lett. **95**, 088001 (2005).
34. M. B. Hastings and B. Kozma, “Critical Phenomena in a Small World”, in *Complex Networks*, edited by E. Ben-Naim, H. Frauenfelder, and Z. Toroczkai (Lecture Notes in Physics, Springer, 2004).

33. B. Kozma, M. B. Hastings, and G. Korniss, “Roughness Scaling for Edwards-Wilkinson Relaxation in Small-World Networks”, preprint cond-mat/0309196, Phys. Rev. Lett. **92**, 108701 (2004).
32. C. Reichhardt, C. J. Olson Reichhardt, and M. B. Hastings, “Glassy Ratchets for Collectively Interacting Particles”, preprint cond-mat/0308097, Phys. Lett. A **342**, 162 (2005).
31. C. J. Olson Reichhardt and M. B. Hastings, “Do Vortices Entangle?”, preprint cond-mat/0307374, Phys. Rev. Lett. **92**, 157002 (2004); featured in Nature News and Views.
30. D. Mozyrsky, I. Martin, and M. B. Hastings, “Quantum limited sensitivity of SET-based displacement detectors”, preprint cond-mat/0306480, Phys. Rev. Lett. **92**, 018303 (2004).
29. M. B. Hastings, “Lieb-Schultz-Mattis in Higher Dimensions”, preprint cond-mat/0305505, Phys. Rev. B **69**, 104431 (2004).
28. M. B. Hastings, “Mean-Field and Anomalous Behavior on a Small-World Network”, preprint cond-mat/0304530, Phys. Rev. Lett. **91**, 098701 (2003).
27. M. B. Hastings, “Random Vibrational Networks and Renormalization Group”, preprint cond-mat/0212303, Phys. Rev. Lett. **90**, 148702 (2003).
26. M. B. Hastings, C. J. Olson Reichhardt, and C. Reichhardt, “Ratchet Cellular Automata”, preprint cond-mat/0211302, Phys. Rev. Lett. **90**, 247004 (2003); featured in Phys. Rev. Focus.
25. M. B. Hastings, C. J. Olson Reichhardt, and C. Reichhardt, “Depinning by Fracture in a Glassy Background”, preprint cond-mat/0209542, Phys. Rev. Lett. **90**, 098302 (2003).
24. M. B. Hastings, I. Martin, and D. Mozyrsky. “Quantum Dynamics in Non-equilibrium Strongly Correlated Environments”, preprint cond-mat/0207005, Phys. Rev. B **68**, 035101 (2003).
23. M. B. Hastings, Z. A. Daya, E. Ben-Naim, and R. E. Ecke, “Entropic Tightening of Vibrated Chains”, preprint cond-mat/0110612, Phys. Rev. E Rapids **66**, 025102 (2002).
22. C. Reichhardt, C.J. Olson, and M.B. Hastings, “Rectification and Phase Locking for Particles on Two Dimensional Periodic Substrates”, Phys. Rev. Lett. **89**, 024101 (2002).
21. M. B. Hastings, “Comment on ‘Large- N Theory of strongly commensurate dirty bosons: absence of a transition in two dimensions’”, J. Phys. A **35**, 2519 (2002).

20. M. B. Hastings, “Exact Multifractal Spectra for Arbitrary Laplacian Random Walks”, preprint cond-mat/0109304, Phys. Rev. Lett. **88**, 055506 (2002).
19. M. B. Hastings, “Scale-Invariant Branch Distribution from a Soluble Stochastic Model”, preprint cond-mat/0105440, J. Stat. Phys. **107**, 1031 (2002).
18. M. B. Hastings, “Growth Exponents with 3.99 Walkers”, preprint cond-mat/0104344, Phys. Rev. E **64**, 46104 (2001).
17. M. B. Hastings, “Fractal to Nonfractal Phase Transition in the Dielectric Breakdown Model”, preprint cond-mat/00103312, Phys. Rev. Lett. **87**, 175502 (2001).
16. M. B. Hastings, “Effective Gauge Theories of Spin Systems”, preprint cond-mat/0011125.
15. M. B. Hastings and S. L. Sondhi, “Breakdown of Conformal Invariance at Strongly Random Critical Points”, preprint cond-mat/0011124, Phys. Rev. B **64**, 94204 (2001).
14. M. B. Hastings and T. C. Halsey, “High-Dimensional Diffusive Growth”, preprint cond-mat/0010400, Europhysics Lett. **55**, 679 (2001).
13. M. B. Hastings, “Dirac Structure, RVB, and Goldstone Modes in the Kagomé Antiferromagnet”, preprint cond-mat/0005391, Phys. Rev. B **63**, 14413 (2001).
12. M. B. Hastings, “The Dielectric Breakdown Model at Small η : Pole Dynamics”, preprint cond-mat/9910274, Phys. Rev. E **65**, 066121 (2002).
11. M. B. Hastings, “Eigenvalue Distribution In The Self-Dual Non-Hermitian Ensemble”, preprint cond-mat/9909234, J. Stat. Phys. **103**, 903 (2001).
10. M. B. Hastings, “Fermionic Mapping For Eigenvalue Correlation Functions Of (Weakly) Non-Hermitian Symplectic Ensemble”, preprint cond-mat/9907302, Nuc. Phys. B **572** [FS] 535 (2000).
9. M. B. Hastings, “Ground State and Spin Glass Phase of the Large N Infinite Range Spin Glass Via Supersymmetry”, preprint cond-mat/9906186, J. Stat. Phys. **99**, 171 (2000).
8. M. B. Hastings, “Bose Glass in Large N Commensurate Dirty Boson Model”, preprint cond-mat/9811121, Phys. Rev. B **64**, 024517 (2001).
7. M. B. Hastings, “Renormalization Group for Large N Strongly Commensurate Dirty Boson Model”, Phys. Rev. B **60**, 9755-9762 (1999).
6. M. B. Hastings, “Non-hermitian Fermion Mapping for One-Component Plasma”, J. Stat. Phys. **90**, 311 (1998).
5. M. B. Hastings and L. S. Levitov, “Laplacian growth as one-dimensional turbulence”, Physica D **116**, 244 (1998).

4. M. B. Hastings and L. S. Levitov, “Bragg Resonances for Tunneling Between Edges of a 2D Quantum Hall System”, Phys. Rev. Lett. **77**, 4422 (1996).
3. M. B. Hastings, “Renormalization Theory of Stochastic Growth”, Phys. Rev. E **55**, 135 (1997).
2. M. B. Hastings, A. D. Stone, and H. U. Baranger, “Inequivalence of Weak Localization and Coherent Backscattering”, Phys. Rev. B **50**, 8230 (1994).
1. O. Sinanoglu, J. Alia, and M. Hastings, “Valency Interactions in AH_m ”, J. Phys. Chem. **98**, 5867 (1994).