

## 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, 1991-2003.
- 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.

### Prizes and awards:

- Clay foundation Senior Scholar, 2012.
- William R. Kenan 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:

- 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: Oliver Cheng, Adrien Kassel, Martin Tassy
- Sunil Chhita, 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, *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 2012 MSRI semester on “Random Spatial Processes”.
- Co-organizer of Oberwolfach workshop “Discrete differential geometry”, 2009.
- Co-organizer of semester “random shapes” at IPAM, 2007.
- Co-organizer of Oberwolfach workshop “Discrete differential geometry”, 2006.
- Co-organizer of BIRS workshop “moduli spaces and combinatorics”, 2006.
- Editor of the *Bulletin et Mémoires de la Société Mathématique Française*, 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.

**General information:**

Age 47, U.S. citizen, married, 4 children.

## Publications:

### Chapters in books:

- (1) Lectures on dimers. Statistical mechanics, 191–230, IAS/Park City Math. Ser., 16, Amer. Math. Soc., Providence, RI, 2009.
- (2) The dimer model, in Exact methods in low dimensional statistical physics and quantum computing. J. Jacobsen et al, eds. Oxford Univ. Press. 2010.
- (3) Dimer problems, in Encyclopedia of mathematical physics, J.-P. Francoise, G. L. Naber and T. S. Tsun, eds., Academic Press, 2006.
- (4) An introduction to the dimer model, School and conference on probability theory, 267-304, ICTP lectures notes XVII *Abdus Salam Cent. Theoret. Phys.* 2004 .
- (5) Pavages aléatoires par dimères, Pavages, 91-103. Ed. Ecole Polytech., Palaiseau, 2001.
- (6) Self-Replicating Tilings, in Symbolic dynamics and its applications, AMS Contemp. Math. Series **135**, P. Walters, ed., (1992), 239–263.

### Refereed journal articles:

- (1) Hausdorff dimension of the multiplicative golden mean shift, with Y. Peres and B. Solomyak, CRAS to appear.
- (2) Hausdorff dimension for fractals invariant under the multiplicative integers, with Y. Peres and B. Solomyak, ETDS to appear.
- (3) Spanning forests and the vector bundle Laplacian, Ann. Prob. 2011, Vol. 39, No. 5, 1983-2017
- (4) Double-dimer pairings and skew Young diagrams, with D. Wilson, Electron. J. Combin. 18 (2011), no. 1, Paper 130, 22 pp.
- (5) On the characterization of expansion maps for self-affine tilings, with B. Solomyak, Discrete Comput. Geom. 43 (2010), no. 3, 577593,
- (6) Combinatorics of tripartite boundary connections for trees and dimers. with D. Wilson, Electron. J. Combin. 16 (2009), no. 1, Research Paper 112, 28 pp
- (7) Branched polymers, with P. Winkler, Amer. Math. Monthly 116 (2009), no. 7, 612628.
- (8) Resonance in monotone loop models, with Alan Hammond, *PTRF*, to appear.
- (9) Boundary partitions in trees and dimers, with D. Wilson, Trans. Amer. Math. Soc. 363 (2011), no. 3, 13251364.
- (10) Height fluctuations in the honeycomb dimer model *Comm. Math. Phys.* **281**(2008), 675-709.
- (11) Limit shapes and the complex Burgers equation, with A. Okounkov, *Acta Math.* **199** (2007), 263-302.
- (12) Dimers and amoebae, with A. Okounkov and S. Sheffield. *Ann. Math.* **163**(2006), 1019-1056.
- (13) Planar dimers and Harnack curves, with A. Okounkov, *Duke Math J.*, **131** (2006) 499-524.
- (14) Topological mixing for substitutions on two letters, with B. Solomyak and L. Sadun, *Erg. Thy. Dyn. Syst.*, 25 (2005), no. 6, 1919–1934

- (15) What is ... a dimer?, with A. Okounkov. *Notices Amer. Math. Soc.* **52** (2005), no. 3, 342-343.
- (16) Rhombic embeddings of planar graphs. With J.-M. Schlenker, *Trans. AMS* **357** (2005), no. 9, 3443-3458 (electronic).
- (17) Dimers, Tilings and trees, with S. Sheffield, *J. Combin. Thy Ser. B* **92** (2004), no. 2, 295–317
- (18) Critical resonance in the non-intersecting lattice path model, with D. Wilson, *Prob. Thy. Related Fields* **130** (2004), 289-318.
- (19) Constructing rational maps from subdivision rules. With J. Cannon, W. Floyd, W. Parry. *Conf. Geometry and Dynamics* **7** (2003), 76-102 (electronic).
- (20) The Laplacian and Dirac operators on critical planar graphs, *Invent. Math.* **150** (2002), 409-439.
- (21) The low-temperature expansion of the Wulff crystal in the three-dimensional Ising model, with Raphael Cerf. *Comm. Math. Phys* **222** (2001), 147-179.
- (22) A variational principle for domino tilings, with H. Cohn, J. Propp, *J. Amer. Math. Soc.*, **14** (2001), no.2, 297-346.
- (23) Dominos and the Gaussian free field, *Ann. Probab.* **29**, no.3 (2001), 1128-1137.
- (24) The asymptotic determinant of the discrete Laplacian, *Acta Math*, **185** (2000), 239-286.
- (25) Conformal invariance of domino tiling, *Ann. Probab.*, **28** (2000), 759-795.
- (26) Long-range properties of spanning trees, *J. Math. Phys.* **41** (2000), 1338–1363.
- (27) 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).
- (28) Trees and Matchings, with J. Propp, D. Wilson, *El. J. Combin.* **7** (2000), Research paper 25, 34pp.
- (29) Billiards on rational-angled triangles, with J. Smillie, *Commentarii Math. Helv.* **75** (2000), 65–108.
- (30) Geometry of self-affine tiles II, with J. Li, R. Strichartz, Y. Wang. *Indiana Univ. Math. J.* **48** (1999), 25–42.
- (31) Hyperbolic Geometry, with J. Cannon, W. J. Floyd, W. R. Parry, *Flavors of Geometry*, MSRI pubs. number 31, Cambridge Univ. Press. 1998.
- (32) Tilings and discrete Dirichlet problems, *Isr. J. Math* **105** (1998), 61–84.
- (33) Arithmetic construction of sofic partitions of hyperbolic toral automorphisms (with A. Vershik), *Erg. Thy. and Dyn. Syst.* **18** (1998), 357–372.
- (34) Local statistics of lattice dimers, *Ann. Inst. H. Poincaré, Probabilités* **33** (1997), 591–618.
- (35) Tilings of convex polygons, *Ann. Inst. Fourier* **47** (1997), 929–944.
- (36) Projecting the one-dimensional Sierpinski gasket, *Isr. J. math* **97** (1997), 221–238.

- (37) Tiling a rectangle with the fewest squares, *J. Combin. Thy. Ser. A* **76**, No. 2. (1996), 272–291.
- (38) The construction of self-similar tilings, *Geom. and Func. Analysis* **6** (1996), 417–488.
- (39) A group of paths in the plane, *Trans. AMS* **348** (1996), 3155–3172.
- (40) A note on tiling with integer-sided rectangles, *J. Combin. Thy. Ser. A* **74**, No. 2 (1996), 321–332.
- (41) Measures of Full dimension on Affine-Invariant Sets (with Yuval Peres), *Erg. Thy. and Dyn. Syst.* **16** (1996), 307–323.
- (42) Hausdorff dimensions of sofic affine-invariant sets (with Yuval Peres), *Isr. J. Math* **94** (1996), 157–178.
- (43) Inflationary tilings with a similarity structure. *Comment. Math. Helv.* **69** (1994), 169–198.
- (44) Tiling a Polygon with Parallelograms, *Algorithmica* **9** (1993), 382–397.
- (45) Rigidity of planar tilings, *Invent. Math.* **107** (1992), 637–651. Erratum: **112** (1993), 223.
- (46) How to Take Short Cuts, (with Claire Kenyon), *Disc. Comput. Geom.* **8** (1992), 251–264.
- (47) Tiling a polygon with rectangles, (with Claire Kenyon), 33rd annual Symposium on Foundations of Computer Science (FOCS), (1992), 610–619.
- (48) 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 and work in progress

- (1) Dimers and cluster integrable systems, with A. Goncharov, submitted
- (2) Spanning trees of graphs on surfaces and the intensity of loop-erased random walk on  $\mathbb{Z}^2$ , with D. Wilson, submitted
- (3) Conformal invariance of loops in the double-dimer model. submitted
- (4) The Laplacian on surface graphs.

#### Selected invited lectures:

- Yale conference in honor of Roy Adler, 1991.
- Workshop on Geometric Visualisation, MSRI, 1992.
- Warwick conference on  $\mathbf{Z}^n$ -actions, 1993.
- Conference on Algorithmic geometry, Val d’Ajol 1994.
- Dynamical systems and number theory, Luminy 1995.
- Long-range aperiodic order, Waterloo 1995.

- Rencontres Lyon-Geneve-Grenoble, 1996.
- Weizmann Institute and Hebrew University, 1997.
- Forschungsordnung und aperiodizität, Oberwolfach 1998.
- Fractal geometry and stochastics, Greifswald 1998.
- Conference on Inhomogeneous Random Systems, Palaiseau, 1999.
- Eurandom, Eindhoven, phase transitions and complexity, Orsay 1999.
- Journées de la SMF, 1999.
- Rencontres entres physiciens et mathematiens, Strasbourg 2000.
- Bernoulli society meeting, Guanajuato 2000.
- International congress of mathematical physics, London 2000.
- Hot topics workshop, MSRI, 2001.
- “Hypathie” seminar, ENS-Lyon, 2002.
- ICTP Trieste, minicourse: dimers and geometry 2002.
- Eurandom workshop on discrete probability, Eindhoven, 2002.
- Luminy workshop on operator algebras and ergodic theory 2002.
- Nevanlinna colloquium plenary lecture, 2003.
- Conference in honor of Persi Diaconis, Toulouse, 2003.
- “Conformal invariance” conference, Edinburg, 2003.
- Conference on tropical geometry, MSRI, 2004.
- Pacific northwest probability seminar, 2004.
- Minneapolis conference ”New frontiers in probability”, 2005.
- Victoria Northwest dynamics symposium, 2005.
- Winnepeg CMS-Mitacs meeting, plenary speaker, 2007.
- IAS Park City summer school lecturer, 2007.
- Saint Flour summer school lecturer, 2008.
- Ecole de physique les Houches lecturer, 2008.
- AMS Western section meeting, Vancouver, plenary speaker, 2008.
- Ritt lectures at Columbia University, May 2009.
- Short course (3 hours) at the Cornell probability summer school, July 2009.
- Northeast probability seminar, Nov. 2009.
- AMS/MAA Joint meetings, San Francisco, plenary speaker Jan 2010.
- Sherman lectures, Indiana, April 2010.
- Clay summer school, short course, Brazil, August 2010.
- Heilbronn Institute Annual conference, September 2010.
- SACNAS modern math workshop, Los Angeles, October 2010.
- MASS colloquium, Penn State, October 2010.
- Conference on Current Developments in Mathematics, Harvard, Nov. 2011.
- FPSAC 2011, Reykjavik 2011.