Joshua Southerland

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Current position

Ph.D. Candidate, University of Washington, Seattle

Research Interests

I work at the intersection of harmonic analysis, geometry, and dynamics, and I study two primary objects: translation surfaces and metric graphs (tropical curves). Both objects are forms of a singular manifold, and I hope to connect the Laplacian to *dynamical* and *algebraic* properties of these objects.

Education

2022	PhD in Mathematics, University of Washington (expected)
2019	MSc in Mathematics, University of Washington
2009	BSc in Mechanical Engineering, Minor in Music, Columbia University

Work Experience

2009-2016	Senior Mechanical Engineer and Sustainability Consultant, BuroHappold Consulting Engineers, New York

Honors & awards

2021-2022	Nominated for Excellence in Teaching Award, University of Washington
2020-2021	Nominated for Excellence in Teaching Award, University of Washington
2018-2019	Excellence in Teaching, University of Washington Mathematics Departmental Award

Papers

2021	Superdensity and bounded geodesics in moduli space, preprint
2021	Shrinking targets on primitive square-tiled surfaces, arXiv:2104.09634, submitted
2019	The Laplacian: An Exploration and Historical Survey Tailored for Translation Surfaces, Master's Thesis, pdf

Mentorship

Winter 2022   Washington Directed Reading Program: Mostly Surfaces, Mentee: Hai Li sites.uw.edu/wdrp/winter-2022

Winter 2022   Washington Directed Reading Program: Mostly Surfaces, Mentee: Runchi Tan sites.uw.edu/wdrp/winter-2022

Spring 2021   Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Emma Favier sites.uw.edu/wdrp/spring-2021

Spring 2021   Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Zheng (James) Cao sites.uw.edu/wdrp/spring-2021

Winter 2021   Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Haley Riggs sites.uw.edu/wdrp/winter-2021

Talks

Invited

Jun 2021   *A shrinking target property for primitive square-tiled surfaces*, Pacific Dynamics Seminar

Dec 2021   *A shrinking target property for primitive square-tiled surfaces*, Group Actions Seminar, University of California San Diego

Graduate Dynamics Seminar, University of Washington

Nov 2021   *The Ergodic Theorem and Multiplicative Ergodic Theorem*

Feb 2021   *Arnoux-Rauzy IETs: Minimality and Unique Ergodicity (following Dynnikov, Hubert, and Skripchenko)*

Mar 2020   *Structure Theory of Veech Groups*

Mar 2020   *Examples of Shrinking Target Problems*

Feb 2020   *Hyperbolic Toral Automorphisms are Mixing*

Jan 2020   *Borel-Cantelli and Shrinking Targets*

Nov 2019   *Quantum-Classical Correspondence on the Upper Half-Plane*

Oct 2019   *An Analytic Approach to Real Hodge Theory*

Jan 2019   *Complex Exponentials, Eigenfunctions, Algebra Homomorphisms and Invariant Subspaces of L^2G*

Jan 2019   *Fourier Analysis on $\mathbb{R}^n$ and the n-Torus*

Nov 2018   *Lie Algebras and Representation Theory: Vector Fields on Lie Groups*

Oct 2018   *Lie Algebras and Representation Theory: Engel's Theorem*

Apr 2018   *The Laplacian on a Graph*

Apr 2017   *Definition of Topological Entropy*

Jan 2017   *Continued Fractions*

Defenses & Exams

Apr 2020   *Shrinking Targets on a Square-Tiled Surface*

Mar 2019   *The Laplacian: An Exploration and Historical Survey Tailored for Translation Surfaces*

Teaching

Winter 2021	Teaching Assistant, Topology and Geometry of Manifolds
Summer 2021	Pre-Doctoral Instructor, Mathematical Reasoning: Introduction to Proofs *(Remote)*
Spring 2021	Teaching Assistant, Linear Algebra *(Remote)*
Winter 2021	Teaching Assistant, Linear Algebra *(Remote)*
Fall 2020	Teaching Assistant, Linear Algebra *(Remote)*
Summer 2020	Pre-Doctoral Instructor, Linear Algebra *(Remote)*
Spring 2020	Pre-Doctoral Instructor, Linear Algebra *(Remote)*
Winter 2020	Pre-Doctoral Instructor, Linear Algebra
Fall 2019	Pre-Doctoral Instructor, Linear Algebra
Summer 2019	Pre-Doctoral Instructor, Linear Algebra
Spring 2019	Pre-Doctoral Instructor, Multivariable Calculus
Winter 2019	Pre-Doctoral Instructor, Multivariable Calculus
Fall 2018	Teaching Assistant, Topology
Summer 2018	Pre-Doctoral Instructor, Multivariable Calculus
Spring 2018	Teaching Assistant, Precalculus
Winter 2018	Teaching Assistant, Introductory Multivariable
Fall 2017	Teaching Assistant, Differential Calculus
Summer 2017	Teaching Assistant, Introductory Real Analysis
Spring 2017	Teaching Assistant, Introductory Multivariable
Winter 2017	Teaching Assistant, Differential Calculus
Fall 2016	Teaching Assistant, Integral Calculus

Service to the Community

2019 - present	Co-Organizer, Washington Directed Reading Program, sites.uw.edu/wdrp

Last updated: January 3, 2022