

Curriculum Vitae

SARA C. BILLEY

October 7, 2011

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Department of Mathematics
University of Washington
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Seattle, WA 98195-4350

Citizenship: United States

Research interests:

Algebraic combinatorics, Lie theory and computational algebraic geometry: Affine Grassmannians, Schubert varieties, Schubert polynomials, flag manifolds, symmetric functions, root systems, diagonal harmonics, computer aided combinatorics, complexity theory.

Education:

University of California, San Diego, Ph.D., Mathematics, June, 1994.

University of California, San Diego, M.A., Mathematics, September 1991.

Massachusetts Institute of Technology, B.S., Mathematics, June 1990.

Academic positions:

UNIVERSITY OF WASHINGTON
September 2009-present
Professor of Mathematics. Seattle, WA

UNIVERSITY OF WASHINGTON
September 2003-August 2009
Associate Professor of Mathematics. Seattle, WA

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
1998-2003
Assistant/Associate Professor of Applied Mathematics. Cambridge, MA

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
January 1994-1998 Cambridge, MA

Applied Mathematics Instructor and NSF Postdoctoral Fellow under the mentorship of Richard Stanley. (on leave 1995)

UNIVERSITY OF CALIFORNIA San Diego, CA
January 1995-December 1995
Presidential Postdoctoral Fellow under the mentorship of Nolan Wallach.

Grants and awards:

National Science Foundation Grant awarded June 2011-2016.

Top Cited Author Award for an article published in *Advances in Applied Math* 2005-2010. Awarded August 2010.

National Science Foundation Grant awarded April 2009-2011.

Department of Mathematics Faculty Fellowship 2007-2009.

Royalty Research Grant awarded 2006.

Advance Grant awarded in 2004.

Class of 1922 Career Development Professorship awarded June 2001-2003.

Presidential Early Career Award for Scientists and Engineers (PECASE) awarded October 2000-2006.

National Science Foundation Career Grant awarded April 2000.

National Science Foundation Postdoctoral Fellowship in Mathematics 1994-1998.

University of California, Presidential Postdoctoral Fellowship, 1995-1997.

National Physical Science Consortium fellow 1990-1994 (first graduate).

List of research publications:

1. *Some Combinatorial Properties of Schubert Polynomials* (with W. Jockusch and R. Stanley) *J. of Algebraic Comb.* **(2) 4** (1993).
2. *RC-Graphs and Schubert polynomials.* (with N. Bergeron) *Experimental Mathematics*, Vol.2 (1993), No. 4.
3. *An Abstract Definition of Schubert Polynomials.* University of California, San Diego, Ph.D. thesis 1994.
4. *Schubert polynomials for the classical groups.* (with M. Haiman) *J. of the AMS*, Vol.8, Num. 2, April 1995.
5. *Kostant polynomials and the cohomology ring for G/B ,* announcement. *Proc. Natl. Acad. Sci. USA*, Vol.94, pp. 29–32, January 1997.

6. *Kostant polynomials and the cohomology ring for G/B* . Duke Math. J., Vol. 96, No. 1, pp. 205-224, 1999.
7. *Transition Equations for Isotropic Flag Manifolds*. Discrete Math., Special Issue devoted to the Conference in Taormina, Sicily, in honor of Adriano Garsia, vol. 193 (1998) pp. 69–84.
8. *Vexillary elements of the hyperoctahedral group* (with Tao Kai Lam). J. of Algebraic Combinatorics, v.8 (1998) pp. 139-152.
9. *Pattern avoidance and rational smoothness of Schubert varieties*. Advances in Math, vol. 139 (1998) pp. 141–156.
10. *The parabolic map* (with C. K. Fan and J. Losonczy) J. of Algebra, vol. 214 (1999).
11. *On the Singular Locus of a Schubert Variety* (with V. Lakshmibai). Journal of the Ramanujan Mathematical Society, 15 (2000), no. 3, 155–223.
12. *Kazhdan-Lusztig Polynomials for 321-hexagon-avoiding permutations*, (with Gregory Warrington). J. of Algebraic Combinatorics, (2001) v.13, pp. 111-136.
13. *Maximal Singular Loci of Schubert Varieties in SL_n/B* (with Gregory Warrington). Trans. AMS. v. 355 (2003) pp. 3915–3945.
14. *Lower bounds for Kazhdan-Lusztig polynomials from patterns* (with Tom Braden). Transform. Groups 8 (2003), no. 4, 321–332.
15. *A vector partition function for the multiplicities of $sl_k(C)$* (with Victor Guillemin and Etienne Rassart). Journal of Algebra 278 (2004), no. 1, 251–293.
16. *Smoothness of Schubert varieties via patterns in root subsystems* (with Alexander Postnikov). Advances in Applied Mathematics Volume 34, Issue 3 , April 2005, Pages 447-466.
17. *Intersections of Schubert varieties and other permutation array schemes* (with Ravi Vakil). IMA Volumes in Mathematics and its Applications Volume 146: Algorithms in Algebraic Geometry, 2007, pages 21–54.
18. *Flag arrangements and triangulations of products of simplices* (with Federico Ardila). Advances in Mathematics, Volume 214, Issue 2, 1 October 2007, Pages 495-524.
19. *Embedded factor patterns for Deodhar elements in Kazhdan-Lusztig theory* (with Brant Jones). Special Issue of Annals of Combinatorics dedicated to Permutation Patterns. v. 11 (2007) pp. 285-333.
20. *Affine partitions and affine Grassmannians* with Stephen Mitchell. Electronic Journal of Combinatorics, Special Issue in honor of Anders Bjorner’s 60th Birthday, R18, Volume 16(2), 2009.

21. *An appendix to: Permutations with Kazhdan-Lusztig polynomial $P_{id,w}(q) = 1 + q^h$* with Jonathan Weed and included in the article by Alexander Woo. The Electronic Journal of Combinatorics Volume 16(2), 2009. Published May 12, 2009.
22. *Smoothness and palindromic Schubert varieties in Affine Grassmannians* with Stephen Mitchell. Journal of Algebraic Combinatorics (2010) 31:169-216.
23. *A pattern characterization of rationally smooth affine Schubert varieties of type A*, joint with Andrew Crites. Preprint on Math ArXive: 1008.5370.
24. *Rational smoothness and affine Schubert varieties of type A*, joint with Andrew Crites. Abridged version of the paper above. Accepted for a talk at FPSAC 2011 in Reykjavik, Iceland. To appear in the FPSAC conference proceedings.
25. *Singularities of generalized Richardson varieties* joint with Izzet Coskun at the University of Illinois at Chicago. To appear in Communications in Algebra. Also on Math ArXive: 1008.2785.
26. *Affine dual equivalence and k -Schur positivity* joint with Sami Assaf, a postdoc at MIT. In preparation.
27. *Rigid structures and branched polymers* joint with Dave Anderson, an NSF postdoc here at UW. In preparation.

List of book publications:

1. *Singular Loci of Schubert Varieties*. (with V. Lakshmibai) Progress in Mathematics, Birkhauser Boston, v. 182, 2000.

Sequences added to Sloane's On-Line Encyclopedia of Integer Sequences:

A058094, A061539, A061710, A180635

Invited addresses:

Invited speaker for special session "Geometry and Combinatorics in Flag Manifolds and Beyond for the AWM 40-year anniversary conference. September 17-18, 2011 at Brown University.

Plenary Speaker for CanaDAM 2011, June 1-4, Victoria.

Institute for Defense Analysis, San Diego. Talk. December 2010

Winter CMS Meeting invited speaker in special session on "Discrete Mathematics." Vancouver 4-6 December 2010.

University of Kentucky, invited speaker at "Combinatorics 2010: Advances, Trends and Speculations" March 26, 2010.

AIM invited speaker at the "Equivariant cohomology and Localization" Workshop 3-15-2010 -3-19-2010.

University of Kansas, Combinatorics Seminar, January 2010.

UW Algebra Seminar June 3, 2009.

MIT, Combinatorics Seminar May 6, 2009.

MSRI January 2009.

University of California, Santa Barbara colloquium, May 2008.

AMS Special Session on "Applications of Computer Algebra in Enumerative and Algebraic Combinatorics" in San Diego at joint meetings, January, 2008.

AMS Special Session on "Invariants of Lie Group Actions and Their Quotients" at Rutgers, October 2007.

University of North Carolina, two talks Colloquium and Lie Theory Seminar, September 2007.

IMA workshop entitled "What is Algebraic Geometry" in Minneapolis on April 13-14, 2007

University of Michigan, Combinatorics Seminar, February 2007.

Lusztig's 60th Birthday Conference held in Cambridge, MA, June 2006.

AMS-IMS-SIAM Joint Summer Research Conference on "Integer points in Polyhedra. Geometry, Number Theory, Representation Theory, Algebra, Optimization, Statistics" June 11-15, 2006 in Snowbird, Utah.

Summer Institute in Algebraic Geometry held at the University of Washington, August, 2005.

Formal Power Series and Algebraic Combinatorics (FPSAC), subsection devoted to Adriano Garsia June 2005.

University of British Columbia, Colloquium, March 2005.

University of California, Berkeley Colloquium, February 2005.

University of California, Davis, Combinatorics Seminar, November 2004.

Fall Western Section Meeting, Albuquerque, NM, October 2004.

Richard Stanley's 60th Birthday Conference, June 2004.

Formal Power Series and Algebraic Combinatorics (FPSAC) June 2004.

Summer Institute in Mathematics at UW July 2003-2006..

Mathday at University of Washington, March 2003, 2004, 2005.

Current Problems Seminar, University of Washington, October 2003, 2005.

Western Algebraic Geometry Seminar (WAGS), Bellingham, WA, November 2002.

AMS, Meeting in San Diego, January 2002, Special Session on The Theory and Applications of Symmetric Functions,

Northeastern Seminar December 2001

University of Wisconsin, (two talks) Colloquium and Lie Theory seminars, November 2001.

University of Michigan, Combinatorics Seminar October 2001.

Valley Discrete Math Day, October 2001.

Cornell University, September 2001.

Brandeis University, Fellowship of the ring, May 2001.

Massachusetts Institute of Technology, combinatorics seminar April 2001.

AMS, Central Section Meeting in Toronto, Canada on "Modern Schubert Calculus", September 22-24, 2000.

Classical Combinatorics: In Honor of Dominique Foata's 65th birthday, at Temple University, Philadelphia, July 7-9, 2000.

Combinatorics Seminar at UCSD, February 22, 2000.

University of Pennsylvania, Mathematics Colloquium, October 13, 1999.

Moore Instructor's Conference at MIT, October 9, 1999.

City University of Hong Kong, Combinatorics Seminar June 2, 1999.

Tamkang University, Tamsui, Taiwan. Combinatorics Seminar May 27, 1999.

Princeton University, Representation Theory and Combinatorics seminar. April 15, 1999.

AMS special session on Geometry and Lie Groups, Tucson Arizona, November 13-15, 1998

Conference on Algebraic Combinatorics and Applications, Oakland University, Rochester, Michigan. May 1-3, 1998

AMS special session on Algebraic Combinatorics, Louisville Kentucky, March 20 - 21, 1998

George Washington University combinatorics seminar, July 1997.

Oberwolfach session on Schubert Varieties, April 1997.

AMS special session on Algebraic Combinatorics, San Diego, January 1997.

MSRI during the Posets and Enumerative Combinatorics Workshop, October 1996.

Massachusetts Institute of Technology, combinatorics seminar October 1996.
Massachusetts Institute of Technology, combinatorics seminar May 1996.
Thurnau Germany, Summer School on Degeneracy Loci and Schubert Varieties, June 1995.
California Institute of Technology, combinatorics seminar April 1995.
University of California San Diego, combinatorics seminar April 1995.
Smith College Regional Conference, December 1994.
Massachusetts Institute of Technology, combinatorics seminar November 1994.
Northeastern University, September 1994.
Conference in Honor of Adriano Garsia, Taormina, Sicily, July 1994.
University of Chicago, algebraic geometry seminar May 1994.
S.I.A.M. minisymposium on Algebraic Combinatorics, Philadelphia, July 1993.
Smith College Regional Conference, December 1992.

Workshops Organized:

ICERM = INSTITUTE FOR COMPUTATIONAL AND EXPERIMENTAL RESEARCH
IN MATHEMATICS

Co-organizing a semester entitled "Automorphic forms, combinatorial representation theory, and multiple Dirichlet series" with Dan Bump, Ben Brubaker, Gautam Chinta, Dorian Goldfeld, Solomon Friedberg, Jeff Hoffstein, Anne Schilling, and Nicolas Thiery. Spring 2013.

BANFF INTERNATIONAL RESEARCH STATION

Co-organized a workshop entitled "Quasisymmetric Functions" with Lou Billera and Richard Stanley in November 2010.

FORMAL POWER SERIES AND ALGEBRAIC COMBINATORICS (FPSAC)

Program committee co-chair along with Victor Reiner for FPSAC 2010.

AMS 2008 FALL WESTERN SECTION MEETING

Co-organizing a session entitled "Combinatorial Representation Theory" Vancouver, CA, October 2008 with Stephanie van Willigenburg and Alexander Kleshchev.

AMS WESTERN SECTION MEETING

Co-organized a session entitled "Algebraic Combinatorics and Geometry," Eugene Oregon, Nov. 2005 with Mark Haiman.

BANFF INTERNATIONAL RESEARCH STATION

Co-organized a workshop entitled "Recent advances in algebraic combinatorics" with Ian Goulden, Curtis Greene, David Jackson, Richard Stanley in May 2003.

Other professional activities:

CENTER FOR COMMUNICATIONS RESEARCH, SAN DIEGO
Consulting/Advisory board member, 2011-present.

ADVANCES IN MATHEMATICS
Editor, 2004-present.

JOURNAL OF COMBINATORICS
Editor, 2010-present.

AMERICAN MATHEMATICAL SOCIETY
Member at Large on the Council, 2005-2008.

COMBINATORICS SEMINAR ORGANIZER
At MIT from 1996-2002. At UW from 2003-present with Isabella Novik.

UW/PACIFIC SCIENCE CENTER ADVISORY FACULTY TEAM March 2005-present.

INDO-U.S. FRONTIERS OF SCIENCE SYMPOSIUM Sponsored by the National
Academy of Science, held January 9-11 in Bangalore India.

FORMAL POWER SERIES AND ALGEBRAIC COMBINATORICS
Program committee member, 1998, 2001, 2005.

NATIONAL SCIENCE FOUNDATION
Reviewer and panel member 2000,2002,2003,2007, 2009, 2010.

NATIONAL PHYSICAL SCIENCE CONSORTIUM January, 2002-present
Mentor.

CENTER FOR COMMUNICATIONS RESEARCH Summers 1994 and 1996.
Research consultant during SCAMP.

IBM - CAMBRIDGE RESEARCH CENTER Summers of 90 and 91.
Programming for a statistical software package.

Thesis students:

Gregory Warrington (Harvard University), Ph.D 2001.

Thao Tran (MIT), Master's degree 2003.

Etienne Rassart (MIT), Ph.D completed March, 2004.

Brant Jones (University of Washington), Ph.D. May 2007.

Beth Kelly (University of Washington), Ph.D. August 2007.

Kurt Luoto (University of Washington), Ph.D June 2009.

Andrew Crites (University of Washington), Ph.D expected June 2011.

Brendan Pawlowski (University of Washington), Ph.D expected June 2013.

Austin Roberts (University of Washington), Ph.D expected June 2014.

Ruth David (University of Washington), Undergraduate thesis December 2008.

Henry Kvinge (University of Washington), Undergraduate thesis March 2010.

Undergraduate research students:

Lee Spires, Natalie Hobson, Kun Ling (2011) Adam Mosher (2010), Eva Fornaeus, Alexander Leaf, Hannah Manuel, John Pardo, and Zhen Wei (REU 2010) Henry Kvinge (2009-2010), Ruth Davidson (2008-2009), Chris Fox and Morgan Eichwald (2009), Jonathan Weed (2008), Kristen Boreman and Catherine Porter (2007), Tom Boothby, Sean Howe and Emily Kirkman, (2007) Richard Kelley (2005), Abinav Kumar (2001), Sarah Kolitz (2001), Dug Eichelberger (2001), Mike Walsh(2000), Edward Early (1999), Ephrem Paredes (1998), Anna Khasin (1997), Jessica Maia (1997), Jorge Rodriguez (1997), Jan Skotheim (1997), Lynn Mirales (1996), Matthew Berman (1996), Gillian Bidgood (1996), Anna Khasin (1996).

Postdoctoral Advisees:

Federico Ardila (2005), David Anderson (2009-present).

Ph.D Thesis Advisors: Mark Haiman and Adriano Garsia