

David Bruce Wilson

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Education

- Ph.D., Mathematics, Massachusetts Institute of Technology (1996)
- S.B., Electrical Engineering, Massachusetts Institute of Technology (1991)
- S.B., Computer Science, Massachusetts Institute of Technology (1991)
- S.B., Mathematics, Massachusetts Institute of Technology (1991)

Awards and Honors

- o Rollo Davidson Prize of Cambridge University for early-career probabilists (awarded jointly to Kurt Johansson).
- o 2017 Paul R. Ford–Lester R. Halmos Award of the Mathematical Association of America (awarded jointly to Adrien Kassel).
- o 2000 Outstanding Simulation Publication Award, presented by the Institute for Operations Research and the Management Sciences College on Simulation (awarded jointly to James Propp).
- o William A. Martin Memorial Prize for best MIT undergraduate computer science thesis.
- o National Science Foundation Postdoctoral Fellowship.
- o National Defense Science and Engineering Graduate Fellowship. Also offered a National Science Foundation Graduate Fellowship and an Applied Mathematics Fellowship from the MIT math department.
- o Honorable mention for the 1988, 1989, and 1990 William Lowell Putnam mathematical competitions: 41st, 29 $\frac{1}{2}$ th (even-way tie), and 41st.

Employment and Affiliations

- UNIVERSITY of WASHINGTON DEPARTMENT of MATHEMATICS Seattle, WA
2000 – present: Affiliate faculty, currently Affiliate Professor.
- MICROSOFT RESEARCH Redmond, WA
1998 – 2017: Researcher in the theory group analyzing random structures and stochastic processes.
(Most recent position: Principal Researcher.)
- INSTITUTE for ADVANCED STUDY SCHOOL of MATHEMATICS Princeton, NJ
Fall 1997 – Spring 1998: Studied 2-dimensional statistical mechanical models.
- STANFORD UNIVERSITY DEPARTMENT of STATISTICS Paolo Alto, CA
Summer 1997: Visiting scholar participating in Markov chain Monte Carlo program for 1 $\frac{1}{2}$ months.
- CENTER for DISCRETE MATHEMATICS & THEORETICAL COMPUTER SCIENCE (DIMACS) Piscataway, NJ
Spring 1997: Participant in DIMACS’s special focus on discrete probability.
- UNIVERSITY of CALIFORNIA at BERKELEY DIVISION of COMPUTER SCIENCE Berkeley, CA
MATHEMATICAL SCIENCES RESEARCH INSTITUTE Berkeley, CA
Fall 1996: Postdoctoral researcher working on algorithms related to probability.
- COLORADO STATE UNIVERSITY DEPARTMENT of STATISTICS Ft. Collins, CO
Summer 1996: Visiting scholar working on random sampling algorithms.
- MIT DEPARTMENT of ELECTRICAL ENGINEERING and COMPUTER SCIENCE Cambridge, MA
Spring 1996: Teaching assistant for “Structure and Interpretation of Computer Programs.”
- MIT DEPARTMENT of MATHEMATICS Cambridge, MA
Fall 1994: Teaching assistant for “Math for Computer Science.”
Fall 1990: Graded problem sets for a graduate theory of computation class.
Fall 1988 – Spring 1990: Developed educational software for differential equations and probability.
- SANDIA NATIONAL LABORATORIES Albuquerque, NM
Summers 1991, 1992, 1995: Analyzed cryptographic algorithms and stochastic processes.
- QUEUES ENFORTH DEVELOPMENT Cambridge, MA
Spring 1990 – Fall 1990: Programming consultant.
- MIT LABORATORY for COMPUTER SCIENCE Cambridge, MA
Fall 1989 – Fall 1990: Programmed.
Summer 1989: Wrote solutions to exercises for Cormen, Leiserson, & Rivest’s *Introduction to Algorithms*.
- MCDONNELL DOUGLAS CORPORATION Saint Louis, MO
Summer 1988: Programmed.
- BOY SCOUTS of AMERICA Belleville, IL
Summer 1987: Taught astronomy merit badge at summer camp for Okaw Valley Council.

Articles (with hyperlinks)

1. “The Green’s function on the double cover of the grid and application to the uniform spanning tree trunk” (with Richard Kenyon), [arXiv:1708.05381](#).
2. “The six-vertex model and Schramm–Loewner evolution” (with Richard Kenyon, Jason Miller, and Scott Sheffield), *Physical Review E* 95(5):052146, 2017. [arXiv:1605.06471](#).
3. “Active spanning trees with bending energy on planar maps and SLE-decorated Liouville quantum gravity for $\kappa > 8$ ” (with Ewain Gwynne, Adrien Kassel, and Jason Miller), *Communications in Mathematical Physics*, to appear. [arXiv:1603.09722](#).
4. “Active spanning trees and Schramm–Loewner evolution” (with Adrien Kassel), *Physical Review E* 93(6):062121, 2016. [arXiv:1512.09122](#).
5. “Bipolar orientations on planar maps and SLE_{12} ” (with Richard Kenyon, Jason Miller, and Scott Sheffield), [arXiv:1511.04068](#).
6. “Sandpiles and unicycles on random planar maps” (with Xin Sun), *Electronic Communications in Probability* 21(57):1–12, 2016. [arXiv:1506.08881](#).
7. “Supercritical minimum mean-weight cycles” (with Jian Ding and Nike Sun), *Transactions of the American Mathematical Society*, to appear. [arXiv:1504.00918](#).
8. “Finitary coloring” (with Alexander E. Holroyd and Oded Schramm), *Annals of Probability*, to appear. [arXiv:1412.2725](#).
9. “The space of circular planar electrical networks” (with Richard W. Kenyon), *SIAM Journal on Discrete Mathematics* 31(1):1–28, 2017. [arXiv:1411.7425](#).
10. “Pfaffian formulas for spanning tree probabilities” (with Greta Panova), *Combinatorics, Probability & Computing* 26(1):118–137, 2017. [arXiv:1407.3748](#).
11. “A forward-backward single-source shortest paths algorithm” (with Uri Zwick), *SIAM Journal on Computing* 44(3):698–739, 2015. [arXiv:1405.7619](#). Extended abstract appeared in *Proc. 54th Annual Symposium on Foundations of Computer Science (FOCS)*, pp. 707–716, 2013.
12. “The looping rate and sandpile density of planar graphs” (with Adrien Kassel), *American Mathematical Monthly* 123(1):19–39, 2016. [arXiv:1402.4169](#).
13. “The conformal loop ensemble nesting field” (with Jason Miller and Samuel S. Watson), *Probability Theory and Related Fields* 163(3):769–801, 2015. [arXiv:1401.0218](#).
14. “Extreme nesting in the conformal loop ensemble” (with Jason Miller and Samuel S. Watson), *Annals of Probability* 44(2):1013–1052, 2016. [arXiv:1401.0217](#).
15. “On the asymptotics of dimers on tori” (with Richard W. Kenyon and Nike Sun), *Probability Theory and Related Fields* 166(3):971–1023, 2016. [arXiv:1310.2603](#).
16. “The Hausdorff dimension of the CLE gasket” (with Jason Miller and Nike Sun), *Annals of Probability* 42(4):1644–1665, 2014.
17. “Dyck tilings, increasing trees, descents, and inversions” (with Jang Soo Kim, Karola Mészáros, and Greta Panova), *Journal of Combinatorial Theory A* 122:9–27, 2014. Extended abstract appeared in *Proc. 24th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC)*, 2012.
18. “The min mean-weight cycle in a random network” (with Claire Mathieu), *Combinatorics, Probability & Computing* 22(5):763–782, 2013.
19. “Avoidance coupling” (with Omer Angel, Alexander E. Holroyd, James Martin, and Peter Winkler), *Electronic Communications in Probability* 18(58):1–13, 2013.
20. “Spanning trees of graphs on surfaces and the intensity of loop-erased random walk on planar graphs” (with Richard W. Kenyon), *Journal of the American Mathematical Society* 28(4):985–1030, 2015. [arXiv:1107.3377](#).
21. “XOR-Ising loops and the Gaussian free field,” [arXiv:1102.3782](#).
22. “Dimension of the loop-erased random walk in three dimensions,” *Physical Review E* 82(6):062102, 2010.
23. “Double-dimer pairings and skew Young diagrams” (with Richard W. Kenyon), *Electronic Journal of Combinatorics* 18(1) #P130, 2011.
24. “Schramm’s proof of Watts’ formula” (with Scott Sheffield), *Annals of Probability* 39(5):1844–1863, 2011.
25. “Approach to criticality in sandpiles” (with Anne Fey and Lionel Levine), *Physical Review E* 82(3):031121, 2010. (Contains proofs of results announced in below PRL article.)

26. “Driving sandpiles to criticality and beyond” (with Anne Fey and Lionel Levine), *Physical Review Letters* [104:145703](#), 2010.
27. “Event-chain Monte Carlo algorithms for hard-sphere systems” (with Etienne P. Bernard and Werner Krauth), *Physical Review E* [80\(5\):056704](#), 2009.
28. “Combinatorics of tripartite boundary connections for trees and dimers” (with Richard W. Kenyon), *Electronic Journal of Combinatorics* [16\(1\):R112](#), 2009.
29. “A sharp threshold for minimum bounded-depth and bounded-diameter spanning trees and Steiner trees in random networks” (with Omer Angel and Abraham D. Flaxman), *Combinatorica* [32\(1\):1–33](#), 2012.
30. “Coupling from the past” (with James G. Propp), Chapter 22 of the textbook *Markov Chains and Mixing Times*, by David A. Levin, Yuval Peres, and Elizabeth L. Wilmer, published by the American Mathematical Society, 2009.
31. “Chip-firing and rotor-routing on directed graphs” (with Alexander E. Holroyd, Lionel Levine, Karola Mészáros, Yuval Peres, and James Propp), *In and out of Equilibrium II*, eds. V. Sidoravicius, M. E. Vares, “Progress in Probability” #60, pp. 331–364, Birkhäuser (2008).
32. “Card shuffling and Diophantine approximation” (with Omer Angel and Yuval Peres), *Annals of Applied Probability* [18\(3\):1215–1231](#), 2008.
33. “The electrical response matrix of a regular $2n$ -gon” (with Nathaniel D. Blair-Stahn), *Proceedings of the American Mathematical Society* [137\(6\):2015–2025](#), 2009.
34. “Two-player Knock ’em Down” (with James A. Fill), *Electronic Journal of Probability* [13\(9\):198–212](#), 2008.
35. “Conformal radii for conformal loop ensembles” (with Oded Schramm and Scott Sheffield), *Communications in Mathematical Physics* [288\(1\):43–53](#), 2009.
36. “Boundary partitions in trees and dimers” (with Richard W. Kenyon), *Transactions of the American Mathematical Society* [363\(3\):1325–1364](#), 2011.
37. “Tug-of-war and the infinity Laplacian” (with Yuval Peres, Oded Schramm, and Scott Sheffield), *Journal of the American Mathematical Society* [22\(1\):167–210](#), 2009.
(260 citations.)
38. “Random-turn Hex and other selection games” (with Yuval Peres, Oded Schramm, and Scott Sheffield), *American Mathematical Monthly* [114:373–387](#), May 2007. ([math.PR/0508580](#))
39. “SLE coordinate changes” (with Oded Schramm), *New York Journal of Mathematics* [11:659–669](#), 2005.
40. “Balanced Boolean functions that can be evaluated so that every input bit is unlikely to be read” (with Itai Benjamini and Oded Schramm), *Proc. 37th ACM Symposium on Theory of Computing (STOC)*, pp. 244–250, 2005.
41. “Excited random walk” (with Itai Benjamini), *Electronic Communications in Probability* [8\(9\):86–92](#), 2003.
42. “Mixing time of the Rudvalis shuffle,” *Electronic Communications in Probability* [8\(8\):77–85](#), 2003.
43. “Winding angle variance of Fortuin-Kasteleyn contours” (with Benjamin Wieland), *Physical Review E* [68\(5\):056101](#), 2003.
44. “On the Red-Green-Blue model,” *Physical Review E* [69\(3\):037105](#), 2004.
45. “Critical resonance in the non-intersecting lattice path model” (with Richard W. Kenyon), *Probability Theory and Related Fields* [130\(3\):289–318](#), 2004.
46. “Mixing times of lozenge tiling and card shuffling Markov chains,” *Annals of Applied Probability* [14\(1\):274–325](#), 2004.
(Over 180 citations.)
47. “On the critical exponents of random k -SAT,” *Random Structures & Algorithms* [21\(2\):182–195](#), 2002.
48. “The scaling window of the 2-SAT transition” (with Béla Bollobás, Christian Borgs, Jennifer T. Chayes, and Jeong Han Kim), *Random Structures & Algorithms* [18\(3\):201–256](#), 2001.
(Over 210 citations.)
49. “Diagonal sums of boxed plane partitions,” *Electronic Journal of Combinatorics* [8\(1\):N1](#), 2001.
50. “Layered multishift coupling for use in perfect sampling algorithms (with a primer on CFTP),” *Monte Carlo Methods*, edited by Neil Madras, *Fields Institute Communications* #26, pp. 143–179. American Mathematical Society, 2000. ([math.PR/9912225](#))
51. “Trees and matchings” (with Richard W. Kenyon and James G. Propp), *Electronic Journal of Combinatorics* [7\(1\):R25](#), 2000.

52. “How to couple from the past using a read-once source of randomness,” *Random Structures & Algorithms* 16(1):85–113, 2000.
53. “Scaling limits for minimal and random spanning trees in two dimensions” (with Michael Aizenman, Almut Burchard, and Charles M. Newman), *Random Structures & Algorithms* 15(3&4):319–367, 1999.
54. “Sampling spin configurations of an Ising system” (with Dana Randall), *Proc. Tenth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pp. S959–960, 1999.
55. “Coupling from the past: a user’s guide” (with James Propp), *DIMACS Series in Discrete Mathematics and Theoretical Computer Science*, “Microsurveys in Discrete Probability,” D. Aldous and J. Propp, editors, American Mathematical Society, 1998.
56. “How to get a perfectly random sample from a generic Markov chain and generate a random spanning tree of a directed graph” (with James G. Propp), *Journal of Algorithms* 27(2):170–217, 1998. Earlier version appeared in *Proc. Seventh Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pp. 448–457, 1996. (Over 200 citations.)
57. “Random random walks on \mathbb{Z}_2^d ,” *Probability Theory and Related Fields* 108(4):441–457, 1997.
58. “Determinant algorithms for random planar structures,” *Proc. Eighth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pp. 258–267, 1997.
59. “Generating random spanning trees more quickly than the cover time,” *Proc. 28th Annual ACM Symposium on the Theory of Computing (STOC)*, pp. 296–303, 1996. (Over 330 citations.)
60. “Beyond islands: runs in clone-probe matrices” (with David S. Greenberg and Cynthia A. Phillips), *Proc. First Annual International Conference on Computational Molecular Biology (RECOMB)*, pp. 320–329, 1997.
61. “Learning foraging thresholds for lizards: an analysis of a simple learning algorithm” (with Leslie Ann Goldberg and William E. Hart), *J. Theoretical Biology* 197(3):361–369, 1999. Earlier version appeared in *Proc. Ninth Annual Conference on Computational Learning Theory (COLT)*, pp. 2–9, 1996.
62. “Exact sampling with coupled Markov chains and applications to statistical mechanics” (with James G. Propp), *Random Structures & Algorithms* 9(1&2):223–252, 1996. (Over 1270 citations.)
63. “On the number of graphs which lack small cycles” (with Daniel J. Kleitman), *Discrete Mathematics*, to appear.
64. “Fast exponentiation with precomputation: algorithms and lower bounds” (with Ernest F. Brickell, Daniel M. Gordon, and Kevin S. McCurley), *Advances in Cryptology — Eurocrypt ’92*, Lecture Notes in Computer Science #658, pp. 200–207, 1993. (Over 360 citations.)
65. “Embedding leveled hypercube algorithms into hypercubes,” *Proc. 4th Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, pp. 264–270, 1992.

Miscellaneous

Co-organizer of the following conferences and workshops: Pacific Northwest Theory Day (2004), the Pacific Northwest Probability Seminar (2008, 2010, 2012, 2013, and 2014), the Oded Schramm Memorial Conference (2009), the ICERM (Institute for Computational and Experimental Research in Mathematics) workshop on cluster algebras and statistical physics (2011), and the MSRI (Mathematical Sciences Research Institute) workshop on lattice models and combinatorics (2012).

Ph.D. thesis committee member for Nathaniel Blair-Stahn (University of Washington) and Zhongyang Li (Brown University). Rapporteur for the Ph.D. theses of Adrien Kassel (École Normale Supérieure) and Béatrice de Tilière (Université Paris Sud).

Co-organized the first within-MIT contest to determine who would represent MIT at the ACM Programming Contest, and served as team manager.

Mentor for FIRST Robotics Competition team #488 (2012 and 2013).

Mentor for five interns at Microsoft Research (Benjamin Wieland, Nike Sun, Samuel Watson, Xin Sun, and Ewain Gwynne).

Mentor for REU (research experiences for undergraduates) program run by James Morrow at the University of Washington (2013).

Preferred computer languages: C, Mathematica, and JavaScript; familiar with numerous others.

Designed the error correcting codes used in the Xbox 360’s Southbridge chip.