

John Willis

Department of Mathematics	jmart.will@gmail.com
University of Colorado at Boulder	(860)803-0261
Colorado Ave.	Born in Providence,
Boulder CO 80302 USA	Rhode Island December 13, 1986

Education

- **The University of Colorado at Boulder**, Boulder, Colorado
PhD Candidate in Mathematics
Advisor: Jonathan Wise
August 2013 - Present
- **The University of South Carolina**, Columbia, South Carolina
PhD Candidate in Mathematics
August 2011 - May 2013
- **University of Vermont**, Burlington, Vermont
M.S. in Mathematics, May 2011
Advisor: John Voight
- **Canisius College**, Buffalo, New York
B.S., May 2009
Majors: Mathematics and Physics
Minor: Computer Science

Awards

- Summer Support Grant
University of Colorado Graduate School Grant for \$6000; Summer 2017
- Summer Support Grant
University of Colorado Summer Research Support for \$4500; Summer 2015
- Summer Support Grant
University of Colorado Summer Research Support for \$4500; Summer 2014
- AMS Travel Grant
AMS Western Sectional travel grant for \$350; Spring 2013
- Outstanding First Year Graduate Student Award
Department of Mathematics, University of South Carolina; Columbia, South Carolina; May 2012
- J.F. Kenney Award for Excellence in Mathematics
Department of Mathematics, University of Vermont; Burlington, Vermont; May, 2011
- V.A. Ruskiewicz Memorial Prize for Distinction in Physics
Department of Physics, Canisius College; Buffalo, New York; May, 2009

Research

- 2017, *Exact and Étale Topologies for Monoids*
The University of Colorado at Boulder, Department of Mathematics
Advisor: Jonathan Wise
- 2015, *Arizona Winter School, The Class of the Affine Line in the Grothendieck Ring is a Zero Divisor*
The University of Arizona
Project Group: Ravi Vakil
- 2013, *Arizona Winter School, Class Polynomials for Non-Holomorphic Modular Functions*
The University of Arizona
Project Group: Ken Ono
- 2010-2011, *Power Series Expansions for Modular Forms*
The University of Vermont, Department of Mathematics,
Advisor: Dr. John Voight
- 2007-2009, *Horizon Based Composite Section Formation via Horizon Annealing*
Canisius College, Department of Physics
Advisor: Dr. H. David Sheets,

Seminar Addresses

- November 17, 2017
Introduction to Schemes
The University of Colorado at Boulder, Initial Conditions Seminar
- February 28, 2017
Algebraic Theta Functions
The University of Colorado at Boulder, Theta Functions Seminar
- September 10, 2014
What are Schemes?
The University of Colorado at Boulder, Slow Pitch Seminar
- June 20, 2014
Cubic Forms and Cubic Rings Part II
The University of Colorado at Boulder, Geometry of Bhargava's Higher Composition Laws Seminar
- June 16, 2014
- *Cubic Forms and Cubic Rings Part I*
The University of Colorado at Boulder, Geometry of Bhargava's Higher Composition Laws Seminar
- March 24, 2014
Geometric Interpretation of Modular Forms
The University of Colorado at Boulder, Slow Pitch Seminar

- December 4, 2013
Smooth and Unramified Morphisms of Schemes
The University of Colorado at Boulder, Algebraic Geometry Seminar
- September 16, 2013
Etale Cohomology of Number Fields
The University of Colorado at Boulder, Geometry and Topology Seminar
- March 30, 2013
Class Polynomials of Non-Holomorphic Modular Functions
The University of South Carolina, Number Theory Seminar
- November 27, 2012
An overview of the Birch & Swinnerton-Dyer Conjecture, Part II
The University of South Carolina, Number Theory Seminar
- October 30, 2012
An overview of the Birch & Swinnerton-Dyer Conjecture, Part I
The University of South Carolina, Number Theory Seminar
- October 4, 2011
Power Series Expansions for Modular Forms
The University of South Carolina, Number Theory Seminar
- April 16, 2009
Time Translation and Schrödinger's Equation
Canisius College, Ignatius Scholarship Day
- March 25, 2009
Conservative Fields and Conformal Mappings
Canisius College, Student Seminar
- December 3, 2008
The Origins and Postulates of Quantum Mechanics
Canisius College, Student Seminar

Other Seminar Participation

- Fall 2017
Morse Theory, Ulam Seminar, University of Colorado at Boulder
- Spring 2017
Theta Functions, University of Colorado at Boulder
- Spring 2015
Class Field Theory, University of Colorado at Boulder
FRAGMENT, University of Colorado at Boulder/Colorado State University
- Fall 2014
Slow Pitch Seminar, University of Colorado at Boulder
Number Theory, University of Colorado at Boulder
FRAGMENT, University of Colorado at Boulder/Colorado State University

- Summer 2014
Geometry of Bhargava's Higher Composition Laws,
University of Colorado at Boulder
- Spring 2014
Number Theory, University of Colorado at Boulder
Slow Pitch Seminar, University of Colorado at Boulder
FRAGMENT, University of Colorado at Boulder/Colorado State University
- Fall 2013
Representation Theory, University of Colorado at Boulder
Geometry and Topology, University of Colorado at Boulder
Algebraic Geometry, University of Colorado at Boulder
- Spring 2013
Number Theory, University of South Carolina
- Fall 2012
Number Theory, University of South Carolina
Algebra and Logic, University of South Carolina
- Spring 2012
Number Theory, University of South Carolina
Algebra and Logic, University of South Carolina
- Fall 2012
Number Theory, University of South Carolina
Algebra and Logic, University of South Carolina

Seminar Organization

- Summer 2017
Geometry of Algebraic Curves, University of Colorado at Boulder
- Summer 2014
Geometry of Bhargava's Higher Composition Laws, University of Colorado at Boulder

Conference Addresses

- April 30, 2011
Power Series Expansions for Modular Forms
Cornell University, Upstate Number Theory Conference
- April 3, 2009
Time Translation and Schrödinger's Equation
Rochester Institute of Technology, Seaway Section Meeting

Other Conferences Attended

- March 14-18, 2015
University of Arizona, Arizona Winter School, Arithmetic and Higher Dimensional Varieties
- December 1-5, 2014
University of California at Berkeley, Shimura Varieties, L-functions, Automorphic Forms,
and Galois Representations
- November 11-15, 2014
CRM, Counting Arithmetic Objects
- October 17-19, 2014
University of Georgia, Georgia Algebraic Geometry Symposium
- October 10-12, 2014
University of Idaho, Western Algebraic Geometry Symposium
- April 11-12, 2014
University of Colorado at Boulder, Western Algebraic Geometry Symposium
- March 15-19, 2014
University of Arizona, Arizona Winter School, Arithmetic Statistics
- May 3-5, 2013
University of Illinois at Chicago, Atkin Memorial Lecture and Workshop, Cohen-Lenstra
Heuristics
- April 19-21, 2013
Yale University, AGNES
- April 12-14, 2013
University of Colorado at Boulder, AMS Western Sectional itemize March 9-13, 2013
University of Arizona, Arizona Winter School, Modular Forms and Modular Curves
- January 9-12, 2013
San Diego, Joint Mathematics Meetings
- December 1 - 2, 2012
University of South Carolina, Palmetto Area Number Theory Series
- March 30 - April 1, 2012
Western Carolina University, Southeastern Regional Meeting on Numbers
- March 17-18, 2012
College of Charleston, Southeast Geometry Conference
- October 1-3, 2011
Wake Forest University, AMS Southeastern Sectional Conference
- September 10-11, 2011
Emory University, Palmetto Area Number Theory Series

Teaching

- Math 2300, Calculus II
The University of Colorado at Boulder; Boulder, Colorado; Fall 2017
- Math 2300, Calculus II
The University of Colorado at Boulder; Boulder, Colorado; Spring 2017
- Math 1300, Calculus I
The University of Colorado at Boulder; Boulder, Colorado; Spring 2015
- Math 1300, Calculus I
The University of Colorado at Boulder; Boulder, Colorado; Fall 2014
- Math 1081, Business Calculus Recitation
The University of Colorado at Boulder; Boulder, Colorado; Spring 2014
- Math 1071, Finite Math Recitation
The University of Colorado at Boulder; Boulder, Colorado; Fall 2013
- Math 141, Calculus I
The University of South Carolina; Columbia, South Carolina; Spring 2013
- Math 141, Calculus I Lab and Recitation
The University of South Carolina; Columbia, South Carolina; Fall 2012
- Math 111, College Algebra
The University of South Carolina; Columbia, South Carolina; Fall 2012
- Math 241, Vector Calculus
The University of South Carolina; Columbia, South Carolina; Summer 2012
- Math 142L, Calculus II Lab and Recitation
The University of South Carolina; Columbia, South Carolina; Spring 2012
- Math 115, College Pre-Calculus
The University of South Carolina; Columbia, South Carolina; Fall 2011
- Math 015, College Pre-Calculus
The University of Vermont; Burlington, Vermont; Summer 2011
- Math 019, Calculus with Applications
The University of Vermont; Burlington, Vermont; Fall 2010
- Math 019, Calculus with Applications
The University of Vermont; Burlington, Vermont; Fall 2010
- Math 019, Calculus with Applications
The University of Vermont; Burlington, Vermont; Spring 2010
- Math 017, Finite Mathematics
The University of Vermont; Burlington, Vermont; Fall 2009

Skills

- Coding Languages/Environments: C; Java; Python/SAGE; MatLab; Latex; Visual Basic

Other Employment

- Jax Fish House
Line and Prep Cook; Denver CO; June 2015 - June 2016
- Willis, Towers and Watson
Data Analyst; Denver, CO; June 2016 - October 2016

Publications

- (3) *Singular moduli for a distinguished non-holomorphic modular function*
(with Valerio Dose, Nathan Green, Michael Griffin, Tianyi Mao, Larry Rolen), accepted to "Proceedings of the AMS".

Here we study the integrality properties of singular moduli of a special non-holomorphic function $\gamma(z)$ which was previously studied by Siegel, Masser, Bruinier, Sutherland, and Ono. Similar to the modular j -invariant, γ has algebraic values at any CM-point. We show that primes dividing the denominators of these values must have absolute value less than that of the discriminant and are not split in the corresponding quadratic field. Moreover we give a bound for the size of the denominator.

- (2) *Power Series Expansions of Modular Forms* (with John Voight), accepted to "Computations with Modular Forms".

We exhibit a method to numerically compute power series expansions of modular forms on a cocompact Fuchsian group, using the explicit computation of a fundamental domain and linear algebra. As applications, we compute Shimura curve parametrizations of elliptic curves over a totally real field, including the image of CM points, and equations for Shimura curves.

- (1) *Horizon Annealing: A Collection Based Approach to Automated Sequencing of the Fossil Record* (with H. David Sheets, Charles E. Mitchell, Zachary T. Izard, Michael J. Melchin, and Christopher Holmden), *Lethaia*, Vol. 45, pp.532-547

A number of different approaches to quantitative biochronology have been proposed and used to construct high resolution time scales for a range of uses. We present a new approach, Horizon Annealing, which uses simulated annealing to optimize the sequencing of collection horizons. Temporal sequences of events produced by this method are compared with those produced by graphic correlation, CONOP and RASC for a series of previously studied exemplar data sets. produce results similar to other methods, but it does have some properties, the ordination of collections, and the avoidance of some local minima, which make it useful for high resolution studies, particularly those based on capture-mark-recapture methods which require detailed presence-absence data for individual collections and taxa. Horizon Annealing is shown to produce results similar to other methods, but it does have some properties, the ordination of collections, and the avoidance of some local minima, which make it useful for high resolution studies, particularly those based on capture-mark-recapture methods which require detailed presence-absence data for individual collections and taxa.