

DANIEL ORR

Mathematics (MC 0123), McBryde, RM 460, Virginia Tech
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Employment

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Associate Professor with Tenure (2021–present)

Assistant Professor (2014–2021)

Patricia Ann Caldwell Post-Doctoral Fellow (2013–2014)

Education

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Ph.D. in Mathematics (May 2013)

Nonsymmetric Difference Whittaker Functions and Double Affine Hecke Algebras

Advisor: Ivan Cherednik

DAVIDSON COLLEGE

B.S. in Mathematics, *magna cum laude* (2008)

Studies at JULIUS-MAXIMILIANS-UNIVERSITÄT WÜRZBURG, GERMANY (2006–2007)

Research Interests

Representation theory, algebraic combinatorics, Hecke algebras, Macdonald polynomials

Funding

- Simons Foundation, Collaboration Grants for Mathematicians, “Combinatorics and geometry via quantum algebra representations” (2019-2024)
- NSF DMS-1600653 “Combinatorics of Koornwinder polynomials and stable double affine Hecke algebras” (co-PI with Mark Shimozono, 2016-2019)

Publications

- Takafumi Kouno, Satoshi Naito, Daniel Orr, and Daisuke Sagaki. Inverse K -Chevalley formulas for semi-infinite flag manifolds, I: minuscule weights in ADE type. *Forum of Mathematics, Sigma*, to appear (2021).
- Satoshi Naito, Daniel Orr, and Daisuke Sagaki. Pieri-Chevalley formula for anti-dominant weights in the equivariant K -theory of semi-infinite flag manifolds. *Advances in Mathematics*, to appear (2021).
- Dinakar Muthiah and Daniel Orr. On the double-affine Bruhat order: the $\varepsilon = 1$ conjecture and classification of covers in ADE type. *Algebraic Combinatorics 2* (2019), no. 2, 197–216.
- Evgeny Feigin, Ievgen Makedonskyi, and Daniel Orr. Generalized Weyl modules and non-symmetric q -Whittaker functions. *Advances in Mathematics* 330 (2018), 997–1033.

- Dinakar Muthiah and Daniel Orr. Walk algebras, distinguished subexpressions, and point counting in Kac-Moody flag varieties. *Representations of Lie algebras, quantum groups and related topics*, 187–203, Contemporary Math., 713, Amer. Math. Soc., Providence, RI, 2018.
- Daniel Orr and Mark Shimozono. Specializations of nonsymmetric Macdonald-Koornwinder polynomials. *Journal of Algebraic Combinatorics* 47 (2018), no. 1, 91–127.
- Daniel Orr and Leonid Petrov. Stochastic higher spin six vertex model and q -TASEPs. *Advances in Mathematics* 317 (2018), 473–525.
- Ivan Cherednik and Daniel Orr. Nonsymmetric difference Whittaker functions. *Mathematische Zeitschrift* 279 (2015), no. 3-4, 879–938.
- Ivan Cherednik and Daniel Orr. One-dimensional nil-DAHA and Whittaker functions II. *Transformation Groups* 18 (2013), no. 1, 23–59.
- Ivan Cherednik and Daniel Orr. One-dimensional nil-DAHA and Whittaker functions I. *Transformation Groups* 17 (2012), no. 4, 953–987.

Preprints

- Daniel Orr. Equivariant K -theory of the semi-infinite flag manifold as a nil-DAHA module (2020). arXiv:2001.03490
- Daniel Orr and Mark Shimozono. On cyclic quiver parabolic Kostka-Shoji polynomials (2019). arXiv:1906.06758
- Daniel Orr and Mark Shimozono. Quiver Hall-Littlewood functions and Kostka-Shoji polynomials (2018). arXiv:1704.05178

Graduate Advising

Ph.D. advisees at Virginia Tech

- Richard Shaplin (2020–present)
- Benjamin Goodberry (2018–present)
- Amanda Welch, *Double Affine Bruhat Order* (2019)
Employment: Assistant Professor (tenure-track), Eastern Illinois University (2021–present),
Visiting Assistant Professor, College of the Holy Cross (2019–2021)

M.S. advisees at Virginia Tech

- Aidan Quinlan, *Miki Images of Quantum Toroidal Algebra Generators* (2020)
- Richard Shaplin, *Spherical Elements in the Affine Yokonuma-Hecke Algebra* (2020)
- Benjamin Goodberry, *Multiparameter BC_n -Kostka-Foulkes Polynomials* (2018)
- Mark Hertz, *Difference Raising Operators for Kirillov-Reshetikhin Characters and Parabolic Jing Operators* (2017)

Professional Service

Organizer

Algebra Seminar, Virginia Tech (2015–2020)

Special Session on Macdonald Polynomials and Related Structures
AMS Southeastern Sectional Meeting, Vanderbilt (April 2018)

Reviewer

Mathematical Reviews (MathSciNet)
Zentralblatt der Mathematik

Referee

Advances in Mathematics
Algebraic Combinatorics
Communications in Algebra
Duke Mathematical Journal
Forum of Mathematics, Pi
International Mathematics Research Notices (IMRN)
Inventiones Mathematicae
Journal für die reine und angewandte Mathematik (Crelle's Journal)
Journal of Combinatorial Theory, Series A
Michigan Mathematical Journal
NSF DMS Algebra & Number Theory
Representation Theory
Simons Foundation
Symmetry, Integrability, Geometry: Methods and Applications (SIGMA)
Transformation Groups

Talks (*1-hour invited talk)

- “Equivariant K -theory of the semi-infinite flag manifold as a nil-DAHA module”
AMS Eastern Sectional Meeting, Virtual (March 2021)
*Southeastern Lie Theory Workshop, Charleston (May 2020) – CANCELED
Geometric Methods in Representation Theory, UNC-CH (April 2020) – CANCELED
AMS Eastern Sectional Meeting, Tufts (March 2020) – CANCELED
- “On cyclic quiver parabolic Kostka-Shoji polynomials”
AMS Southeastern Sectional Meeting, Gainesville (November 2019)
- “Semi-infinite flag manifolds via nonsymmetric Macdonald polynomials”
Colloquium, USNA (October 2019)
Colloquium, Virginia Tech (September 2019)
- “Semi-infinite flag manifolds and the nonsymmetric q -Toda system”
AMS Eastern Sectional Meeting, Hartford (April 2019)
AMS Southeastern Sectional Meeting, Auburn (March 2019)
*Representation Theory, Combinatorics, and Geometry, UVA (October 2018)

- “Quiver Hall-Littlewood functions and Kostka-Shoji polynomials”
 *Geometry and Representation Theory..., Bochum, Germany (September 2018)
 Colloquium, University of Maryland (April 2017)
 Algebra Seminar, Virginia Tech (March 2017)
- “Hecke algebras and some of their incarnations”
 Algebra Seminar, Virginia Tech (September 2017)
- “Generalized Weyl modules and nonsymmetric q -Whittaker functions”
 Integrability and Representation Theory Seminar, UIUC (October 2017)
 AMS Southeastern Sectional Meeting, NC State (November 2016)
 Algebra Seminar, University of Virginia (October 2016)
 Algebra Seminar, University of Cologne (July 2016)
 AMS Western Sectional Meeting, University of Utah (April 2016)
- “A length function for the double-affine Bruhat order”
 Algebra Seminar, Virginia Tech (September 2016)
- “Specializations of Macdonald polynomials and the PBW filtration”
 *Mini-Workshop 1609a, Mathematisches Institut Oberwolfach (March 2016)
- “Creation operators for Macdonald polynomials”
 Algebra Seminar, Virginia Tech (November 2015)
- “Combinatorics of nonsymmetric Macdonald polynomials”
 Geometry, Algebra, and Physics Seminar, University of Alberta (October 2015)
 *Southeastern Lie Theory Workshop, NC State (October 2015)
- “Elliptic Hall algebra, spherical DAHA, and symmetric function operators”
 AMS Southeastern Sectional Meeting, UNC Greensboro (November 2014)
 Algebra Seminar, University of Virginia (October 2014)
- “Specializations of nonsymmetric Macdonald polynomials at infinity”
 Geometric Methods in Representation Theory Seminar, UNC-CH (September 2014)
 Combinatorial Representation Theory, CRM, Montreal (April 2014)
 CAGE Seminar, Drexel University (March 2014)
 Whittaker Functions, BIRS (October 2013)
- “The Toda lattice in algebra and geometry”
 Colloquium, Wake Forest University (April 2014)
 Colloquium, Haverford College (March 2014)
- “Macdonald polynomials, positivity, and specializations”
 Colloquium, Virginia Tech (January 2014)
- “Macdonald polynomials and their specializations”
 Algebra Seminar, Virginia Tech (November 2013)
- “The Toda lattice, Dunkl operators, and Macdonald polynomials”
 Colloquium, Virginia Tech (September 2013)
- “Double affine Hecke algebras and difference Whittaker functions”
 Southeastern Lie Theory Workshop, College of Charleston (December 2012)
 Algebra Seminar, Virginia Tech (November 2012)

“ q -Hermite polynomials, nil-DAHA, and q -Whittaker functions”

AMS Southeastern Sectional Meeting, Wake Forest University (September 2011)

Invited Conferences and Workshops

Representation Theory, Combinatorics, and Geometry

University of Virginia (October 2018)

Geometry and Representation Theory at the interface of Lie algebras and quivers

Ruhr-Universität Bochum, Germany (September 2018)

PBW Structures in Representation Theory

Mathematisches Forschungsinstitut Oberwolfach (February–March 2016)

Théorie des Représentations

Université Paris Diderot (January 2015)

Whittaker Functions: Number Theory, Geometry and Physics

Banff International Research Station (October 2013)

Double Affine Hecke Algebras, the Langlands Program, Affine Flag Varieties, ...

Physics-Mathematics Summer Institute, CIRM (June 2011)

Teaching

Courses taught at Virginia Tech

Elementary Complex Analysis (Spring 2021)

Graduate Abstract Algebra (Fall 2019, Spring 2020, incl. *course redesign*)

Number Theory (Spring 2018, 2020)

Linear Algebra II (Spring 2019)

Graduate Combinatorics (Spring and Fall 2015, Spring 2017)

Introduction to Abstract Algebra (Fall 2014, 2016, 2017, 2018)

Applied Combinatorics and Graph Theory (Spring 2014, 2016, 2018, Fall 2020)

Introduction to Differential Equations (Fall 2013)

Elementary Linear Algebra (Summer 2013)

Courses taught at UNC-CH

Calculus of Functions of Several Variables (Summer 2013)

Number Theory and its Applications (HHMI Science Seminar, Spring 2013)

Selected Topics in Mathematics (Spring 2012, Spring 2011)

Calculus of Functions of One Variable I, II (2010-2011)

Intuitive Calculus (Fall 2009)

Awards

MAA Student Chapter Math Professor of the Year, Virginia Tech	2019
“Thank a Teacher” Recognition, Virginia Tech	2019
NSF “US Junior Oberwolfach Fellows” Travel Support	2016
Favorite Faculty Award, Virginia Tech (student nominated)	2014
HHMI Science Seminar Grant, UNC-CH	2013
GAANN Fellow, UNC-CH	2008–2009