Joshua Southerland

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Current position

Fourth Year Graduate Student, University of Washington, Seattle

Research Interests

My research interests center around translation surfaces and homogeneous dynamics, where I am beginning to investigate questions motivated by quantum mechanics. Luc Hillairet and others have explored defining a Laplacian for translation surfaces. I hope to understand this construction and look for ways to further the connection between the quantum realm (eigenfunctions of the Laplacian) and the classical mechanics realm (geodesics). I am currently learning about one particular instances of this quantum-classical correspondence on hyperbolic surfaces where Anke Pohl, Don Zagier and others have established a connection between eigenfunctions of the hyperbolic laplacian and geodesics on the surfaces. I also have an interest in representation theory, especially how it relates to the spectral properties of the Laplacian on the upper-half plane.

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, BuroHappold Consulting Engineers, New York

Honors & awards

2018-2019 Excellence in Teaching, Graduate Student Award, University of Washington

Master's Thesis

2019 Southerland, Josh (2019), "The Laplacian: An Exploration and Historical Survey Tailored for Translation Surfaces"

Talks

Graduate Dynamics Seminar, University of Washington

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*

Teaching

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

Professional Activities

2019 - 2020 Co-Director, Washington Directed Reading Program, sites.uw.edu/wdrp

Graduate Coursework

Real Analysis, Complex Analysis, Algebra, Topological Manifolds, Smooth Manifolds, Differential Topology, Riemannian Geometry, Complex Manifolds, Ergodic Theory (Reading Course), Lie Algebras and Representation Theory (Reading Course), Laplacian on a Riemannian Manifold (Reading Course), Fuchsian Groups (Reading Course)

References

Jayadev Athreya

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