Richard Kenyon
William R. Kenan University Professor of Mathematics
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Mathematics Dept., Brown University, Providence, RI 02912

Current position:
Full Professor, Brown University, 2007-.

Education/Diplomas:
- Habilitation thesis from Université Paris-Sud, 1999:
Sur la dynamique, la combinatoire et la statistique des pavages.
- Ph.D. from Princeton University in mathematics, 1990.
Thesis: *Self-Similar Tilings.* Thesis director W. P. Thurston.
- B.A. in mathematics and physics from Rice University, 1986.

Previous positions:
- Full Professor and CRC chair tier 1, University of British Columbia, 2004-2007.
- Visiting Professor, Princeton University, 2003-2004.
- Research Director (Directeur de recherches) at the Centre National de Recherche Scientifique (CNRS), ENS-Lyon and Université Paris-Sud, 1997-2003.
- Visiting researcher, Microsoft theory group, summers of 1999-2003.
- Visiting assistant professor, Univ. of California at Berkeley, 1994-1995.
- Chargé de recherches at CNRS, based at ENS-Lyon 1993-1997.
- Chargé de recherches at CNRS, based at Institut J. Fourier, Grenoble, 1991-1993.
- Chateaubriand Post-Doctoral fellowship at the Institut des Hautes Etudes Scientifiques (IHES), France, 1990-91. Advisor: Dennis Sullivan

Prizes and awards:
- Simons Investigator, 2014-2018.
- American Academy of Arts and Sciences, member since 2014.
- Clay foundation Senior Scholar, 2012.
- William R. Kenan Jr. University Professorship, 2009.
- Loève prize 2007.
- Prix Charles-Louis de Saulses de Freycinet from the French Académie des Sciences, 2002.
- Rollo Davidson prize, 2001.
- CNRS Bronze medal, 1999.
- Gauthier-Villars/Institut Henri Poincaré prize, 1997 (best paper of 1997 in the journal, *Annales de l'Institut Henri Poincaré, section probabilités et statistiques*).
- IBM Graduate Fellowship, Princeton, 1989-90.

Grants:
- 2017: 3-year NSF grant DMS-1713033, $300K.
- 2016: 1-year NSF grant DMS-1612668, $79K.
- 2014: Simons Investigator five year grant, $500K.
- 2012: 3-year NSF grant DMS-1208191, $390K.
- 2008: 3-year NSF grant DMS-0805493, $240K.
- 2005: CFI (Canadian Foundation for Innovation) infrastructure grant $75K CAD.

• 2004: 5-year NSERC grant $250K CAD.

Research directed:
• Current PhD students: Xufan Zhang, Terrence George, Xiang Li
• Previous students: Ian Alevy (PhD 2017), Sanjay Ramassamy (PhD 2016), Ningning Ma (PhD 2015), Oliver Cheng, Martin Tassy (PhD 2014), Adrien Kassel (PhD 2013), Sunil Chhita (PhD 2011), Zhongyang Li (PhD 2011), Ben Young (PhD 2007), Cédric Boutillier (PhD 2005), Béatrice de Tilière (PhD 2004).
• Master's research topic: Cédric Boutillier, 2002, Massimiliano Mattera, 1998, Jean-Réné Geoffroy, 1999.

Service:
• Editor, IMRN, 2014-.
• Editor, Annales de l'Institut Henri Poincaré-D, 2013-.
• Editor, Inventiones Mathematicae, 2007-present.
• Chair of the Brown University grievance committee, 2009-2011.
• Vice-chair of the Brown University grievance committee, 2008-2009.
• Member of ICERM scientific advisory board, 2010-2012.
• Member of PIMS scientific review panel, 2006-2009.
• Organizer of the 2015 ICERM semester on "Phase transitions and emergence".
• Organizer of the 2012 MSRI semester on "Random Spatial Processes".
• Co-organizer of semester "random shapes" at IPAM, 2007.
• Co-organizer of Oberwohlfach workshop "Discrete differential geometry", 2006, 2009, 2012, 2015.
• Co-organizer of BIRS workshop "moduli spaces and combinatorics", 2006.
• Editor of the *Bulletin et Mémoires de la Société Mathématique Francaise*, 2000-2005.
• Organizer of trimester on random growth processes, IHP, spring 2003.
• Reviewer for Mathematical Reviews, 1993-2007.
• Organizer of the geometry/topology seminar at Université Paris-Sud, 1997-2003.

Publications:

Chapters in books:

(1) The Laplacian on planar graphs and graphs on surfaces, Current Developments in Mathematics, 2011, International Press.

(2) Lectures on dimers. Statistical mechanics, 191–230, IAS/Park City Math. Ser., 16, Amer. Math. Soc., Providence, RI, 2009.

(3) The dimer model, in Exact methods in low dimensional statistical physics and quantum computing. J. Jacobsen et al, eds. Oxford Univ. Press. 2010.

(4) Dimer problems, in Encyclopedia of mathematical physics, J.-P. Françoise, G. L. Naber and T. S. Tsun, eds., Academic Press, 2006.

(5) An introduction to the dimer model, School and conference on probability theory, 267-304, ICTP lectures notes XVII *Abdus Salam Cent. Theoret. Phys.* 2004 .

(6) Pavages aléatoirs par dimères, Pavages, 91-103. Ed. Ecole Polytech., Palaiseau, 2001.

(7) Self-Replicating Tilings, in Symbolic dynamics and its applications, AMS Contemp. Math. Series **135**, P. Walters, ed., (1992), 239–263.

Refereed journal articles:

(1) The space of circular planar electrical networks, with D. Wilson, SIAM J. Discrete Math, to appear

(2) Determinantal spanning forests on planar graphs, Ann. Prob., to appear

(3) The phases of large networks with edge and triangle constraints, with C. Radin, K. Ren, L. Sadun J. Phys. A 50 (2017)

(4) Fixed-energy harmonic functions, with A. Abrams, Discrete Analysis (2017)

(5) On the asymptotics of constrained exponential random graphs with M. Yin, J. Appl. Probab. 54 (2017), no. 1, 165–180

(6) Bipodal structure in oversaturated random graphs, with C. Radin, K. Ren, L. Sadun, IMRN (2016)

(7) Multipodal Structure and Phase Transitions in Large Constrained Graphs, with K. Ren, C. Radin. L. Sadun, J. Stat. Phys. 168 (2017), no. 2, 233–258

(8) Right-angled hexagon tilings of the hyperbolic plane, Proceedings of the Thurston memorial conference, to appear.

(9) On the asymptotics of dimers on tori, with N. Sun and D. Wilson, Probab. Theory Related Fields 166 (2016), no. 3-4, 971–1023

(10) Random curves on surfaces induced from the Laplacian determinant, with A. Kassel, Ann. Prob., 45, Number 2 (2017), 932-964

(11) Double-dimers, the Ising model and the hexahedron recurrence, with R. Pemantle, J. Combin. Theory Ser. A 137 (2016), 27–63

(12) Random two-component spanning forests, with A. Kassel and W. Wu, Ann. IHP 4, 51 (2015)1457–1464

(13) Spanning trees of graphs on surfaces and the intensity of loop-erased random walk on $\mathbb{Z}^2$, with D. Wilson, JAMS 28 (2015), 985-1030.

(14) Principal minors and rhombus tilings, with R. Pemantle, J. Phys. A: Math. Theor. 47 (2014)

(15) Conformal invariance of loops in the double-dimer model, CMP (2014), Volume 326, Issue 2, pp 477-497.

(16) Dimers and cluster integrable systems, with A. Goncharov, Ann. Sci. ENS, 4 (2013), 747-813.

(17) Hausdorff dimension of the multiplicative golden mean shift, with Y. Peres and B. Solomyak, Comptes rendus - Mathématique (June 2011), 349 (11-12), pg. 625-628.

(18) Hausdorff dimension for fractals invariant under the multiplicative integers, with Y. Peres and B. Solomyak, Ergodic Theory and Dynamical Systems 2012;32(5):1567-1584.

(19) Spanning forests and the vector bundle Laplacian, Ann. Prob. 2011, Vol. 39, No. 5, 1983-2017

(20) Double-dimer pairings and skew Young diagrams, with D. Wilson, Electron. J. Combin. 18 (2011), no. 1, Paper 130, 22 pp.

(21) On the characterization of expansion maps for self-affine tilings, with B. Solomyak, Discrete Comput. Geom. 43 (2010), no. 3, 577–593,

(22) Combinatorics of tripartite boundary connections for trees and dimers. with D. Wilson, Electron. J. Combin. 16 (2009), no. 1, Research Paper 112, 28 pp

(23) Branched polymers, with P. Winkler, Amer. Math. Monthly 116 (2009), no. 7, 612–628.

(24) Resonance in monotone loop models, with Alan Hammond, *PTRF*, to appear.

(25) Boundary partitions in trees and dimers, with D. Wilson, Trans. Amer. Math. Soc. 363 (2011), no. 3, 1325–1364.

(26) Height fluctuations in the honeycomb dimer model *Comm. Math. Phys.* **281**(2008), 675-709.

(27) Limit shapes and the complex Burgers equation, with A. Okounkov, *Acta Math.* **199** (2007), 263-302.

(28) Dimers and amoebae, with A. Okounkov and S. Sheffield. *Ann. Math.* **163**(2006), 1019-1056.

(29) Planar dimers and Harnack curves, with A. Okounkov, *Duke Math J.*, **131** (2006) 499-524.

(30) Topological mixing for substitutions on two letters, with B. Solomyak and L. Sadun, *Erg. Thy. Dyn. Syst.*, 25 (2005), no. 6, 1919–1934

(31) What is ... a dimer?, with A. Okounkov. *Notices Amer. Math. Soc.* 52 (2005), no. 3 , 342-343.

(32) Rhombic embeddings of planar graphs. With J.-M. Schlenker, *Trans. AMS* 357 (2005), no. 9, 3443-3458 (electronic).

(33) Dimers, Tilings and trees, with S. Sheffield, *J. Combin. Thy Ser. B* 92 (2004), no. 2, 295–317

(34) Critical resonance in the non-intersecting lattice path model, with D. Wilson, *Prob. Thy. Related Fields* **130** (2004), 289-318.

(35) Constructing rational maps from subdivision rules. With J. Cannon, W. Floyd, W. Parry. *Conf. Geometry and Dynamics* **7** (2003), 76-102 (electronic).

(36) The Laplacian and Dirac operators on critical planar graphs, *Invent. Math.* **150** (2002), 409-439.

(37) The low-temperature expansion of the Wulff crystal in the three-dimensional Ising model, with Raphael Cerf. *Comm. Math. Phys* **222** (2001), 147-179.

(38) A variational principle for domino tilings, with H. Cohn, J. Propp, *J. Amer. Math. Soc.*, **14** (2001), no.2, 297-346.

(39) Dominos and the Gaussian free field, *Ann. Probab.* **29**, no.3 (2001), 1128-1137.

(40) The asymptotic determinant of the discrete Laplacian, *Acta Math*, **185** (2000), 239-286.

(41) Conformal invariance of domino tiling, *Ann. Probab.*, **28** (2000), 759-795.

(42) Long-range properties of spanning trees, *J. Math. Phys.* **41** (2000), 1338–1363.

(43) The planar dimer model with boundary: a survey, Directions in mathematical quasicrystals, M. Baake and R. Moody, eds. CRM monograph series (AMS, Providence, RI, 2000).

(44) Trees and Matchings, with J. Propp, D. Wilson, *El. J. Combin.* **7** (2000), Research paper 25, 34pp.

(45) Billiards on rational-angled triangles, with J. Smillie, *Commentarii Math. Helv.* **75** (2000), 65–108.

(46) Geometry of self-affine tiles II, with J. Li, R. Strichartz, Y. Wang. *Indiana Univ. Math. J.* **48** (1999), 25–42.

(47) Hyperbolic Geometry, with J. Cannon, W. J. Floyd, W. R. Parry, *Flavors of Geometry*, MSRI pubs. number 31, Cambridge Univ. Press. 1998.

(48) Tilings and discrete Dirichlet problems, *Isr. J. Math* **105** (1998), 61–84.

(49) Arithmetic construction of sofic partitions of hyperbolic toral automorphisms (with A. Vershik), *Erg. Thy. and Dyn. Syst.* **18** (1998), 357–372.

(50) Local statistics of lattice dimers, *Ann. Inst. H. Poincaré, Probabilités* **33** (1997), 591–618.

(51) Tilings of convex polygons, *Ann. Inst. Fourier* **47** (1997), 929–944.

(52) Projecting the one-dimensional Sierpinski gasket, *Isr. J. math* **97** (1997), 221–238.

(53) Tiling a rectangle with the fewest squares, *J. Combin. Thy. Ser. A* **76**, No. 2. (1996), 272–291.

(54) The construction of self-similar tilings, *Geom. and Func. Analysis* **6** (1996), 417–488.

(55) A group of paths in the plane, *Trans. AMS* **348** (1996), 3155–3172.

(56) A note on tiling with integer-sided rectangles, *J. Combin. Thy. Ser. A* **74**, No. 2 (1996), 321–332.

(57) Measures of Full dimension on Affine-Invariant Sets (with Yuval Peres), *Erg. Thy. and Dyn. Syst.* **16** (1996), 307–323.

(58) Hausdorff dimensions of sofic affine-invariant sets (with Yuval Peres), *Isr. J. Math* **94** (1996), 157–178.

(59) Inflationary tilings with a similarity structure. *Comment. Math. Helv.* **69** (1994), 169–198.

(60) Tiling a Polygon with Parallelograms, *Algorithmica* **9** (1993), 382–397.

(61) Rigidity of planar tilings, *Invent. Math.* **107** (1992), 637–651. Erratum: **112** (1993), 223.

(62) How to Take Short Cuts, (with Claire Kenyon), *Disc. Comput. Geom.* **8** (1992), 251–264.

(63) Tiling a polygon with rectangles, (with Claire Kenyon), 33rd annual Symposium on Foundations of Computer Science (FOCS), (1992), 610–619.

(64) Intersecting Random Translates of Invariant Cantor Sets, (with Yuval Peres), *Invent. Math.* **104** (1991), 601–629.

Unrefereed articles

(1) Les travaux d'Andrei Okounkov sur le modèle des dimères *Gaz. Math.* **112** (2007), 18-22.

(2) Pavages, arbres, et labyrinths aléatoires, with W. Werner, Images des Maths, 2003.

(3) La mathématique des interfaces aléatoires, *CNRS-Info magazine* special issue in mathematics, May, 2000, 21-22. http://www.cnrs.fr/presse

(4) Dominos et ferromagnétisme à deux dimensions, *CNRS-Info magazine* **376** (1999), 7-8.

(5) Sur la dynamique, la combinatoire, et la statistique des pavages, Thèse d'Habilitation, 1999.

Preprints

(1) A Family of Minimal and Renormalizable Rectangle Exchange Maps, with I. Alevy, R. Yi

(2) Shellability of face posets of electrical networks and the CW poset property, with P. Hersh

(3) Holomorphic quadratic differentials on graphs and the chromatic polynomial, with Wai Yeung Lam

(4) Permutations with fixed pattern densities, with D. Kral, C. Radin, P. Winkler

(5) Bipolar orientations on planar maps and SLE_{12}, with J. Miller, S. Sheffield, D. Wilson

(6) The six-vertex model and Schramm-Loewner evolution with J. Miller, S. Sheffield, D. Wilson

(7) Shape Convergence for Aggregate Tiles in Conformal Tilings, with K. Stephenson

(8) The Green's function on the double cover of the grid and application to the uniform spanning tree trunk, with D. Wilson