

Alexander Rhys Duncan

Department of Mathematics
University of South Carolina
701 Assembly Street 1022B
Columbia, SC 29208

people.math.sc.edu/duncan
duncan@math.sc.edu
1 (803) 777 7508

Education

- 2007-2011 **Doctor of Philosophy**, Mathematics
University of British Columbia
Advisor: Zinovy Reichstein
- 2005-2007 **Master of Science**, Mathematics
University of British Columbia
Advisor: Zinovy Reichstein
- 2001-2005 **Honours Bachelor of Science**, Mathematics and Physics
University of Toronto

Academic Positions

- 2020–Present **Associate Professor**
Department of Mathematics
University of South Carolina, Columbia
- 2015–2020 **Assistant Professor**
Department of Mathematics
University of South Carolina, Columbia
- 2012–2015 **RTG Postdoctoral Assistant Professor**
Department of Mathematics
University of Michigan, Ann Arbor
Mentor: Gopal Prasad
- 2011–2012 **RTG Assistant Adjunct Professor**
Department of Mathematics
University of California, Los Angeles
Mentor: Alexander Merkurjev

Publications and Preprints

Refereed Publications

- J. Blanc, I. Cheltsov, A. Duncan, and Yu. Prokhorov. *Birational self-maps of threefolds of (un)-bounded genus or gonality*. Amer. J. Math. (To Appear).
- M. Ballard, A. Duncan, and P. McFaddin. *Derived categories of centrally-symmetric smooth toric Fano varieties*. Math. Nachr. (To Appear).
- M. Ballard, A. Duncan, and P. McFaddin. *On derived categories of arithmetic toric varieties*. Ann. K-Theory **4** (2019), no. 2, 211–242.

Publications and Preprints (continued)

I. Dolgachev and A. Duncan. *Automorphisms of cubic surfaces in positive characteristic*. *Izv. Math.* **83** (2019), no. 3, 15–92.

M. Ballard, A. Duncan, and P. McFaddin. *The toric Frobenius morphism and a conjecture of Orlov*. *Eur. J. Math.* **5** (2019), no. 3, 640–645.

I. Dolgachev and A. Duncan. *Regular pairs of quadratic forms on odd-dimensional spaces in characteristic 2*. *Algebra Number Theory* **12** (2018), no. 1, 99–130.

A. Duncan. *Equivariant unirationality of del Pezzo surfaces of degree 3 and 4*. *Eur. J. Math.* **2** (2016), no. 4, 897–916.

A. Duncan. *Twisted forms of toric varieties*. *Transform. Groups* **21** (2016), no. 3, 763–802.

I. Dolgachev and A. Duncan. *Fixed points of a finite subgroup of the plane Cremona group*. *Algebr. Geom.* **3** (2016), no. 4, 441–460.

A. Duncan and Z. Reichstein. *Versality of algebraic group actions and rational points on twisted varieties*. *J. Algebraic Geom.* **24** (2015), 499–530.

A. Duncan and Z. Reichstein. *Pseudo-reflection groups and essential dimension*. *J. London Math. Soc.* **90** (2014), no. 3, 879–902.

A. Duncan. *Finite groups of essential dimension 2*. *Comment. Math. Helv.* **88** (2013), no. 3, 555–585.

A. Duncan. *Essential dimensions of A_7 and S_7* . *Math. Res. Lett.* **17** (2010), no. 2, 263–266.

A. Duncan and Z. Reichstein. *SAGBI bases for rings of invariant Laurent polynomials*. *Proc. Amer. Math. Soc.* **137** (2009), no. 3, 835–844.

A. Duncan, M. LeBlanc, and D. L. Wehlau. *A SAGBI basis for $\mathbb{F}[\mathbb{V}_2 \oplus \mathbb{V}_2 \oplus \mathbb{V}_3]^{C_p}$* . *Canad. Math. Bull.* **52** (2009), no. 1, 72–83.

Preprints

M. Ballard, A. Duncan, A. Lamarche, and P. McFaddin. *Consequences of the existence of exceptional collections in arithmetic and rationality*. arXiv:2009.10175 [math.AG] (22 pages)

M. Ballard, A. Duncan, A. Lamarche, and P. McFaddin. *Separable algebras and coflasque resolutions*. arXiv:2006.06876 [math.AG] (29 pages)

J. Blanc, I. Cheltsov, A. Duncan, and Yu. Prokhorov. *Finite quasisimple groups acting on rationally connected threefolds*. arXiv:1809.09226 [math.AG] (41 pages)

Publications and Preprints (continued)

Unrefereed Conference Proceedings

A. Duncan. *Automorphisms of del Pezzo surfaces in positive characteristic*. Pages 1710–1712 of F. Catanese, I. Cheltsov, J. Déserti, and Y. Prokhorov, “Subgroups of Cremona Groups,” Oberwolfach Rep. **15** (2018), no. 2, 1685–1743.

Teaching

University of South Carolina, Columbia

2021 Spring Math 300H, Transitions to Advanced Mathematics, 17 students
2021 Spring Math 746, Commutative Algebra (graduate), 15 students
2020 Fall Math 142, Calculus II, 60 students
2020 Fall Math 748, Computational Algebra (graduate), 9 students
2020 Spring Math 547H, Algebraic Structures II, 10 students
2020 Spring Math 748, Galois Cohomology (graduate), 9 students
2019 Fall Math 141, Calculus I, 60 students
2019 Fall Math 546H, Algebraic Structures I, 16 students
2019 Spring Math 747, Algebraic Geometry (graduate), 9 students
2019 Spring Math 300, Transitions to Advanced Mathematics, 19 students
2018 Fall Math 546, Algebraic Structures I, 21 students
2018 Fall Math 142H, Calculus II, 21 students
2018 Spring Math 548, Geometry, Algebra, and Algorithms, 8 students
2017 Fall Math 142, Calculus II, 54 students
2017 Fall Math 142, Calculus II, 48 students
2017 Spring Math 702, Algebra II (graduate), 9 students
2016 Fall Math 701, Algebra I (graduate), 8 students
2016 Fall Math 142H, Calculus II, 18 students
2016 Spring Math 742, Representation and Invariant Theory (graduate), 6 students
2016 Spring Math 300, Transition to Advanced Mathematics, 24 students
2015 Fall Math 141, Calculus I, 53 students

University of Michigan, Ann Arbor

2014 Fall Math 217, Linear Algebra, 27 students
2014 Fall Math 217, Linear Algebra, 28 students
2013 Fall Math 217, Linear Algebra, 28 students
2013 Fall Math 217, Linear Algebra, 30 students
2013 Winter Math 217, Linear Algebra, 30 students
2012 Fall Math 115, Calculus I, 29 students

University of California, Los Angeles

2012 Spring Math 3B, Calculus for Life Sciences Students, 204 students
2012 Winter Math 3B, Calculus for Life Sciences Students, 209 students
2011 Fall Math 115A, Linear Algebra, 36 students

University of British Columbia

2009 Fall Math 102, Differential Calculus with Applications to Life Sciences, 82 students

Teaching (continued)

- 2008 Winter Math 105, Integral Calculus for Social Science and Commerce, 80 students
2006 Fall Math 184, Differential Calculus for Social Science and Commerce, 60 students

Invited Talks

- 2021 **Derived categories of arithmetic toric varieties**
Algebra and Geometry of Homogeneous Spaces
(Online)
- 2020 **Cohomological invariants and separable algebras**
Quadratic forms, linear algebraic groups and beyond
(Online)
- 2020 **Distinguishing objects with separable algebras**
Algebraic Geometry Seminar
Washington University in St. Louis
- 2020 **Finite subgroups of Cremona groups**
Winter school on Cremona Groups, Geometric Topology and Algebraic Geometry
Instituto de Matematicas UNAM, Cuernavaca, Mexico
- 2019 **Indistinguishability and simple algebras**
Interactions between Brauer Groups, Derived Categories and Birational Geometry of Projective Varieties
Banff International Research Station
- 2019 **Finite subgroups of Cremona groups**
Geometry/Topology Seminar
University of Chicago
- 2019 **Finite groups of low essential dimension**
Braids, Resolvent Degree and Hilbert's 13th Problem
Institute for Pure & Applied Mathematics, UCLA
- 2018 **Exceptional collections on arithmetic toric varieties**
Affine Algebraic Groups, Motives and Cohomological Invariants
Banff International Research Station
- 2018 **Automorphisms of del Pezzo surfaces in positive characteristic**
Subgroups of Cremona Groups
Mathematisches Forschungsinstitut Oberwolfach, Germany
- 2018 **Exceptional collections on arithmetic toric varieties**
Laboratory of Algebraic Geometry and its Applications
Higher School of Economics, Moscow, Russia
- 2018 **Automorphism groups of cubic surfaces in arbitrary characteristic**
Algebra, algebraic geometry and number theory (95th anniversary of I. R. Shafarevich)
Steklov Institute of Mathematics, Moscow, Russia
- 2018 **Automorphism groups of cubic surfaces in arbitrary characteristic**
Algebraic groups and related topics
Canadian Mathematical Society Summer Meeting
Fredericton, Canada

Invited Talks (continued)

- 2018 **Exceptional collections on arithmetic toric varieties**
Cohomology — a link between numbers and geometry
Canadian Mathematical Society Summer Meeting
Fredericton, Canada
- 2017 **Toric varieties over general fields**
Coloquio IMAFI
Universidad de Talca, Chile
- 2017 **Automorphisms of del Pezzo surfaces in small characteristic**
Conference on aspects of the algebraic and analytic theory of quadratic forms
University of Georgia, Athens
- 2017 **Equivariant analogs of the arithmetic of del Pezzo surfaces**
Algebra and Number Theory Seminar
Emory University, Atlanta
- 2016 **Automorphisms of cubic surfaces in arbitrary characteristic**
Workshop on Algebraic Geometry
Hanga Roa, Chile
- 2016 **Equivariant analogs of arithmetic questions for rational surfaces**
Variety Seminar
Independent University of Moscow, Russia
- 2016 **Rational surfaces in positive characteristic**
Pencils of quadrics
Automorphisms of cubic surfaces
Automorphisms of del Pezzo surfaces of degree 1 and 2
Spring School on Surfaces in Positive Characteristics
Laboratory of Algebraic Geometry and its Applications
Higher School of Economics, Moscow, Russia
- 2016 **Pairs of quadratic forms in characteristic 2**
Algebraic Geometry and Number Theory Seminar
Clemson University, South Carolina
- 2015 **Automorphisms of del Pezzo surfaces in positive characteristic**
Cohomological Methods in Quadratic Forms and Algebraic Groups
CMS Winter Meeting
Montreal, Canada
- 2015 **Pairs of quadratic forms in characteristic 2**
The Use of Linear Algebraic Groups in Geometry and Number Theory
Banff International Research Station
- 2015 **Equivariant unirationality of surfaces**
Laboratory of Algebraic Geometry and its Applications
Higher School of Economics, Moscow, Russia
- 2015 **Pencils of quadrics in characteristic 2**
Steklov Institute of Mathematics, Moscow, Russia
- 2015 **Automorphisms of pencils of quadrics**
Special Session on Quadratic Forms in Arithmetic and Geometry
AMS Spring Southeastern Sectional Meeting
University of Alabama in Huntsville

Invited Talks (continued)

- 2015 **Essential dimension of finite groups**
Departmental Colloquium
University of Arizona, Tucson
- 2015 **Essential dimension of finite groups**
Departmental Colloquium
University of South Carolina, Columbia
- 2014 **Twisted forms of toric varieties**
Workshop on Algebraic and Geometric Invariants of Linear Algebraic Groups and Homogeneous Spaces
University of Ottawa, Ottawa, Canada
- 2014 **Forms of toric varieties**
Algebra and Number Theory Seminar
Emory University, Atlanta
- 2014 **Forms of toric varieties**
Special Session on Algebraic Geometry
AMS Southeastern Spring Sectional Meeting
University of Tennessee, Knoxville
- 2014 **Equivariant unirationality**
Research Institute for Mathematical Sciences
Kyoto University, Japan
- 2013 **Equivariant unirationality**
Algebraic and Arithmetic Geometry - "BIRPOL6"
University of Basel, Switzerland
- 2013 **Essential dimension and versal varieties**
Algebra Seminar
Michigan State University, East Lansing
- 2013 **Toric varieties and Severi-Brauer varieties**
Spring School and Workshop on Torsors, Motives and Cohomological Invariants
Fields Institute
- 2013 **Equivariant rational maps and unirationality**
Special Session on Algebraic Geometry
AMS Spring Western Sectional Meeting
University of Colorado, Boulder
- 2013 **G-unirationality**
Algebraic Geometry Seminar
Queen's University, Kingston
- 2012 **Essential dimension and versal varieties**
International Conference on Essential Dimension and Cremona Groups
Chern Institute of Mathematics, Nankai University, Tianjin, China
- 2012 **Essential dimension**
Department of Mathematics Colloquium
University of California, Riverside

Invited Talks (continued)

- 2012 **Versal varieties with a twist**
Algebraic Geometry Seminar
Rice University
- 2011 **Toric varieties and essential dimension**
Algebraic Groups and Related Structures Seminar
University of British Columbia
- 2011 **Versal varieties and twisting**
Southern California Algebraic Geometry Seminar
University of California, Los Angeles
- 2011 **Introduction to essential dimension I**
Introduction to essential dimension II
Finite groups of low essential dimension
Essential Dimension and Birational Geometry
University of Edinburgh
- 2011 **Versal torsors**
Ramification in Algebra and Geometry
Emory University
- 2011 **Finite groups of low essential dimension**
Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2009 **Finite groups of essential dimension 2**
Linear Algebraic Groups and Related Structures
Banff International Research Station
- 2009 **Finite groups of essential dimension 2**
Algebraic Group Actions and Invariant Theory Session
CMS Summer Meeting, Memorial University of Newfoundland

Other Talks (Internal and Outreach)

- 2021 **Quasipolynomials**
Graduate Colloquium
University of South Carolina, Columbia
- 2021 **Cremona groups and representation dimension**
Algebra, Geometry, and Number Theory Seminar
University of South Carolina, Columbia
- 2019 **The Ring of Periods**
Graduate Colloquium
University of South Carolina, Columbia
- 2019 **Undecidable Problems**
Graduate Colloquium
University of South Carolina, Columbia
- 2017 **Cubic surfaces in positive characteristic**
Algebraic Geometry, Arithmetic Geometry and Commutative Algebra Seminar
University of South Carolina, Columbia

Other Talks (Internal and Outreach) (continued)

- 2017 **Hilbert's 13th Problem**
Graduate Colloquium
University of South Carolina, Columbia
- 2015 **The plane Cremona group**
Graduate Colloquium
University of South Carolina, Columbia
- 2015 **Pairs of quadratic forms in characteristic 2**
Algebraic Geometry, Arithmetic Geometry and Commutative Algebra Seminar
University of South Carolina, Columbia
- 2015 **Normal forms for pencils of quadrics**
Postdoc Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2014 **Automorphisms of del Pezzo surfaces**
Postdoc Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2013 **Finite subgroups of the plane Cremona group**
Postdoc Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2013 **Undecidable Problems**
Undergraduate Math Club
University of Michigan, Ann Arbor
- 2012 **Forms of Algebraic Varieties**
Postdoc Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2012 **Geometric approaches to essential dimension**
Algebraic Geometry Seminar
University of Michigan, Ann Arbor
- 2012 **Cox Rings of Toric Varieties**
Toric Varieties over Non-algebraically Closed Fields
Algebra Seminar
University of California, Los Angeles
- 2011 **Finite Groups of Low Essential Dimension**
Algebraic Geometry Seminar
University of British Columbia
- 2010 **Solving Equations with Gröbner Bases**
Undergraduate Mathematics Colloquium
University of British Columbia
- 2009 **Essential Dimensions of A_7 and S_7**
Algebraic Groups, Galois Cohomology and Related Topics Seminar
University of British Columbia
- 2009 **Finite Groups of Essential Dimension 2 over \mathbb{C}**
Algebraic Groups, Galois Cohomology and Related Topics Seminar
University of British Columbia

Other Talks (Internal and Outreach) (continued)

Graduate Colloquium, Department of Mathematics, UBC

- 2010 **What is an Undecidable Problem?**
- 2010 **What is Hilbert's Thirteenth Problem?**
- 2008 **Cubic Surfaces**
- 2008 **Continued Fraction Arithmetic**
- 2006 **The Surreal Numbers**
- 2005 **Introduction to Gröbner Bases**

Canadian Undergraduate Mathematics Conferences

- 2005 **Dissection of Rectangles into Squares**
Queen's University, Kingston
- 2004 **The Gamma Function**
Dalhousie University
- 2003 **An Introduction to Invariant Theory**
York University

Awards and Grants

- 2019 – 2024 (exp.) Simons Collaboration Grant (\$42,000 USD)
- 2018 Research in Pairs, Oberwolfach
- 2016 – 2018 NSA Young Investigator Grant (\$40,000 USD)
- 2011 NSERC Postdoctoral Fellowship (\$80,000 CAD) (declined by PI)
- 2009 – 2011 Four Year Fellowship (\$32,000 CAD)
- 2009 Pacific Century Graduate Scholarship (\$10,000 CAD)
- 2009 Graduate Teaching Award, UBC Math. Dept.
- 2007 – 2009 NSERC Canada Graduate Scholarship D (\$70,000 CAD)
- 2007 – 2011 Ph.D. Tuition Fee Award
- 2005 – 2007 NSERC Postgraduate Scholarship M (\$34,600 CAD)
- 2005 Graduate Entrance Scholarship (\$1000 CAD)
- 2005 Faculty of Science Grant Supplement Award (\$4000 CAD)
- 2004 NSERC Undergraduate Student Research Award (\$6800 CAD)
- 2003 NSERC Undergraduate Student Research Award (\$6400 CAD)
- 2003 – 2004 James A and Connie P Dickson Scholarship (\$500 CAD)
- 2002 – 2003 Reuben Wells Leonard Scholarship (\$500 CAD)
- 2002 – 2003 Dr John Knowles Colling Memorial Scholarship (\$964 CAD)
- 2001 – 2005 Howard Ferguson Provincial Scholarship (\$10,000 CAD)
- 2001 – 2002 University of Toronto Entrance Award (\$3,000 CAD)

Supervision and Mentorship

Postdoctoral Scholars

- 2016 – 2017 Patrick McFaddin (acting mentor)

Doctoral Students Supervised

- 2021 – Shreya Sharma
- 2021 – Pankaj Singh

Supervision and Mentorship (continued)

2020 – Bailey Heath
2020 – Jonathan Smith
2017 – Tracy Huggins

Undergraduate Students Supervised

2019 – 2020 Thomas Elgin

Doctoral Thesis Committees

2021 Joe Foster
2020 Joshua Grice
2020 Alicia Lamarche
2020 Harsh Mehta
2020 Robert Vandermolen
2019 Mohammed Alabbood
2017 Wilson Harvey

Masters Thesis Committees

2018 Erin Hanna

Comprehensive Exam Committees

2021 Grant Fickes
2021 Bailey Heath
2021 Jonathan Smith
2019 Jack Dalton
2019 Demmas Salim
2019 Cuyler Warnock
2018 Tracy Huggins
2017 Mohammed Alabbood
2017 Joshua Grice
2017 Robert Vandermolen
2016 Harsh Mehta
2016 Xiaofei Yi

Professional Service

Department

2020 – Present Faculty Advisory Council
2019 – Present Graduate Advisory Council
2016 – Present Website Committee (Chair)
2016 – Present Organizer of *Algebra, Geometry, and Number Theory Seminar*
2015 – 2020 Qualifying Exam Committee
2015 – 2020 Undergraduate Advisor
2018 – 2019 Math 546 Course Coordinator
2017 – 2018 Faculty Advisor of *Graduate Colloquium*
2016 – 2017 Organizer of *Graduate Colloquium*

Professional Service (continued)

2016 – 2017 Graduate Advisory Council
 2015 – 2018 Events Committee

University

2021 Top Scholar Referee
 2017 – 2020 Faculty Senate

Community

2016 – 2019 USC High School Math Contest Judge
 2016 USC Practice AP Exam Proctor

Professional

2021 Organizer of *Algebraic groups and algebraic geometry: in honor of Zinovy Reichstein's 60th birthday*. (Online)

2011 – Present 20 Reviews for Mathematical Reviews, American Mathematical Society

2018 – Present Grant Reviewer for *FONDECYT*, Chilean National Science and Technology Commission; Nederlandse Organisatie voor Wetenschappelijk Onderzoek; *RISE: Research Initiative for Summer Engagement*, UofSC.

2011 – Present Referee for *Acta Mathematica*, *Bulletin of the London Mathematical Society*, *Canadian Journal of Mathematics*, *Commentarii Mathematici Helvetici*, *Documenta Mathematica*, *European Journal of Mathematics*, *International Electronic Journal of Algebra*, *International Journal of Mathematics*, *Journal für die reine und angewandte Mathematik*, *Journal of the American Mathematical Society*, *Journal of the Ramanujan Mathematical Society*, *Journal of Pure and Applied Algebra*, *L'Enseignement mathématique*, *Moscow Math Journal*, *Notices of the American Mathematical Society*, *Pacific Journal of Mathematics*, *Transactions of the American Mathematical Society*, and *Transformation Groups*.

Conferences Attended (participant but not speaker)

2018 A day of Algebraic Geometry in Savannah
 Georgia Southern University, Armstrong Campus, Savannah, Georgia

2018 Georgia Algebraic Geometry Symposium
 Georgia Institute of Technology, Atlanta, Georgia

2017 Emory Conference on Higher Obstructions to Rational Points
 Emory University, Atlanta, Georgia

2017 Beyond Toric Geometry
 Casa Matemática Oaxaca, Oaxaca, Mexico

2017 Algebraic Groups
 Mathematisches Forschungsinstitut Oberwolfach, Germany

2017 Georgia Algebraic Geometry Symposium
 Emory University, Atlanta, Georgia

Conferences Attended (participant but not speaker) (continued)

- 2016 Cremona Conference 2016 (presented a poster)
Universität Basel, Switzerland
- 2016 Georgia Summer Workshop in Algebraic Geometry
University of Georgia, Athens
- 2015 Georgia Algebraic Geometry Symposium
Emory University, Atlanta, Georgia
- 2015 Méthodes cohomologiques dans la théorie des groupes algébriques
Centre International de Rencontres Mathématiques
Luminy, France
- 2013 Cremona Groups
FRG Mini-Workshop, University of Utah
- 2013 Lie Algebras, Torsors and Cohomological Invariants
Banff International Research Station
- 2010 Workshop on Torsors, Lie algebras and Galois Cohomology
University of Ottawa
- 2009 Toric Varieties Workshop
Mathematical Sciences Research Institute
- 2008 Mini Course 2008 : Essential dimension and canonical dimension
Lens, France
- 2008 Lie Theory and Geometry: The Mathematical Legacy of Bertram Kostant
University of British Columbia
- 2008 ABC Algebra Workshop
Simon Fraser University
- 2007 PIMS Algebra Summer School
University of Alberta
- 2007 ABC Algebra Workshop
University of Alberta
- 2006 Symmetry and Spaces: On the Occasion of Gerry Schwarz's 60th Birthday
Fields Institute, Toronto
- 2006 PIMS/UNAM Algebra Summer School
Banff International Research Station
- 2006 ABC Algebra Workshop
University of British Columbia

Other Related Experience

- Winter 2013 Algebraic Geometry Social Director
University of Michigan, Ann Arbor
- May 2011 Moderator, Open Problem Session
Ramification in Algebra and Geometry, Emory University
- Fall 2010 Teaching Assistant, MATH 184 Workshops
University of British Columbia, Department of Mathematics
- 2010 Graduate Student Instructional Skills Workshop
University of British Columbia, Centre for Teaching and Academic Growth

Other Related Experience (continued)

2008	Co-organiser, Graduate Colloquium University of British Columbia, Department of Mathematics
Fall 2007	Marker, MATH 342 University of British Columbia, Department of Mathematics
Winter 2006	Teaching Assistant, Tutorial Centre University of British Columbia, Department of Mathematics
Fall 2005	Marker, MATH 342 University of British Columbia, Department of Mathematics
2004 – 2005	Teaching Assistant University of Toronto, Department of Mathematics
Summer 2004	Student Researcher, NSERC USRA Queen's University, Department of Mathematics
Summer 2003	Student Researcher, NSERC USRA Queen's University, Department of Mathematics