

## Catherine A. Buell

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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, Catherine A. and Loek Helminck, *On Maximal Quasi  $\mathbb{R}$ -split Tori Invariant under an Involution*. (in preparation).
- [2]: Buell, C., A. Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak, *Orbit decompositions in the generalized symmetric spaces of  $SL_2(\mathbb{F}_q)$* . (in preparation).
- [3]: Buell, C. *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/on-ethics-in-mathematics/>, April 2018.
- [4]: Sethi, R., Buell, C., W. Seeley & Y. Gil, *Democratizing the Visual Stylometry of Art: Analysis of Artistic Style through Computational Workflows*. (submitted October 2017).
- [5]: Brown, M., Buell, C., Marr, A., *CCICADA Teaching Module: #Networks4All: Three Introductory Perspectives on Networks: Concept Maps, Social Networks, and Error-correcting Codes*. (submitted July 2017, in review).
- [6]: Buell, C., V. Klima, J. Schaefer, C. Wright, E. Ziliak, *Orbit decompositions of unipotent elements in the generalized symmetric spaces of  $SL_2(\mathbb{F}_q)$* , AWM 2017 Research Symposium Proceedings. (accepted with minor revisions).
- [7]: Berg, J., Buell, C., Day, D., Evans, R., *Meaningful Mathematics: A Social Justice Themed Introductory Statistics Course*, PRIMUS. (to appear).
- [8]: Buell, C. Sethi, R., and Seeley, W., *A Framework for Computing Artistic Style using Artistically Relevant Features*, eScience poster and paper, October 2017.

- [9]: Buell, C., A Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak, *On the Structure of Generalized Symmetric Spaces of  $SL_n(\mathbb{F}_q)$* , Communications in Algebra. Vol. 45, 5123-5136, August 2017.
- [10]: Seeley, W. & Buell, C. *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, April 2017.
- [11]: Buell, C., A Helminck, V. Klima, J. Schaefer, C. Wright, E. Ziliak, *On the Structure of Generalized Symmetric Spaces of  $SL_2(\mathbb{F}_q)$* , Note di Matematica 37 (2), 1-10, January, 2017.
- [12]: Buell, C., Greenstein, S., Wilstein, Z., *Constructing an Inquiry Orientation from a Learning Theory Perspective: Democratizing Access through Task Design*, PRIMUS Vol. 27, (1) 75-95, July 2016.
- [13]: Brown, M., Buell, C., Marr, A., *CCICADA Teaching Module: Cryptography in Forensics* published on the CCICADA educational website: <http://www.ccicada.org/2014/06/10/ccicada-education-modules/#Cryptography>, March 2015.
- [14]: Buell, C.A. and Kimball, E\*, *Frobenius Pseudoprimes and a Cubic Primality Test.*, Notes on Number Theory and Discrete Mathematics, Vol. 20, No.4, 11-20, Nov. 2014.
- [15]: Buell, Catherine A. *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, September 2012.

#### Awards and Grants

- 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

**North Central Correctional Institute-Gardner, MA,**

*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.
- Course: Topics in Mathematics

**Fitchburg State University,**

*Assistant Professor*

**Fall 2014-Present**

- 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: Introduction to Functions, Applied Statistics: Social Justice Themed, Informal Number Theory, Informal Geometry, PreCalculus, Calculus I, Calculus II, Linear Algebra, Independent Study: Applications of Tropical Mathematics, Applied Math Seminar, Mathematics Seminar, 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

**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 Selection 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

**Tri Sigma Sorority Faculty Advisor,**

**September 2015-May 2017**

I am the faculty advisor for one of the three sororities on campus. I attend weekly meetings as well as events on campus with the sisters.

**SGA Faculty Advisor,**

**November 2016-May 2017**

SGA met twice a week once with the executive board and then again with the entire senate. I attended weekly meetings and retreats to support the student-led club.

**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 Talks

- *Meaningful Mathematics: Social Justice and Ethical Discussions in College Mathematics*, Ethics in Mathematics, 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.
- *Making WAIVS!*, Fitchburg Art Museum, Making WAIVS! Workshop, May 2017.
- *Tropical Mathematics: A New Dialect*, Elizabeth Haskins Math Competition, Fitchburg State University, April 2017.
- *A New Dialect: Tropical Mathematics for Industrial Processes*, Providence College, April 2017.
- *Social Justice in a General Education Course*, Joint Mathematics Meetings, Jan. 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.
- *Methods to Democratizing Inquiry for K-12 Students and Teachers*, Themed Contributed Paper Session, Joint Mathematics Meetings, Jan. 2015.
- *Stabilizing Discrete Event Systems with Tropical Eigenvalues*, AMS Special Session, Joint Mathematics Meetings, Jan. 2015.
- *On maximal quasi  $\mathbb{R}$ -split tori invariant under an involution*, Joint Mathematics Meeting, Jan. 2014.
- *Critters, Cards, and Encryption: An Adventure in Applied Algebra*, Colby College Colloquium Series, Nov. 2012.
- *On maximal tori invariant under an involution*, 40 Years and Counting: AWM's Celebration of Women in Mathematics Poster Session, Sept. 2011, Providence, RI.
- *On maximal  $\mathbb{R}$ -split tori invariant under an involution*, XXX Workshop for Geometric Methods in Physics, June 2011, Bialowieza, Poland.

### Selected Conferences

- Joint Mathematics Meetings 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.