

Yi Sun

| | |
|-------------------------------|--|
| CONTACT INFORMATION | Address: Department of Mathematics, Columbia University, New York, NY 10027. Email: yisun@math.columbia.edu Webpage: yisun.io |
| RESEARCH INTERESTS | Representation theory, integrable systems, and applications to probability theory and random matrices. |
| EMPLOYMENT | Columbia University New York, NY Simons Fellow (2016–present). |
| EDUCATION | Massachusetts Institute of Technology Cambridge, MA Ph.D., Mathematics (2011–2016), advised by Pavel Etingof. University of Cambridge Cambridge, UK M.A.St., Mathematics, with distinction (2010–2011). Harvard University 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 FELLOWSHIPS AND AWARDS | NSF Grant DMS-1701654, Algebra and Number Theory, 2017–2020. Simons Junior Fellowship, 2016–2019. 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. MIT Praecis Presidential Fellowship, 2011–2012. Churchill Scholarship for study at Cambridge, 2010–2011. William Lowell Putnam Competition, 10 th Place, 2009. COMAP Math Contest in Modeling, Outstanding Winner, SIAM Prize, 2008 and 2009. Intel Science Talent Search, 2 nd Place, 2006. International Mathematical Olympiad, Silver Medal, 2006. Asian Pacific Mathematics Olympiad, Gold Medal, 2005. International Physics Olympiad, Gold Medal, 2004. |
| MATHEMATICS RESEARCH | 16. <i>Principal components in linear mixed models with general bulk</i> (with Z. Fan and Z. Wang), preprint, 2019. arXiv:1903.09592 15. <i>Gaussian fluctuations for products of random matrices</i> (with V. Gorin), submitted, 2018. arXiv:1812.06532 14. <i>Spiked covariances and principal components analysis in high-dimensional random effects models</i> (with Z. Fan and I. Johnstone), preprint, 2018. arXiv:1806.09529 13. <i>Affine Macdonald conjectures and special values of Felder-Varchenko functions</i> (with E. Rains and A. Varchenko), <i>Selecta Mathematica N. S.</i> 24 (2018), 1549–1591. arXiv:1610.01917 12. <i>Laguerre and Jacobi analogues of the Warren process</i> (single author, with an appendix by A. Sarantsev), submitted, 2016. arXiv:1610.01635 11. <i>Traces of intertwiners for quantum affine algebras and difference equations (after Etingof-Schiffmann-Varchenko)</i> (single author), <i>Transformation Groups</i> 23 (2018), 1167–1215. arXiv:1609.09038 10. <i>Matrix models for multilevel Heckman-Opdam and multivariate Bessel measures</i> (single author), submitted, 2016. arXiv:1609.09096 9. <i>Traces of intertwiners for quantum affine \mathfrak{sl}_2 and Felder-Varchenko functions</i> (single author), <i>Communications in Mathematical Physics</i> 347 (2016), 573–653. arXiv:1508.03918 |

| | | |
|---------------------------------|---|--|
| | 8. <i>The polynomial representation of the type A_{n-1} rational Cherednik algebra in characteristic $p \mid n$</i> (with S. Devadas), <i>Communications in Algebra</i> 45 (2016), 1926-1934. arXiv:1505.07891 | |
| | 7. <i>A representation-theoretic proof of the branching rule for Macdonald polynomials</i> (single author), <i>Mathematical Research Letters</i> 23 (2016), 887-927. Extended abstract in FPSAC 2015. arXiv:1412.0714 | |
| | 6. <i>A new integral formula for Heckman-Opdam hypergeometric functions</i> (single author), <i>Advances in Mathematics</i> 289 (2016), 1157-1204. arXiv:1406.3772 | |
| | 5. <i>Finite dimensional representations of the rational Cherednik algebra for G_4</i> (single author), <i>Journal of Algebra</i> 323 (2010), 2864-2887. arXiv:0910.5527 | |
| COMPUTER SCIENCE RESEARCH | 4. D. Kang*, Y. Sun*, T. Brown, D. Hendrycks, and J. Steinhardt, <i>Transfer of adversarial robustness between perturbation types</i> , arXiv:1905.01034 | |
| | 3. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>From random walks to distances on unweighted graphs</i> , NIPS 2015. arXiv:1511.00573 | |
| | 2. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>Metric recovery from directed unweighted graphs</i> , NIPS 2014 workshop (Best Student Paper), AISTATS 2015. arXiv:1411.5720 | |
| | 1. Y. Sun and M. Sundararajan, <i>Axiomatic attribution for multilinear functions</i> , ACM Conf. on Electronic Commerce 2011. arXiv:1102.0989 | |
| RESEARCH PRESENTATIONS | 42. ICML 2019 Workshop: Uncertainty and Robustness in DL (poster) June 2019 Transfer of robustness against adversarial and stochastic distortions | |
| | 41. OpenAI June 2019 Transfer of robustness against adversarial and stochastic distortions | |
| | 40. Virginia: Integrable Probability Summer School June 2019 Fluctuations for products of random matrices | |
| | 39. UCSD: Probability Seminar January 2019 Fluctuations for products of random matrices | |
| | 38. Yale: Geometry, Symmetry, and Physics Seminar April 2018 Affine Macdonald conjectures and special values of Felder-Varchenko functions | |
| | 37. Simons Society of Fellows Retreat February 2018 A probabilistic view on random covariance matrices | |
| | 36. PCMI: Research Program on Random Matrices July 2017 Algebraic structures for multilevel eigenvalue densities | |
| | 35. Rochester: Probability Seminar April 2017 Laguerre and Jacobi analogues of the Warren process | |
| | 34. Perimeter Institute: Mathematical Physics Seminar April 2017 Affine Macdonald conjectures and special values of Felder-Varchenko functions | |
| | 33. Rutgers: Lie Group / Quantum Mathematics Seminar April 2017 Affine Macdonald conjectures and special values of Felder-Varchenko functions | |
| | 32. Columbia-Princeton Probability Day March 2017 Laguerre and Jacobi analogues of the Warren process | |
| | 31. ESI: Workshop on Elliptic Hypergeometric Functions March 2017 Affine Macdonald conjectures and special values of Felder-Varchenko functions | |
| | 30. Columbia: Probability Seminar November 2016 Laguerre and Jacobi analogues of the Warren process | |
| | 29. Columbia: Mathematical Physics Seminar October 2016 Affine Macdonald conjectures and special values of Felder-Varchenko functions | |

| | | |
|---------------------------|--|----------------|
| | 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. 54 th <i>International Mathematical Olympiad</i> (with J. Berman and Z. Feng), <i>Mathematics Magazine</i> 86 (2013), 309–313. | |
| | 5. 53 rd <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> 85 (2012), 312–317. | |
| | 4. 52 nd <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> 84 (2011), 316–319. | |
| | 3. 51 st <i>International Mathematical Olympiad</i> (with Z. Feng and P. Loh), <i>Mathematics Magazine</i> 83 (2010), 320–323. | |
| | 2. <i>A simulation based model of traffic circles</i> (with C. Chang and Z. Fan), <i>The UMAP Journal</i> 30 (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> 29 (2008), 303–324. | |
| TEACHING | Columbia University Instructor for introductory graduate reading course on representation theory | Spring 2019 |
| | US National Math Olympiad Summer Program Instructor (2010, 2012–2018); Assistant (2007–2009). Design curriculum, give lectures, and personally coach US team to International Mathematical Olympiad. | Summers 2007–2018 |
| | Columbia University Instructor for Calculus II. Evaluations: 3.9 (5.0) | Fall 2017 |
| | MIT MathROOTS Academic Coordinator. Design curriculum, give lectures, and manage academic team, guest lectures, website, and sponsorships for first two years of outreach program teaching problem solving to underrepresented minority students. Program received media coverage on MIT homepage and in Notices of the AMS. | Summers 2015–2016 |
| | MIT Undergraduate Research Opportunities Program 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. | |
| | Massachusetts Institute of Technology Teaching Assistant for Differential Equations. Evaluations: 6.2 (7.0) | Spring 2015 |
| | MIT Directed Reading Program Mentor reading project on representation theory of the symmetric group. | January 2011 |
| | Harvard University Course Assistant for Probability Theory. Evaluations: 4.3 (5.0) | Spring 2009 |
| PROFESSIONAL ACTIVITIES | Columbia Probability Seminar Co-organize weekly probability seminar. | Fall 2016–Present |
| | Summer School in Probability | Summer 2017 |

Co-organize graduate summer school “Dyson-Schwinger equations, topological expansions, and random matrices” at Columbia.

MIT Interacting Particle Systems Learning Seminar 2012–2013

Organize learning seminar on recent developments in interacting particle systems.

Google Research

Summer 2010

Research intern. Research attribution and cost-sharing methods, leading to paper published in EC 2010. Mentor: Mukund Sundararajan

SERVICE

Reviewer for: Probability Theory and Related Fields, Selecta Mathematica (N.S.), SIGMA, Journal of Theoretical Probability, Europhysics Letters.

Qualifying Exam committee member for: Ivan Danilenko (Columbia), Maithreya Sitaraman (Columbia)

LANGUAGES

Mandarin (native), French (conversational)

COMPUTER

Sage, Magma, Mathematica, L^AT_EX, C++, Python

REFERENCES

Pavel Etingof (advisor), Professor, Massachusetts Institute of Technology, etingof@math.mit.edu.

Alexei Borodin, Professor, Massachusetts Institute of Technology, borodin@math.mit.edu.

Vadim Gorin, Assistant Professor, Massachusetts Institute of Technology, vadicgor@math.mit.edu.

Eric Rains, Professor, California Institute of Technology, rains@caltech.edu.

Valerio Toledano-Laredo, Professor, Northeastern University, V.ToledanoLaredo@neu.edu.

Po-Shen Loh (teaching), Associate Professor, Carnegie Mellon University, ploh@cmu.edu.