REBECCA E. FIELD

Associate Professor of Mathematics

Department of Mathematics and Statistics

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Unaffiliated Artist and Clothing Designer

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EMPLOYMENT

Visiting Scholar, University of Virginia, Charlottesville, VA 2017-2018

Associate Professor, James Madison University, Harrisonburg, VA, 2013-

Assistant Professor, James Madison University, Harrisonburg, VA, 2008-2013

Visiting Scholar, DPMMS, Center for Mathematical Sciences, Cambridge University, Cambridge, UK, 2007-2008

Visiting Scholar, Reed College, Portland, Oregon, 2007-2008

Visiting Assistant Professor, Bowdoin College, 2005-2007

Visiting Assistant Professor, University of California-Santa Cruz, 2003-2005

VIGRE-Van Vleck Visiting Assistant Professor, University of Wisconsin-Madison, 2000-2003

EDUCATION

PhD. in Mathematics, University of Chicago, August 2000, advisors: Burt Totaro, Peter May.

M.S. in Mathematics, University of Chicago, August 1995.

B.A. in Mathematics and Studio Art, Bowdoin College, May 1994, with high honors in Studio Art.

B.F.A. in Studio training, School of the Art Institute of Chicago: foundry; intermediate sculpture/sheet metal fabrication; kinetic art; accessory design; figure drawing, Spring 1993.

Fabricator training: Bob Stevens (machinist), Brunswick, ME: arc welding; oxyacetylene welding, cutting, bronze brazing; machining, Spring 1992.

Small engine repair and rebuild (Power Tech), Birmingham, MI, Fall 1989 - Spring 1990.

RESEARCH INTERESTS

Algebraic topology, algebraic geometry, and their interactions.

Classifying spaces of reductive groups, and equivariant geometry.

String theory (dynamics of semi-classical strings on non-trivial geometry).

Mathematics of games and puzzles.

Hash algorithms and coding theory.

3D printing, material science, and prosthetics.

Sculpture, painting, textile and clothing design.

PUBLICATIONS

The Chow ring of the symmetric space $Gl(2n, \mathbf{C})/SO(2n, \mathbf{C})$, *Journal of Algebra*, Volume 249, Issue 1, 1 January, 2012.

The Chow ring of the classifying space $BSO(2n, \mathbf{C})$, *Journal of Algebra*, Volume 350, Issue 1, 15 January, 2012.

MU^*BG_2, CH^*BG_2 and descent, joint with I.Grojnowski, preprint, to be submitted to *Journal of Algebra*.

$BSO(2n)$ as an extension of $BO(2n)$ by $BSp(2n)$, joint with I.Grojnowski, preprint.

Dynamics on asymptotically conical geometries, joint with I.Melnikov and B.Weaver, 2017 preprint, arXiv:1710.00404 [hep-th].

Minimal complete Shidoku symmetry groups, joint with B.Arnold, S.Lucas, and L.Taalman, *Journal of Combinatorial Mathematics and Combinatorial Computing*, Volume 87, 2013.

Using truncated addition to analyze add-rotate-xor hash algorithms, joint with B.Jones, *Journal of Mathematical Cryptology* 7 (2) (2013) 97-110.

Nest graphs and minimal complete symmetry groups for magic sudoku variants, joint with

E.Arnold, J.Lorch, S.Lucas, and L.Taalman, *Rocky Mountain Journal of Mathematics*, 2015.

Permutations, pattern avoidance, and the Catalan triangle, joint with B.Jones, D.DeSantis, W.Hough, R.Meissen and J.Ziefle, *Missouri Journal of Mathematics* Vol 24, No. 2, 2012.

Physical properties of hyperbolic space in relation to the history of clothing and armor, preprint, to be submitted to a popular science journal, and joint with A.Lorimer, in preparation, to be submitted to a cultural anthropology journal.

Van Ness rotationplasty prosthetic modification and redevelopment, joint with G.Jansen, in preparation.

A path back to mathematical research: recovering from Traumatic Brain Injury, in preparation (at the suggestion of Dr. Joseph Fins of Weill Cornell Medical College).

The Igusa local zeta function for $x^n + y^m$, joint with V.Gargeya, M.Robinson F.Schoenberg, and R.Scott, 1992 preprint, arXiv:1207.2474 [math.NT].

Hash algorithms over **Z**, preprint, available on request.

Harrisonburg, VA bus survey report, joint with Transportation for the Public/Transporte para el Publico, presented to Harrisonburg Department of Public Transportation, September 2011.

Works of Clothing, undergraduate honors thesis in studio art, Bowdoin College, 1994.

PRESENTATIONS

Introduction to Group Cohomology and a Surprise Appearance of ZFC, Colloquium, JMU, 2018.

Finite generation of group cohomology, WINR Conference, UVA, September, 2018.

Matrix groups as twisted products of spheres, Undergraduate Math Club, UVA, 2018.

Revolutionizing Personal Prosthetics for Below Knee Amputations, Madison Trust Finalist, (joint with K.Fietosa, G.Jansen, H.McLeod, C.Miller, and R.Wunderlich), 2018.

Line bundles and complex cobordism II, Faculty Research Seminar, JMU, 2016.

Line bundles and complex cobordism, Faculty Research Seminar, JMU, 2016.

Why do we care about complex cobordism?, Faculty Research Seminar, JMU, 2016.

Stumbling towards a pattern: how to make pants, Joint Math Meetings, 2014.

$BG2$ and descent, Topology Seminar, University of Virginia, 2013.

MU^*BG_2, CH^*BG_2 and descent, Joint Math Meetings, 2012.

Minimal complete Shidoku symmetry groups, Joint Math Meetings, 2012.

BSO_{2n} as an extension of BO_{2n} by BSp_{2n}, Algebra Seminar at Cambridge University, UK, 2011.

BSO_{2n} as an extension of BO_{2n} by BSp_{2n}, Topology Seminar, University of Virginia, 2010.

The decent spectral sequence for SL_2 and PSL_2, Joint Mathematics Meetings, 2010.

Physical properties of hyperbolic space in relation to the history of clothing and armor, Joint Math Meetings, 2010.

Artist's presentation for Math 467 Math and Art: Beautiful Rigor, 2009.

Algebra seminar, University of California-Davis, 2005.

Colloquium, University of California-Santa Cruz, 2004.

Colloquium, Wayne State University, 2002.

Fifth joint meeting AMS-SMM, Morelia, Mexico, contributing talk, Morelia Mexico, May 23-26, 2001.

Third Annual Midwest Algebraic Geometry Conference, contributing talk, Columbia, Missouri, 1999.

CONFERENCE ORGANIZATION

Topology session, Women's Intellectual Network Research Symposium, UVA, September, 2018.

THESIS

On the Chow ring of the classifying space $BSO(2n, \mathbf{C})$.

AWARDS AND FELLOWSHIPS

Madison Trust Grant Award (joint with K.Fietosa, G.Jansen, H.McLeod, C.Miller, and R.Wunderlich)

Revolutionizing Personal Prosthetics for Below Knee Amputations, 2018.

Educational Leave Support, JMU September 2017-May 2018.

Institute for Computational and Experimental Research in Mathematics Topical Workshop on Illustrating Mathematics, June 2016, workshop participant with full funding.

Institute for Advanced Study/Park City Mathematics Institute Summer Session on Math and Materials, Undergraduate Faculty Program, accepted with full funding, but unable to attend due to traumatic brain injury.

DC/MD/VA Sectional Project NeXT Fellow, 2008-2010.

Faculty Research Grant, Bowdoin College, 2006-2007.

VIGRE Grant, University of Wisconsin-Madison, 2000-2003.

Booth Prize for the four best University of Chicago graduate student instructors, based on student nominations, May 1999.

Graves Memorial Lectureship Teaching Prize, given to Lecturers in Mathematics for effective and responsible undergraduate teaching by their second year of teaching, May 1998.

Nominated for Physical Sciences Division Graduate Student Teaching Prize, based on student nominations, May 1998.

High honors for Bowdoin Honors Thesis in Studio Art: *Works of Clothing*, May 1994.

Honorable mention, AWM Alice T. Schafer Prize , August 1993

Smyth Prize, Bowdoin College, April 1993.

HIGHLIGHTS: MATHY ART OR ARTY MATH

Stumbling towards a pattern: how to make pants, presentation at JMM, 2014.

Physical properties of hyperbolic space in relation to the history of clothing and armor, presentation at JMM, 2010, accompanying paper to be submitted to a popular science journal and (joint with A.Lorimer) a cultural anthropology journal. (Historical, theoretical, and mathematical solutions to the problem of fitting flat materials to curved human bodies.)

Artist's presentation for Math 467 Math and Art: Beautiful Rigor, 2009.

Platonic solids necklace (compressed aluminum candy wrapper solids, rubber tubing and hardware display), 1997.

Sheet plastic can be used as a textile, but it can't be sewn, and its Gaussian curvature is zero (so fitting plastic clothing means covering the body with bits of cylinders and cones - aka like no pattern you've ever seen), 1999.

Flexible chainmail as both a knit and a co-knit (and attempts at its construction), 2010-present.

Robot for 3D printing miniaturizable flexible chain mail (in progress).

3D printed mock up of ocular filter that can show a different image at different angles (in progress).

Non-Newtonian fluid flow (display of chocolate eggs that split along fluid flow surfaces), 1997.

Chaos For-Loops in OpenSCAD for and by general education students, Fall 2018.

The exponential nature of the Hilbert curve makes it a poor choice for shading a realistic image.

The fact that potato chips form a saddle when fried tells us a lot about how the starch molecules in a potato are laid out.

'Looped-lightning diagrams' as piecewise linear expressions for xor in hash algorithms, 2011.

Weaving velvet out of jute twine is reinventing shag carpet, 1998.

Fabric that moves as if there were wind in it (future plans).

Plastigage (an incompressible plastic material for measuring clearance between inaccessible metal parts) is based on the volume of a box.

ART PROJECTS

Debut Collection (Bowdoin Honors Thesis: *Works of Clothing*, 1994) includes a 30 page artist's statement, two week exhibit, and 'fashion show' runway performance with eight dresses and thirteen hats: designed primarily as artworks.

Monkeys and Witch (four monkey costumes and one witch costume for a ballet based on Goethe's Faust, University of Chicago, 1998) Monkeys Theme: wise fool characters in Reign of Terror

mismatched, tattered French aristocrat's clothes. Witch Theme: drama and control - fetish-Victoriana.

RF^2 Collective (with Romero Fernandez): Bike To Work Day Trophies: five crowns with display mounts (welded and riveted bike parts, styrofoam), 2009.

Wearable art/practical garments (selected highlights): shower curtain and packing tape dress; upside-down-army-jacket shrug; *Coat with Teeth* (gap between jacket and sleeve filled with artificial teeth, worn with Corinthian-style teeth eyes); *Queen of Hearts* (chickenwire pope hat and self wrapped in red satin); *Wedding Dress* (red satin strapless with sleeveless Watteau pleat coat made of red rubber supermarket mesh); tarp skirt; draped scrap leather skirt with flame lining.

Costumes: *Marie Antoinette Brought to Life Through Technology*; zebra halloween costume; skinless anatomical specimen gloves and mask; Borg drone; *Barbie* (includes clothes out of craft felt and a artificial chin to smile without moving facial muscles); aged satyr (padded goat pants, point shoes, horns, cane).

Paintings: *Portrait of a fake bonsai tree for aquariums on gold cardboard* (based on Imperial Japanese Great Pine Murals on gold leaf); paintings of Budapest on cardboard; cow skull; portrait of model in robe; eggs and leeks.

Self Portraits: *The decadence of empty space* collage using the New York Times; disappearing portrait in crystal sequins and beads on mirror fragments; aquatint etching; painting on cork board.

Etchings: hard ground portrait of my favorite circuit board; collage queen of spades in aquatint; embossed 'calligraphy' from metal plate corner waste, 1998.

Commissions: album cover for Salome AM/PM; shirt of plastic window screen material; spiral tattoo (jail-house); amauti (traditional Inuit parka) for Doll's trip to Antartica.

2D: lipstick on glass portrait of a power plant; drawings of assorted food molds (colored pencil); front facing portraits of class 8 trucks off I94 from Michigan to Oregon (DSLR).

Sculpture: *No-Bad* (wire, bent aluminum stakes, wax, leather, red paint, saran wrap), *Not a dress dummy* (paint can, iron post, aluminum flashing, curtain rods, chickenwire, armored electrical wire, newsprint, and masking tape); cast iron sun-hat (organic lattice sun-hat, resin bonded sand-cast); *Torso* (bent aluminum siding, chicken wire); Platonic solids necklace; Wayfarer's Harp (welded and braised sheet steal, guitar strings, upholstery padding); found in Leeds (rusted metal and charcoal).

Textiles: sheet plastic prototypes for Doll (zero Gaussian curvature); shower curtain and packing tape; photo-print collage of spring red-bud trees and road signs; microscopic canvas model in jute twine and glue; temporary textile of woven losing lottery tickets; photo-print of interstate median microclimate Oregon-Virginia-Maine; historical velvets and double velvet experiments in jute twine; quilted air in chiffon and organza; chainmail (European 4 in 1 - wire, elastic, 3D printed); friction-free knit (fishing line); dune grass fabric (knit continuous braid, joint with Nana and nieces); white wedding mesh Ghillie suit sample; hammered brass Hoplite bell corselet; *Fishing chaos* (fishing line taped to electric drill to twist); *Marrow L.Glava* (chickenwire and plaster lined with red velvet).

Accidental Art about Commodities (multi-media series).

Dutch Masters Collection (clothing, based on paint crackle, in progress).

TEACHING EXPERIENCE

James Madison University

Advanced Linear Algebra, current

Independent Study in Differential Geometry (with Dr. Duncan), Oct 2018- current

Calculus with functions II, Jan - May 2009, 2015, and current, Sept - Dec 2013

Linear Algebra, September - December 2018

Introduction to 3D Printing and Design, Sept - Dec 2014-2017, 2018 Jan - May 2015-2016

Representation Theory, January -May 2017

Calculus with functions I, Sept - Dec 2008-2009, 2014, 2016, Jan - May 2017

Introduction to Topology, September - December 2010 and current

Putnam Problem Seminar, Sept - Dec, 2010-2013, 2015 (with Dr. Jones), and current (solo)

Advanced Calculus II (Real Analysis), January - May 2016

Advanced Calculus (Real Analysis), January - May and September - December 2015

Independent Study in Differential Geometry of Curves and Surfaces, January - May 2014

Differential Geometry with Applications to General Relativity, January - May 2014

Differential Geometry, September - December 2012

Abstract Algebra II, January - May 2012

Abstract Algebra, January - May 2011, September - December 2011

Linear Algebra with Differential Equations, January - May 2013

Supplemental Course in Group Theory, January - May 2012

JMU NSF Supported REU in Algebraic Combinatorics, June - July 2011

Independent Study in Summer Research, June - July 2011

Independent Study, Topology 2, January - May 2011

Independent Study, Topology, January - May 2013

Independent Study, Abstract Algebra Assistant, September - December 2012

Calculus I, January - May 2011, September - December 2012

Calculus II, January - May 2010, September - December 2010 and January - May 2016

Nature of Mathematics, January - May 2012

Reed College

Topology Learning Seminar, February - May 2008

Bowdoin College

Independent Study in Linear Algebra (from a theoretical prospective), January - May 2006

Linear Algebra (an applied math class), January - May 2006

Introduction to Mathematical Analysis, September - December 2006

Independent Study in Algebraic Geometry, January - May 2006

Introduction to Mathematical Reasoning, January - May 2006

Multivariate Calculus, September - December 2005,
    September - December 2006

Integral Calculus, September - December 2005,
    January - May 2006

Differential Calculus, January - May 2007

University of California-Santa Cruz

Calculus for Science, Engineering, and Mathematics II, March - June 2005

Introduction to Proof and Problem Solving, January - March 2005

Introduction to Topology, September - December 2004

Calculus with Applications II, September - December 2004

Abstract Algebra, September 2003 - March 2004

Precalculus, January - March 2004

Linear Algebra, September - December 2003

University of Wisconsin-Madison

Topics in Algebraic Geometry, January - May 2003

Introduction to Modern Algebra, September - December 2002

College Geometry I, Euclidean and non-Euclidean geometry, January - May 2001.

Arithmetical Problem Solving, for elementary education majors, September - December 2000,
    September - December 2001

Geometrical Inference and Reasoning, for elementary education majors, January - May 2002

University of Chicago

Lecturer for Fundamental Mathematics, pre-calculus, October 1998 - March 1999,

October 1999 - March 2000

Lecturer for Calculus 152-3, intermediate level calculus, October 1997 - March 1998.

Lecturer for Elementary Functions and Calculus 131-2-3, October 1996 - June 1997

Teaching Assistant for Abstract Algebra 254-5-6, October 1995 - June 1996

Outreach for the Chicago Public School System

Teaching Assistant for Summer Institute for the Development of Mathematics Teachers in Chicago High Schools, June - July 2000

Teaching Assistant for supplementary training for CPS middle and high school teachers, September 1998 - May 1999, January 1999 - May 2000

LETTERS OF RECOMMENDATION FROM

Ian Grojnowski, University of Cambridge, Cambridge, England   groj@dpmms.cam.ac.uk

Allen Knutson, Cornell University   allenk@math.ucsd.edu

J. Peter May, University of Chicago   may@math.uchicago.edu

Dave Carothers, James Madison University   carothdc@jmu.edu

Jennifer Taback (teaching letter), Bowdoin College   jtaback@bowdoin.edu