

Steven Glenn Jackson

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CURRENT POSITION	Assistant Professor Department of Mathematics Boston, MA, USA	University of Massachusetts Fall 2003–present
EDUCATION	Ph.D., Mathematics Yale University, New Haven, CT, USA	May 2003
	M.Phil., Mathematics Yale University, New Haven, CT, USA	May 2001
	M.S., Mathematics Yale University, New Haven, CT, USA	May 2000
	B.S., Mathematics, with distinction Pennsylvania State University, University Park, PA, USA	August 1995
HONORS	Award for Outstanding Overall Achievement , UMB College of Science and Mathematics, 2006–2007.	
	Award for Outstanding Achievement in Research and Scholarship , UMB College of Science and Mathematics, 2004–2005.	
	Dolciani-Halloran National Project NExT Fellow , 2003–2004.	
	Visiting Scholar, National University of Singapore , January 2006.	
	Invited Participant, PMET working group , Park City, UT, July 2008.	
RESEARCH INTERESTS	Invariant theory, representation theory, combinatorics, commutative algebra, mathematics education.	
	Dissertation: Standard Monomial Theory for Reductive Dual Pairs . A construction of monomial bases for infinite-dimensional modules arising in the Howe correspondence analogous to “standard monomial” bases constructed by Lakshmibai and Seshadri for finite-dimensional modules.	
PUBLICATIONS	Prehomogeneous spaces associated with complex nilpotent orbits , with A. Noël, Journal of Algebra 289 (2005), pp. 515–557. A computation of isotypic decompositions and relative invariants of prehomogeneous spaces of Dynkin-Kostant type arising from conjugacy classes of nilpotent elements in complex reductive Lie algebras.	

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A LiE subroutine for computing prehomogeneous spaces associated with complex nilpotent orbits, with A. Noël, **Lecture Notes in Computer Science 3516 (2005)**, pp. 611–618. An algorithm for determination of highest weights in prehomogeneous spaces of Dynkin-Kostant type, implemented in the computer algebra system LiE.

A LiE subroutine for computing prehomogeneous spaces associated with real nilpotent orbits, with A. Noël, **Lecture Notes in Computer Science 3482 (2005)**, pp. 512–521. An algorithm for determination of highest weights in prehomogeneous spaces arising via the Kostant-Sekiguchi correspondence from nilpotent orbits in simple real Lie algebras of inner type.

Polarizable theta-stable parabolic subalgebras and $K_{\mathbb{C}}$ -saturation in the non-compact real forms of G_2 and F_4 , with A. Noël, **Lecture Notes in Computer Science 3992 (2006)**, pp. 422–429. Algorithms to find representatives of $K_{\mathbb{C}}$ -conjugacy classes of theta-stable parabolics and compute the $K_{\mathbb{C}}$ -saturation of their nilradicals.

Prehomogeneous spaces associated with real nilpotent orbits, with A. Noël, **Journal of Algebra 305 (2006)**, pp. 194–269. An extension of our calculation of isotypic decompositions and relative invariants to prehomogeneous spaces arising via the Kostant-Sekiguchi correspondence from nilpotent orbits in real reductive Lie algebras.

Prehomogeneous spaces associated with nilpotent orbits in simple real Lie algebras $E_{6(6)}$ and $E_{6(-26)}$ and their relative invariants, with A. Noël, **Experimental Mathematics 15 (2006)**, pp. 455–469. Determination of fundamental characters in exceptional symmetric pairs of non-inner type.

Toric degenerations of branching algebras, with Roger Howe, Eng-Chye Tan, Soo-Teck Lee, and Jeb Willenbring, **Advances in Mathematics 220 (2009)**, pp. 1809–1841. Flat degeneration of varieties associated with branching rules for symmetric pairs to affine toric varieties.

A new approach to computing generators for $\mathcal{U}(\mathfrak{g})^K$, with A. Noël, to appear in **Journal of Algebra**. An algorithm for computing generators for the centralizer of a maximal compact subgroup in the universal enveloping algebra of a reductive Lie algebra.

A short note on nilpotent orbits associated to Coxeter cells, with A. Noël, to appear in **ACM Communications in Computer Algebra**.

PAPERS SUBMITTED
FOR PUBLICATION

A geometric proof of the Newell-Littlewood rule. A proof that certain products of classical nullcones admit flat equivariant deformations to products of a single nullcone and an affine space, leading to a simple proof of the Newell-Littlewood rule governing the corresponding classical tensor product multiplicities.

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Nilpotent orbits associated to Coxeter cells, with A. Noël. An algorithm to identify irreducible representations of classical Weyl groups from their τ -signatures (i.e. the sets of parabolic subgroups admitting sign characters in the restriction). For cell representations (and hence for their special irreducible components) the τ -signature can be read off immediately from the W -graph; in particular, in the context of the *Atlas of Lie Groups and Representations* project this gives a simple algorithm for computing the associated variety of the annihilator of an irreducible Harish-Chandra module.

WORK IN
PROGRESS

Invariant theory of the enveloping algebra. A description of primary and secondary K -invariants in the enveloping algebra of a symmetric pair.

Orbit structure of Dynkin-Kostant spaces, with A. Noël. Full orbit decompositions and closure orderings for Dynkin-Kostant spaces arising from \mathbb{Z} -graded complex reductive Lie algebras.

Limited-depth Littlewood-Richardson cones and toric degeneration of the centralizer of a maximal compact in $SU(p, q)$, with Sangjib Kim. A study of the centralizer of a maximal compact subgroup in the universal enveloping algebra of $\mathfrak{su}(p, q)$, showing, in particular, that this algebra admits a SAGBI degeneration to the toric algebra associated with a polyhedral cone constructed in a straightforward manner from limited-depth Littlewood-Richardson cones, and utilizing a simplicial decomposition of the depth three LR cone to give explicit generators for $\mathcal{U}(\mathfrak{g})^K$ in the cases $\mathfrak{g} = \mathfrak{su}(p, 2)$ and $\mathfrak{su}(p, 3)$.

Conormality of nilpotent orbits in classical Lie Algebras, with Hervé Sabourin. Classification of nilpotent elements whose centralizers admit complementary subalgebras.

Conormality of nilpotent orbits in exceptional Lie Algebras, with Alfred Noël. Computer algebra project to find subalgebras complementary to the centralizers of nilpotent elements in exceptional algebras.

K -spherical flag varieties and multiplicity-free branching rules. An explicit determination of covariant algebras for certain affine spherical cones, leading to combinatorial (positive-sum) branching rules for the corresponding symmetric pairs.

A Macaulay2 package for computation of invariants of reductive group actions. An implementation of Derksen's algorithm for (infinite) reductive algebraic groups.

TALKS

Invariant theory: a gentle introduction via $\mathcal{U}(\mathfrak{g})^K$, New Mexico State University Mathematics Seminar, February 5, 2009.

A generating function for K -invariants in the universal enveloping algebra, MIT Lie Groups Seminar, May 7, 2008.

A Molien series for the centralizer of a maximal compact subgroup, Cornell Lie Groups Seminar, April 25, 2008.

Decomposing cell representations, Meeting of the Atlas of Lie Groups and Representations Project, College Park, MD, March 18, 2008.

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Computing generators for the centralizer of a maximal compact subgroup in the universal enveloping algebra, UMass Boston Mathematics Seminar Series, April 30, 2007.

Polarizable theta-stable parabolic subalgebras and K_C -stauration, International Conference on Computational Science, Reading, UK, May 30, 2006.

Prehomogeneous spaces associated with real nilpotent orbits and their relative invariants, AMS Special Session on Algebraic Groups, Durham, NH, April 23, 2006.

A LiE subroutine for computing prehomogeneous spaces associated with complex nilpotent orbits, International Conference on Computational Science, Workshop on Computer Algebra Systems and Applications, Atlanta, May 25, 2005.

Relative invariants of graded Lie algebras, Yale Algebra and Lie Groups Seminar, April 20, 2005.

Prehomogeneous spaces associated with complex nilpotent orbits, UMASS Boston Mathematics Seminar Series, October 4, 2004.

Coordinate systems and canonical forms, UMASS Boston College of Science and Mathematics Fall Faculty Reception, September 20, 2004.

Scalars, vectors and spinors: symmetry and representation theory in physics, Haitian Scientific Society, June 26, 2004.

Nullcone deformations and depth one tensor products, UMASS Boston Mathematics Seminar Series, April 26, 2004.

Gröbner bases and constructive representation theory, University of Southern Maine Mathematics Seminar, March 7, 2003.

SERVICE

MTEL Objective Review Committee, Massachusetts Department of Elementary and Secondary Education, fall 2007. Reviewed and set objectives for the new mathematics subtest of the Massachusetts Test for Educational Licensure (MTEL) General Curriculum Test, the primary qualifying examination taken by prospective elementary and secondary teachers in Massachusetts.

MTEL Item Review Committee, Massachusetts Department of Elementary and Secondary Education, spring 2008. Evaluated proposed MTEL test items for fairness, alignment to test objectives, and mathematical accuracy.

MTEL Marker Response Committee, Massachusetts Department of Elementary and Secondary Education, fall 2008. Selected sample responses to anchor the scoring system for the MTEL open-response section.

MTEL Qualifying Score Committee, Massachusetts Department of Elementary and Secondary Education, spring 2009.

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Massachusetts Curriculum Frameworks Review Committee, Massachusetts Department of Elementary and Secondary Education, spring 2008–present. Reviewed and revised the Massachusetts Curriculum Frameworks in Mathematics.

STEM Summit Panel on Cross-Disciplinary Cooperation in Mathematics Education, Massachusetts STEM Initiative, fall 2007. Panel discussion on communication and trust-building between mathematics educators and research mathematicians.

McNair Program Advisor, fall 2007–present. Supervised advanced reading and honors research of a Fellow of the Ronald McNair Post-Baccalaureate Achievement Program, which seeks to provide research opportunities for undergraduates from underrepresented groups.

Intel Mathematics Initiative Content Advisory Panel, spring 2008–spring 2009. Advised the Intel Foundation on curriculum development issues related to the Intel Mathematics Initiative.

Curriculum Committee, Department of Mathematics, AY 2004–2005 and 2007–2008. Reviewed textbooks and began preliminary planning for new course sequence *Calculus for Life and Environmental Sciences*.

Wrote final proposals for **six graduate courses** in connection with Graduate College of Education's M.Ed. in secondary mathematics program (spring 2005) and for an advanced undergraduate course in **General Topology** (spring 2008).

Personnel Committee, Department of Mathematics, AY 2005–2006, 2006–2007, and 2007–2008. Participated in annual faculty evaluations and a Periodic Multi-Year Review.

Recruitment Committee, Department of Mathematics. Chaired a successful national search for a faculty position (AY 2005–2006) and participated in searches for two staff positions (AY 2006–2007).

Faculty Senate, College of Science and Mathematics, AY 2005–2006, 2006–2007, and 2007–2008, and 2008–2009.

Moderated **Project NExT** session, MAA MathFest, Providence, RI, summer 2004.

Implemented **tutor training** program, UMB Mathematics Resource Center, fall 2004.

Organized student trips and coached student presentations for the **Hudson River Undergraduate Mathematics Conference**, spring 2006, spring 2007, and spring 2009.

Faculty advisor to the **Mathematics Club**, AY 2006–2007, 2007–2008, and 2008–2009. Helped organize and publicize club events and off-campus trips; helped raise travel funds for five students attending the **Joint Mathematics Meetings** in January 2007; assisted with budget requests and website implementation.

Graded **Writing Proficiency Exams**, 2003–2005.

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Assisted with implementation of **online placement tests**, AY 2005–2006.

Reviewer for *Mathematical Reviews*.

TEACHING
EXPERIENCE

Senior Trainer

Intel Mathematics Initiative
Boston, MA, USA

Intel Foundation

Summer 2007

One of two Massachusetts Mathematics Partnership instructors leading a train-the-trainers scale-up of MMP-type courses in Massachusetts and California. Continuing service as a consultant on curriculum development.

Lead Instructor

Center for Mathematics Achievement
Cambridge, MA, USA

Lesley University

Summer 2004–present

Headed instructional team in mathematics content workshops for K-8 teachers seeking Massachusetts professional licensure.

Courses taught:

Mathematics as a Second Language
Functions and Algebra
Trigonometry and Quadratic Functions
Number Theory
Calculus for Elementary Teachers

Assistant Professor

Department of Mathematics
Boston, MA, USA

University of Massachusetts

Fall 2003–present

Courses taught:

Math 140 (Calculus I), Fall 2003, Spring 2004, Summer 2004, Fall 2007
Math 141 (Calculus II), Fall 2003, Fall 2004, Spring 2009
Math 240 (Calculus III), Spring 2004
Math 260 (Linear Algebra), Fall 2004, Fall 2006, Fall 2007, Fall 2008
Math 360 (Abstract Algebra I), Fall 2005, Fall 2006, Fall 2008
Math 361 (Abstract Algebra II), Spring 2006, Spring 2007, Spring 2009
Math 480 (Special Topics: Differentiable Manifolds and Lie Groups), Spring 2007
Math 480 (Special Topics: Computational Algebraic Geometry), Fall 2007
Math 480 (Special Topics: General Topology), Spring 2008

Instructor

Department of Mathematics
New Haven, CT, USA

Yale University

Fall 1998–Fall 2002

Lectured and moderated student discussions and group work sessions. Designed and scored examinations and homework assignments, with others. Revised departmental syllabus and established departmental assessment guidelines (with M. Frame). Supervised undergraduate research.

Courses taught:

Math 112 (Calculus I), Fall 2000, Fall 2001
Math 115 (Calculus II), Fall 1999, Fall 2002
Math 230 (Honors Vector Calculus and Linear Algebra), course assistant, Fall 1998.

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RELATED WORK EXPERIENCE	Professional Tutor Center for Learning Resources West Haven, CT, USA Individual and small-group tutoring in undergraduate math and physics. Tutored courses ranging from developmental and pre-calculus mathematics through abstract algebra and real analysis.	University of New Haven Fall 1998–Spring 2003
	Professional Tutor Department of Academic Enrichment East Stroudsburg, PA, USA Drop-in and appointment-based tutoring, as above, with emphasis on students with disabilities and other special needs.	East Stroudsburg University Fall 1995–Summer 1997
	Instructor’s Assistant Summer Intensive Study Program East Stroudsburg, PA, USA Provided individual tutoring and assessment services in a basic skills remediation program for economically and academically disadvantaged students.	East Stroudsburg University Summer 1996
TRAINING	Departmental teaching seminar Department of Mathematics New Haven, CT, USA Weekly seminar on issues in the teaching of undergraduate mathematics. Topics included basic teaching skills, testing and grading, student grievances, cultural diversity, and technology in the classroom.	Yale University Fall 1998–Spring 2000
	Tutor training Department of Academic Enrichment East Stroudsburg, PA, USA Topics included learning styles, awareness of student disabilities and other special needs, communication and listening skills, and collaborative learning.	East Stroudsburg University Fall 1995
MEMBERSHIPS	<ul style="list-style-type: none">• Atlas of Lie Groups and Representations Project• Mathematicians and Education Reform Forum• Mathematical Association of America• American Mathematical Society• Phi Beta Kappa	

June 9, 2009