Jiaoyang Huang[1]

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Philadelphia, PA 19104.

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Employment

University of Pennsylvania *Philadelphia, PA*
Associate Professor, Department of Statistics and Data Science, The Wharton School *2025–now*
Associate Professor, Department of Mathematics (secondary appointment) *2025–now*
Affiliated Faculty, Program in Applied Mathematics and Computational Science *2023–now*
Assistant Professor, Department of Statistics and Data Science, The Wharton School *2022–2025*

Courant Institute, New York University *New York, NY*
Simons Junior Fellow (Postdoc) *2020-2022*

Institute for Advanced Study *Princeton, NJ*
Postdoc *2019-2020*

Education

Harvard University *Cambridge, MA*
Ph.D., Mathematics *2019*
Advisor: Horng-Tzer Yau

Massachusetts Institute of Technology (MIT) *Cambridge, MA*
B.S., Mathematics *2014*

Tsinghua University *Beijing, China*
Computer Science and Technology *2010-2011*

Awards and Honors

NSF Career Award *2024*
Sloan Research Fellowship *2024*
Bernoulli Society New Researcher Award *2024*
Current Developments in Mathematics Lecture, Harvard and MIT *2024*
UPenn Math Department Good Teaching Awards *Fall 2022*
Blavatnik Regional Awards *2022*
Simons Junior Fellow *2020–2022*
Harvard Graduate Society Term-time Research Fellowship *2018-2019*
Gold medal in the 50th International Mathematical Olympiad *2009*

Teaching

Instructor, Probability, University of Pennsylvania *Spring 2025*
Instructor, Random Matrix Theory and Applications, University of Pennsylvania *Spring 2023, 2024*
Instructor, Probability Theory, University of Pennsylvania *Fall 2024, 2023, 2022*
Instructor, Calculus 2, New York University *Fall 2021*
Lecturer, Summer School: RMT 2019 at LA, UCLA *Summer 2019*
Instructor, Calculus, Math 1b, Harvard University *Fall 2016, 2017*

[1]Last updated: July 8, 2025

Published or Accepted Articles[2]

1. **Extremal Eigenvalues of Random Kernel Matrices with Polynomial Scaling*
   David Kogan, Sagnik Nandy and Jiaoyang Huang,
   Accepted by Random Matrices: Theory and Applications, 2025.

2. **Convergence Analysis of Probability Flow ODE for Score-based Generative Models*
   Daniel Zhengyu Huang, Jiaoyang Huang and Zhengjiang Lin,
   IEEE Transactions on Information Theory, 71, 6, 2025.

3. **Edge Statistics for Lozenge Tilings of Polygons, II: Airy Line Ensemble*
   Amol Aggarwal and Jiaoyang Huang,
   Forum of Mathematics, 13, Pi, 2025.

4. **Local Statistics and Concentration for Non-intersecting Brownian Bridges With Smooth Boundary Data*
   Amol Aggarwal and Jiaoyang Huang,
   Communications in Mathematical Physics, 406, 70, 2025.

5. **Edge Universality of Sparse Random Matrices*
   Jiaoyang Huang and Horng-Tzer Yau,
   Accepted by Annales de l'Institut Henri Poincaré 2024.

6. **Edge Rigidity of Dyson Brownian Motion with General Initial Data*
   Amol Aggarwal and Jiaoyang Huang,
   Electronic Journal of Probability, 29: 1-62, 2024.

7. **Asymptotics of Generalized Bessel Functions and Weight Multiplicities via Large Deviations of Radial Dunkl Processes*
   Jiaoyang Huang and Colin McSwiggen,
   Probability Theory and Related Fields, 190, 941–1006, 2024.

8. **Efficient, Multimodal, and Derivative-Free Bayesian Inference With Fisher-Rao Gradient Flows*
   Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich and Andrew M. Stuart,
   Inverse Problems, 40(12), 2024.

9. **Pearcey universality at cusps of polygonal lozenge tiling*
   Jiaoyang Huang, Fan Yang and Lingfu Zhang,
   Communications on Pure and Applied Mathematics, 77(9), 3708-3784, 2024.

10. **Dynamical Loop Equation*
    Vadim Gorin and Jiaoyang Huang,
    The Annals of Probability, 52(5), 1758-1863, 2024.

11. **High-dimensional SGD Aligns with Emerging Outlier Eigenspaces*
    Gérard Ben Arous, Reza Gheissari, Jiaoyang Huang and Aukosh Jagannath,
    International Conference on Learning Representations (ICLR), 2024.

12. **Spectrum of Random d-regular Graphs Up to the Edge*
    Jiaoyang Huang and Horng-Tzer Yau,
    Communications on Pure and Applied Mathematics, 77(3), 1635-1723, 2024.

[2]*Publications with authors listed in alphabetical order

13. **Edge Statistics for Lozenge Tilings of Polygons, I: Concentration of Height Function on Strip Domains*
Jiaoyang Huang,
Probability Theory and Related Fields, 1-149, 2023.

14. **Asymptotics of Rectangular Spherical Integral*
Alice Guionnet and Jiaoyang Huang,
Journal of Functional Analysis 285 (11), 110-144, 2023.

15. **Long Random Matrices and Tensor Unfolding*
Gérard Ben Arous, Daniel Zhengyu Huang and Jiaoyang Huang,
Annals of Applied Probability 33 (6B), 5753-5780, 2023.

16. *How Does Information Bottleneck Help Deep Learning?*
Kenji Kawaguchi, Zhun Deng, Xu Ji and Jiaoyang Huang,
International Conference on Machine Learning (ICML), 2023.

17. **Efficient Derivative-free Bayesian Inference for Large-Scale Inverse Problems*
Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich and Andrew M. Stuart,
Inverse Problems, 2022.

18. *PatchGT: Transformer over Non-trainable Clusters for Learning Graph Representations*
Han Gao, Xu Han, Jiaoyang Huang, Jian-Xun Wang and Liping Liu,
Learning on Graphs Conference, 2022.

19. *Robustness Implies Generalization via Data-Dependent Generalization Bounds*
Kenji Kawaguchi, Zhun Deng, Kyle Luh and Jiaoyang Huang,
International Conference on Machine Learning (ICML), 2022.

20. **Eigenvalues for the Minors of Wigner Matrices*
Jiaoyang Huang,
Annales de l'Institut Henri Poincaré, Probabilités et Statistiques, 58(4), 2201-2215, 2022.

21. **Large Deviation Principles via Spherical Integrals*
Serban Belinschi, Alice Guionnet and Jiaoyang Huang,
Probability and Mathematical Physics, 3,3, 2022.

22. *Power Iteration for Tensor PCA*
Jiaoyang Huang, Daniel Zhengyu Huang, Qing Yang and Guang Cheng,
Journal of Machine Learning Research, 23(128), 1-47, 2022.

23. **Invertibility of adjacency matrices for random d-regular graphs*
Jiaoyang Huang,
Duke Mathematical Journal 170(18): 3977-4032, 2021.

24. *Understanding End-to-End Model-Based Reinforcement Learning Methods as Implicit Parameterization*
Clement Gehring, Kenji Kawaguchi, Jiaoyang Huang and Leslie Pack Kaelbling,
Advances in Neural Information Processing Systems (NeurIPS), 2021.

25. *How Shrinking Gradient Noise Helps the Performance of Neural Networks*
Zhun Deng, Jiaoyang Huang and Kenji Kawaguchi,
IEEE International Conference on Big Data (Big Data), 1002-1007, 2021.

26. **Law of Large Numbers and Central Limit Theorems by Jack Generating Functions*
Jiaoyang Huang,
Advances in Mathematics 380, 107545, 2021.

27. **β-Nonintersecting Poisson Random Walks: Law of Large Numbers and Central Limit Theorems*
Jiaoyang Huang,
International Mathematics Research Notices (8), 5898-5942, 2021.

28. **Edge rigidity and universality of random regular graphs of intermediate degree*
Roland Bauerschmidt, Jiaoyang Huang, Antti Knowles and Horng-Tzer Yau,
Geometric and Functional Analysis, 30(3):693–769, 2020.

29. **Dyson Brownian Motion for General β and Potential at the Edge*
Arka Adhikari and Jiaoyang Huang,
Probability Theory and Related Fields, 178(3), 893–950, 2020.

30. **Transition from Tracy-Widom to Gaussian fluctuations of extremal eigenvalues of sparse Erdős-Rényi graphs*
Jiaoyang Huang, Benjamin Landon and Horng-Tzer Yau,
Annals of Probability, 48(2), 916–962, 2020.

31. **Spectral statistics of sparse Erdös-Rényi graph Laplacians*
Jiaoyang Huang and Benjamin Landom,
Annales de l'Institut Henri Poincaré, Probabilités et Statistiques, 56(1), 120–154, 2020.

32. *Towards Understanding the Dynamics of the First-Order Adversaries*
with Zhun Deng, Hangfeng He, Jiaoyang Huang and Weijie Su,
In Proceedings of the 37th International Conference on Machine Learning, 2020.

33. **Dynamics of deep neural networks and neural tangent hierarchy*
Jiaoyang Huang and Horng-Tzer Yau,
In Proceedings of the 37th International Conference on Machine Learning, 2020.

34. **Rigidity and Edge Universality of Discrete β-Ensembles*
Alice Guionnet and Jiaoyang Huang,
Communications on Pure and Applied Mathematics, 72(9), 1875–1982, 2019.

35. **Rigidity and a mesoscopic central limit theorem for Dyson Brownian motion for general β and Potentials*
Jiaoyang Huang and Benjamin Landon,
Probability Theory and Related Fields, 175(1-2), 209–253, 2019.

36. **Local Kesten–McKay Law for Random Regular Graphs*
Roland Bauerschmidt and Horng-Tzer Yau,
Communications in Mathematical Physics, 369(2), 523–636, 2019.

37. **Asymptotic Expansion of Spherical Integral*
Jiaoyang Huang,
Journal of Theoretical Probability, 32(2), 1051–1075, 2019.

38. *Gradient descent finds global minima for generalizable deep neural networks of practical sizes*
Kenji Kawaguchi and Jiaoyang Huang,
In Proceedings of the 57th Allerton Conference on Communication, Control, and Computing (Allerton), IEEE, 2019.

39. *Every Local Minimum Value is the Global Minimum Value of Induced Model in Non-convex Machine Learning*
Kenji Kawaguchi, Jiaoyang Huang and Leslie Pack Kaelbling,
Neural Computation, 31(12), 2293-2323, MIT press, 2019.

40. *Effect of Depth and Width on Local Minima in Deep Learning*
Kenji Kawaguchi, Jiaoyang Huang and Leslie Pack Kaelbling,
Neural Computation, 31(7), 1462-1498, MIT press, 2019.

41. **Mesoscopic Perturbations of Large Random Matrices*
Jiaoyang Huang,
Random Matrices: Theory and Applications, 7(02), 1850004, 2018.

42. **Eigenvector Statistics of Sparse Random Matrices*
Paul Bourgade, Jiaoyang Huang and Horng-Tzer Yau,
Electronic Journal of Probability, 22, 2017.

43. **Bulk eigenvalue statistics for random regular graphs*
Roland Bauerschmidt, Jiaoyang Huang, Antti Knowles and Horng-Tzer Yau,
Annals of Probability, 45(6A), 3626–3663, 2017.

44. **Laurent Phenomenon Sequences*
Joshua Alman, Cesar Cuenca and Jiaoyang Huang,
Journal of Algebraic Combinatorics, 43(3), 589–633, 2016.

45. **Bulk universality of sparse random matrices*
Jiaoyang Huang, Benjamin Landon and Horng-Tzer Yau,
Journal of Mathematical Physics, 56(12), 123301, 2015.

Preprints

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46. **Fast Convergence for High-Order ODE Solvers in Diffusion Probabilistic Models*
Daniel Zhengyu Huang, Jiaoyang Huang and Zhengjiang Lin,
arXiv preprint: 2506.13061, 2025.

47. *On self-training of summary data with genetic applications*
Buxin Su, Jiaoyang Huang, Jin Jin and Bingxin Zhao,
arXiv preprint: 2503.12155, 2025.

48. **Local geometry of high-dimensional mixture models: Effective spectral theory and dynamical transitions*
Gerard Ben Arous, Reza Gheissari, Jiaoyang Huang and Aukosh Jagannath,
arXiv preprint: 2502.15655, 2025.

49. **Gaussian Waves and Edge Eigenvectors of Random Regular Graphs*
Yukun He, Jiaoyang Huang and Horng-Tzer Yau,
arXiv preprint: 2502.08897, 2025.

50. **Extremal eigenvectors of sparse random matrices*
Yukun He, Jiaoyang Huang and Chen Wang,
arXiv preprint: 2501.16444, 2025.

51. **Ramanujan Property and Edge Universality of Random Regular Graphs*
Jiaoyang Huang, Theo McKenzie and Horng-Tzer Yau,
arXiv preprint: 2412.20263, 2025.

52. **The Spectral Distribution of Random Graphs with Given Degree Sequences*
Shuyi Wang, Kevin Li and Jiaoyang Huang,
arXiv preprint: 2412.02087, 2025.

53. **A Convergence Framework For Airy$_\beta$ Line Ensemble via Pole Evolution*
Jiaoyang Huang and Lingfu Zhang,
arXiv preprint: 2411.10586, 2024.

54. **Asymptotics of Symmetric Polynomials: A Dynamical Point of View*
Alice Guionnet and Jiaoyang Huang,
arXiv preprint: 2409.04621, 2024.

55. **Fluctuations for Non-Hermitian Dynamics*
Paul Bourgade, Giorgio Cipolloni and Jiaoyang Huang,
arXiv preprint: 2409.02902, 2024.

56. **Fisher-Rao Gradient Flow: Geodesic Convexity and Functional Inequalities*
José A Carrillo, Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang and Dongyi Wei,
arXiv preprint: 2407.15693, 2024.

57. *Fluctuation of the Largest Eigenvalue of a Kernel Matrix with application in Graphon-based Random Graphs*
Anirban Chatterjee and Jiaoyang Huang,
arXiv preprint: 2401.01866, 2025.

58. **Sampling via Gradient Flows in the Space of Probability Measures*
Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich and Andrew M Stuart,
arXiv preprint:2310.03597, 2024.

59. **Strong Characterization for the Airy Line Ensemble*
Amol Aggarwal and Jiaoyang Huang,
arXiv preprint: 2308.11908, 2023.

60. **Edge universality of random regular graphs of growing degrees*
Jiaoyang Huang and Horng-Tzer Yau,
arXiv preprint: 2305.01428, 2023.

61. **Edge Universality for Nonintersecting Brownian Bridges*
Jiaoyang Huang,
arXiv preprint: 2011.01752, 2020.

62. **Height Fluctuations of Random Lozenge Tilings Through Nonintersecting Random Walks*
Jiaoyang Huang,
arXiv preprint: 2011.01751, 2020.

Invited Talks

2025: Shandong University: Mount Everest Lecture Series.
Harvard CMSA: Program on Classical, Quantum, and Probabilistic Integrable Systems – Novel Interactions and Applications.
University of Edinburgh: North British Probability Seminar.
Online seminar on Random Matrix Theory and Applications. University of Connecticut: AMS Special Session on Probability and Combinatorics.
Princeton ORFE Wilks Memorial Seminar in Statistics.

Columbia University: Probability Seminar.
Joint IAS/Princeton Universality Groups and Dynamics Seminar.

2024: CIRM: Random Hyperbolic Surfaces and Random Graphs.
University of Chicago: Probability and Statistical Physics Seminar.
Advances in Probability Theory and Interacting Particle Systems: A Conference in Honor of S. R. Srinivasa Varadhan.
Bernoulli-IMS Worldcongress 2024: New Researcher Award Session.
JSM 2024: Advances in Statistical Learning and Uncertainty Quantification: Theory and Computation.
Peking University: Colloquium.
Tsinghua, Yau Mathematical Sciences Center: Probability Seminar.
Harvard: Statistics Colloquium Series.
Harvard: The Current Developments in Mathematics (CDM) Conference.

2023: Columbia University: Informal Mathematical Physics Seminar.
New York University: Probability Seminar.
ICERM Workshop: Asymptotic Limits of Discrete Random Structures.
University of California Berkeley: Probability Seminar.
EcoSta 2023: Workshop on recent advances in high-dimensional statistics and machine learning.
The second International Conference for Chinese Young Probability Scholars: Universality in Probability Theory and Statistical Physics.
New Jersey Institute of Technology: Statistics Seminar.
Princeton: Physics for Neural Networks.
University of Pennsylvania: Student Seminar.
Columbia University: Probability Seminar.

2022: Yale: Statistics and Data Science Department Seminar.
Princeton: Probability Seminar.
MIT: Stochastics and Statistics Seminar.
University of California, Davis: QMATH 15 Conference.
University of North Carolina at Chapel Hill: Southeastern Probability conference 2022.
Harvard University: New Frontiers: Interactions between Quantum Physics and Mathematics.
Spectral Geometry in the Clouds.
Northwestern University: Laplacians on Random Hyperbolic Surfaces and on Random Graphs.
University of California San Diego: Probability Seminar.
University of Pennsylvania: Wharton Statistics and Data Science Seminars.
Brown University: Applied Math Seminar.
University of California, Los Angeles: Probability Seminar.

2021: National University of Singapore: Young Mathematician Lecture Series.
University of California Berkeley: Probability seminar.
Carnegie Mellon University: Probability seminar.
Northwestern University: Analysis seminar.
University of Washington: Probability seminar.
Cornell University: Probability Seminar.
University of Chicago: Probability Seminar.
New Jersey Institute of Technology: Applied Math Colloquium.
MSRI: Connections and Introductory Workshop.
New York University: Student Probability Seminar.
University of Victoria: Applied Math Seminar.

2020: Columbia University: Integrable Probability Seminar.
THU-PKU-BNU Joint Probability Webinar.
University of Kansas: KU Probability and Statistics Seminar.
One World Probability Seminar.
Stanford University: Probability Seminar.
University of Minnesota: Probability Seminar.
University of Wisconsin-Madison: Probability Seminar.
University of pennsylvania: Penn/Temple Probability Seminar.
Columbia University: Probability Seminar.

2019: University of Michigan: Integrable Systems and Random Matrix Theory Seminar.
University of Strasbourg: Probability Seminar.
8th Strasbourg/Zurich Meeting: Frontiers in Analysis and Probability.
Yale University: Combinatorics Seminar.
IAS Analysis-Mathematical Physics Seminar.
Google.
CIRM: Random Matrices and Random Graphs.
Brandeis University: Brandeis-Harvard-MIT-Northeastern Joint Mathematics Colloquium.
Brown University: 6th Annual AMS Grad Student Conferences at Brown.
University of Chicago: Probability Seminar.

2018: Oberwolfach Workshop: Free Proability Theory.
Ohio State University: Probability Seminar.
MIT: FRG Integrable probability meeting.
Cornell University: Probability Seminar.
Princeton University: Topics in Probability Seminar.
MIT: Combinatorics Seminar.
Columbia University: Probability Seminar.
University of Virginia: Probability Seminar.
Gothenburg: Conference on Stochastic Processes and their Applications.
IPAM: Workshop "Random Matrices and Free Probability Theory".
Northeastern University: AMS Special Session on The Gaussian Free Field and Random Geometry.

2017: ENS Lyon: Conference "ProbabLY ON Random Matrices".
University of Wisconsin-Madison: Combinatorics Seminar.

Advising and Mentoring

Ph.D. Thesis Committee:

- Sagnik Nandy (UPenn, Committee Member)–Placement: Assistant Professor at Ohio State University.
- Donghwan Lee (UPenn, Committee Member)–Placement: Industry.
- Mauricio Daros Andrade (UPenn, Committee Member)–Placement: To be decided.
- Anirban Chatterjee (UPenn, Committee Member)–Placement: To be decided.

Master's Student Mentees: Haoxuan Fu (UPenn), Yulei Xu (UPenn).

Undergraduate Mentees: David Kogan (UPenn), Kevin Li (UPenn), Arjun Shah (UPenn), Shuyi Wang (UPenn).

Professional Service

Seminar Organizer
Penn/Temple probability seminar (2022-now).
Wharton statistics and data science department seminar (2022-2023).
Harvard student probability seminar (2018-2019).

Committee Member
Wharton Statistics and Data Science Department Ph.D. Admissions Committee, Fall 2024.
Wharton Statistics and Data Science Department Larry Brown Student Award Committee, Fall 2024.
Wharton Statistics and Data Science Department Faculty Search Committee, Fall 2023.
Wharton Statistics and Data Science Department Ph.D. Admissions Committee, Fall 2023.
Wharton Statistics and Data Science Department Postdoc Search Committee, Fall 2022.

Grant Reviewer
National Science Foundation DMS Probability program panel.

Journal Reviewer: Ann. Appl. Probab., Ann. of Math., Ann. Probab., Comm. Math. Phys., C. R. Math. Acad. Sci. Paris, Duke Math. J., Electron. Commun. Probab., Electron. J. Probab., Probab., IEEE TPAMI, IEEE Trans. Inform. Theory, Int. Math. Res. Not., Invent. math., J. Eur. Math. Soc., J. Funct. Anal., J. Theoret. Probab., Probab. Theory Related Fields, Proc. Lond. Math. Soc. Publications mathématiques de l'IHÉS,

Current Grants

Name of Grant	Funding Agency	Period of Grant	Type of Grant	Role in Grant	Total Direct Cost	Total Indirect Cost	Additional Comments
CAREER: Interacting Particle Systems: Asymptotic Behaviors and Applications	National Science Foundation	9/24-8/29	Career Research Grant	Principal Investigator	$266,346	$133,654	Total award: $400,000.
Sloan Research Fellowship	Alfred P. Sloan Foundation	9/15/24-9/14/26	Early Career Research Fellowship	Principal Investigator	$75,000	N/A	
NSF Grant: Random Matrices, Random Graphs, and Deep Neural Networks	National Science Foundation	7/23-3/26, (original 4/21-3/24)	Research Grant (Transfer Grant from NYU)	Principal Investigator	$90,061	$56,289	Total original award: $ 153,697, Penn total amount: $146,350.