Curriculum Vitae
Shannon Starr
Spring 2016

Professional Preparation

(Unless otherwise noted, all years correspond to academic years, roughly September–June.)

U. C. Berkeley	1992–1996	B.A. mathematics.
U. C. Davis	1998–2001	Ph.D. mathematics. Advisor: Bruno Nachtergaele, Thesis: "Properties of the Low Energy Spectrum for the XXZ Model"
Princeton University	2001–2003	NSF-MSPRF Postdoc. Supervisor: Elliott Lieb
McGill University	2003–2004	Postdoctoral research position Supervisor and PI: Vojkan Jaksic
Université de Montreal and McGill University	September 2004– December 31, 2004	CRM-ISM Postdoctoral Fellowship

Professional Appointments

U. C. Los Angeles	Assistant Adjunct Professor of Mathematics	Jan. 1, 2005– June 2006
University of Rochester	Assistant Professor of Mathematics	2006 to 2012
UAB	Assistant Professor of Mathematics	2012 to present

Graduate Students Trained

- Meg Walters, *University of Rochester*. Graduated May 2015 from UR Mathematics. Ph.D. title: "Applications of the Concentration of Measure Phenomenon."

Grant Support

- NSF, DMS 0102009 Mathematical Sciences Postdoctoral Research Fellowship. *Quantum Spin Systems.* Amount: $90,000. Start date: 07/07/01. Award duration: 24 months.
- NSF, DMS 0706927 in program: Probability. *Probabilistic methods in quantum spin systems and spin glasses.* Amount: $89,183. Start date: 07/01/07. Award duration: 36 months.

- NSF, DMS 0757327 in program: Applied Mathematics. *FRG: Collaborative Research: Quantum Spin Systems. Theory and Applications in Quantum Computation.* (Co-PI, with Bruno Nachtergaele, Robert Simsl and H.T.Yau) Amount: $49,064. Start date: 07/15/08. Award duration: 36 months.
- NSF, DMS 0952143 in program: Probability. REU Supplement (for Meg Walters). *Probabilistic methods in quantum spin systems and spin glasses.* Amount: $2,250. Start date: 07/01/07. Award duration: 6 months.
- NSA Mathematical Sciences Program in: Probability. *Symmetry Methods in Probability*. Amount $19,898 awarded. Start date: 02/2011. Award duration 12 months.

Service Grants (Conferences)

- NSF, DMS-134732 CBMS Conference: *Quantum Spin Systems.* Amount: $34,779.00. Start date: 02/01/14. Award duration: 12 months.
- NSF, DMS-1449574 Travel Grant: *US Travel Support for IHP Trimester in Probability.* $ 48,000.00. Start date: 11/15/14. Award duration: 12 months.

Awards

Alice Leung mathematics prize in graduate research, U.C. Davis, 2000.

Conferences organized

- NSF FRG Workshop on Quantum Spin Systems and Quantum Information Theory.
  - May 21–25, 2010. University of Rochester, Mathematics Department, Rochester, NY.
  - 22 participants from Caltech, Clarkson University, Harvard, IBM Research, Los Alamos, Tokyo University, University of Arizona, U.C. Davis, University of Cardiff.
  - Including invited lectures from researchers at University of Rochester from both Mathematics and Physics departments (also advertised to the Computer Science department).
  - See website for more details: `http://www.math.rochester.edu/people/faculty/sstarr/FRGmain.html`.
- Fall Eastern Sectional Meeting, Rochester Institute of Technology, Rochester, NY September 22-23, 2012 (Saturday - Sunday) Meeting #1082: Special Session on Probability and Statistical Physics, co-organized with Carl Mueller and Wenbo Li.

- CBMS Regional Conference Series in Mathematics, UAB. "Quantum Spin Systems," with distinguished lecturer Bruno Nachtergaele from UC Davis. This took place at the University of Alabama at Birmingham June 16-20. There were approximately 50 participants, from all over the world, including many graduate students and young researchers.

Invited Conference Talks

- International Conference on Differential Equations and Mathematical Physics, Birmingham, AL, November 2000.
- 20th Annual Western States Mathematical Physics Meeting, Caltech, February 2001.
- Volterra-CIRM International School on Quantum Probability, Trento, Italy, December 2001.
- 23rd Annual Western States Mathematical Physics Meeting, Caltech, February 2004.
- Workshop on Dynamics in Statistical Mechanics, organized by Vojkan Jaksic and C.-A. Pillet, Montréal, Canada, Summer 2004.
- AMS Regional Meeting, Special Session on Probability and Statistical Physics, San Francisco, April 2006.
- 95th Statistical Mechanics Conference, Rutgers University, May 2006.
- Young Researchers Symposium of the International Congress of Mathematical Physics, Rio de Janeiro, Brazil, July 2006.
- YEP-V (Young European Probabilists) : Statistical Mechanics on Random Structures, Eindhoven, Netherlands, March 2008.
- CRM Workshop, Integrable Quantum Systems and Solvable Statistical Mechanical Models, Montreal, Canada, July 2008.
- Mini-Workshop on Collective Phenomena in Quantum Mechanics, Oberwolfach, Germany, September 2008.
- Canadian Mathematics Society Meeting, St. Johns, Newfoundland, June 2009.
- NSF FRG Workshop on Quantum Spin Systems and Quantum Information Theory, University of Arizona, Tucson, AZ, May 2009.
- Statistical Mechanics on Random Structures, International Research Station, Banff, November 2009.
- Canadian Society of Applied and Industial Mathematics, St. Johns, Newfoundland, June 2010.

- NSF FRG Workship on Quantum Spin Systems and Quantum Information Theory, Harvard, Cambridge, MA, May 2011.
- "Mathematical Challenges in Graphical Models and Message-Passing Algorithms," IPAM, UCLA, Los Angeles, January 2012.
- Arizona School of Analysis and Mathematical Physics, Tucson, AZ, March 2012.
- "Disorder in Probability and Statistical Mechanics," Modena, Italy, June 2012.
- AMS, Fall Eastern Sectional Meeting, Special Session on Probability and Statistical Mechanics, September 2012.
- AMS, Fall Western Sectional Meeting, Special Session on Mathematical Physics: Spectral and Dynamical Properties of Quantum Systems, October 2012.
- CIRM Workshop, "Disordered Systems," (1hour), June 21-28, 2013, Luminy, France.
- University of Alabama, Applied Mathematics, Joint Program Meeting (30min), Tuscaloosa, AL, November 8, 2013.
- Banff International Research Station Workshop, "Spin Glasses and Related Topics," 30 minute talk. Banff, Alberta, CANADA. July 20, 2014.
- "Laplacians, Random Walks, Bose Gas, Quantum Spin Systems," (1 hour) 15–19 Sept 2014, University of Bristol, UK.
- University of Alabama, Applied Mathematics, Joint Program Meeting (30 min), Birmingham, AL, November 8, 2014.
- "Spin glasses, Random graphs and Percolation," (45 min) 16 February 2015 - 20 February 2015, Institut Henri Poincaré, Paris, France.
- AMS, Central Spring Sectional Meeting, Special Session on Spectral Theory, Disorder, and Quantum Many Body Physics, March 2015.
- AMS, Spring Southeastern Sectional Meeting, Special Session on Stochastic Processes and Related Topics , March 2015.
- The Dynamical Systems, Ergodic Theory and Probability Conference Dedicated to the Memory of Nikolai Chernov, (30 min) 18–20 May 2015, University of Alabama at Birmingham.
- Mini-Workshop on Scaling Limits in Statistical Mechanics, Oberwolfach, Germany, September 2015.

Contributed Conference Talks and Poster Sessions

- Poster, International Congress of Mathematical Physics, London, England, Summer 2000.
- Five minute talk, 84th Statistical Mechanics Conference, Rutgers University, December 2000.
- Poster, International Congress of Mathematical Physics, Lisbon, Portugal, Summer 2003.
- Five minute talk, 88th Statistical Mechanics Conference, Rutgers University, December 2003.
- Student/participant lecture at Les Houches summer school on statistical mechanics, France, Summer 2005.
- Poster, International Congress of Mathematical Physics, Rio de Janeiro, Brazil, Summer 2006.
- Thirty minute talk, International Congress of Mathematical Physics, Prague, Czech Republic, August 2009.
- Thirty minute talk, NSF-CBMS Conference at UAHuntsville Small Deviation Probabilities: Theory and Applications, June 2012.
- NSF-CBMS conference on "Analysis of Stochastic Partial Differential Equations," at Michigan State University, contributed talk (30min), August 19-23, 2013.
- 110th Statistical Mechanics Conference Rutgers University (short talk, 5 min) December 15–17, 2013.
- 113th Statistical Mechanics Conference Rutgers University (short talk, 5 min) May 10–12, 2015.

Seminars and Colloquia

Recent talks:

- University of Rochester. 09/21/12
- University of Alabama at Huntsville. (Colloquium) 09/14/12
- University of Alabama at Birmingham (Colloquium) 02/02/12
- Stanford University. 05/21/12
- The Technion University, Haifa, Israel. 05/14/12
- FernUniversitaat Hagen, Germany, Mathematics Department Seminar (1hr), July 4, 2013.
- University of Illinois at Urbana Champaign, Probability Seminar (1hr), November 12, 2013.

- University of Chicago, Probability and Statistical Physics Seminar (1hr), November 15, 2013.
- SUNY Stonybrook, Yang Institute of Theoretical Physics Seminar (1hr), May 6, 2015.

Older talks: U.C. Davis; U.C.L.A; U.C. Irvine; U.C. Santa Cruz; University of Southern California; University of Illinois at Urbana Champaign; UMass, Amherst; University of Michigan; Johannes Gutenberg University, Mainz, Germany; ETH-Hoenggerberg, Switzerland; Universität Osnabrück, Germany; Università di Bologna, Italy; McGill University, Canada; Centre de recherches mathématiques, Montréal, Canada; University of Rochester; Memorial University of Newfoundland, St. Johns, Newfoundland, Canada; University of Erlangen, Germany.

Undergraduate mentees: independent research and reading projects

- Matt Conomos (UR) 2007, one paper, "Asymptotics of the Spectral Gap for the Interchange Process on Large Hypercubes," published in Journal of Statistical Mechanics.
- Lam Tran (UR) 2008, one paper, "Counterexamples to Ferromagnetic Ordering of Energy Levels," published in Journal of Mathematical Physics, the full list of coauthors is Wolfgang Spitzer, Lam Tran and me.
- Meg Walters (UR) 2009, while an undergraduate we studied conformal random processes: primarily circle packing and random meromorphic functions. Meg continued as a graduate student in mathematics at UR, starting in 2010, and received her PhD in Spring 2015.
- Rahul Patel (UR) 2009. He studied Greg Lawler's textbook, "Conformally Invariant Processes in the Plane." Now attending Law School.
- Taurean Parker (UR) 2011. He worked on "Spectral ordering of cycles in Specht modules." He graduated and went on to Teach for America for 1 year. Then he went to a MS in Data Science at New York University. (Taurean was a highly talented student who was introduced to me by the McNair program director at UR.)
- Mallick Hossein (UAB) 2012-2013. Topic: Gaussian and Non-Gaussian Concentration of Measure.
- Tandin Dorji (UAB) 2013 Spring "De Finetti's Theorem and Population Genetics." He went on to a Biostatistics PhD program at the University of Vermont.
- Sahil Patel (UAB) 2013–2014. Sahil read Diaconis and Graham's "Magical Mathematics," and then we began to study applications of algebra to card shuffling. He is still a student at UAB.
- Scott Williams (UAB) 2015 and presently. Topic: Emptiness Formation Probability in Dimers.

I also taught two independent study courses on representations of Lie Groups/Lie Algebras to John Samples, who was a Fast track student who entered the University of Washington PhD program in mathematics in 2014. I taught a special topics course on Fourier Analysis at the request of Andrew Arnold,

who is a current Fast Track student (currently in an exchange program for the year in Budapest mathematics program which is famous among mathematicians). I taught and am currently teaching a special topics independent study course at the request of Forrest Taylor, who is a current Fast Track student.

Journals refereed for

Communications in Mathematical Physics; Journal of Statistical Physics; Methodology and Computing in Applied Probability; Journal of Physics A: Mathematical and Theoretical; Journal of Mathematical Physics; Journal of Functional Analysis; Advances in Mathematical Physics; Annals of Applied Probability; Probability Theory and Related Fields; European Physical Journal B; Journal of Physics: Condensed Matter; Annals of Probability; Physical Review B; Mathematical Physics Electronic Journal; Stochastic Processes and their Applications; Journal of Statistical Mechanics; Reviews in Mathematical Physics; Proceedings of the American Mathematical Society

Courses taught at UAB

2012 Fall: MA 126, Calculus II; MA 793, Probability and Mathematical Physics Seminar

2013 Spr: MA 107, Precal Algebra/Trigonometry; MA 486, Mathematical Statistics; MA 586, Mathematical Statistics

2013 Sum: MA 593, Special Topics "Naive Lie Theory"

2013 Fall: MA 125, Calculus I; MA 440 Advanced Calculus; MA 540 Advanced Calculus; MA 593, Special Topics "Intro. to Lie Algebras"; MA 690, Mathematics Seminar (colloquium)

2014 Spr: MA 441, Advanced Calculus II; MA 541, Advanced Calculus II;

2014 Sum: MA 298, Research in Mathematics

2014 Fall: MA 125, Calculus I; MA 440 Advanced Calculus; MA 540 Advanced Calculus; MA 693, Probability and Mathematical Physics Seminar; MA 694, Special Topics "Mathematical Information Theory Seminar"; MA 793, Probability and Mathematical Physics Seminar; MA 794, Special Topics "Mathematical Information Theory Seminar";

2015 Spr: MA 441, Advanced Calculus II; MA 486, Mathematical Statistics; MA 492, Special Topics "Fourier Analysis"; MA 493, Special Topics "Population Genetics"; MA 541, Advanced Calculus II; MA 586, Mathematical Statistics; MA 592, Special Topics "Fourier Analysis"; MA 695, Special Topics "Mathematical Information Theory Seminar"; MA 696, Probability and Mathematical Physics Seminar;

2015 Fall: EGR 265, Math Tools for Engr Prob Solving; MA 484, Mathematical Finance; MA 492, Special Topics "Topology, Geometry and Physics Applications"; MA 584, Mathematical Finance;

Postdoctoral mentees

- Brigitta Vermesi, 2006-08. Two papers: "Some Observations for Mean-Field Spin Glass Models," published Letters in Mathematical Physics, " About thinning invariant partition structures," published in Journal of Statistical Physics, which is also joint with Ang Wei.
- Ang Wei, 2010-12. One paper: " About thinning invariant partition structures," published in Journal of Statistical Physics, which is also joint with Brigitta Vermesi.
- Andrew Ledoan, 2007-2009. One paper: "A Universality Property of Gaussian Analytic Functions," published in Journal of Theoretical Probability. The full list of coauthors is Marco Merkli, Andrew Ledoan, and me.
- Stephen Ng, 2011-12. One paper: "Dual bases for the graphical representation of $\mathcal{U}_q(\mathfrak{sl}_2)$." In preparation.

Journal Articles

1. (with Oscar Bolina, Pierluigi Contucci and Bruno Nachtergaele) Finite-volume excitations of the 111 interface in the quantum XXZ model. *Comm. Math. Phys.* **212** (2000) 63–91. http://arxiv.org/abs/math-ph/9908018
2. (with O. Bolina, P. Contucci and B. Nachtergaele) A continuum approximation for the excitations of the $(1, 1, \ldots, 1)$ interface in the quantum Heisenberg model. *Electron. J. Diff. Eq.* **4** (2000) 1–10. http://arxiv.org/abs/math-ph/9909018
3. (with B. Nachtergaele) Droplet states in the XXZ Heisenberg chain. *Comm. Math. Phys.* **216** (2001) 569–607. http://arxiv.org/abs/math-ph/0009002
4. (with B. Nachtergaele and Tohru Koma) The spectral gap for the ferromagnetic spin-J XXZ chain. *Adv. Theor. Math. Phys.* **5** (2001) 1047–1090. http://arxiv.org/abs/math-ph/0110017
5. (with Wolfgang Spitzer) Improved bounds on the spectral gap above frustration free ground states of quantum spin chains. *Lett. Math. Phys.* **63** (2003) 251–270. http://arxiv.org/abs/math-ph/0212029
6. (with Michael Aizenman and Robert Sims) An extended variational principle for the SK spin-glass model. *Phys. Rev. B* **68** (2003) 214403. http://arxiv.org/abs/cond-mat/0306386
7. (with B. Nachtergaele and W. Spitzer) Ferromagnetic ordering of energy levels. *J. Statist. Phys.* **116** (2004) 719–738. http://arxiv.org/abs/math-ph/0308006

8. (with B. Nachtergaele) A ferromagnetic Lieb-Mattis theorem. *Phys. Rev. Lett.* **94** (2005) 057206. http://arxiv.org/abs/math-ph/0408020

9. (with Eugene Kritchevski) The extended variational principle for mean-field, classical spin systems. *Rev. Math. Phys.* **17** (2005) 1209–1239. http://arxiv.org/abs/math-ph/0505001

10. (with B. Nachtergaele and W. Spitzer) Droplet excitations for the spin-1/2 XXZ chain with kink boundary conditions. *Ann. Henri Poincaré* **8** (2007) 165–201. http://arxiv.org/abs/math-ph/0508049

11. (with Marek Biskup and Lincoln Chayes) Quantum spin systems at positive temperature. *Commun. Math. Phys.* **69** (2007) 611–657. http://arxiv.org/abs/math-ph/0509017

12. (with Cristian Giardiná) Variational bounds for the Generalized Random Energy Model. *J. Statist. Phys.* **127** (2007) 1–20. http://arxiv.org/abs/math-ph/0601068

13. (with Brigitta Vermesi) Some observations for mean-field spin glass models. *Lett. Math. Phys.* **83** (2008) 281–303. http://arxiv.org/abs/0707.0031

14. (with Jaideep Mulherkar, B. Nachtergaele and R. Sims) Isolated eigenvalues of the ferromagnetic spin-J XXZ chain with kink boundary conditions. *J. Stat. Mech.* P01016 (2008). http://front.math.ucdavis.edu/0709.1733

15. (with Marco Merkli) A resonance theory for open quantum systems with time-dependent dynamics. *J. Statist. Phys.* **134** (2009) 871–898. http://arxiv.org/abs/0810.3540

16. (with P. Contucci) Thermodynamic Limit for Spin Glasses. Beyond the Annealed Bound. *J. Statist. Phys.* **135** (2009) 1159–1166. http://arxiv.org/abs/0809.4229

17. Thermodynamic Limit for the Mallows Model on S_n. *J. Math. Phys.* **50** (2009) 095208. http://arxiv.org/abs/0904.0696

18. (with B. Nachtergaele, Benjamin Schlein, R. Sims and Valentin Zagrebnov) On the existence of the dynamics for anharmonic quantum oscillator systems. *Rev. Math. Phys.* **22** (2010) 207–231. http://arxiv.org/abs/0909.2249

19. (with Matt Conomos) Asymptotics of the spectral gap for the interchange process on large hypercubes. *J. Statist. Mech.* **2011** P10018. http://arxiv.org/abs/0802.1368

20. (with Andrew Ledoan and M. Merkli) A universality property of Gaussian analytic functions. *J. Theoret. Probab.* **25** (2012) 496–504. http://arxiv.org/abs/1003.1951

21. (with B Nachtergaele and Stephen Ng) Ferromagnetic Ordering of Energy Levels for $U_q(\mathfrak{sl}_2)$ symmetric spin chains. *Lett. Math. Phys.* **100** (2012) 327–356. http://arxiv.org/abs/1105.5264

22. (with W. Spitzer and Lam Tran) Counterexamples to Ferromagnetic Ordering of Energy Levels. *J. Math. Phys.* **53** (2012) 043302 (22 pages). http://arxiv.org/abs/1107.1266

23. (with B. Vermesi and Ang Wei) About thinning invariant partition structures. *J. Statist. Phys.* **148** (2012), 325–344. http://arxiv.org/abs/1106.0267

24. (with Carl Mueller) The length of the longest increasing subsequence of a random Mallows permutation. *J. Theoret. Probab.* (2013) **26**, no. 2, 514–540. http://arxiv.org/abs/1102.3402

25. (with P. Contucci and Emanuele Mingione) Factorization Properties in d-Dimensional Spin Glasses. Rigorous Results and Some Perspectives. *J. Statis. Phys.* (2013) **151**, no. 5, 809–829. http://arxiv.org/abs/1212.5281

26. (with P. Contucci, Sander Dommers and C. Giardiná) Antiferromagnetic Potts model on the Erdos-Renyi random graph. *Commun. Math. Phys.* (2013) **323**, no. 2, 517–554. http://arxiv.org/abs/1106.4714

27. (with M. Walters) A Note on Mixed Matrix Moments for the Complex Ginibre Ensemble. *J. Math. Phys.* (2015) **56**, 013301. http://arxiv.org/abs/1409.4494

28. (with Michael Froehlich and Paul Jung) As Target Frequency Analysis of functional MRI Data. *Int. J. Clin. Biostat. Biom.* (2015) 1:007.

Refereed Proceedings Articles

1. (with B. Nachtergaele and W. Spitzer) On the dynamics of interfaces in the ferromagnetic XXZ chain under weak perturbations. In Y. Karpeshina, G. Stolz, R. Weikard, and Y. Zeng (Eds), *Advances in Differential Equations and Mathematical Physics, Contemporary Mathematics, vol. 327*, American Mathematical Society (2003) pp. 251–270. http://arxiv.org/abs/math-ph/0210017

2. (with B. Nachtergaele) Ordering of energy levels in Heisenberg models and applications. In Joachim Asch and Alain Joye (Eds.), *Mathematical Physics of Quantum Mechanics: Selected and Refereed Lectures from QMath9, Lecture Notes in Physics, Vol. 690.* Springer-Verlag, 2006. http://arxiv.org/abs/math-ph/0503056

3. (with M. Aizenman and R. Sims) Mean-Field Spin Glass models from the CavityROSt Perspective. In J. C. Mourao, J. P. Nunes, R. Picken and J.-C. Zambrini (Eds), *Prospects in Mathematical Physics, Contemporary Mathematics vol. 437*, American Mathematical Society (2007) pp. 1–30. http://arxiv.org/abs/math-ph/0607060

4. Universality of Correlations for Random Analytic Functions. In R. Sims and D. Ueltschi (Eds), *Entropy and the Quantum II, Contemporary Mathematics vol. 552*, American Mathematical Society (2011) pp. 135–144. http://arxiv.org/abs/1107.4135

Preprints

1. (with S. Ng and Nicholas Crawford.) Emptiness Formation Probability. Accepted for publication at *Commun. Math. Phys*. http://arxiv.org/abs/1410.3928
2. (with M. Walters.) Phase Uniqueness for the Mallows Measure on Permutations. Conditionally accepted to *J. Math. Phys.* (under revision) http://arxiv.org/abs/1502.03727
3. (with B. Nachtergaele and W. Spitzer.) Asymptotic Ferromagnetic Ordering of Energy Levels for the Heisenberg Model on Large Boxes. Submitted to the arXiv. http://arxiv.org/abs/1509.00907

Service to the Mathematics Department and University at UAB

- 2012-3: Mentored Fasttrack Student, Mallick Hossein.
- 2012-3: Assisted Graduate Program Director Gunter Stolz to plan some new courses in Mathematical Finance and Advanced Statistics (with other faculty members Paul Jung and Kolya Chernov).
- 2012-3: Co-organized the Probability-Math-Physics seminar.
- 2013-4: Organized Department Colloquium.
- 2013-4: Represented Mathematics Department at Fall 2013 Commencement.
- 2013-4: Mentored Fasttrack Student, Sahil Patel.
- 2013-4: Mentored Bridge Student, Brandon Johnson.
- 2013-4: Served on Hiring Committee (as did the entire mathematics department).
- 2013-4: Worked on a joint project culminating (so far) in a joint Faculty Development Grant application with Michael Kightley, Department of English at UAB. (Kightley left UAB, so the grant was not awarded.)
- 2014-5: Worked on a joint project with Paul Jung and Michael Froelich, culminating in a joint paper, submitted for publication.
- 2015-6: Co-organized the Probability-Math-Physics seminar.
- 2015: Mentored Fasttrack Student, Garrett Higginbotham.
- 2015: Currently meeting with Allan Dobbins and a group of other faculty exploring a Biology and Computing interdisciplinary grant application.