Curriculum Vitae of Ewain Gwynne

University of Chicago
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Employment

Associate professor, University of Chicago Sep. 2020—Present

Clay research fellow Jul. 2019—Jul. 2023

Trinity College, Cambridge junior research fellow Jul. 2018—Jul. 2022

Herchel Smith postdoctoral fellow (Cambridge) Aug. 2018—Jul. 2019

Microsoft Research theory group intern, Redmond WA Jun. 2015—Aug. 2015

Education

Ph.D., Mathematics Sep. 2013—Jun. 2018
Massachusetts Institute of Technology
Adviser: Scott Sheffield

B.A., Mathematics & Mathematical Methods in the Social Sciences Sep. 2009—Jun. 2013
Northwestern University
Honors in Mathematics, Summa Cum Laude

Research interests

Probability theory and statistical mechanics, including Liouville quantum gravity, Schramm-Loewner evolution, random planar maps, random walk in random environment, random permutations, etc.

Awards and honors

1. Sectional talk at the International Congress of Mathematicians 2022
2. David G. Kendall Award 2021
3. Rollo Davidson Prize 2020
4. Clay research fellowship 2019
5. Johnson Prize for a paper written by an MIT graduate student 2018
6. National Defense Science and Engineering Graduate Fellowship (NDSEG) 2013
7. Barry M. Goldwater Scholarship 2012

Articles

Articles published or accepted for publication

1. **Uniqueness of the critical and supercritical Liouville quantum gravity metrics** (with Jian Ding). *Proceedings of the London Mathematical Society.* arXiv:2110.00177
2. **Up-to-constants comparison of Liouville first passage percolation and Liouville quantum gravity** (with Jian Ding). *Science China Mathematics.* arXiv:2108.12060
3. **Geodesic networks in Liouville quantum gravity surfaces**. *Probability and Mathematical Physics.* arXiv:2010.11260

4. **Geodesics and metric ball boundaries in Liouville quantum gravity** (with Josh Pfeffer and Scott Sheffield). *Probability Theory and Related Fields.* arXiv:2010.07889

5. **Tightness of supercritical Liouville first passage percolation** (with Jian Ding). *Journal of the European Mathematical Society.* arXiv:2005.13576

6. **The distance exponent for Liouville first passage percolation is positive** (with Jian Ding and Avelio Sepúlveda). *Probability Theory and Related Fields.* arXiv:2005.13570

7. **Random walks on mated-CRT planar maps and Liouville Brownian motion** (with Nathanael Berestycki). *Communications in Mathematical Physics.* arXiv:2003.10320

8. **Mating of trees for random planar maps and Liouville quantum gravity: a survey** (with Nina Holden and Xin Sun). *Panoramas et Syntheses.* arXiv:1910.04713

9. **The dimension of the boundary of a Liouville quantum gravity metric ball**. *Communications in Mathematical Physics.* arXiv:1909.08588

10. **Random surfaces and Liouville quantum gravity**. *Notices of the American Mathematical Society.* arXiv:1908.05573

11. **KPZ formulas for the Liouville quantum gravity metric** (with Josh Pfeffer). *Transactions of the American Mathematical Society.* arXiv:1905.11790

12. **Joint scaling limit of site percolation on random triangulations in the metric and peanosphere sense** (with Nina Holden and Xin Sun). *Electronic Journal of Probability.* arXiv:1905.06757

13. **Conformal covariance of the Liouville quantum gravity metric for $\gamma \in (0,2)$** (with Jason Miller). *Annales de l'Institut Henri Poincaré.* arXiv:1905.00384

14. **Existence and uniqueness of the Liouville quantum gravity metric for $\gamma \in (0,2)$** (with Jason Miller). *Inventiones Mathematicae.* arXiv:1905.00383

15. **Confluence of geodesics in Liouville quantum gravity for $\gamma \in (0,2)$** (with Jason Miller). *Annals of Probability.* arXiv:1905.00381

16. **Weak LQG metrics and Liouville first passage percolation** (with Julien Dubédat, Hugo Falconet, Josh Pfeffer, and Xin Sun). *Probability theory and related fields.* arXiv:1905.00380

17. **Local metrics of the Gaussian free field** (with Jason Miller). *Annales de l'Institut Fourier.* arXiv:1905.00379

18. **Bounds for distances and geodesic dimension in Liouville first passage percolation** (with Josh Pfeffer). *Electronic Communications in Probability.* arXiv:1903.09561

19. **Liouville quantum gravity surfaces with boundary as matings of trees** (with Morris Ang). *Annales de l'Institut Henri Poincaré.* arXiv:1903.09120

20. **Liouville quantum gravity with matter central charge in $(1,25)$: a probabilistic approach** (with Nina Holden, Josh Pfeffer, and Guillaume Remy). *Communications in Mathematical Physics.* arXiv:1903.09111

21. **External diffusion limited aggregation on a spanning-tree-weighted random planar map** (with Josh Pfeffer). *Annals of Probability.* arXiv:1901.06860

22. **Conformal invariance of $\mathbf{CLE}_\kappa$ on the Riemann sphere for $\kappa \in (4,8)$** (with Jason Miller and Wei Qian). *International Math Research Notices.* arXiv:1811.00514

23. **The Tutte embedding of the Poisson-Voronoi tessellation of the Brownian disk converges to $\sqrt{8/3}$-Liouville quantum gravity** (with Jason Miller and Scott Sheffield). *Communications in Mathematical Physics.* arXiv:1809.02091

24. **An invariance principle for ergodic scale-free random environments** (with Jason Miller and Scott Sheffield). *Acta Mathematica.* arXiv:1807.07515

25. **Harmonic functions on mated-CRT maps** (with Jason Miller and Scott Sheffield). *Electronic Journal of Probability.* arXiv:1807.07511

26. **Anomalous diffusion of random walk on random planar maps** (with Tom Hutchcroft). *Probability theory and related fields.* arXiv:1807.01512

27. **The fractal dimension of Liouville quantum gravity: universality, monotonicity, and bounds** (with Jian Ding). *Communications in Mathematical Physics.* arXiv:1807.01072

28. **Connectivity properties of the adjacency graph of $\mathbf{SLE}_\kappa$ bubbles for $\kappa \in (4, 8)$** (with Josh Pfeffer). *Annals of Probability.* arxiv:1803.04923

29. **Random walk on random planar maps: spectral dimension, resistance, and displacement** (with Jason Miller). *Annals of Probability.* arxiv:1711.00836

30. **A mating-of-trees approach for graph distances in random planar maps** (with Nina Holden and Xin Sun). *Probability Theory and Related Fields.* arxiv:1711.00723

31. **The Tutte embedding of the mated-CRT map converges to Liouville quantum gravity** (with Jason Miller and Scott Sheffield). *Annals of Probability.* arxiv:1705.11161

32. **Convergence of percolation on uniform quadrangulations with boundary to $\mathbf{SLE}_6$ on $\sqrt{8/3}$-Liouville quantum gravity** (with Jason Miller). *Asterisque.* arxiv:1701.05175

33. **Characterizations of $\mathbf{SLE}_\kappa$ for $\kappa \in (4, 8)$ on Liouville quantum gravity** (with Jason Miller). *Asterisque.* arxiv:1701.05174

34. **Convergence of the free Boltzmann quadrangulation with simple boundary to the Brownian disk** (with Jason Miller). *Annales de l'Institut Henri Poincaré.* arxiv:1701.05173

35. **Chordal $\mathbf{SLE}_6$ explorations of a quantum disk** (with Jason Miller). *Electronic Journal of Probability.* arxiv:1701.05172

36. **Convergence of the self-avoiding walk on random quadrangulations to $\mathbf{SLE}_{8/3}$ on $\sqrt{8/3}$-Liouville quantum gravity** (with Jason Miller). *Annales de l'ENS.* arxiv:1608.00956

37. **Metric gluing of Brownian and $\sqrt{8/3}$-Liouville quantum gravity surfaces** (with Jason Miller). *Annals of Probability.* arxiv:1608.00955

38. **Scaling limit of the uniform infinite half-plane quadrangulation in the Gromov-Hausdorff-Prokhorov-uniform topology** (with Jason Miller). *Electronic Journal of Probability.* arxiv:1608.00954

39. **A distance exponent for Liouville quantum gravity** (with Nina Holden and Xin Sun). *Probability Theory and Related Fields.* arxiv:1606.01214

40. **Active spanning trees with bending energy on planar maps and SLE-decorated Liouville quantum gravity for $\kappa > 8$** (with Adrien Kassel, Jason Miller, and David Wilson). *Communications in Mathematical Physics.* arxiv:1603.09722

41. **Dimension transformation formula for conformal maps into the complement of an SLE curve** (with Nina Holden and Jason Miller). *Probability theory and related fields.* arxiv:1603.05161

42. **An almost sure KPZ relation for SLE and Brownian motion** (with Nina Holden and Jason Miller). *Annals of Probability.* arxiv:1512.01223

43. **Brownian motion correlation in the Peanosphere for $\kappa > 8$** (with Nina Holden, Jason Miller, and Xin Sun). *Annales de l'Institut Henri Poincaré.* arxiv:1510.04687

44. **Scaling limits for the critical Fortuin-Kasteleyn model on a random planar map II: local estimates and empty reduced word exponent** (with Xin Sun). *Electronic Journal of Probability.* arxiv:1505.03375

45. **Scaling limits for the critical Fortuin-Kasteleyn model on a random planar map I: cone times** (with Cheng Mao and Xin Sun). *Annales de l'Institut Henri Poincaré.* arxiv:1502.00546

46. **Almost sure multifractal spectrum of SLE** (with Jason Miller and Xin Sun). *Duke Mathematical Journal.* arxiv:1412.8764

Articles posted to the arXiv

47. **On the geometry of uniform meandric systems** (with Jacopo Borga and Minjae Park). 2022. arXiv:2212.00534
48. **Internal DLA on mated-CRT maps** (with Ahmed Bou-Rabee). 2022. arXiv:2211.04891
49. **The Minkowski content measure for the Liouville quantum gravity metric** (with Jinwoo Sung). 2022. arXiv:2211.04701
50. **Harmonic balls in Liouville quantum gravity** (with Ahmed Bou-Rabee). 2022. arXiv:2208.11795
51. **Permutons, meanders, and SLE-decorated Liouville quantum gravity** (with Jacopo Borga and Xin Sun). 2022. arXiv:2207.02319
52. **Loewner evolution driven by complex Brownian motion** (with Josh Pfeffer, simulations by Minjae Park). 2022. arXiv:2203.07313
53. **Introduction to the Liouville quantum gravity metric** (with Jian Ding and Julien Dubédat). 2021. arXiv:2109.01252
54. **The critical Liouville quantum gravity metric induces the Euclidean topology** (with Jian Ding). 2021. arXiv:2108.12067
55. **Regularity and confluence of geodesics for the supercritical Liouville quantum gravity metric** (with Jian Ding). 2021. arXiv:2104.06502
56. **Joint scaling limit of a bipolar-oriented triangulation and its dual in the peanosphere sense** (with Nina Holden and Xin Sun). 2016. arxiv:1603.01194
57. **Scaling limits for the critical Fortuin-Kasteleyn model on a random planar map III: finite volume case** (with Xin Sun). 2015. arxiv:1510.06346
58. **Asymptotic behavior of the Eden model with positively homogeneous edge weights** (with Sébastien Bubeck). 2015. arxiv:1508.05140

Articles written as an undergraduate

59. **On Beckner's Inequality for Gaussian Measures** (with Elton Hsu). *Elemente der Mathematik*.
60. **Functional Inequalities for Gaussian and Log-Concave Probability Measures**. Undergraduate Thesis, advised by Elton Hsu. *Northwestern University Undergraduate Research Journal*.
61. **On a Quaternionic Analogue of the Cross Ratio** (with Matvei Libine). *Advances in Applied Clifford Algebras*. arxiv:1112.0612
62. **The Poisson Integral Formula and Representations of SU(1,1)**. *Rose-Hulman Undergraduate Math Journal*.

Teaching

1. **Teaching at Chicago** Spring 2020-Present

   I taught an undergraduate course on Markov chains, martingales, and Brownian motion in Spring 2021. I will teach graduate-level complex analysis in Spring 2023.

2. **Supervisions for Trinity college** 2018-2019

   I supervised pairs of students for Metric and Topological spaces and Analysis II in Michaelmas term, 2018; Complex Analysis in Lent term, 2019; and revisions for Part 1B (second year) courses in Easter term, 2019.

3. **MIT Teaching Assistant** 2016-2018

   I taught recitations for 18.03 (ordinary differential equations) in Spring 2016 and for 18.022 (multivariable calculus) in Fall 2016. I was a grader for 18.615 (intro to stochastic processes) in each of Spring 2017 and Spring 2018.

4. **Northwestern University undergraduate teaching assistant** 2011-2013

   I taught discussion sections for four sections of integral calculus, one section of single variable differential calculus, and one section of multivariable differential calculus.

Mentoring / Supervising

1. **Ph.D students** 2021-present

   I am working with six Ph.D students at UChicago (some of whom are fully or partially advised by others).

2. **Undergraduate reading courses** 2021-present

   I supervise reading courses for UChicago undergraduate students.

3. **UChicago REU** 2021-2022

   I gave lectures for the REU students in 2021 and 2022 and mentored two students in 2021.

4. **Master's student** 2020 - 2021

   I supervised a student, Wanli Cheng, for Chicago's Master of Science Program in the Physical Sciences.

5. **Undergraduate student research projects** 2019

   I supervised two undergraduate students, Robert Koirala and Kaidi Xhang, working on a summer research project.

6. **Mentor for directed Reading Program** 2014, 2017

   I mentored an MIT undergraduate student studying probability during MIT's Independent Activities Period (the month of January).

Departmental service

1. **Organizer of university of Chicago probability seminar** 2021-present

2. **University of Chicago department committees** 2020-present

   Graduate admissions committee (3 years), hiring committee (2 years), colloquium committee (3 years).

3. **Integration Bee co-organizer** 2014-2017

   I was a co-organizer for the MIT integration bee, an event where undergraduate students compete to evaluate integrals and win prizes, in 2014, 2016, and 2017. I also contributed integrals in 2014-2018.

Professional service

1. Associate editor of *Probability and Mathematical physics*, 2022-present
2. Schramm-Loewner evolution workshop at UPenn, co-organizer Feb. 2023
3. *Random Geometry and Statistical Physics* workshop at UPenn, co-organizer Oct. 2022
4. *Random Geometry and Statistical Physics* online seminar, co-organizer 2020-present
5. Reviewer for academic journals

   Annales de l'Institut Henri Poincaré, Communications in Mathematical Physics, Electronic Journal of Probability, Probability theory and related fields, Proceedings of the London Mathematical Society, Annals of Math, Forum of Math: Pi, Duke Math Journal, etc.

Talks

1. NYU Courant probability seminar. Feb. 2023
2. Institute for Advanced Study probability seminar. Oct. 2022
3. *Universality in Mathematical physics* mini school in Lyon. Sep. 2022
4. Kendall award lecture, Royal Statistical Society meeting in Aberdeen. Sep. 2022
5. ICM sectional lecture (online). Jul. 2022
6. *Probability and Mathematical Physics* ICM satellite conference in Helsinki. Jul. 2022
7. *Universality: Random Matrices, Random Geometry and SPDEs* conference at Oberwolfach. May 2022
8. UChicago colloquium. Apr. 2022
9. Stanford probability seminar. Apr. 2022
10. *The Analysis and Geometry of Random Spaces* workshop at MSRI. Mar. 2022
11. Lyon probability seminar (online). Feb. 2022
12. Geneva Mathematical Physics seminar (online). Nov. 2021
13. Expository talk for Trinity college, Cambridge alumni (online). Jan. 2021
14. Oberseminar Stochastik at University of Bonn (online). Dec. 2020
15. University of Bristol probability seminar (online). Nov. 2020
16. AMS Sectional meeting (originally at Penn State, now online). Oct. 2020
17. Bernoulli-IMS One World Symposium, "Models in Physics" session (online) Aug. 2020
18. University of Bath probability seminar (online). Apr. 2020
19. Cambridge mathematical physics seminar. Mar. 2020
20. Wharton (UPenn) statistics seminar. Jan. 2020
21. Northwestern University colloquium. Dec. 2019
22. University of Chicago colloquium. Dec. 2019
23. University of Chicago probability seminar. Dec. 2019
24. *Heat Kernels, Stochastic Processes and Functional Inequalities* conference at Oberwolfach. Nov. 2019
25. EPFL probability seminar. Oct. 2019
26. Princeton University probability seminar. Sep. 2019
27. Penn/Temple probability seminar. Sep. 2019
28. Stochastic Processes and their Applications conference, Northwestern University. Jul. 2019
29. *Probability and quantum field theory* conference, Porquerolle, France. Jun. 2019
30. University of Cambridge probability seminar. May. 2019
31. Vienna probability seminar. Mar. 2019
32. Warwick probability seminar. Feb. 2019
33. Amir Dembo birthday conference, Stanford. Dec. 2018
34. Imperial College London stochastic analysis seminar. Oct. 2018

35. Columbia University probability seminar. Oct. 2018
36. Random Geometry followup workshop at the Isaac Newton Institute. July 2018
37. IST Austria Summer School in Probability and Mathematical Physics. June 2018
38. University of Chicago proseminar in probability. Mar. 2018
39. Stony Brook University analysis seminar. Mar. 2018
40. Brown University graduate student conference. Feb. 2018
41. Penn/Temple probability seminar. Feb. 2018
42. Tel Aviv University probability seminar. Dec. 2017
43. Oberwolfach seminar: *Scaling limits of random planar maps and Liouville quantum gravity.* Oct. 2017
44. Zurich graduate student probability seminar. Oct. 2017
45. Zurich probability seminar. Oct. 2017
46. Princeton University topics in probability seminar. Sep. 2017
47. *Stochastic Analysis: Geometry of Random Processes* workshop at Oberwolfach. May 2017
48. Brown university discrete math seminar. Apr. 2017
49. AMS sectional meeting at Indiana University. Apr. 2017
50. *SLE, GFF, and LQG in NYC* workshop at Columbia University. Mar. 2017
51. Cornell probability seminar. Feb. 2017
52. *Recent developments in SLE* conference at the Institut Mittag-Leffler. Jun. 2016
53. MIT probability seminar. Feb. 2016
54. University of Chicago probability seminar. Jan. 2016
55. Michigan State University probability seminar. Nov. 2015
56. Northwestern University analysis seminar. Oct. 2015
57. Microsoft Research, Redmond, WA. Aug. 2015
58. *Conformally invariant scaling limits* conference at the Isaac Newton Institute. Jan. 2015
59. MIT Pure Math graduate seminar. Nov. 2014
60. MIT Pure Math graduate seminar. Feb. 2014