Clayton Williams

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I am a Ph.D. student in mathematics at the University of Illinois. My (number theoretic) research is in the field of modular and mock modular forms.

Written Work

Hecke Relations for Eta Multipliers and Congruences of Crank and Rank Moments **2024**
- *Submitted* [preprint]

An Infinite Family of Vector-Valued Mock Theta Functions **2023**
- The Ramanujan Journal [journal] [preprint]

Vector-Valued Mock Theta Functions **2022**
- Master's Thesis, Department of Mathematics, Brigham Young University

The Fractal Dimension of Product Sets **2021**
- [preprint]

The Lie Algebra of Conserved Quantum Observables **2019**
- Bachelor's Thesis, Department of Mathematics [pdf]

Magnetic Field Modulation Toward High Energy Particle Accelerator RF Source Replacement **2019**
- Journal of the Utah Academy of Sciences, Arts, and Letters [journal]

Related Experience

University of Illinois – Department of Mathematics **August 2022 – Present**
Graduate Research/Teaching Assistant *Urbana, IL*
- Constructed an infinite family of vector-valued mock theta functions together with their representation
- Taught 4 sections of Calculus I and 4 sections of Calculus III recitations
- Mentored student research in modular curves for the Illinois Geometry Labratory
- Co-organized the Graduate Student Number Theory Seminar

Brigham Young University – Department of Mathematics **August 2020 – July 2022**
Graduate Research/Teaching Assistant *Provo, UT*
- Constructed spaces of vector valued modular forms transforming according to the Weil representation, each related to an order of Ramanujan's mock theta functions
- Using vector valued forms transforming according to the Weil representation to generate identities among mock theta functions
- Taught as primary instructor for a finite mathematics class, led recitations for 5 sections of Calculus II and a section of Abstract Algebra, and graded for a graduate topology class

Utah Valley University – Departments of Mathematics and Physics **August 2019 – April 2020**
Undergraduate Teaching Assistant *Orem, UT*
- Introduced a nonstandard Minkowski dimension which is product-summable for all sets
- Modelled heat equation in collapsing neutron stars
- Introduced recitations for upper-division mathematics classes, taught recitations for complex and real analysis courses
- Wrote senior thesis relating Lie algebras to Schrödinger's equation
- Teaching assistant for upper and lower-division courses in mathematics and physics departments

Education

University of Illinois **August 2022 – Current**
Ph.D. in Mathematics *Urbana, IL*
- Funded by Teaching Assistantship

Brigham Young University **August 2020 – July 2022**
Master's in Mathematics *Provo, UT*
- Funded by Teaching/Research Assistantship

Utah Valley University **April 2016 – April 2020**
Bachelor's of Science, Dual Major in Mathematics and Physics *Orem, UT*
- Education concurrent with service in United States Marine Corps Reserves
- Dean's List (multiple semesters)
- 2019-2020 funded by NSF Pro-STEM scholarship/grant

Graduate Coursework

- Topology
- Real Analysis
- Algebra I
- Algebra II
- Functional Analysis
- Complex Analysis
- Analytic Number Theory
- Algebraic Number Theory
- Modular Forms
- Mock Modular Forms
- Exponential Sums
- Theory of the Zeta Function

Seminar and Conference Talks

An Infinite Family of Mock Theta Functions

- Special Session on Mock Modular Forms and Physics, Joint Mathematics Meeting San Francisco, CA January 2024
- 35th Automorphic Forms Workshop, Louisiana State University, LA May 2023

Mock Theta Functions and the Weil Representation

- Brigham Young University Student Research Conference, March 2022 [pdf]
- Brigham Young University Number Theory Seminar, November 2021 [pdf]

The Fractal Dimension of Product Sets
Utah Academy of Sciences, Arts, and Letters, March 2021 [pdf]

Goldfeld-Gross-Zagier Effective Lower Bound for h(d)
Brigham Young University Number Theory Seminar, November 2020 [pdf]

The Lie Algebra of Conserved Quantum Observables
Utah Valley University Department of Mathematics Senior Presentation, April 2019

Magnetic Field Modulation Toward High Energy Particle Accelerator RF Source Replacement
Thomas Jefferson National Accelerator Facility Summer Thesis Presentation, August 2018

Leadership, Honors, and Other Experience

United States Marine Corps Reserves **August 2015 – August 2021**
Corporal of Marines *C Co. 4th LAR Battalion 4th Marine Division*

- Mortar Section Leader, 2020-2021
- Fire Direction Center Chief, 2020-2021
- Assistant Fire Direction Center Chief 2018-2019
- Responsible for accurate and effective indirect fire as well as the health and professional development of a section of infantry Marines

Battalion Command Team Certificate of Commendation **June 2019**
Corporal of Marines *C Co. 4th LAR Battalion 4th Marine Division*

- Awarded for superior performance as Assistant Fire Direction Center Chief providing indirect fire support to multiple live fire assault courses, tank assault courses, platoon attacks, and company offensive and defensive operations, with a minimum deviation of 400 m from ground forces

Thomas Jefferson National Accelerator Facility **June 2018 – August 2018**
R&D Intern

- Researched methods for improving magnetron control and performance as sources of radio-frequency radiation in applications to high-energy particle accelerators, culminating in a peer-reviewed paper

Utah Valley University **Fall 2017**
Student *Department of Mathematics*

- Assisted in forming Utah Valley University's first Putnam Competition seminar

National Society of Collegiate Scholars **2017 – Present**
Member *Utah Valley University*

- Invited to join this national honor society for high performance as a new undergraduate at Utah Valley University