

# Yi Sun

CONTACT INFORMATION	Address: Department of Mathematics, Columbia University, New York, NY 10027. Email: <a href="mailto:ysisun@math.columbia.edu">ysisun@math.columbia.edu</a> Webpage: <a href="http://ysisun.io">ysisun.io</a>
RESEARCH	Integrable probability, random matrix theory, machine learning, representation theory.
EMPLOYMENT	<b>Columbia University</b> New York, NY Joseph F. Ritt Assistant Professor (2019–present), Simons Fellow (2016–2019).
EDUCATION	<b>Massachusetts Institute of Technology</b> Cambridge, MA Ph.D., Mathematics (2011–2016), advised by Pavel Etingof. <b>University of Cambridge</b> Cambridge, UK M.A.St., Mathematics, with distinction (2010–2011). <b>Harvard University</b> Cambridge, MA A.M., Mathematics (2006–2010). A.B., Mathematics, <i>magna cum laude</i> , with secondary field in Economics (2006–2010). Phi Beta Kappa (one of 24 juniors inducted)
GRANTS AND AWARDS	NSF Grant DMS-1701654, Alg. and NT, 2017–2020. (\$141,999, Highly Recommended) Simons Junior Fellowship, 2016–2019. (\$364,214) Open Philanthropy Project Grant, 2019. (\$10,000, co-PI) NSF Mathematical Sciences Postdoctoral Research Fellowship, 2016–2019 (declined). Johnson Prize for best research paper by MIT graduate student in mathematics, 2016. NSF Graduate Research Fellowship, 2012–2015. Churchill Scholarship, 2010–2011. / MIT Praecis Presidential Fellowship, 2011–2012. COMAP Math Contest in Modeling, Outstanding Winner, SIAM Prize, 2008 and 2009. Intel Science Talent Search, 2 <sup>nd</sup> Place, 2006. / Putnam Competition, 10 <sup>th</sup> Place, 2009. Int'l Math Olym., Silver Medal, 2006. / Asian Pacific Math Olym., Gold Medal, 2005. Int'l Physics Olympiad, Gold Medal, 2004. / USA Computing Olympiad, Finalist, 2005.
MATHEMATICS AND STATISTICS RESEARCH	19. <i>Likelihood landscape and maximum likelihood estimation for the discrete orbit recovery model</i> (with Z. Fan, T. Wang, and Y. Wu), preprint, 2020. <a href="https://arxiv.org/abs/2004.00041">arXiv:2004.00041</a> 18. <i>Probabilistic conformal blocks for Liouville CFT on the torus</i> (with P. Ghosal, G. Remy, and X. Sun), preprint, 2020. <a href="https://arxiv.org/abs/2003.03802">arXiv:2003.03802</a> 17. <i>Principal components in linear mixed models with general bulk</i> (with Z. Fan and Z. Wang), submitted, 2019. <a href="https://arxiv.org/abs/1903.09592">arXiv:1903.09592</a> 16. <i>Gaussian fluctuations for products of random matrices</i> (with V. Gorin), submitted, 2019. <a href="https://arxiv.org/abs/1812.06532">arXiv:1812.06532</a> 15. <i>Spiked covariances and principal components analysis in high-dimensional random effects models</i> (with Z. Fan and I. Johnstone), preprint, 2018. <a href="https://arxiv.org/abs/1806.09529">arXiv:1806.09529</a> 14. <i>Affine Macdonald conjectures and special values of Felder-Varchenko functions</i> (with E. Rains and A. Varchenko), <i>Sel. Math. N. S.</i> <b>24</b> (2018), 1549–1591. <a href="https://arxiv.org/abs/1610.01917">arXiv:1610.01917</a> 13. <i>Laguerre and Jacobi analogues of the Warren process</i> (single author, with an appendix by A. Sarantsev), submitted, 2017. <a href="https://arxiv.org/abs/1610.01635">arXiv:1610.01635</a> 12. <i>Traces of intertwiners for quantum affine algebras and difference equations (after Etingof-Schiffmann-Varchenko)</i> (single author), <i>Transform. Groups</i> <b>23</b> (2018), 1167–1215. <a href="https://arxiv.org/abs/1609.09038">arXiv:1609.09038</a> 11. <i>Matrix models for multilevel Heckman-Opdam and multivariate Bessel measures</i> (single author), submitted, 2016. <a href="https://arxiv.org/abs/1609.09096">arXiv:1609.09096</a> 10. <i>Traces of intertwiners for quantum affine <math>\mathfrak{sl}_2</math> and Felder-Varchenko functions</i> (single author), <i>Commun. Math. Phys.</i> <b>347</b> (2016), 573–653. <a href="https://arxiv.org/abs/1508.03918">arXiv:1508.03918</a> 9. <i>The polynomial representation of the type <math>A_{n-1}</math> rational Cherednik algebra in characteristic <math>p \mid n</math></i> (with S. Devadas), <i>Commun. Algebra</i> <b>45</b> (2016), 1926–1934. <a href="https://arxiv.org/abs/1505.07891">arXiv:1505.07891</a>

COMPUTER SCIENCE RESEARCH	8. <i>A representation-theoretic proof of the branching rule for Macdonald polynomials</i> (single author), Math. Res. Lett. <b>23</b> (2016), 887–927. <a href="#">arXiv:1412.0714</a>	
	7. <i>A new integral formula for Heckman-Opdam hypergeometric functions</i> (single author), Adv. Math. <b>289</b> (2016), 1157–1204. <a href="#">arXiv:1406.3772</a>	
	6. <i>Finite dimensional representations of the rational Cherednik algebra for <math>G_4</math></i> (single author), J. Algebra <b>323</b> (2010), 2864–2887. <a href="#">arXiv:0910.5527</a>	
	5. D. Kang*, Y. Sun*, D. Hendrycks, T. Brown, and J. Steinhardt, <i>Testing robustness against unforeseen adversaries</i> , submitted, 2019. <a href="#">arXiv:1908.08016</a>	
	4. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>From random walks to distances on unweighted graphs</i> , NIPS 2015. <a href="#">arXiv:1511.00573</a>	
OTHER RESEARCH	3. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>Metric recovery from directed unweighted graphs</i> , NIPS 2014 workshop (Best Student Paper), AISTATS 2015. <a href="#">arXiv:1411.5720</a>	
	2. Y. Sun and M. Sundararajan, <i>Axiomatic attribution for multilinear functions</i> , ACM Conf. on Electronic Commerce 2011. <a href="#">arXiv:1102.0989</a>	
RESEARCH PRESENTATIONS	1. R. G. Yang*, P. Y. Wang*, Y. Sun, A. Litwin-Kumar, R. Axel, and LF Abbott, <i>Evolving the olfactory system</i> , submitted, 2019. CCN 2019, NeurIPS 2019 Neuro+AI Workshop.	
	46. Google X Testing robustness against unforeseen adversaries	March 2020
	45. UW Madison: Mathematics Colloquium Fluctuations for products of random matrices	February 2020
	44. UChicago: Statistics Colloquium Fluctuations for products of random matrices	January 2020
	43. AMS Fall Western Sectional Meeting Fluctuations for products of random matrices	November 2019
	42. ICML 2019 Workshop: Uncertainty and Robustness in DL (poster) Transfer of robustness against adversarial and stochastic distortions	June 2019
	41. OpenAI Transfer of robustness against adversarial and stochastic distortions	June 2019
	40. Virginia: Integrable Probability Summer School Fluctuations for products of random matrices	June 2019
	39. UCSD: Probability Seminar Fluctuations for products of random matrices	January 2019
	38. Yale: Geometry, Symmetry, and Physics Seminar Affine Macdonald conjectures and special values of Felder-Varchenko functions	April 2018
	37. Simons Society of Fellows Retreat A probabilistic view on random covariance matrices	February 2018
	36. PCMI: Research Program on Random Matrices Algebraic structures for multilevel eigenvalue densities	July 2017
	35. Rochester: Probability Seminar Laguerre and Jacobi analogues of the Warren process	April 2017
	34. Perimeter Institute: Mathematical Physics Seminar Affine Macdonald conjectures and special values of Felder-Varchenko functions	April 2017
	33. Rutgers: Lie Group / Quantum Mathematics Seminar Affine Macdonald conjectures and special values of Felder-Varchenko functions	April 2017
	32. Columbia-Princeton Probability Day Laguerre and Jacobi analogues of the Warren process	March 2017
	31. ESI: Workshop on Elliptic Hypergeometric Functions Affine Macdonald conjectures and special values of Felder-Varchenko functions	March 2017

	30. Columbia: Probability Seminar Laguerre and Jacobi analogues of the Warren process	November 2016
	29. Columbia: Mathematical Physics Seminar Affine Macdonald conjectures and special values of Felder-Varchenko functions	October 2016
	28. IESC: QIS's, CFT's, and Stochastic Processes (poster) Laguerre and Jacobi analogues of the Warren process	September 2016
	27. MIT: Infinite-Dimensional Algebra Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	March 2016
	26. MIT: Integrable Probability Seminar Laguerre and Jacobi analogues of the Warren process	February 2016
	25. HCM: Asymptotic Analysis in Strongly Coupled Systems (poster) Laguerre and Jacobi analogues of the Warren process	January 2016
	24. NIPS 2015 (poster) From random walks to distances on unweighted graphs	December 2015
	23. ETH Zurich: ITS Talks in Theoretical Sciences 2015 Random matrices and representation theory	November 2015
	22. UC Berkeley: RTGC Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	November 2015
	21. ETH Zurich: Mathematical Physics Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	October 2015
	20. NEU: Geometry, Physics and Representation Theory Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	October 2015
	19. Columbia: Mathematical Physics Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	October 2015
	18. Yale: Geometry, Symmetry, and Physics Seminar Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	September 2015
	17. FPSAC 2015 (poster) A representation-theoretic proof of the branching rule for Macdonald polynomials	July 2015
	16. Clay Math Inst.: Random Polymers and Algebraic Combinatorics A representation-theoretic proof of the branching rule for Macdonald polynomials	May 2015
	15. AISTATS 2015 (poster) Metric recovery from directed unweighted graphs	May 2015
	14. ICERM: Workshop on Limit Shapes (poster) A representation-theoretic proof of the branching rule for Macdonald polynomials	April 2015
	13. NIPS 2014: Workshop on Networks (poster) Metric recovery from directed unweighted graphs	December 2014
	12. UC Berkeley: GRASP Seminar A representation-theoretic proof of the branching rule for Macdonald polynomials	November 2014
	11. IHP: Workshop on Macdonald Processes and Hecke Algebras A new integral formula for Heckman-Opdam hypergeometric functions	May 2014
	10. MIT: Integrable Probability Seminar A new integral formula for Heckman-Opdam hypergeometric functions	April 2014
OUTREACH PRESENTATIONS	9. Math Olympiad Program 2018 Threshold signatures	June 2018
	8. MIT "Meta-Math" Meetup 2017 How to do a Literature Search	May 2017
	7. Summer Program in Applied Rationality and Cognition 2016 Problem Solving: Contests vs. Real Life	August 2016
	6. Math Olympiad Summer Program 2016 Distribution Testing: Is this die fair?	June 2016

	5. MIT Open House 2016 Universality: Mathematics in the real world	April 2016
	4. Math Olympiad Summer Program 2015 Fair coin flips from unfair coins	June 2015
	3. Math Olympiad Summer Program 2014 The Ising model	June 2014
	2. Math Olympiad Summer Program 2013 Random matrices	June 2013
	1. Math Olympiad Summer Program 2012 Random partitions and Fock space	June 2012
OTHER PUBLICATIONS	6. <i>54<sup>th</sup> International Mathematical Olympiad</i> (with J. Berman and Z. Feng), Mathematics Magazine <b>86</b> (2013), 309–313.	
	5. <i>53<sup>rd</sup> International Mathematical Olympiad</i> (with Z. Feng), Mathematics Magazine <b>85</b> (2012), 312–317.	
	4. <i>52<sup>nd</sup> International Mathematical Olympiad</i> (with Z. Feng), Mathematics Magazine <b>84</b> (2011), 316–319.	
	3. <i>51<sup>st</sup> International Mathematical Olympiad</i> (with Z. Feng and P. Loh), Mathematics Magazine <b>83</b> (2010), 320–323.	
	2. <i>A simulation based model of traffic circles</i> (with C. Chang and Z. Fan), The UMAP Journal <b>30</b> (2009), 225–244.	
	1. <i>hsolve: A difficulty metric and puzzle generator for Sudoku</i> (with C. Chang and Z. Fan), The UMAP Journal <b>29</b> (2008), 303–324.	
TEACHING	<b>Columbia University</b> Instructor. Fall 2017: Calculus II, eval 3.9 (5.0). Spring 2019: Graduate reading course on representation theory. Fall 2019: Calculus II, eval 3.7 (5.0). Spring 2020: Calculus II.	Fall 2017–2020
	<b>US National Math Olympiad Summer Program</b> Instructor (2010, 2012–2018); Assistant (2007–2009). Design curriculum, give lectures, and personally coach US team to International Mathematical Olympiad.	Summers 2007–2018
	<b>MIT MathROOTS</b> Academic Coordinator. Design curriculum, give lectures, and manage academic team, guest lectures, and website for first two years of outreach program in problem solving for underrepresented minority students. Covered on MIT homepage and Notices of the AMS.	Summers 2015–2016
	<b>MIT Undergraduate Research Opportunities Program</b> Mentor two undergraduate research projects, leading to published research paper.	Fall 2012–2015
	• Sheela Devadas (rational Cherednik algebras in char $p \leq n$ ), 2014–2015.	
	• Ryan Yoo (characters of rational Cherednik algebras in char $p > n$ ), 2012–2014.	
	<b>Massachusetts Institute of Technology</b> Teaching Assistant for Differential Equations. Evaluations: 6.2 (7.0)	Spring 2015
	<b>MIT Directed Reading Program</b> Mentor reading project on representation theory of the symmetric group.	January 2011
	<b>Harvard University</b> Course Assistant for Probability Theory. Evaluations: 4.3 (5.0)	Spring 2009
PROFESSIONAL ACTIVITIES	<b>Columbia Probability Seminar</b> Co-organize weekly probability seminar.	Fall 2016–Present
	<b>Summer School in Probability</b> Co-organize graduate summer school “Dyson-Schwinger equations, topological expansions, and random matrices” at Columbia.	Summer 2017
	<b>MIT Interacting Particle Systems Learning Seminar</b> Organize learning seminar on recent developments in interacting particle systems.	2012–2013
	<b>Google Research</b>	Summer 2010

	Research intern. Research attribution and cost-sharing methods, leading to paper published in EC 2010. Mentor: Mukund Sundararajan
SERVICE	Reviewer: Probability Theory and Related Fields, Selecta Mathematica (N.S.), SIGMA, Journal of Theoretical Probability, Europhysics Letters, Information and Inference. Qualifying Exam Committee: Ivan Danilenko (Columbia), Maithreya Sitaraman (Columbia)
LANGUAGES	Python, PyTorch, C++, $\text{\LaTeX}$ , Magma, Mathematica / Mandarin (native), French