

Catherine A. Buell

CONTACT INFORMATION Department of Mathematics
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EDUCATION **North Carolina State University**, Raleigh, NC USA

Ph.D., Mathematics, North Carolina State University, 2011

- Thesis Topic: *On Maximal \mathbb{R} -split Tori Invariant under an Involution*
- Advisor: Dr. Aloysius Helminck

M.S., Mathematics, 2008

Springfield College, Springfield, MA USA

B.S., Mathematics, 2006

- Minors in Computer Programming and Dance

RESEARCH INTERESTS Algebra: generalized symmetric spaces, algebraic groups, group theory, representation theory, Lie algebras and Lie groups, visual stylometry, math and social justice and equity.

PUBLICATIONS: (* denotes undergraduate)

- [1]: Buell, C.A. and B. Shulman, editors. *Mathematics for Social Justice*. Routledge. Print. Planned Publication Date: 10 May 2021
- [2]: Buell, C., A. Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak (2020) Classifying the orbits of the generalized symmetric spaces of $SL_2(\mathbb{F}_q)$, *Communications in Algebra* 48:4, 1744-1757.
- [3]: Buell, C. A. and Piercey, V. (2019) Ethics in Mathematics. *FOCUS*, Feb/March.
- [4]: Buell, C.A. & Shulman, B. (2019) An Introduction to Mathematics for Social Justice, *PRIMUS*, 29:3-4, 205-209.
- [5]: berg, j., Buell, C., Day D., & Evans, R. (2019) Meaningful Mathematics: A Social-Justice-Themed-Introductory Statistics Course, *PRIMUS*, 29:3-4, 300-311.
- [6]: Buell, C. (2018) *What's the buzz? Tell me what's happening: A conference on ethics in mathematics*. Invited Guest Blogger for AMS inclusion/exclusion blog: <https://blogs.ams.org/inclusionexclusion/2018/04/30/conference-on-ethics-in-mathematics/>.
- [7]: Buell, C., V. Klima, J. Schaefer, C. Wright, E. Ziliak (2018) *Orbit decompositions of unipotent elements in the generalized symmetric spaces of $SL_2(\mathbb{F}_q)$* , *Advances in the Mathematical Sciences*. A. Deines et al. (eds.). Association for Women in Mathematics Series 15, p.69-77.
- [8]: Sethi, R., Buell, C., W. Seeley & Y. Gil (2017) Democratizing the Visual Stylometry of Art: Analysis of Artistic Style through Computational Workflows, *Communications of the Association for Computing Machinery*.

- [9]: Buell, C. Sethi, R., and Seeley, W. (2017) A Framework for Computing Artistic Style using Artistically Relevant Features, eScience poster and paper.
- [10]: Buell, C., A Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak (2017) On the Structure of Generalized Symmetric Spaces of $SL_n(\mathbb{F}_q)$, *Communications in Algebra*. Vol. 45, 5123-5136.
- [11]: Seeley, W. & Buell, C. (2017) A Question of Artistic Style: Digital Image Analysis and the Classification of Paintings. *Conference Paper and Presentation. Pacific Division Meeting of the American Society for Aesthetics*, Asilomar Conference Grounds, Pacific Grove, California.
- [12]: Buell, C., A Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak (2017) On the Structure of Generalized Symmetric Spaces of $SL_2(\mathbb{F}_q)$, *Note di Matematica* 37 (2), 1-10.
- [13]: Buell, C., Greenstein, S., Wilstein, Z (2016) Constructing an Inquiry Orientation from a Learning Theory Perspective: Democratizing Access through Task Design, *PRIMUS* Vol. 27, (1) 75-95.
- [14]: Brown, M., Buell, C., Marr, A. (2015) *CCICADA Teaching Module: Cryptography in Forensics* published on the CCICADA educational website: <http://www.ccicada.org/2014/06/10/ccicada-education-modules/#Cryptography>.
- [15]: Buell, C.A. and Kimball, E* (2014) Frobenius Pseudoprimes and a Cubic Primality Test., *Notes on Number Theory and Discrete Mathematics*, Vol. 20, No.4, 11-20.
- [16]: Buell, Catherine A. (2012) On Maximal \mathbb{R} -split Tori Invariant under an Involution, *Proceedings from XXX Workshop on Geometric Methods in Physics: Trends in Mathematics*. Birkhauser Publishing House, XII.

AWARDS AND GRANTS

- Cultivating Cultures of Ethics in STEM (now Ethics in Research) Incubation Grant from the NSF, 2020. (\$59,733)
- MassHumanities grant for public workshops, 2019. (\$3,000)
- Crocker Center Grant for public workshops, 2019. (\$1,000)
- AWM Travel Grant 2017 (\$2,300)
- American Society for Aesthetics for *Making WAIVS! Workshop* with Co-Pis, 2017. (\$4,500)
- National Endowment for the Humanities Digital Start-up Grant for *Scientific Workflows, Image Analysis, and Visual Stylometry in the Digital Analysis of Art* with Co-Pis, 2016. (\$40,000)
- Collaborate@ICERM, 2016 & 2017& 2018
- Center for Teaching and Learning Grant for Pedagogical Discussion Group, Fitchburg State University, 2016. (\$500)
- Fitchburg State University Workshop Grant for “Math and Social Justice Workshop”, Rollins College, 2016. (\$4,000)
- Fitchburg State University Workshop Grant for “Precalculus Redesign”, 2016. (\$4,000)
- Associated Colleges of the South Workshop Grant for “Math and Social Justice Workshop”, Rollins College, 2016. (\$15,000)
- Special Project Grant Travel Fund to attend MathFest Washington D.C., Fitchburg State University, 2015. (\$700)
- Professional Development Grant, Fitchburg State University, 2015. (\$250)

- SQuaRE at American Institute of Mathematics, 2014.
- Bates Faculty Development Grant for international conference, 2013. (\$2,500)
- Award to attend ICERM/AIM: Research Experience for Undergraduate Faculty, 2013
- Publicly-Engaged Academic Project (PEAP Grant), Harvard Center for Community Partnerships, Bates College, 2012. (\$800)
- AMW Travel Grant, 2012. (\$2,000)
- AWM/NSF Sonia Kovalevsky High School Math Day Grant, 2012. (\$1,500)
- Project NExT Fellow, 2012

TEACHING
EXPERIENCE

Massachusetts Department of Corrections/Mount Wachusett Community College

Instructor

Fall 2017-Present

- Responsibilities: Weekly lectures, all classroom activities, syllabus, book creation, quiz and test writing, grading, holding tutoring ours, administering all grades, development of new course.
- Foundations of Mathematics and Topics in Mathematics

Fitchburg State University,

Associate Professor

September 2018-Present

Assistant Professor

Fall 2014-September 2018

- Responsibilities: Daily lectures, all classroom activities, syllabus, book choice, quiz and test writing, grading, holding office hours, administering all grades, development of new courses, and advising students.
- Courses: Mathematics in Society, Introduction to Functions, Applied Statistics: Social Justice Themed, Informal Number Theory, Informal Geometry, PreCalculus, Calculus I, Calculus II, Linear Algebra, Abstract Algebra, Applied Math Seminar, Mathematics Seminar, Independent Studies, Student Research.

Bates College,

Visiting Assistant Professor

Fall 2011-Spring 2014

- Responsibilities: Daily lectures, all classroom activities, syllabus, book choice, quiz and test writing, grading, holding office hours, administering all grades, development of new courses, advising students (majors and minors)
- Courses: Working with Data, Great Ideas in Mathematics, Calculus I, Linear Algebra, Introduction to Abstraction (proofs course), Matrix Theory and Applications of Linear Algebra, Abstract Algebra, Senior Seminar (Capstone Course): Generalized Symmetric Spaces, Independent Study: Primality and Number Fields.
- One-semester and two-semester senior thesis advising.
- Summer 2012 and 2013: Team-taught the Bates Summer Scholars Program for incoming students from underrepresented groups in STEM disciplines.

North Carolina State University,

Course Instructor

Fall 2007 to Spring 2011

- Responsibilities: Daily lectures, all classroom activities, quiz and test writing, grading tests and working with graders, holding office hours, and administering all grades.

- Courses: Calculus I & II for Life Sciences, Calculus I & II for Engineering, Applications of Abstract Algebra with Matlab and Maple.

Massachusetts Mathematics Institute,

Instructor - Presenter **January 2004 to Summer 2006, August 2012**

The MMI course for elementary and middle school teachers was a math content and pedagogy intensive course which travelled to underperforming districts in Massachusetts. As part of the program I was responsible for assisting in group work, preparing lessons, and teaching.

OTHER SCHOLARSHIP EXPERIENCES

Workshop for Faculty Learning Community (FLC) at WPI

Advisor and Presenter **August 2018**

I received an invitation to run a workshop for the Worcester Polytechnic Institute's FLC. The workshop was with approximately 10 faculty from STEM and non-STEM fields and involved showing faculty what I did in your class, outcomes, and providing them with tips, exercises, activities, etc. to get them started with how to do the same in their classes. The workshop was specific to the faculty members disciplines.

Collaborate@ICERM

Research Group Co-Organizer **July 2016 & August 2017 & July 2018**

Together with collaborators, I was awarded a week at ICERM for computational research workshop with my research group.

Themed Contributed Paper Session: Intertwining Mathematics and Social Justice

Organizer **January 2017**

The special session will take place at the 2017 Joint Mathematics Meetings in Atlanta, GA. The session features nearly 20 speakers and the session is associated with the special issue of PRIMUS.

Associate Editor for Special Edition of PRIMUS: Intertwining Mathematics and Social Justice

Co-Editor **2016-present**

PRIMUS granted myself and my collaborator a special edition of PRIMUS focussed on teaching Math and Social Justice at the undergraduate level.

REUF: Mathematics of Data at Duke University

Research Participant **July 2016**

Together with Duke's iiD program, this weeklong experience paired groups of undergraduate faculty in algebra, geometry, and topology with researchers at Duke working in big data questions.

Hosted ACS/FSU Workshop on Mathematics and Social Justice

Co-Organizer **May 2016**

The Associated Colleges of the South, Rollins College, University of Richmond, and Fitchburg State University supported a grant for a workshop on creating social justice mathematics materials.

Themed Contributed Paper Session: Democratizing Access to Authentic Mathematical Activities

Organizer

August 2015

The special session will take place at the 100th anniversary celebration of MathFest in Washington D.C. The session will feature talks on math and social justice, techniques to use inquiry in all classrooms, and programs that democratize access to research and math to all students.

RECONNECT 2014 & 2015 & 2018,

Accepted Participant

June 2014, 2015, 2018

This week long experience was co-sponsored by DIMACS (Center for Discrete Mathematics and Theoretical Computer Science) and CCICADA (The Command, Control and Interoperability Center for Advanced Data Analysis). At the end of the 2014 experience on Forensics, my module group created and submitted a module on MD5 (submitted January 2015). The 2015 conference was on social network analysis. Again, my group will submit a module on networks for K-12 classrooms. The final Reconnect did not require module writing.

Research SquaRE,

Co-organizer

August 2014

The purpose of AIM's research program called SquaREs (Structured Quartet Research Ensembles) is to allow a dedicated group of four to six mathematicians to spend a week at AIM in Palo Alto, California. I attended with my collaborators on Generalized Symmetric Spaces.

Research Experiences for Undergraduate Faculty,

Invited Participant

July 2013

This week long experience was co-sponsored by AIM and ICERM. I was part of a group of five faculty at various undergraduate institutions and we worked together on a research project in group theory. We have continued our collaboration.

Student Research Presented at AMS Selectional Meeting Special Session,

Advisor

April 2013

My thesis student was invited to present his research at the Special Session on Research by Undergraduates and Students in Post-Baccalaureate Programs held at Boston College.

AMS Special Session on "Generalized Symmetric Spaces",

Organizer

January 2013

The special session took place with support from the AMS at the San Diego Joint Meetings. The session attracted some national and international leaders in the field and early career mathematicians. It was well attended and well received.

MENTORING
EXPERIENCES

Honors Program Coordinator,

January 2018-present

Coordinator of the Honors Program at Fitchburg State. Responsible for curriculum, programming, advising, and regional and national correspondence.

Hudson River Undergraduate Math Conference,

2015, 2016, 2017

Traveled to Union College with 12 students to participate in the HRUMC in 2015. In 2016, we brought nearly 15 students up to St. Michael's College in Vermont. In 2017, we brought 8 students to Westfield State. I have had two students present research at this conference.

Virginia Summer Mathematics Institute,

Facilitator

May 2013

I was one of six facilitators for the Virginia Summer Mathematics Institute (SMI). SMI is a week-long summer development and training program for Henry County and Martinsville City Public School teachers on the use and practice of Inquiry Based Learning and Problem Based Learning (IBL & PBL) in mathematics. We worked with the middle school and high school teachers. Co-funded by: The Harvest Foundation (in Virginia) and the Henry County Public Schools. I was a Co-PI on the grant.

Sonia Kovalevsky High School Women in Math Day,

Organizer and Mentor

Spring 2012

I held Bates College's first SK Day for 25 local high school women. The event brought a diverse group of young women to Bates College for a day of mathematics. The event was funded by the AWM/NSF and the Harvard Center for Community Partnerships (Bates College).

Enhancing Diversity in Graduate Education (EDGE),

Graduate Mentor

Summer 2010

I worked as a graduate mentor for 15 women entering graduate schools all over the country in the fall. Responsibilities included holding office hours, working problem sessions, organizing social events, and being a friend, mentor, and support system.

SELECTED

INVITED

TALKS/WORKSHOPS

- *JMM Committee on the Profession Panel: Ethics in Mathematics*, JMM Denver, CO January 2020.
- *Ethics in Mathematics: The role of teachers and mathematicians*, Montclair State University, NJ, November 2019.
- *Ethics in Mathematics: An Existence Theorem*, MathFest, August 2019.
- *Doing Something: Mathematics, Ethics, and You*, Ethics in Mathematics Conference 2, Cambridge University, UK, April, 2019.
- *Generalized Symmetric Spaces over finite fields*, AMS Special Session: Generalizations of Symmetric Spaces, University of Hawaii at Manoa, March, 2019.
- *Workshop for Faculty Learning Community (FLC)*, Worcester Polytechnic Institute, August 2018.
- *Meaningful Mathematics: Social Justice and Ethical Discussions in College Mathematics*, Ethics in Mathematics Conference, Cambridge University, UK, April, 2018.
- *Meaning Mathematics: Social Justice and Mathematics*, SUMS: Math and Social Responsibility, Brown University, March 2018.
- *Using Culturally Relevant Materials in the STEM Classroom*, PKAL, Bridgewater State University, Jan. 2018.
- *Intertwining Social Justice in the STEM Classroom (workshop)*, PKAL Fitchburg State University, June 2017.
- *A New Dialect: Tropical Mathematics for Industrial Processes*, Providence College, April 2017.

- *Making WAIVS: Image Analysis Tools for Art Historians* Science Seminar at WRHS, Wachusett, MA, Nov. 2016.
- *On the structure of generalized symmetric spaces of $SL_n(\mathbb{F}_q)$* , AMS Special Session: Lie Groups, Discretization, and Gelfand Pairs, Joint Mathematics Meeting, Jan. 2016.
- *Tropical Mathematics: A New Dialect.*, Southern New Hampshire University, November 2015.
- *On maximal quasi \mathbb{R} -split tori invariant under an involution*, AMS Special Session, AMS Sectional Meeting, March 2015.
- *Stabilizing Discrete Event Systems with Tropical Eigenvalues*, AMS Special Session, Joint Mathematics Meetings, Jan. 2015.
- *Critters, Cards, and Encryption: An Adventure in Applied Algebra*, Colby College Colloquium Series, Nov. 2012.
- *On maximal \mathbb{R} -split tori invariant under an involution*, XXX Workshop for Geometric Methods in Physics, June 2011, Bialowieza, Poland.

SELECTED TALKS

- *Tropical Mathematics: A New Dialect*, Elizabeth Haskins Math Competition, Fitchburg State University, April 2017.
- *Making WAIVS!*, Fitchburg Art Museum, Making WAIVS! Workshop, May 2017.
- *Social Justice in a General Education Course*, Joint Mathematics Meetings, Jan. 2017.
- *Methods to Democratizing Inquiry for K-12 Students and Teachers*, Themed Contributed Paper Session, Joint Mathematics Meetings, Jan. 2015.
- *On maximal quasi \mathbb{R} -split tori invariant under an involution*, Joint Mathematics Meeting, Jan. 2014.
- *On maximal tori invariant under an involution*, 40 Years and Counting: AWM's Celebration of Women in Mathematics Poster Session, Sept. 2011, Providence, RI.

SELECTED CONFERENCES

- AMS Sectional Meeting, Honolulu, Hawaii, March 2019 (to attend).
- Joint Mathematics Meetings 2019, 2017, 2016, 2015, 2014, 2013, 2012, and 2011.
- Mathematics of Planet Earth 2013+ (MPE2013+) Workshop: Not in My Back Yard (NIMBY) 2018: Mathematical and Computational tools for Decision Making, Allentown, PA, June 2018.
- AMS Sectional Meeting, Lansing, Michigan, March 2015.
- MathFest 2015, 2012 and 2011.
- Generalizations of Symmetric Spaces, The Lorentz Center, Leiden, The Netherlands, Nov. 2013.
- Symmetric Spaces and their Generalisations II, Trento, Italy, June 2012.
- XXX Workshop for Geometric Methods in Physics, Bialowieza, June 2011.
- Summer School on Representation Theory and Related Topics with Workshop, Shanghai, China, July 2010.
- International Conference on Bifurcation Theory, Integrable Systems, and the Bispectral Problem, Sofia University Sofia, Bulgaria, May 2010.
- International Workshop on Quantized Algebra and Physics, Chern Institute of Mathematics, Tianjin, China, July 2009.
- International Workshop on Algebraic Groups, Quantum Groups, and Related Topics, Peking University, Beijing, China, July 2009.

COMPUTER SKILLS

- Programming skills in C++, JAVA, BASIC, PERL, HTML and Maple.

- Knowledge of Microsoft Office (Powerpoint, Access, Word, and Excel).
- Knowledge of LaTeX, Maple, Mathematica, Matlab, and StatCrunch.