

Curriculum Vitae

LIONEL LEVINE

Address: Department of Mathematics Email Address: levine@math.cornell.edu
Cornell University Homepage: <https://pi.math.cornell.edu/~levine>
Ithaca, NY 14853 Citizenship: USA

Employment

2019 – **Frank Spitzer and Narahari Prabhu Associate Professor of Mathematics,**
Cornell University
2017 – 2019 **Associate Professor,** Cornell University
2011 – 2017 **Assistant Professor,** Cornell University
2008 – 2011 **C. L. E. Moore Instructor,** MIT

Education

2002 – 2007 **Ph.D.** in Mathematics, University of California, Berkeley
1998 – 2002 **A.B.** in Mathematics, Harvard University

Grants and Awards

2020 – Fellow of the American Mathematical Society
2018 – 2019 Simons Fellowship
2018 – 2019 Von Neumann Fellowship, Institute for Advanced Study
2015 – 2020 National Science Foundation Grant DMS-1455272 (CAREER)
2014 – 2016 Alfred P. Sloan Research Fellowship
2013 – 2014 Good Judgment Project “Superforecaster”
2011 – 2014 National Science Foundation Grant DMS-1243606

Research Interests

Probability, combinatorics, statistical physics, theoretical computer science

Ph.D. students

Hannah Cairns (Ph.D. expected 2022)
Feng Liang (Ph.D. expected 2022)
Andrew Melchionna (Ph.D. expected 2022)
Ryan McDermott (Ph.D. 2021)
Lila Greco (Ph.D. 2020, now at Berkshire Hathaway)
Swee Hong Chan (Ph.D. 2019, now Hedrick Assistant Professor at UCLA)

Postdocs mentored

John Pike (2013–16)
Daniel C. Jerison (2014–17)
Wilfried Huss (2015–16)
Ecaterina Sava-Huss (2015–16)
Lilla Tothmérész (2017–18)
Viktor Kiss (2017–18)
Christian Noack (2019–)

Publications and Preprints

- preprints 1. Lionel Levine and Feng Liang,
Exact sampling and fast mixing of Activated Random Walk. arXiv:2110.14008
2. Lila Greco and Lionel Levine,
Branching in a Markovian environment. arXiv:2106.11249
3. Viktor Kiss, Lionel Levine, and Lilla Tóthmérész
The devil's staircase for chip-firing on random graphs and on graphons. arXiv:2004.13104
- 2022 4. Swee Hong Chan and Lionel Levine,
Abelian networks IV. Dynamics of nonhalting networks
Memoirs of the American Mathematical Society, to appear. arXiv:1804.03322
5. Lionel Levine and Vittoria Silvestri,
How far do Activated Random Walkers spread from a single source?
Journal of Statistical Physics, to appear. arXiv:2011.02535
6. Lionel Levine, Hanbaek Lyu, and John Pike,
Double jump phase transition in a soliton cellular automaton.
International Math Research Notices (2022) 665–727
- 2021 7. Swee Hong Chan, Lila Greco, Lionel Levine, and Peter Li, *Random walks with local memory*.
Journal of Statistical Physics 184 (2021), Article 6, 28 pp.
- 2019 8. Shirshendu Ganguly, Lionel Levine, and Sourav Sarkar,
Formation of large-scale random structure by competitive erosion.
Annals of Probability (2019) 47:3649–3704
9. Daniel C. Jerison, Lionel Levine, and John Pike,
Mixing time and eigenvalues of the abelian sandpile Markov chain.
Transactions of the American Mathematical Society (2019) 372:8307–8345
10. Bob Hough, Daniel C. Jerison, and Lionel Levine, *Sandpiles on the square lattice*.
Communications in Mathematical Physics (2019) 367:33–87.
11. Lionel Levine and Vittoria Silvestri,
How long does it take for Internal DLA to forget its initial profile?
Probability Theory and Related Fields (2019) 174:1219–1271.
12. Alexander E. Holroyd, Lionel Levine, and Peter Winkler, *Abelian logic gates*.
Combinatorics, Probability, and Computing (2019) 28:388–422.
- 2018 13. Wilfried Huss, Lionel Levine and Ecaterina Sava-Huss,
Interpolating between random walk and rotor walk.
Random Structures & Algorithms (2018) 52.2:263–282
- 2017 14. Lionel Levine, Wesley Pegden and Charles K. Smart,
The Apollonian structure of integer superharmonic matrices.
Annals of Math (2017) 186:1–67
15. Elisabetta Candellero, Shirshendu Ganguly, Christopher Hoffman and Lionel Levine,
Oil and water: a two-type internal aggregation model.
Annals of Probability (2017) 45:4019–4070
16. Lionel Levine and Yuval Peres, *Laplacian growth, sandpiles and scaling limits*.
Bulletin of the American Mathematical Society (2017) 54:355–382
17. Lionel Levine and Ramis Movassagh,
The gap of the area-weighted Motzkin spin chain is exponentially small.
Journal of Physics A: Mathematical and Theoretical (2017) 50:255302

18. Shirshendu Ganguly, Lionel Levine, Yuval Peres and James G. Propp, *Formation of an interface by competitive erosion*. Probability Theory and Related Fields (2017) 168:455–509
- 2016 19. Benjamin Bond and Lionel Levine, *Abelian networks I. Foundations and examples*. SIAM Journal on Discrete Mathematics (2016) 30:856–874.
20. Benjamin Bond and Lionel Levine, *Abelian networks II. Halting on all inputs*. Selecta Mathematica (2016) 22:319–340.
21. Benjamin Bond and Lionel Levine, *Abelian networks III. The critical group*. Journal of Algebraic Combinatorics (2016) 43:635–663.
22. Laura Florescu, Lionel Levine and Yuval Peres, *The range of a rotor walk*. The American Mathematical Monthly, (2016) 123(7):627–642.
23. Matthew Farrell and Lionel Levine, *CoEulerian graphs*. Proceedings of the American Mathematical Society (2016) 144:2847–2860.
24. Matthew Farrell and Lionel Levine, *Multi-Eulerian tours of directed graphs*. Electronic Journal of Combinatorics (2016) 23:P2.21.
25. Lionel Levine, Mathav Murugan, Yuval Peres and Baris Ugurcan, *The divisible sandpile at critical density*. Annales Henri Poincaré (2016) 17(7):1677–1711.
26. Lionel Levine, Wesley Pegden and Charles K. Smart, *Apollonian structure in the abelian sandpile*. Geometric And Functional Analysis (2016) 26(1):306–336.
- 2015 27. Lionel Levine, *Threshold state and a conjecture of Poghosyan*, Poghosyan, Priezzhev and Ruelle. Communications in Mathematical Physics (2015) 335(2):1003–1017
28. Louis J. Billera, Lionel Levine and Karola Mészáros, *How to decompose a permutation into a pair of labeled Dyck paths by playing a game*. Proceedings of the American Mathematical Society (2015) 143:1865–1873.
- 2014 29. Lionel Levine and Yuval Peres, *The looping constant of \mathbb{Z}^d* . Random Structures & Algorithms (2014) 45:1–13
30. David Jerison, Lionel Levine and Scott Sheffield, *Internal DLA and the Gaussian free field*. Duke Mathematical Journal (2014) 163(2):267–308
31. Laura Florescu, Shirshendu Ganguly, Lionel Levine and Yuval Peres, *Escape rates for rotor walks in \mathbb{Z}^d* . SIAM Journal on Discrete Mathematics (2014) 28(1):323–334.
32. David Jerison, Lionel Levine, and Scott Sheffield. *Internal DLA for cylinders*, in *Advances in Analysis: The Legacy of Elias M. Stein* (2014): 189.
- 2013 33. Lionel Levine, Scott Sheffield and Katherine E. Stange, *A duality principle for selection games*. Proceedings of the American Mathematical Society (2013) 141(12):4349–4356.
34. David Jerison, Lionel Levine and Scott Sheffield, *Internal DLA in higher dimensions*. Electronic Journal of Probability (2013) 18(98):1–14.
35. Tobias Friedrich and Lionel Levine, *Fast simulation of large-scale growth models*. Random Structures & Algorithms (2013) 42:185–213.
36. Christopher J. Hillar, Lionel Levine and Darren Rhea, *Equations solvable by radicals in a uniquely divisible group*. Bulletin of the London Mathematical Society (2013) 45:61–79.
- 2012 37. David Jerison, Lionel Levine and Scott Sheffield, *Logarithmic fluctuations for internal DLA*. Journal of the American Mathematical Society (2012) 25:271–301.
38. Lionel Levine and Katherine E. Stange, *How to make the most of a shared meal: plan the last bite first*. American Mathematical Monthly (2012) 119:550–565.

39. Giuliano Giacaglia, Lionel Levine, James Propp and Linda Zayas-Palmer. *Local-to-global principles for the hitting sequence of a rotor walk*. Electronic Journal of Combinatorics (2012) 19:P5.
- 2011 40. Lionel Levine, *Sandpile groups and spanning trees of directed line graphs*. Journal of Combinatorial Theory A (2011) 118:350–364.
41. Lionel Levine, *Parallel chip-firing on the complete graph: devil’s staircase and Poincaré rotation number*. Ergodic Theory and Dynamical Systems (2011) 31:891–910
- 2010 42. Anne Fey, Lionel Levine and David B. Wilson, *Driving sandpiles to criticality and beyond*. Physical Review Letters (2010) 104:145703.
43. Anne Fey, Lionel Levine and David B. Wilson, *The approach to criticality in sandpiles*. Physical Review E (2010) 82:031121.
44. Anne Fey, Lionel Levine and Yuval Peres, *Growth rates and explosions in sandpiles*. Journal of Statistical Physics (2010) 138:143–159.
45. Lionel Levine and Yuval Peres, *Scaling limits for internal aggregation models with multiple sources*. Journal d’Analyse Mathématique (2010) 111:151–219.
46. Lionel Levine and James Propp, *What is a sandpile?* Notices of the American Mathematical Society (2010) 57:976–979.
47. Wouter Kager and Lionel Levine, *Rotor-router aggregation on the layered square lattice*. Electronic Journal of Combinatorics (2010) 17:R152.
48. Wouter Kager and Lionel Levine, *Diamond aggregation*. Mathematical Proceedings of the Cambridge Philosophical Society (2010) 149:351–372.
- 2009 49. Lionel Levine and Yuval Peres, *Strong spherical asymptotics for rotor-router aggregation and the divisible sandpile*. Potential Analysis (2009) 30:1–27.
50. Itamar Landau and Lionel Levine, *The rotor-router model on regular trees*. Journal of Combinatorial Theory A (2009) 116:421–433.
51. Lionel Levine, *The sandpile group of a tree*. European Journal of Combinatorics (2009) 30:1026–1035.
- 2008 52. Alexander E. Holroyd, Lionel Levine, Karola Meszaros, Yuval Peres, James Propp and David B. Wilson, *Chip-firing and rotor-routing on directed graphs*, in “In and Out of Equilibrium 2,” Progress in Probability vol. 60, 331–364.
53. Lionel Levine and Yuval Peres, *Spherical asymptotics for the rotor-router model in \mathbb{Z}^d* . Indiana University Mathematics Journal (2008) 57:431–450.
- 2007 54. Christopher J. Hillar and Lionel Levine, *Polynomial recurrences and cyclic resultants*. Proceedings of the American Mathematical Society (2007) **135**:1607–1618.
- 2006 55. Lionel Levine, *Fractal sequences and restricted Nim*. Ars Combinatoria (2006) **80**:113–127.

Selected talks

- 2021 Nov. CUNY probability seminar (via Zoom)
 Nov. Cornell “What is” seminar: *What is Brownian Motion?*
 Oct. Berkeley probability seminar (via Zoom)
 Aug. AIM workshop on Arithmetic Reflection Groups (via Zoom)
 Apr. University of Washington probability seminar (via Zoom)
 Mar. Duke probability seminar (via Zoom)

- Mar. University of South Carolina discrete math seminar (via Zoom)
Mar. University of Birmingham applied math seminar (via Zoom)
- 2020 Oct. One World probability seminar (via Zoom)
Oct. AMS Sectional meeting (two talks, via Zoom)
May Kent State measure theory seminar (via Zoom)
Jan. La Sapienza probability seminar, Rome, Italy
- 2019 Nov. ICERM workshop on illustrating dynamics and probability
Jun. Joint Meeting of the Vietnam and American Mathematical Societies, Quy Ngon, Vietnam
Mar. IAS discrete math seminar, Princeton, NJ
Mar. University of Chicago probability seminar
Feb. ICTS program on universality in random structures, Bangalore, India (4 lectures)
Feb. IIT Mumbai mathematics colloquium
- 2018 Sep. Penn State MASS seminar and mathematics colloquium
Jul. Montreal workshop on challenges in probability and statistical physics
- 2017 Oct. Stony Brook mathematics colloquium
Oct. Princeton probability seminar
Sep. Cornell probability and dynamics (joint seminar)
Jul. Mathematical Congress of the Americas, Special session on probability, Montreal
- 2016 Nov. Berkeley probability seminar
July PROMYS alumni lecture, Boston Univeristy
Apr. Math Awareness Public Lecture, Cornell
Apr. Finger Lakes Probability Seminar, Cornell
Jan. CIRM workshop on nonequilibrium statistical physics, Marseilles, France
- 2015 Nov. BIRS Workshop on sandpile groups, Oaxaca, Mexico
Oct. CIB Conference on statistical physics on transitive graphs, EPFL Lausanne, Switzerland
Aug. MAA Centennial, Invited session on “Arithmetic of Spheres”
Apr. Harvard random matrix and statistical physics seminar
Feb. Triangle Lectures in Combinatorics, University of North Carolina
- 2014 Dec. Tufts mathematics colloquium
Nov. IMPA Workshop on First-Passage Percolation, Rio de Janeiro, Brazil
Jun. CIRM Conference on Random Media, Marseille, France
May MIT probability seminar
Apr. University of Arizona mathematics colloquium
- 2013 Oct. Midwest Probability Colloquium, Northwestern University
Aug. Mathematical Congress of the Americas, special session on applied combinatorics
Jan. Cornell applied mathematics colloquium
- 2012 Dec. Tel Aviv University mathematics colloquium
Apr. University of Connecticut mathematics colloquium
Jan. MSRI program on random spatial processes
- 2011 Nov. 80th birthday conference in honor of Harry Kesten, Cornell University
May Southeastern Probability Conference, Duke University
Mar. MSRI workshop on free boundary problems, Berkeley, CA
Jan. University of British Columbia mathematics colloquium
- 2010 Aug. Formal Power Series and Algebraic Combinatorics (FPSAC’10), San Francisco, CA
Feb. IMPA probability seminar, Rio de Janeiro, Brazil
Jan. University of Washington / PIMS mathematics colloquium
- 2009 Oct. Dartmouth computer science colloquium
Jul. 27th Brazilian Colloquium of Mathematics, Rio de Janeiro

2008 Aug. CRM Workshop on Laplacian growth and related topics, Montreal
 2007 Oct. International symposium on stochastic large scale interacting systems, Fukuoka, Japan
 Sep. Workshop on sandpile models and related fields, Eindhoven, Netherlands

Professional Service

- Editor, *Combinatorial Theory* (2020–). This is the successor to *Journal of Combinatorial Theory A*, formerly published by Elsevier. It is a mathematician-run journal, owned by its Editorial Board.
- Co-organizer, Cornell Probability Summer School (2013, 2014, 2019, 2022).
- Co-organizer, Invited session at the World Congress in Probability and Statistics, July 2016.
- Co-organizer, AIM workshop on generalizations of chip-firing and the critical group, July 2013.
- Organizer, Workshop on sandpiles and number theory, Oct. 2012.
- Co-organizer, Special session on Laplacian growth, AMS/MAA joint meetings, Jan. 2011.
- Co-organizer, Cornell probability seminar (2012–)
- Co-organizer, MIT probability seminar (2008–2011)

Journals and Conferences Refereed:

American Mathematical Monthly	Journal of Physics A
Annals of Combinatorics	Journal of Statistical Physics
Annals of Probability	Linear Algebra And Its Applications
Archive for Rational Mechanics and Analysis	Mathematics of Operations Research
Combinatorics, Probability and Computing	Notices of the American Mathematical Society
Communications in Mathematical Physics	Physica A
Discrete Mathematics	Physical Review E
Duke Mathematical Journal	Potential Analysis
Electronic Journal of Combinatorics	Probability Theory and Related Fields
Foundations of Computer Science (FOCS)	Random Structures & Algorithms
International Mathematics Research Notices	SIAM Journal on Discrete Mathematics
Journal d'Analyse Mathématique	Stochastic Processes And Their Applications
Journal of the American Mathematical Society	Symposium on Discrete Algorithms (SODA)
Journal of Combinatorial Theory A	Symposium on Theory of Computing (STOC)
Journal of Integer Sequences	

Teaching

- 2022 Spring Limits of discrete random structures (MATH 7710, graduate topics class in probability)
- 2021 Fall Graduate Probability I (MATH 6710) at Cornell
- 2021 Fall Calculus I (MATH 1110) at Cornell
- 2021 Spring Graduate Probability II (MATH 6720) at Cornell
- 2020 Fall Abelian Networks (MATH 7710, graduate topics class in probability) at Cornell
- 2020 Fall Graduate Probability I (MATH 6710) at Cornell
- 2020 Spring Nonlinear Dynamics and Chaos (MATH 4210/ MAE 5790) at Cornell
- 2020 Spring Graduate Probability II (MATH 6720) at Cornell
- 2019 Fall Graduate Probability I (MATH 6710) at Cornell
- 2018 Spring Graduate Probability II (MATH 6720) at Cornell
- 2017 Spring Graduate Probability II (MATH 6720) at Cornell
- 2017 Spring Stochastic Processes (MATH 4740) at Cornell
- 2016 Spring Mathematics and Politics (MATH 1340) at Cornell
- 2015 Spring Stochastic Processes (MATH 4740) at Cornell
- 2014 Fall Graduate Probability (MATH 6710) at Cornell
- 2014 Spring Stochastic Processes (MATH 4740) at Cornell
- 2013 Spring Stochastic Processes (MATH 4740) at Cornell
- 2012 Fall Laplacian Growth (MATH 7770, graduate topics class in probability) at Cornell
- 2011 Spring Algebraic Combinatorics (18.312) at MIT

Mentoring and Outreach

- 2021 Mentored prospective math major Bryan Lu on a *stochastic model of attention*.
- 2019 Taught a five-week minicourse on *probability, combinatorics, and computation* for gifted high school students at the PROMYS program.
Designed a research project on *ladder sandpiles* for PROMYS students Siddhant Chaudhary and Ashwin Padaki. They presented their results at the 2020 Joint Math Meetings.
- 2018 Designed research projects on *random spanning trees* and *greedy avoidance of arithmetic progressions* for PROMYS counselors (undergraduate math majors) and high school students
Supervised independent research for Cornell math major Mike Sosa.
Spoke on *the future of prediction* at the MAA New York sectional meeting
- 2017 Supervised senior thesis research for Cornell math major Peter Li.
Peter's thesis topic: *The vector-valued martingale invariance principle*
Designed research project on *random game trees* for PROMYS students
- 2016 PROMYS alumni lecture, Boston University, July 6, 2016.
Math Awareness Public Lecture, April 29, 2016.
- 2015 Mentored high school students Karthik Karnik and Mikaeel Yunus in the PROMYS program, and sponsored them for the Siemens and JSHS competitions.
- 2014 Supervised senior thesis research for Cornell undergraduate Matthew Farrell.
Matt's thesis title: *The halting problem for chip-firing on finite directed graphs*
- 2013 Supervised research for Cornell undergraduates Young Jun Song and Matt Weatherly.
Supervised senior thesis research for Cornell undergraduate Diwakar Raisingh.
Diwakar's thesis title: *Toward an axiomatic characterization of the smash sum*
Presented on *the sandpile group of a graph* at the Cornell Math Club.
- 2012 Presented on *patterns in coin-flipping* to an audience of secondary school teachers.
Contributed mathematical art to MSRI's Wild Beauty outreach event.
- 2011 Presented on *primes in Pascal's triangle* at the Boston Math Circle.
Co-mentored high school student Ziv Scully in MIT's PRIMES program.
- 2009–2011 Mentored MIT undergraduates Joshua Alman, Ben Bond, Giuliano Giacaglia, Neil Gurram, Damien Jiang, Aviva Siegel and Linda Zayas-Palmer in the UROP program.