

# jacobdenson

## Research Interests

Harmonic Analysis and  
Geometric Measure  
Theory

## Contact Information

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## Education

### 2020-Present

PhD in Mathematics at  
the University of  
Wisconsin, Madison.

### 2017-2019

Masters in  
Mathematics at the  
University of British  
Columbia (Thesis:  
Cartesian Products  
Avoiding Patterns).

### 2013-2017

Bachelors in  
Computing Science at  
the University of  
Alberta.

## Awards

### 2019

February Fourier Talks  
Poster Presentation  
Award (2nd Place)

### 2018

NSERC CGSM Master's  
Scholarship  
UBC Science Graduate  
Award (2nd Time)

### 2017

UBC Science Graduate  
Award  
U of A Dean's Silver  
Medal in Science  
NSERC USRA  
(2nd and 3rd Time)

## Research Projects

### 2021-Now **Radial Fourier Multipliers on Manifolds**

*Collaboration with Dr. Andreas Seeger.* The goal of this project is to use the technology of Fourier Integral Operators to extend results about radial Fourier multipliers on Euclidean space to obtain bounds for multipliers for the Laplace-Beltrami operator on compact Riemannian manifolds.

### 2020-Now **Salem Sets Avoiding Patterns**

The goal of this project is to explore new tools which enable one to extend pattern avoidance methods which construct sets with large Hausdorff dimension avoiding patterns, to construct large Salem sets avoiding patterns. I am currently exploring ways to improve the probabilistic construction methods discussed in the paper "Large Salem Sets Avoiding Nonlinear Configurations" to construct optimal Salem sets avoiding patterns, as well as exploring the use of techniques based in extremizer theory to calculate the Fourier dimension of surfaces in Euclidean space with large codimension.

### 2018-2019 **Large Sets Avoiding Rough Patterns**

*Collaboration with Dr. Malabika Pramanik and Dr. Joshua Zahl.* In this project, we hope to find subsets of Euclidean space with large fractal dimension avoiding particular point configurations, which might be described as having a 'rough' character, such as those related to additive structure on fractals.

## Publications

### [Large Salem Sets Avoiding Nonlinear Configurations](#)

Jacob Denson

*(Submitted 2021)*

### [Cartesian Products Avoiding Patterns](#)

Jacob Denson

MSc Thesis (University of British Columbia) (2019)

### [Large Sets Avoiding Rough Patterns](#)

Jacob Denson, Malabika Pramanik, Joshua Zahl

Harmonic Analysis and Applications (2021) pp. 59–75. *Springer International Publishing*

### [Proofs in Three Bits or Less \(Expository Article\)](#)

Jacob Denson

CMS Notes from the Margin (2018) pp. 1–3

## Awards (Continued)

2016

Jason Lang Scholarship  
(3rd Time)

2015

Jason Lang Scholarship  
(2nd Time)

2014

NSERC USRA  
Jason Lang Scholarship

2013

U of A Academic  
Excellence Scholarship  
U of A Science  
Academic Excellence  
Scholarship  
Alexander Rutherford  
Achievement  
Scholarship

## Teaching Assistantships

2023

Introduction to Discrete  
Mathematics  
Elementary Matrix and  
Linear Algebra

2022

Introduction to Discrete  
Mathematics

2021

Algebra & Trigonometry  
Calculus I

2020

Calculus with Algebra &  
Trigonometry

2019

Multivariate Calculus  
Graph Theory

2018

Introduction to Discrete  
Mathematics  
Introduction to  
Probability

2017

Calculus for Forestry  
Students

Calculus for Business  
Students

2015

Tangible Introduction to  
Computer Science  
Undergraduate TA

## Conference Presentations

2020-2021 **Salem Sets Avoiding Patterns**

*Presented at:*

- *The 2020 Ohio River Analysis Meeting.*
- *The University of Wisconsin Analysis Student Seminar.*
- *The 17th Prairie Analysis Seminar.*

A talk discussing my work constructing high dimensional Salem sets avoiding configurations. I emphasized the square root cancellation result necessary to extend previous results on Hausdorff dimension to constructing Salem sets, and the various concentration of measure results one can use to obtain this square root cancellation when using randomized constructions.

2018-2019 **Fractals Avoiding Fractal Sets**

*Presented at:*

- *The 2018 Mid-Atlantic Analysis Meeting.*
- *The 2018 CMS Winter Meeting.*
- *The 2019 Geometric and Harmonic Analysis (GAHA) Conference.*
- *Poster at the 2019 February Fourier Talks. Awarded Prize for 2nd Best Poster out of 19 participants.*
- *Poster at the 2019 Madison Lectures in Fourier Analysis.*

A talk discussing my work with Dr. Malabika Pramanik and Dr. Joshua Zahl on constructing high dimensional sets avoiding configurations. I emphasized the idea behind the discretization of a problem when working a single scale.

## Expository Talks

Notes for these talks can be found at my website: <https://jdjake.github.io/notes>, or individually linked below by hyperlink.

2023 **The Lax Hörmander Parametrix for the Half-Wave Equation**

UW Madison Graduate Analysis Seminar

2022 **Anticoncentration and Polynomial Decompositions**

UC Irvine 2022 Summer School: Learning Theory and Fourier Analysis

2022 **Nodal Domains on Riemannian Manifolds via Diffusion Processes**

Bonn 2022 Summer School: Nodal Domains and Landscape Functions.

2022 **Logarithmic Improvements to  $L^p$  Bounds for Laplace-Beltrami Eigenfunctions on Hyperbolic Manifolds**

UW Madison 2022 Summer School: Harmonic Analysis on Manifolds

2021 **Algorithmic Aspects of Brascamp Lieb Inequalities**

Bonn 2021 Summer School: Brascamp Lieb Inequalities

2019 **Incidence Theorems over Field of Arbitrary Characteristic**

Math 616A Class: The Polynomial Method

2018 **Hodge Theory: Harmonic Analysis in Topology**

Math 529 Class: Differential Topology

2018 **Theta Functions**

Math 600D Class: Modular Forms

2017 **Proofs in Three Bits or Less**

UBC Graduate Seminar

2016 **Why Physicists Care About the Fourier-Stieltjes Transform**

Math 642 Class: Non Commutative Harmonic Analysis

2016 **A Brief Respite in Abelian Harmonic Analysis**

Math 642 Class: Non Commutative Harmonic Analysis