Jeffrey Kuan

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Personal
Born on December 1, 1987, in San Francisco, California.

Research Interests
Integrable probability, representation theory, mathematical physics, combinatorics.

Education
B.S. Mathematics, California Institute of Technology, 2010.

Ph.D. Mathematics, Harvard University, 2015.

Academic Positions
Assistant Professor, Texas A&M University, 2018 – present.

NSF Postdoc, Columbia University, 2015–2018.

Fellowships, Awards and Scholarships
Co-PI for "Quantized Symmetries in Operator Algebras and Quantum Information", 8/2022–present (DMS–2000331). Transferred from PI Michael Brannan.

Senior Personnel for "REU Site Grant: Undergraduate Research in the Mathematical Sciences and their Applications", 5/2022–4/2025 (DMS-2150094). PIs: Maurice Rojas and Anne Shiu.

Simons Foundation Collaboration Grant, 2020–2022 (voluntarily ended due to NSF support).

National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship, 2015–2018.

National Science Foundation Graduate Research Fellowship Program, 2010-2013.

George W. and Bernice E. Green Prize, California Institute of Technology, 2010.

Scott Russell Johnson Prize for Graduating Senior, California Institute of Technology Mathematics Department, 2010.

Eric Temple Bell Undergraduate Mathematics Research Award, California Institute of Technology Mathematics Department, 2009.

Fredrick J. Zeigler Award, California Institute of Technology, 2008.

Axline and Lingle Scholarships, California Institute of Technology, 2006–2010.

Research

An asterisk * indicates a graduate student; a double asterisk ** indicates an undergraduate student (at the time the paper was completed).

30.   An explicit central element of $U_q(so_5)$ and its corresponding quantum Hamiltonian, arXiv preprint: arXiv:2305.19156v1.

29.   Orthogonal Dualities of Dynamic Stochastic Higher Spin Vertex Models through Drinfeld Twister (with Zhengye Zhou*), arXiv preprint: arXiv:2305.17602

28.   Asymptotics of two-point correlations in the multi-species q-TAZRP (with Zhengye Zhou*), submitted to *Brazilian Journal of Probability and Statistics.*

27.   Orthogonal Polynomial Duality for Type D ASEP (with Danyil Blyschak**, Olivia Burke**, Dennis Li**, Sasha Ustilovsky** and Zhengye Zhou*), to appear in *Journal of Statistical Physics*.

26.   Orthogonal polynomial duality and unitary symmetries of multi–species $\text{ASEP}(q, \boldsymbol{\theta})$ and higher–spin vertex models via *–bialgebra structure of higher rank quantum groups (with Chiara Franceschini and Zhengye Zhou*), submitted to *Communications in Mathematical Physics*.

25.   Joint q-moments and shift invariance for the multi-species q-TAZRP on the infinite line, to appear in *Annales de l'Institut Henri Poincaré D: Combinatorics, Physics and their Interactions*.

24.   Three-dimensional Gaussian fluctuations of spectra of overlapping stochastic Wishart matrices (with Zhengye Zhou*), to appear in *Random Matrices: Theory and Applications*.

23.   Stochastic Baxterisation of a Fused Hecke Algebra, Preprint: arXiv:2012.11564

22.   A Short Note on Markov Duality in Multi-species Higher Spin Stochastic Vertex Models, *Electronic Communications in Probability*, 26: 1-11 (2021)

21.   Algebraic Symmetry and Self–Duality of an Open ASEP, *Math Phys Anal Geom* 24, 12 (2021).

20.   Interacting Particle Systems with type D Symmetry and Duality (with Mark Landry**, Andrew Lin**, Andrew Park**, Zhengye Zhou*. Houston Journal of Mathematics, Volume 48, Number 3, 2022, Pages 499–538.

19.   Determinantal Expressions in Multi–species TASEP, *SIGMA*, 16 (2020), 133, 6 pages.

18.   Two dualities: Markov and Schur–Weyl, *International Mathematics Research Notices*, International Mathematics Research Notices, Volume 2022, Issue 13, July 2022, Pages 9633–9662,

17.   Coxeter Group Actions on Interacting Particle Systems. *Stochastic Processes and their Applications*, Elsevier, vol. 150(C), pages 397-410 (August 2022).

16.   Stochastic Fusion of Interacting Particle Systems and Duality Functions, to appear in *Annales de l'Institut Henri Poincaré (B)*.

15.   Probability distributions of multi–species q–TAZRP and ASEP as double cosets of parabolic subgroups, *Annales Henri Poincaré*, April 2019, 20(4), 1149-1173.

14.   Explicit central elements of $U_q(gl_n)$ (with Keke Zhang**), to appear in *SIGMA*.

13.   An algebraic construction of duality functions for the stochastic $U_q(A_n^{(1)})$ vertex model and its degenerations. *Communications in Mathematical Physics*, 359(1):121–187, Apr 2018.

12.   Hard–edge asymptotics of the Jacobi growth process (with Mark Cerenzia*), *Annales de l'Institut Henri Poincaré (B)*, Volume 56, Number 4, November 2020, pages 2329–2355.

11.   A multi-species ASEP(q, j) and q-TAZRP with stochastic duality. *International Mathematics Research Notices*, 2018(17):5378–5416, 2018.

10.   A (2+1)-dimensional Gaussian field as fluctuations of quantum random walks on quantum groups, submitted to *Journal of Mathematical Physics.*

9.   An interacting particle system with geometric jump rates near a partially reflecting boundary, *Electronic Communications in Probability*, Volume 21 (2016), paper no. 76, 15 pp.

8.   Stochastic duality of ASEP with two particle types via symmetry of quantum groups of rank two, *Journal of Physics A, Mathematical and Theoretical*, Volume 49, Number 11 (2016), 29 pp.

7.   Three–dimensional Gaussian fluctuations of non–commutative random surfaces along time–like paths, *Advances in Mathematics*, Volume 303, 5 November 2016, Pages 716–744.

6.   Two constructions of Markov chains on the dual of $U(n)$, *Journal of Theoretical Probability*, Volume 31, Pages 1411-1428 (2018).

5.   Strong Szegő asymptotics and zeros the zeta-function (with Paul Bourgade), *Communications on Pure and Applied Mathematics*, Volume 67, Issue 6, pages 1028–1044, June 2014.

4.   Asymptotics of a discrete-time particle system near a reflecting boundary, *Journal of Statistical Physics*, Volume 150, Issue 2 (2013), Pages 398–411.

3.   The Gaussian free field in interlacing particle systems, *Electronic Journal of Probability*, Volume 19 (2014), no. 72, 1-31.

2.   Random surface growth with a wall and Plancherel measures for $O(\infty)$ (with Alexei Borodin), *Communications on Pure and Applied Mathematics*, Volume 63, Issue 7, July 2010, Pages 831–894.

1.   Asymptotics of Plancherel measures for the infinite-dimensional unitary group (with Alexei Borodin), *Advances in Mathematics*, Volume 219, Issue 3, 20 October 2008, Pages 894–931.

Advising

Zhengye Zhou, Ph.D. student at Texas A&M University, 2019 – present.

Ting Lu, Ph.D. student at Texas A&M University, 2021 – present.

Keke Zhang, REU student (2016 and 2017 at Columbia) and senior thesis (2018). She is currently a Ph.D. student at the University of Waterloo.

Nguyen Dung (REU 2016 at Columbia). He has completed a Ph.D. in Mathematics at Columbia, and is currently a Quantitative Researcher at Goldman Sachs.

Noah Miller (REU 2016 at Columbia). He is currently a Ph.D. student in Physics at Harvard University.

Junho Won (REU 2016 at Columbia). He is currently a Ph.D. student in Mathematics at Northwestern University.

Ravi Campbell (REU 2017 at Columbia). He is currently in industry.

Zachary Davis (REU 2017 at Columbia). He is currently a Ph.D. student in Mathematics at Ohio State University.

Max Krawczyk (REU 2017 at Columbia). He is currently in industry.

Andrew Lin (REU 2020 at Texas A&M University). He is currently a Ph.D. student in Mathematics at Stanford with an NSF Graduate Research Fellowship.

Andrew Park (REU 2020 at Texas A&M University). He received at least one graduate school acceptance, but is now in industry.

Mark Landry (REU 2020 at Texas A&M University). He went on to a Ph.D. Program at Duke University in the Decision Sciences program at the Fuqua School of Business.

Lauren Neudorf (REU 2021 at Texas A&M University). She is currently a M.A. student in Mathematics at the University of Wisconsin, Madison.

Emily Bosche and Ray Shang (REU 2021 at Texas A&M University). Both are still undergraduates.

Danyil Blyschak, Dennis Li, Olivia Burke, Sasha Ustilovsky (REU 2022 at Texas A&M University). All are currently still undergraduates.

Professional Activities

Referee for Annals of Mathematics, Probability Theory and Related Fields, Communications in Mathematical Physics, Annals of Probability, Memoirs of the American Mathematical Society, International Mathematics Research Notices, Journal of Statistical Physics, SIGMA (Symmetry Integrability and Geometry Methods and Applications) [two times], MPAG (Mathematical Physics, Analysis and Geometry), Electronic Journal of Probability, Electronic Communications in Probability, and Annals of Applied Probability.

Organizer for concentration week "Probability and Algebra: New Expressions in Mathematics," Texas A&M University, College Station, July 2023.

REU at Texas A&M University, Summer 2022.

Co–organizer for conference "Algebraic Duality Methods in Probability," online, June 2021.

REU at Texas A&M University, Summer 2021.

REU at Texas A&M University, Summer 2020.

Co–organizer for Austin – Texas A&M Probability day, 2018 – present.

Co–organizer for Texas A&M Probability Seminar, 2018 – present.

Senior Thesis advisor for Keke Zhang, Fall 2017.

REU at Columbia University, Summer 2017.

REU at Columbia University, Summer 2016.

Co–organizer for Columbia Probability Seminar, 2015–2018.

Teaching Assistant for Mathematical Sciences Research Institute Summer School, July 2014.

Teaching

Instructor for Mathematical Probability (including honors section), Texas A&M, Spring 2023.

Instructor for Advanced Calculus I (two sections), Texas A&M, Fall 2022.

Instructor for Applied Probability, Texas A&M, Spring 2022.

Instructor for Engineering Mathematics III, Texas A&M, Spring 2022.

Instructor for Advanced Calculus I, Texas A&M, Fall 2021.

Instructor for Topics Class in Representation Theory and Integrable Probability, Texas A&M, Fall 2020.

Instructor for Mathematical Probability (including honors section), Texas A&M, Fall 2020.

Instructor for Mathematical Probability (two sections), Texas A&M, Fall 2019.

Instructor for Mathematical Probability (three sections, including one honors), Texas A&M, Fall 2018.

Instructor for Calculus III, Columbia University, Fall 2017.

Instructor for Calculus III, Columbia University, Fall 2016.

Teaching Fellow for Multivariable Calculus (two sections), Harvard University, Fall 2014.

Graduate Course Fellow for Linear Algebra, Harvard University, Spring 2014.

Graduate Course Assistant for Real Analysis, Harvard University, Fall 2013.

Graduate Course Assistant for Analytic Number Theory, Harvard University, Spring 2013.

Graduate Course Assistant for Random Matrix Theory and Number Theory, Harvard University, Fall 2012.

Graduate Course Assistant for Probability Theory and Stochastic Processes, Harvard University, Spring 2012.

Presentations
Colloquia

University of Southern California, Los Angeles, January 29, 2018.

Texas A&M University, College Station, January 26, 2018.

University of California at Irvine, Irvine, December 8, 2017.

University of Southern California, Los Angeles, November 1, 2017.

Colby College, Waterville, November 25, 2013.

Seminars

Probability Seminar, University of Wisconsin–Madison, February 9, 2023.

Probability Seminar (organized at National Institute for Pure and Applied Mathematics in Brazil), Online, December 1, 2021.

Probability Seminar (organized at University of Bristol), Online, October 1st, 2021.

Interdisciplinary Science Seminar (organized at Harvard University Center of Mathematical Sciences and Applications), Online, July 29, 2021.

Solvable Lattice Models Seminar (organized at Stanford University), Online, July 28, 2021.

Integrable Probability Seminar (organized at Columbia University), Online, June 5, 2020.

Probability Seminar, Columbia University, New York, March 13, 2020 (canceled due to COVID–19).

Probability Seminar, Tulane University, New Orleans, November 20, 2019.

Integrable Probability Seminar, Columbia University, New York, February 15, 2019.

Non–commutative Geometry Seminar, Texas A&M University, College Station, December 6, 2018.

Probability Seminar, Texas A&M University, College Station, April 30, 2018.

Probability Seminar, Cornell University, Ithaca, March 12, 2018.

Probability Seminar, Temple / University of Pennsylvania, Philadelphia, January 16, 2018.

Probability Seminar, University of Washington, Seattle, December 4, 2017.

Combinatorics Seminar, University of Michigan, Ann Arbor, December 1, 2017.

Functional Analysis Seminar, University of California at San Diego, San Diego, November 9, 2017.

Representation Theory Seminar, University of California at Berkeley, Berkeley, November 8, 2017.

Mathematical Physics and Probability Seminar, University of California at Davis, Davis, November 6, 2017.

Stochastics Seminar, University of Utah, Salt Lake City, November 3, 2017.

Probability Seminar, University of California at Los Angeles, Los Angeles, November 2, 2017.

Integrable Probability Seminar, Columbia University, New York, January 20, 2017.

Probability Seminar, Columbia University, New York, March 4, 2016.

Mathematical Physics and Probability Seminar, University of California at Davis, Davis, January 27, 2016.

Probability Seminar, City University of New York, New York, December 8, 2015.

Integrable Probability Seminar, Massachusetts Institute of Technology, Cambridge, May 14, 2015.

Integrable Probability Seminar, Massachusetts Institute of Technology, Cambridge, October 10 and 31, 2013.

Probability Seminar, Technische Universität Berlin, Berlin, August 21, 2013.

Discrete Math and Combinatorics Seminar, Brown University, Providence, November 13, 2012.

Analysis and Probability Seminar, University of Connecticut, Storrs, September 30, 2011.

Conferences and Summer Schools

Vertex Models: Algebraic and Probabilistic Aspects of Universality (invited speaker), Institute for Pure and Applied Mathematics, Los Angeles, May 2024.

Columbia Probability Workshop (invited speaker), Columbia University, New York City, May 22, 2023.

Recent Developments in Stochastic Duality (invited speaker), Eindhoven University of Technology, Eindhoven, Netherlands, December 12, 2022.

Recent Developments in Stochastic Duality (invited speaker), Eindhoven University of Technology, Eindhoven, Netherlands, December 12, 2022.

Northeast Probability Seminar, Columbia University, New York City, November 18, 2022.

Pacific Northwest Integrable Probability Conference (invited speaker), Oregon State University, Corvallis, November 4, 2022.

Frontier Probability Days (plenary speaker), University of Nevada at Las Vegas, Las Vegas, December 4th, 2021.

Summer Informal Regional Functional Analysis Seminar, Texas A&M University , College Station, July 31st, 2021.

Integrable Probability Meeting, University of Wisconsin, Madison, April 22, 2020 (canceled due to COVID–19).

Integrable Probability New York, Columbia University, New York, March 20, 2020 (canceled due to COVID–19).

AMS Fall Western Sectional Meeting, Special Session on Random Matrices and Related Structures, Riverside, November 9, 2019.

Summer Informal Regional Functional Analysis Seminar, Texas A&M, College Station, July 27, 2019.

Stochastic Processes and their Applications, Northwestern University, Evanston, July 9, 2019.

A Symposium on Optimal Stopping, Rice University, Houston, June 29, 2018.

Integrable Probability Boston 2018, MIT, Cambridge, May 15, 2018.

Summer School in Probability, Northwestern University, Evanston, July 18, 2016.

New approaches to non-equilibrium and random systems: KPZ integrability, universality, applications and experiments, Kavli Institute for Theoretical Physics, Santa Barbara, February 10, 2016.

Random Matrices, Random Growth Processes and Statistical Physics, Simons Center for Geometry and Physics, Stony Brook, September 8, 2015.

Random Polymers and Algebraic Combinatorics, Oxford University, Oxford, May 26, 2015.

Northeast Probability Seminar, Columbia University, New York, November 20, 2014.

From Macdonald Processes to Hecke Algebras and Quantum Integrable Systems, Institut Henri Poincaré, Paris, May 27, 2014.

Randomness in Physics and Mathematics, Center for Interdisciplinary Research, Bielefeld University, Bielefeld, August 14, 2013.

Focus Program on Noncommutative Distributions in Free Probability Theory, Fields Institute, Toronto, July 8, 2013.

Young Researchers Conference at The International Congress in Mathematical Physics, Aalborg, August 3, 2012.

6th Prague Summer School in Mathematical Statistical Mechanics, Prague University, Prague, August 30, 2011.

7th Cornell Probability Summer School, Cornell University, Ithaca, July 19, 2011.

5th Cornell Probability Summer School, Cornell University, Ithaca, July 14, 2009.

Random Tilings, Random Partitions and Stochastic Growth Processes, Centre de Recherches Mathématiques, Montreal, September 5, 2008.

Volunteering

Volunteer judge at Student Research Week, Texas A&M University, 2022 and 2023.

Evaluated applications for the Avilés–Johnson Fellowship, Texas A&M University, 2022.

Classroom Assistant in Mathematics at Cambridge Rindge and Latin School, February 2013–May 2014.

Math Tutor at Arlington High School, September 2011 - May 2012.