

EMPLOYMENT	2025 - present	Associate Professor, ORFE, Princeton
	2024 - present	Associated Faculty, PACM, Princeton
	2023 - present	Member of Technical Staff, Foundry Technologies (part-time)
	2020 - 2025	Assistant Professor, ORFE, Princeton
	2017 - 2020	Assistant Professor, Department of Mathematics, Texas A&M
	2014 - 2017	NSF Postdoctoral Fellow, Department of Mathematics, MIT (Sponsoring Scientist: Professor Alice Guionnet)
VISITING POSITIONS	Spring 2020	Visiting Scientist, Google, Mountain View, CA
	Summer 2019	Visiting Scientist, Foundations of Deep Learning Program, Simons Institute, Berkeley, CA
	Spring 2019	Visiting Scientist, Facebook AI Research, NYC
EDUCATION	2009 - 2014	Ph.D. in Mathematics, Northwestern University
	2005 - 2009	B.S. in Mathematics (with honors), Stanford University
AWARDS AND GRANTS	2025 - 2027	<i>Principles for Cheap and Flexible AI Evaluation (DARPA AIQ-HR001124S0029, \$2,000,000)</i>
	2024 - 2027	<i>Sloan Fellowship in Mathematics</i>
	2022	<i>Alfred Rheinstein Faculty Award (School of Engineering and Applied Sciences at Princeton)</i>
	2022 - 2027	<i>CAREER: Random Neural Nets and Random Matrix Products</i> (NSF DMS-2143754, \$577,241)
	2022 - 2025	<i>Collaborative Research: Probabilistic, Geometric, and Topological Analysis of Neural Networks, From Theory to Applications</i> (NSF DMS-2133806, \$500,000)
	2019 - 2023	<i>Random Neural Networks</i> (NSF DMS-1855684, \$150,000)
	2014 - 2017	NSF Postdoctoral Fellowship (DMS-1400822, \$150,000)

SUBMITTED FOR PUBLICATION

1. Hyperparameter Transfer with Mixture-of-Expert Layers, with T. Jiang, B. Borodelon, C. Pehlevan. (2026) arXiv:2601.20205.
2. Implicit Bias of the JKO Scheme, with P. Halmos. (2025) arXiv:2511.14827.
3. Global Universality of Singular Values in Products of Many Large Random Matrices, with T. Jiang. Available online: arXiv:2503.07872.
4. Optimizing Model Selection for Compound AI Systems, with L. Chen, J. Q. Davis, P. Bailis, M. Zaharia, J. Zou, I. Stoica. Available online: arXiv:2502.14815.
5. BARE: Combining Base and Instruction-Tuned Language Models for Better Synthetic Data Generation, with A. Zhu, P. Asawa, J. Q. Davis, L. Chen, I. Stoica, J. Gonzalez, M. Zaharia. Available online: arXiv:2502.01697.

JOURNAL ARTICLES
ON NEURAL NETS

1. B. Hanin, A. Zlokapa *Bayesian Inference with Deep Weakly Nonlinear Networks*, In Press: Physical Review Letters. Available online: arXiv:2405.16630.
2. Deep Neural Nets at Hamiltonians, with M. Winer. Physical Review E 113 (1), 015303. Available online: arXiv:2503.23982.
3. S. Favaro, B. Hanin, D. Marinucci, I. Nourdin, and G. Peccati. *Quantitative CLTs in Deep Neural Networks*. In Press: Probability Theory and Related Fields. Available online: arXiv:2307.06092.
4. G. DeZoort, B. Hanin. *Principles for Initialization and Architecture Selection in Graph Neural Networks with ReLU Activations*. SIAM Journal on Mathematics of Data Science, Vol. 7, Iss. 1 (2024)10.1137/23M1600621.
5. Hanin, B. *Random Fully Connected Neural Networks as Perturbatively Solvable Hierarchies*. Journal of Machine Learning Research, 25(267):1058, 2024.
6. Hanin, B., Zlokapa, A., *Bayesian Interpolation with Deep Linear Networks*. In Press: Proceedings of the National Academy of Sciences. Volume 120, No. 23., Pages e2301345120, 2023.
7. Hanin, B. *Random Neural Networks in the Infinite Width Limit as Gaussian Processes*. The Annals of Applied Probability 33 (6A), 4798-4819, 2023.
8. Hanin, B. and Paouris G. *Non-asymptotic Results for Singular Values of Gaussian Matrix Products*. Geometric and Functional Analysis 31 (2), 268-324, 2021.
9. DeVore, R., Hanin, B. and Petrova, G. *Neural Network Approximation*. Acta Numerica 30, 327-444, 2021.
10. Daubechies, I., DeVore, R., Foucart, S., Hanin, B. and Petrova, G. *Nonlinear Approximation and (Deep) ReLU Nets*. Constructive Approximation, 1-46, 2021.
11. Hanin, B. and Nica, M. *Products of Many Large Random Matrices and Gradients in Deep Neural Networks*. Communications in Mathematical Physics, 1-36, 2019.
12. Hanin, B. *Universal Function Approximation by Deep Neural Nets with Bounded Width and ReLU Activations*. Mathematics 2019, 7(10), 992 (Special Issue on Computational Mathematics, Algorithms, and Data Processing).

CONFERENCE
ARTICLES ON
NEURAL NETS

1. N. Razin, S. Malladi, A. Bhaskar, D. Chen, S. Arora, B. Hanin. *Unintentional Unalignment: Likelihood Displacement in Direct Preference Optimization*. ICLR 2025. Available online: arXiv:2410.08847.
2. J. Q. Davis, B. Hanin, L. Chen, P. Bailis, I. Stoica. M. Zaharia. *Networks of Networks: Complexity Class Principles Applied to Compound AI Systems Design*. NeurIPS 2024. Available online: arXiv:2407.16831.
3. L. Chen, J. Q. Davis, B. Hanin, P. Bailis, M. Zaharia, I. Stoica, and J. Zou. *Are More LLM Calls All You Need? Towards Scaling Laws of Compound Inference Systems*. NeurIPS 2024. Available online: arXiv:2403.02419.
4. Bordelon, B., Noci, L., Li, M., Hanin, B., Pehlevan, C. *Depthwise Hyperparameter Transfer in Residual Networks: Dynamics and Scaling Limit*. ICLR 2024. Available online: arXiv:2309.16620.
5. Hanin, B., Iyer, G., Rolnick, D., *Maximal Initial Learning Rates in Deep ReLU Networks*. Proceedings of the 40th International Conference on Machine Learning, PMLR 202:14500-14530, 2023. Available online: arXiv:2212.07295.
6. Chen, W., Wu, J., Hanin, B., Wang, Z. *Principled Architecture-Aware Scaling of Hyperparameters, with*. ICLR 2024. Available online: arXiv:2402.17440.

7. Chen, W., Huang, W. Gong, X., Hanin, B. and Wang, Z. *Deep Architecture Connectivity Matters for Its Convergence: A Fine-Grained Analysis*. NeurIPS 2022. Available online: arXiv:2205.05662.
8. Hanin, B., Jeong, R., and Rolnick, D. *Deep ReLU Networks Preserve Expected Length*. ICLR 2022. Available online: arXiv:2102.10492.
9. Hanin, B. and Sun, Y. *Data Augmentation as Stochastic Optimization*. NeurIPS 2021. Available online: arXiv:2010.11171.
10. Hanin, B. and Nica, M. *Finite Depth and Width Corrections to the Neural Tangent Kernel*. Spotlight ICLR 2020.
11. Hanin, B. and Rolnick, D. *Deep ReLU Nets have Surprisingly Few Activation Regions*. Accepted: Advances in Neural Information Processing Systems, 2019.
12. Hanin, B. and Rolnick, D. *Complexity of Linear Regions in Deep Networks*. International Conference on Machine Learning, 2019.
13. Hanin, B. *Which Neural Net Architectures Give Rise to Exploding and Vanishing Gradients?*. NIPS 2018.
14. Hanin, B. and Rolnick, D. *How to Start Training: The Effect of Initialization and Architecture*. NIPS 2018.

JOURNAL ARTICLES
ON SPECTRAL
THEORY

1. Hanin, B. and Zelditch, S. *Scaling Asymptotics of Spectral Wigner Functions*. Journal of Physics A 55 (41), 2022. Special Edition on Claritons and the Asymptotics of Ideas: the Physics of Michael Berry.
2. Hanin, B. and Zelditch, S. *Interface Asymptotics of Wigner-Weyl Distributions for the Harmonic Oscillator*. Journal d'Analyse, Volume 147, pages 69-98, 2022.
3. Hanin, B. and Zelditch, S. *Interface Asymptotics of Eigenspace Wigner distributions for the Harmonic Oscillator*. Communications in Partial Differential Equations 45 (11), 1589-1620, 2021.
4. Canzani, Y. and Hanin, B. *Local Universality for Zeros and Critical Points of Monochromatic Random Waves*. Communications in Mathematical Physics 378 (3), 1677-1712, 2020.
5. Hanin, B. and Beck, T. *Level Spacings and Nodal Sets at Infinity for Radial Perturbations of the Harmonic Oscillator*. Int. Math Research Notices. 2018.
6. Beck, T., Hanin, B., and Hughes, S. *Nodal Sets of Functions with Finite Vanishing Order*. Calculus of Variations and PDE. Calc. Var. (2018) 57: 140.
7. Hanin, B., Zelditch, S., and Zhou, P. *Scaling of Harmonic Oscillator Eigenfunctions and Their Nodal Sets Around the Caustic*. Communications in Mathematical Physics. Vol. 350, no. 3, pp. 1147–1183, 2017.
8. Canzani, Y. and Hanin, B. *C^∞ Scaling Asymptotics for the Spectral Function of the Laplacian*. The Journal of Geometric Analysis. January 2018, Volume 28, Issue 1, pp. 111 - 122.
9. Canzani, Y. and Hanin, B. *Scaling Limit for the Kernel of the Spectral Projector and Remainder Estimates in the Pointwise Weyl Law*. Analysis and PDE, Vol. 8 (2015), No. 7, pp. 1707-1731.
10. Canzani, Y. and Hanin, B. *High Frequency Eigenfunction Immersions and Supremum Norms of Random Waves*. Electronic Research Announcements. MS 22, no. 0, January 2015, pp. 76 - 86.
11. Hanin, B., Zelditch, S., and Zhou, P. *Nodal Sets of Random Eigenfunctions for the Isotropic Harmonic Oscillator*, International Mathematics Research Notices, Vol. 2015, No. 13, pp. 4813 - 4839.

JOURNAL ARTICLES ON RANDOM POLYNOMIALS	<ol style="list-style-type: none"> 1. Hanin, B. <i>Pairing of Zeros and Critical Points for Random Meromorphic Functions on Riemann Surfaces</i>. Mathematics Research Letters, Vol. 22 (2015), No. 1, pp. 111-140. 2. Hanin, B., Epstein, M., and Lundberg E. <i>The Lemniscate Tree of a Random Polynomial</i>. Annales de l'Institut Fourier, 70 (4), 1663-1687, 2020. 3. Hanin, B. <i>Pairing of Zeros and Critical Points for Random Polynomials</i>. Annales de l'Institut Henri Poincaré (B). Volume 53, Number 3 (2017), 1498-1511. 4. Hanin, B. <i>Correlations and Pairing Between Zeros and Critical Points of Gaussian Random Polynomials</i>. International Math Research Notices (2015), Vol. (2), pp. 381-421.
PUBLICATIONS ON OTHER TOPICS	<ol style="list-style-type: none"> 1. Contributed research to “The principles of deep learning theory,” published by Cambridge University Press in 2022 and written by Roberts, Daniel A. and Yaida, Sho. Available online: arXiv:2106.10165. 2. Hanin, L., Fisher, R., Hanin, B. <i>An Intriguing Property of the Center of Mass for Points on Quadratic Curves and Surfaces</i>, Mathematics Maganize, v. 80, No. 5, pp. 353-362, 2007.
TEACHING AWARDS	<p>2020 - 2025 Letter of Commendation for Teaching, School of Engineering and Applied Science at Princeton (each year).</p> <p>2018 - 2019 Texas A&M Math Department Award for Outstanding Teaching for: “For his outstanding teaching of undergraduate and graduate courses, and his extremely successful graduate topics course in fall 2018 that had an enrollment of 100+.”</p>
INVITED COURSES	<ol style="list-style-type: none"> 1. Spring 2025. Physics for AI Workshop at Oxford University. 2. Winter 2024. Mathematics of Deep Learning at University of Luxembourg. 3. Winter 2023. Deep Learning Theory at Tor Vergata University, Rome. 4. Summer 2022. Les Houches Summer School on Statistical Physics of Machine Learning (joint with Yasaman Bahri)
PROFESSIONAL SERVICE	<p>2023 - present Associate Editor, Advances in Theoretical and Mathematical Physics</p> <p>2023 - present Associate Editor, Mathematics of Operations Research</p> <p>2021 - present Associate Editor, Pure and Applied Analysis</p> <p>2021 - present Sole organizer, Princeton ML Theory Summer School</p> <p>June 2023 Co-organizer, Workshop on Foundations of Data Science and Machine Learning at FoCM 2023</p> <p>April 2023 Co-organizer, Neural Networks for Physics (Princeton Center for Theoretical Sciences)</p> <p>2019 - 2021 Program Committee Mathematical and Scientific Machine Learning (MSML)</p> <p>2019 - 2020 Member of TAMIDS Research Committee</p>