

# Yi Sun

CONTACT	Address:	Department of Mathematics, Columbia University, New York, NY 10027.
INFORMATION	Email:	yisun@math.columbia.edu
	Webpage:	yisun.io
RESEARCH	Representation theory, integrable probability, random matrix theory, machine learning.	
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	NSF Grant DMS-1701654, Alg. and NT, 2017–2020. (\$141,999, Highly Recommended)	
FELLOWSHIPS	Simons Junior Fellowship, 2016–2019. (\$364,214)	
AND AWARDS	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	17. <i>Principal components in linear mixed models with general bulk</i> (with Z. Fan and Z. Wang), submitted, 2019. <a href="#">arXiv:1903.09592</a>	
RESEARCH	16. <i>Gaussian fluctuations for products of random matrices</i> (with V. Gorin), submitted, 2019. <a href="#">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="#">arXiv:1806.09529</a>	
	14. <i>Affine Macdonald conjectures and special values of Felder-Varchenko functions</i> (with E. Rains and A. Varchenko), Sel. Math. N. S. <b>24</b> (2018), 1549–1591. <a href="#">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="#">arXiv:1610.01635</a>	
	12. <i>Traces of intertwiners for quantum affine algebras and difference equations (after Etingof-Schiffmann-Varchenko)</i> (single author), Transform. Groups <b>23</b> (2018), 1167–1215. <a href="#">arXiv:1609.09038</a>	
	11. <i>Matrix models for multilevel Heckman-Opdam and multivariate Bessel measures</i> (single author), submitted, 2016. <a href="#">arXiv:1609.09096</a>	
	10. <i>Traces of intertwiners for quantum affine <math>\mathfrak{sl}_2</math> and Felder-Varchenko functions</i> (single author), Commun. Math. Phys. <b>347</b> (2016), 573–653. <a href="#">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), Commun. Algebra <b>45</b> (2016), 1926–1934. <a href="#">arXiv:1505.07891</a>	
	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>	

COMPUTER SCIENCE RESEARCH	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>	
	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>	
OTHER RESEARCH	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.	
RESEARCH PRESENTATIONS	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)	January 2016
	Laguerre and Jacobi analogues of the Warren process	
	24. NIPS 2015 (poster)	December 2015
	From random walks to distances on unweighted graphs	
	23. ETH Zurich: ITS Talks in Theoretical Sciences 2015	November 2015
	Random matrices and representation theory	
	22. UC Berkeley: RTGC Seminar	November 2015
	Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	
	21. ETH Zurich: Mathematical Physics Seminar	October 2015
	Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	
	20. NEU: Geometry, Physics and Representation Theory Seminar	October 2015
	Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	
	19. Columbia: Mathematical Physics Seminar	October 2015
	Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	
	18. Yale: Geometry, Symmetry, and Physics Seminar	September 2015
	Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions	
	17. FPSAC 2015 (poster)	July 2015
	A representation-theoretic proof of the branching rule for Macdonald polynomials	
	16. Clay Math Inst.: Random Polymers and Algebraic Combinatorics	May 2015
	A representation-theoretic proof of the branching rule for Macdonald polynomials	
	15. AISTATS 2015 (poster)	May 2015
	Metric recovery from directed unweighted graphs	
	14. ICERM: Workshop on Limit Shapes (poster)	April 2015
	A representation-theoretic proof of the branching rule for Macdonald polynomials	
	13. NIPS 2014: Workshop on Networks (poster)	December 2014
	Metric recovery from directed unweighted graphs	
	12. UC Berkeley: GRASP Seminar	November 2014
	A representation-theoretic proof of the branching rule for Macdonald polynomials	
	11. IHP: Workshop on Macdonald Processes and Hecke Algebras	May 2014
	A new integral formula for Heckman-Opdam hypergeometric functions	
	10. MIT: Integrable Probability Seminar	April 2014
	A new integral formula for Heckman-Opdam hypergeometric functions	
OUTREACH PRESENTATIONS	9. Math Olympiad Program 2018	June 2018
	Threshold signatures	
	8. MIT “Meta-Math” Meetup 2017	May 2017
	How to do a Literature Search	
	7. Summer Program in Applied Rationality and Cognition 2016	August 2016
	Problem Solving: Contests vs. Real Life	
	6. Math Olympiad Summer Program 2016	June 2016
	Distribution Testing: Is this die fair?	
	5. MIT Open House 2016	April 2016
	Universality: Mathematics in the real world	
	4. Math Olympiad Summer Program 2015	June 2015
	Fair coin flips from unfair coins	
	3. Math Olympiad Summer Program 2014	June 2014
	The Ising model	
	2. Math Olympiad Summer Program 2013	June 2013
	Random matrices	
	1. Math Olympiad Summer Program 2012	June 2012
	Random partitions and Fock space	

OTHER PUBLICATIONS	6. 54 <sup>th</sup> <i>International Mathematical Olympiad</i> (with J. Berman and Z. Feng), <i>Mathematics Magazine</i> <b>86</b> (2013), 309–313.
	5. 53 <sup>nd</sup> <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> <b>85</b> (2012), 312–317.
	4. 52 <sup>nd</sup> <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> <b>84</b> (2011), 316–319.
	3. 51 <sup>st</sup> <i>International Mathematical Olympiad</i> (with Z. Feng and P. Loh), <i>Mathematics Magazine</i> <b>83</b> (2010), 320–323.
	2. <i>A simulation based model of traffic circles</i> (with C. Chang and Z. Fan), <i>The UMAP Journal</i> <b>30</b> (2009), 225–244.
	1. <i>hsolve: A difficulty metric and puzzle generator for Sudoku</i> (with C. Chang and Z. Fan), <i>The UMAP Journal</i> <b>29</b> (2008), 303–324.
TEACHING	<b>Columbia University</b> Fall 2017–2020 Instructor. Fall 2017: Calculus II, evaluations 3.9 (5.0). Spring 2019: Graduate reading course on representation theory. Fall 2019: Calculus II.
	<b>US National Math Olympiad Summer Program</b> Summers 2007–2018 Instructor (2010, 2012–2018); Assistant (2007–2009). Design curriculum, give lectures, and personally coach US team to International Mathematical Olympiad.
	<b>MIT MathROOTS</b> Summers 2015–2016 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.
	<b>MIT Undergraduate Research Opportunities Program</b> Fall 2012–2015 Mentor two undergraduate research projects, leading to published research paper. <ul style="list-style-type: none"> <li>• Sheela Devadas (rational Cherednik algebras in char <math>p \leq n</math>), 2014–2015.</li> <li>• Ryan Yoo (characters of rational Cherednik algebras in char <math>p &gt; n</math>), 2012–2014.</li> </ul>
	<b>Massachusetts Institute of Technology</b> Spring 2015 Teaching Assistant for Differential Equations. Evaluations: 6.2 (7.0)
	<b>MIT Directed Reading Program</b> January 2011 Mentor reading project on representation theory of the symmetric group.
	<b>Harvard University</b> Spring 2009 Course Assistant for Probability Theory. Evaluations: 4.3 (5.0)
	<b>Columbia Probability Seminar</b> Fall 2016–Present Co-organize weekly probability seminar.
	<b>Summer School in Probability</b> Summer 2017 Co-organize graduate summer school “Dyson-Schwinger equations, topological expansions, and random matrices” at Columbia.
	<b>MIT Interacting Particle Systems Learning Seminar</b> 2012–2013 Organize learning seminar on recent developments in interacting particle systems.
PROFESSIONAL ACTIVITIES	<b>Google Research</b> Summer 2010 Research intern. Research attribution and cost-sharing methods, leading to paper published in EC 2010. Mentor: Mukund Sundararajan
	<b>Service</b> Reviewer for: <i>Probability Theory and Related Fields</i> , <i>Selecta Mathematica</i> (N.S.), <i>SIGMA</i> , <i>Journal of Theoretical Probability</i> , <i>Europhysics Letters</i> , <i>Information and Inference</i> . Qualifying Exam committee member for: Ivan Danilenko (Columbia), Maithreya Sitaraman (Columbia)
	<b>LANGUAGES</b> Mandarin (native), French (conversational)
COMPUTER	Sage, Magma, Mathematica, L <sup>A</sup> T <sub>E</sub> X, C++, Python
	Last updated: October 15, 2019.