

Gregory S. Warrington

CURRICULUM VITAE

February 27, 2025

Department of Mathematics & Statistics
Innovation Hall, E444
University of Vermont
82 University Place
Burlington, VT 05405

802.656.2195
gregory.warrington@uvm.edu
<https://gswarrin.w3.uvm.edu/>

EMPLOYMENT

Professor, University of Vermont	2020 – Present (on leave AY25–26; on sabbatical AY23–24)
Associate Chair, Department of Mathematics & Statistics	Fall 2014 – Spring 2021 (on sabbatical AY16–17)
Associate Professor, University of Vermont	2014 – 2020
Assistant Professor, University of Vermont	2009 – 2014
Assistant Professor, Wake Forest University	2004 – 2008
NSF Postdoctoral Fellow	
Wake Forest University	2006 – 2007
University of Pennsylvania	2003 – 2004
Visiting Assistant Professor, University of Massachusetts, Amherst	2001 – 2003

EDUCATION

Harvard University: Ph.D. in Mathematics	1996 – 2001
Advisor — Sara Billey, MIT	
Thesis — <i>Kazhdan-Lusztig polynomials, pattern avoidance and singular loci of Schubert varieties</i>	
Princeton University: B.A. in Mathematics, magna cum laude	1991 – 1995

GRANTS & FELLOWSHIPS

Simons Foundation Collaboration Grant	2017 – 2022
Title — <i>Rational Catalan Combinatorics and Quasisymmetric Functions</i>	
Award # 429570	
National Science Foundation Standard Grant	2012 – 2016
Title — <i>Combinatorial polynomials arising from representations</i>	
Award # DMS-1201312	
Simons Foundation Collaboration Grant	2011 – 2012
Title — <i>Combinatorial polynomials arising from representations</i>	
Award # 197419 (years 2–5 declined; predominantly travel support)	
NSA Young Investigators Grant	2008 – 2010
Title — <i>Combinatorics of diagonal harmonics and Kazhdan-Lusztig polynomials</i>	
Award # H98230-09-1-0023	
Wake Forest Sterge Faculty Fellowship	2006 – 2008
NSF Postdoctoral Fellowship	2003 – 2007
AMS Project NExT Fellowship	2002 – 2003

RESEARCH INTERESTS

Algebraic combinatorics

Symmetric and quasisymmetric functions, diagonal harmonics module, Kazhdan-Lusztig polynomials, Schubert varieties, combinatorics of Weyl groups

Redistricting and voting

Quantifying asymmetry in district plans, combinatorics of district plans, ranked-choice voting

Public health/opioid use

Modeling

REFEREED RESEARCH PUBLICATIONS

A rooted variant of Stanley's chromatic symmetric function

(with N. Loehr), *Discrete Mathematics*, 347 (3), (2024).

Simulated Packing and Cracking

(with J. Buzas), *Election Law Journal*, 20 (4) (Dec 2021).

All hands-on deck and all decks on hand:

Surmounting supply chain limitations during the COVID-19 pandemic

(with J.S. Warrington, J.W. Crothers, T. Hong, A. Goodwin, L. Coulombe, L. Bryan, V. Clark, L. Risley, C. Wojewoda, M. Fung, M. Lewis), *Academic Pathology*, 8 (2021).

Abacus histories and the combinatorics of creation operators

(with N. Loehr), *J. Comb. Theory Series A*, 177 (Jan 2021).

Urinary Buprenorphine, Norbuprenorphine and Naloxone Concentrations and Ratios: Review and Potential Clinical Implications.

(with Jill S. Warrington, Samuel Francis-Fath, John Brooklyn), *Journal of Addiction Medicine*, 14 (6) (Dec. 2020).

Contribution: Data analysis and visualization.

Use of urinary naloxone levels in a single provider practice: a case study

(with Jill S. Warrington, John Brooklyn, Samuel Francis-Fath), *Addiction Science & Clinical Practice*, 15 (3) (2020).

Contribution: Data analysis and visualization.

Accumulation charts for instant-runoff elections

(with B. E. Tenner), *Notices of the Amer. Math. Soc.*, 66 (11), (Dec., 2019) 1793–1799.

A comparison of partisan-gerrymandering measures

Election Law Journal 18 (3) (September 2019) 262–281.

Quasisymmetric and Schur expansions of cycle index polynomials

(with N. Loehr), *Discrete Mathematics* 342 (1) (January 2019) 113–127.

What are your patients using (and how do you know): Using clinical laboratory results to understand drug use patterns in a state-wide model

(with Jill S. Warrington), *poster presentation; 2018 PAINWeek Abstract Book Postgraduate Medicine* 130 (1) (2018) 1–91.

Contribution: Data analysis.

Quantifying gerrymandering using the vote distribution

Election Law Journal 17 (1) (March 2018) 39–57.

Predicting effects of future development on a territorial forest songbird: methodology matters

(with Michelle Brown, Therese M. Donovan, Ruth Mickey, W. Scott Schwenk, David Theobald),

Landscape Ecology 33 (1) (January 2018) 93–108.

Contribution: Fourth author, data analysis.

Orthogonal bases for transportation polytopes applied to Latin squares, magic squares and Sudoku boards

Linear Algebra and its Applications 531 (October 2017) 285–304.

Shape and pattern containment of separable permutations

(with A. Crites, G. Panova), *Ars Combinatoria CXXVIII* (July 2016) 103–116.

Rational parking functions and Catalan numbers

(with D. Armstrong, N. Loehr), *Annals of Combinatorics* 20 (1) (March 2016) 21–58.

Sweep maps: A continuous family of sorting algorithms

(with D. Armstrong, N. Loehr), *Advances in Mathematics* 284 (2015) 159–85.

Martin Gardner’s minimum no-three-in-a-line problem

(with A. Cooper, O. Pikhurko, J. Schmitt), *Amer. Math. Monthly* 121 (3) (2014) 213–221.

Evaluation of Choosing Wisely cervical cancer screening guidelines at a rural tertiary academic medical center: How are we doing?

(with S. Brownschidle, T. St. Johns, M. Fung, E. Everett, J. Warrington), *Journal of the American Society of Cytopathology* 3 (5) (Sept.-Oct. 2014) S74–S75.

Contribution: Fifth author; data analysis.

Transition matrices for symmetric and quasisymmetric

Hall-Littlewood polynomials

(with N. Loehr, L. Serrano), *J. Combinatorial Theory, Series A* 120 (8) (2013) 1996–2019.

On the existence of three-dimensional Room frames and Howell cubes

(with J. Dinitz, E. Lamken), *Discrete Mathematics* 313 (12) (2013) 1368–1384.

What to expect in a game of memory

(with D. Velleman), *American Mathematical Monthly* 120 (9) (2013) 787–805.

Estimating landscape carrying capacity through maximum clique analysis

(with T.M. Donovan, W.S. Schwenk, J.H. Dinitz), *Ecological Applications* 22 (8) (2012) 2265–2276.

Contribution: Second author; data analysis.

Quasisymmetric expansions of Schur-function plethysms

(with N. Loehr), *Proceedings of the American Mathematical Society* 140 (2012) 1159–1171.

Equivalence classes for the μ -coefficient of Kazhdan-Lusztig polynomials in S_n

Experimental Mathematics 20 (4) (2011) 457–466.

The spectra of certain classes of Room frames: the last cases

(with J. Dinitz), *Electronic J. of Combinatorics* 17 (1) (2010) Research Paper 74, 13 pp.

From quasisymmetric expansions to Schur expansions via a modified inverse Kostka matrix

(with E. Egge, N. Loehr), *European Journal of Combinatorics* 31 (8) (2010) 2014–2027.

A combinatorial version of Sylvester’s four-point problem

Advances in Applied Mathematics 45 (3) (2010) 390–394.

A continuous family of partition statistics equidistributed with length

(with N. Loehr), *Journal of Combinatorial Theory, Series A* 116 (2) (2009) 379–403.

Nested quantum Dyck paths and $\nabla(s_\lambda)$

(with N. Loehr), *International Math. Research Notices* (5) (2008) Art. ID: rnm157, 29pp.

Bitableau bases for Garsia-Haiman modules of hollow type

(with E. Allen, M. Marion), *J. Combinatorial Theory, Series A* 115 (7) (2008) 1127–1155.

**A human proof for a generalization of Shalosh B. Ekhad's
10ⁿ Lattice Paths Theorem**

(with N. Loehr, B. Sagan), *Ars Combinatoria* 89 (2008) 421–429.

Square q, t -lattice paths and $\nabla(p_n)$

(with N. Loehr), *Trans. of the American Mathematical Society* 359 (2) (2007) 649–669.

Juggling probabilities

American Mathematical Monthly 112 (2) (2005) 105–118.

The combinatorics of a three-line circulant determinant

(With N. Loehr, H. Wilf), *Israel Journal of Mathematics* 143 (2004) 141–156.

Counterexamples to the 0-1 Conjecture

(With T. McLarnan), *Representation Theory* 7 (2003) 181–195.

A formula for inverse Kazhdan-Lusztig polynomials in S_n

Journal of Combinatorial Theory, Series A 104 (2) (2003) 301–316.

Maximal singular loci of Schubert varieties in $SL(n)/B$

(With S. Billey), *Trans. of the American Mathematical Society* 355 (10) (2003) 3915–3945.

Kazhdan-Lusztig polynomials for 321-hexagon-avoiding permutations

(With S. Billey), *Journal of Algebraic Combinatorics* 13 (2001) 111–136.

ADDITIONAL CONTRIBUTIONS

Skeletal generalizations of Dyck paths, parking functions, and chip-firing games

(with S. Backman, C. Charbonneau, N.A. Loehr, P. Mullins, M. O'Connor)

<https://www.arxiv.org/abs/2408.06923>

SymmetryCat symmetry classifier (beta)

<https://symmetrycat.org/>

Interactive viewer for Accumulation Charts

<https://gswarrin.w3.uvm.edu/accumulation-chart/accumulation-chart.html>

Packed voters and cracked voters

<https://arxiv.org/abs/1806.11074>

**Gerrymandering and the net number of US House seats won
due to vote-distribution asymmetries**

(with J. Buzas), <https://arxiv.org/abs/1707.08681>

Optimized random chemistry

(with J. Buzas), <http://arxiv.org/abs/1302.2895>

Cyballs: Cyborg juggling balls

<http://www.cems.uvm.edu/~gswarrin/cyballs/index.html>

KLC: Computer code and database for Kazhdan-Lusztig polynomials

<http://www.cems.uvm.edu/~gswarrin/research/klc/klc.html>

A photographic assignment for abstract algebra

PRIMUS 19 (6) (2009) 561–564.

Peer reviewed paper on pedagogy.

Juggling performers + Math = ?

Math Horizons 15 (3) (Feb. 2008) 18–20.

Invited, non-research contribution; not peer reviewed.

GERRYMANDERING RESEARCH: IMPACT & COVERAGE

The declination metric for gerrymandering has appeared in the following federal cases:

Plaintiff's Motion for Temporary Injunction*Derrick Graham et al. v. Michael Adams et al., 2021 (Kentucky).***Complaint***League of Women Voters of Ohio v. Ohio Redistricting Commission, 2021.***Expert witness testimony***Householder v. Ohio A. Philip Randolph Institute, 373 F. Supp. 3d 978 (S.D. Ohio 2019).*

I was interviewed about my work on WCAX on March 22, 2018.

TEACHING

Linear algebra	20{13,14,23,24}
Development of Mathematics	20{20,21,22,23,25}
Topics in combinatorics	20{06,08,10,12,13,16,21}
Groups & Rings	20{07,08,11,12,18,20,21,22,24}
First-semester combinatorics	20{09,10,17,21,22}
Discrete Structures (through Dept. of Computer Science)	2019
Junior-senior seminar	2018
Third-semester calculus	20{07,10,11,18}
Representation theory of the symmetric group (Independent study)	2015
Differential geometry	2015
Graph theory	2005 & 2011 & 2014
Abstract algebra	2014
Masters seminar	2013
Algebraic graph theory (Independent study)	2010 & 2011
Combinatorial geometry (Independent study)	2011
Concrete mathematics (Independent study)	2010
The history and ethics of measurement (First-year seminar)	2006
Discrete mathematics	2003 & 2005
Second-semester calculus	1999 – 2005
Fundamental concepts in mathematics	2002
First-semester calculus	1998 – 2002
Representation theory (Junior seminar)	2001

SERVICE

Department	
Graduate Program Director	Fall 2024 – Present
Promotion and Reappointment Comm. (chair)	Fall 2024
Tenure-track Search (chair)	Fall 2022 – Spring 2023
Promotion and Reappointment Comm. (chair)	Fall 2022
Reappointment Comm. (chair)	Fall 2022
Undergraduate Curriculum Comm. (chair)	Fall 2022 – Spring 2023
Graduate Comm.	Fall 2012 – Spring 2014, Fall 2021 – Spring 2022
Math & Stats Chair Search Committee	Spring 2021
GTA Committee (chair)	Spring 2021
Associate Chair	Fall 2017 – Spring 2021
Assessment Coordinator	Fall 2017 – Spring 2021
GIV Advisory Board	Spring 2015 – Spring 2021
Tenure-track Search (chair)	Fall 2018 – Spring 2019
Undergraduate Curriculum Comm. (chair)	Fall 2017 – Spring 2018
Undergraduate Curriculum Comm. (chair)	Fall 2015 – Spring 2016

Tenure-track Search	Fall 2015 – Spring 2016
Associate Chair	Fall 2014 – Spring 2016
Tenure-track Search (chair)	Fall 2014 – Spring 2015
Math Club Comm.	Fall 2011 – Spring 2014
Vision Comm. (chair)	Fall 2013
Peers & Aspirants Comm.	Fall 2013
Lecturer Reappointments	2012
Colloquium Comm.	Fall 2010 – Spring 2012
Undergraduate Curriculum Comm.	Fall 2010 – Spring 2012
Faculty Evaluation Guidelines Comm.	Fall 2009 – Spring 2010
Masters Oral Exam	Spring 2010 & 2012
College of Engineering & Mathematical Sciences	
College Curriculum Comm. (chair)	Fall 2022 – Spring 2023
Facilities Comm.	Fall 2010 – Spring 2016
Research talk to CEMS Board of Advisors	Spring 2012
University	
Professional Standards Committee	Fall 2204 – Present
Natural Sciences Gen Ed Ad Hoc Committee	Spring 2020
CEMS Dean Search Committee	Fall 2017 – Spring 2018
IBB Cost Pool Methodology Subcommittee	Fall 2013 – Spring 2014
Faculty Senator	Fall 2013 – Spring 2014
Juggling Club, Faculty Advisor	Fall 2009 – Spring 2014
Profession	
FPSAC 2024 reviewer	Fall 2023
Austrian Science Fund — grant reviewer	Spring 2022
Reviewer for Math Reviews	2004 – 2021
FPSAC 2017 (London, UK) Program Comm.	2016 – 2017
AMS-Simons Travel Grants Comm.	2014 – 2017
Book reviewer	2015 & 2019
NSF Panelist (combinatorics)	2014
NSA Discrete Mathematics Panelist	Fall 2012 – Spring 2014
Minisymposium organizer: SIAM Discrete Mathematics	2004
Referee for	
Adv. in App. Math.	Exp. Math.
Adv. in Math.	FPSAC 20{02,17,20}
Alg. Comb.	J. of Alg.
Amer. Math. Monthly	J. of Alg. Comb.
Annals of Comb.	J. of App. Prob.
Austral. J. Comb.	J. of Comb.
Canad. J. Math.	J. of Comb. Theory, Ser. A
Comb. Theory	J. of Exp. Math.
Disc. App. Math.	J. of Int. Seq.
Disc. Math.	Math. Mag.
Elec. J. Comb.	Notices of AMS
Elec. Law J.	Proc. of the AMS
Enum. Comb. and App.	SIAM J. Disc. Math
Europ. J. Comb.	Trans. of the AMS
	NSA-AMS Grant Program

PH.D. DISSERTATION COMMITTEES

Calum Buchanan

2025

Jeremy Quail	2025
Damin Zhu	2023
Sophia Gonet	2021
Nadia Lafrenière (Univ. Québec, Montréal)	2019
Louis-Francois Preville-Ratelle (Univ. Québec, Montréal)	2012
Matt Welz	2009 – 2012
Paige Rinker (Dartmouth)	2011
Kirsten Stor	2010
Melanie Brown	2010

PH.D. ADVISING

Keith Sullivan	2022 – Present
Michael Drennan	2021 – 2025
Ada Morse (co-advisor)	2018

MASTERS THESIS COMMITTEES

Jo Martin	2020
Ben Emery	2019
Wendy Cole (Rubenstein School)	2013

UNDERGRADUATE & MASTERS THESES ADVISED

Hannah Warn (Undergraduate)	Anticipated
Jonathan Godbout (Masters)	Fall 2012 – Spring 2013
Alli Morse (Undergraduate)	Fall 2011 – Spring 2012

INVITED TALKS

Quantized rational chip firing CanaDAM (Ottawa, ON)	2025
Skeletal generalizations of Dyck paths, parking functions and chip-firing games AMS Special Session on Symmetric Functions and Applications (Albany, NY)	2024
Catch!: Exploring the art of juggling with math Math Encounters, Museum of Mathematics (New York, NY)	2023
Chromatic symmetric functions and rooted variations Combinatorics Seminar, Dartmouth College	2023
Combinatorics Seminar, Washington University (St. Louis)	2023
Does it matter how we quantify gerrymandering? Electoral Innovation Lab Seminar, Princeton University	2021
[Canceled due to pandemic] Algebraic Combinatorics workshop at KTH (Stockholm, Sweden)	2020
AMS Special Session on Rep. Theory and Alg. Geometry (Charlottesville, VA)	2020
AMS Special Session on The Mathematics of Redistricting (Charlottesville, VA)	2020
Creation operators for Hall-Littlewood polynomials Garsia Fest — Adriano Garsia 90th Birthday Conference (La Jolla, CA)	2019

Math and gerrymandering Binghamton University Combinatorics Seminar (Binghamton, NY)	2019
Quasisymmetric functions in algebraic combinatorics 30th Cumberland Conference (Huntington, WV)	2018
Mathematical analyses of gerrymandering Davidson College, Bernard Public Lecture	2017
What to expect in a game of memory Virginia Tech, Combinatorics Seminar	2017
Orthogonal bases for transportation polytopes University of Washington, Combinatorics Seminar	2017
Quasisymmetric expansions of cycle indices AMS Special Session on the Combinatorics of Symmetric Functions (Brunswick, ME) AMS Special Session on Plethysm and Kronecker Products (Athens, GA)	2016 2016
Combinatorics of the rational Catalan University of Notre Dame, Discrete Math Seminar	2016
Rational q, t-Schröder numbers York University, Applied Algebra Seminar	2015
Rational q-Catalan numbers and q-binomials AMS Special Session on Generalized Catalan Algebraic Comb. (Halifax, NS)	2014
Crosshatch permutations AMS Special Session on Geometric Applications of Alg. Comb. (Baltimore, MD)	2014
The sweep map CMS Special Session on Symmetric Functions and Generalizations (Ottawa, CA)	2013
Quasisymmetric expansions of Schur plethysms AMS Special Session on Symmetric Functions (Washington, DC)	2012
Quasisymmetric expansions Combinatorial algebra meets algebraic combinatorics (Montréal, Québec)	2012
On the μ-coefficients of Kazhdan-Lusztig polynomials University of Massachusetts, Amherst; Representation Theory Seminar AMS Special Session on Combinatorics of Coxeter Groups (Worcester, MA)	2012 2011
Quasisymmetric expansions of symmetric functions AMS Special Session on Combinatorial Representation Theory (Worcester, MA) LaCIM, Montréal, Québec MIT, Combinatorics Seminar	2011 2011 2010
On the shape of separable permutations AMS Special Session on Algebraic and Topological Combinatorics (South Bend, IN)	2010
Infinitely many new partition statistics AMS Special Session on the Combinatorics of Symmetric Functions (Minneapolis, MN) AMS Special Session on Algebraic Combinatorics (State College, PA)	2010 2009
Statistics in combinatorics MAA MathFest Invited Speaker	2009
A combinatorial version of Sylvester's four-point problem Dartmouth College, Combinatorics Seminar MAA MathFest Session on "Gems in Combinatorics"	2009 2009

Bitableau bases for Garsia-Haiman modules of hollow type	
AMS Special Session on Rings, Algebras and Varieties in Comb. (Raleigh, NC)	2009
Kazhdan-Lusztig polynomials of maximum possible degree	
AMS Special Session on Computational Methods in Lie Theory (Raleigh, NC)	2009
Combinatorial structures associated to the nabla operator	
Banff International Research Station (Banff, Alberta; Jim Haglund, proxy speaker)	2007
Combinatorial aspects of $\nabla(s_\lambda)$	
Centre de Recherches Mathématiques (CRM), (Montréal, Québec)	2007
Counterexamples to the 0-1 Conjecture	
Yale University, Algebra Seminar	2004
MIT, Combined Lie Groups/Combinatorics Seminar	2002
CRM, Conference on Computational Lie Theory	2002
Towards pictures of Kazhdan-Lusztig polynomials	
SUNY Albany, Discrete Math Day	2002
Properties of Betti numbers of Schubert varieties	
AMS Special Session on Algebraic Combinatorics (Ann Arbor, MI)	2002

CONTRIBUTED TALKS

Combinatorics of the rational Catalan	
UVM, Combinatorics Seminar	2019
Merry Deranging: Gerrymandering	
UVM Colloquium	2018
A combinatorial version of Sylvester's four-point problem	
Amherst College, Colloquium	2013
UVM, Applied Combinatorics Seminar	2009
A photography assignment for abstract algebra	
AMS-MAA Joint Meetings, MAA Session	2012
Standardizations of symmetric functions	
UVM, Combinatorics Seminar	2012
Separable permutations and Greene's Theorem	
UVM, Combinatorics Seminar	2011
Quasisymmetric expansions of symmetric functions	
Banff International Research Stations (Banff, Alberta)	2010
Quasisymmetric functions and the inverse Kostka matrix	
UVM, Combinatorics Seminar	2010
Catalan polynomials	
Middlebury College, Colloquium	2010
Infinitely many new partition statistics	
Discrete Mathematics of New England	2009
Points, planes and permutations	
Middlebury College, Colloquium	2009
Kazhdan-Lusztig polynomials of maximum possible degree	
UVM, Applied Combinatorics Seminar	2009

(0, 1, q)-Permutations

University of Pennsylvania, Combinatorics Seminar	2004
University of Washington, Combinatorics Seminar	2003

Ribbon tableaux and Kazhdan-Lusztig polynomials

University of Pennsylvania, Combinatorics Seminar	2004
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Counterexamples to the 0-1 Conjecture

Yale University, Algebra Seminar	2004
MIT, Combined Lie Groups/Combinatorics Seminar	2002
CRM, Conference on Computational Lie Theory	2002

An overview of Kazhdan-Lusztig polynomials

University of Pennsylvania, Combinatorics Seminar	2003
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Maximal singular loci of Schubert varieties in $SL(n)/B$

University of Massachusetts, Amherst; Representation Theory Seminar	2001
University of Michigan, Combinatorics Seminar	2000

Kazhdan-Lusztig polynomials and 321-hexagon-avoiding permutations

AMS Special Session in Honor of G.-C. Rota (Washington, DC)	2000
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“MATHEMATICS OF JUGGLING” TALKS**Juggling probabilities/Mathematical juggling in the 21st century**

SUNY Plattsburgh, Pi Mu Epsilon Induction Ceremony	2019
Governor’s Institute of Vermont	20{09,13,18,22}
Davidson College, Bernard Lecturer	2017
University of Notre Dame, Math for Everyone Series	2016
Moravian College, Student Research Conference	2015
MAA/NES Spring Meeting	2014
National Museum of Mathematics MOVES Conference	2013
UVM Honors College Seminar: Mathematics and the Arts	2013
Missisquoi Middle School students	2012
MATHCOUNTS	2012
North Carolina Governor’s School	2005 – 2007
James Madison University, SUMS Conference	2005
EDGE Program, Greensboro, NC	2005
University of Georgia, VIGRE Seminar	2005
University of North Carolina, Charlotte, Super Competition	2005
Appalachian State University, Colloquium	2004
Davidson College, Math Coffee	2004
Yale University, Colloquium	2004
St. Michael’s College, Colloquium	2003

Mathematics of juggling (* – with A. Knutson)

University of Massachusetts, Amherst, Colloquium*	2002
MIT Museum, Family Day	2001
Haverford College, Colloquium*	1999
MIT, Applied Mathematics Colloquium*	1999
The Math Circle, Boston, MA	1998
IAS/PCMI Representation Theory Summer Session*	1998

Juggling and Markov chains

Dartmouth College, Discrete Math Day	2002
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