Carsten Peterson

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Research Interests

buildings, (locally) symmetric spaces, quantum chaos, representation theory of real and p-adic groups, spectral theory, polytopal geometry, homogeneous dynamics

Education

University of Michigan, Ann Arbor, Michigan
Ph.D. in Mathematics
Advised by Ralf Spatzier
Thesis title: "Quantum Ergodicity on Bruhat-Tits Buildings"
April 2023

Yale University, New Haven, Connecticut
B.A. in Mathematics
May 2017

Budapest Semesters in Mathematics, Budapest, Hungary
Fall 2015 and Spring 2016

Academic Positions

Sorbonne University - Institut de Mathémathiques de Jussieu, Paris, France
Postdoctoral researcher funded by the Cofund MathInGreaterParis Fellowship and working with Farrell Brumley in the Automorphic Forms group.

October 2024 – September 2025

Paderborn University, Paderborn, Germany
Postdoctoral researcher in the Collaborative Research Center between Bielefeld University and Paderborn University on the thematic program Integral Structures in Geometry and Representation Theory (Projects B3 and B4). Member of the Spectral Analysis group of Tobias Weich.

September 2023 – October 2024 (offered three years of funding but spending the second year in Paris)

Research Visits

Aalto University, Espoo, Finland
Visiting researcher in the group of Tuomas Sahlsten
Summer 2023

Preprints

2. *A degenerate version of Brion's formula*. 41 pages. (2024)

1. *Quantum ergodicity on the Bruhat-Tits building for* $\mathrm{PGL}(3, F)$ *in the Benjamini-Schramm limit*. 71 pages. (2023)

Publications

3. *A geometric perspective on the MSTD question*, with S. J. Miller.
Discrete and Computational Geometry 62, 832-855 (2019).

2. *The bidirectional ballot polytope*, with S. J. Miller, C. Sprunger, and R. Van Peski.
Integers 18 (2018), #A81.

1. *Summand minimality and asymptotic convergence of generalized Zeckendorf decompositions*, with K. Cordwell, M. Hlavacek, C. Huynh, S. J. Miller, and Y. N. T. Vu.
Research in Number Theory (2018) 4: 43.

Invited Talks

- *Degenerate Brion's formula and applications to symmetric spaces and buildings*
Geometry & Groups Seminar, Heidelberg University, July 2024
- *Quantum ergodicity in the Benjamini-Schramm limit on higher rank real and* p*-adic locally symmetric spaces*
Dynamics Seminar, Northwestern University, May 2024
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3) in the Benjamini-Schramm limit*
Analysis & Number Theory Seminar, Tübingen University, April 2024
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3) in the Benjamini-Schramm limit*
New England Dynamics and Number Theory Seminar, April 2024 (virtual talk)
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3) in the Benjamini-Schramm limit*
Groups, Dynamics, & Topology Seminar, Jagiellonian University, March 2024
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3) in the Benjamini-Schramm limit*
Group Actions Seminar, UC San Diego, February 2024 (virtual talk)
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Topology/Geometry Seminar, Göttingen University, January 2024
- *Quantum ergodicity on Bruhat-Tits buildings*
Geometric and Functional Analysis Seminar, University of Helsinki, January 2024
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Number Theory Seminar, Johns Hopkins University, December 2023
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Number Theory & Representation Theory Seminar, University of Maryland–College Park, December 2023
- *Brion's formula and its applications to analysis on Bruhat-Tits buildings*
Groups & Geometry Seminar, Bielefeld University, December 2023
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Number Theory Lunch Seminar/Analytic Number Theory & Automorphic Forms Seminar, Max Planck Institute/Bonn University, November 2023
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Geometric & Harmonic Analysis Seminar, Paderborn University/Aarhus University, October 2023
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
Buildings 2023, Gießen University, October 2023
- *Quantum ergodicity on Bruhat-Tits buildings*
Mathematical Physics Seminar, Aalto University, August 2023

- *Quantum ergodicity on Bruhat-Tits buildings*
  Number Theory & Representation Theory Seminar, University of Wisconsin–Madison, March 2023
- *Quantum ergodicity on Bruhat-Tits buildings of type* $\tilde{A}_2$
  RTG Geometry, Dynamics and Topology Seminar, University of Michigan, April 2022

Contributed Talks/Posters

- *Degenerate Brion's formula and applications*
  60th Sophus Lie Seminar, Paderborn University, September 2024
- *Quantum ergodicity in the Benjamini-Schramm limit in higher rank*
  Bridging the Physics and Mathematics of Quantum Many Body Chaos, University of Helsinki, June 2024 (poster)
- *Quantum ergodicity in the level aspect on higher rank real and* p*-adic locally symmetric spaces*
  36th Automorphic Forms Workshop, Oklahoma State University, May 2024
- *Quantum ergodicity on the Bruhat-Tits building for PGL(3, F) in the Benjamini-Schramm limit*
  Summer School: Microlocal and Probabilistic Methods in Geometry and Dynamics, Jussieu, France, July 2023 (poster)
- *Quantum ergodicity on Bruhat-Tits buildings of type* $\tilde{A}_2$
  2022 Midwest Representation Theory Conference, University of Michigan, March 2022
- *On summand minimality of generalized Zeckendorf decompositions*
  Joint Math Meetings, Atlanta, GA, January 2017
- *A geometric perspective on the MSTD question*
  INTEGERS 2016, University of West Georgia, October 2016
- *Generalized numerical semigroups of minimal embedding dimension*
  MAA MathFest 2015, Washington, D.C., August 2015
- *Some results on two-lifts of graphs*
  Joint Math Meetings 2015, San Antonio, TX, January 2015

Learning Seminar Talks

- *Non-uniform tree lattices*
  Learning Seminar on Lattices in Lie Groups, Paderborn University, July 2024
- *Anosov representations on Bruhat-Tits buildings*
  Patterson-Sullivan Theory/Anosov Representations Learning Workshop, Paderborn University, March 2024
- *The local Weyl law*
  Microlocal Analysis Learning Seminar, Aalto University/University of Helsinki, November 2023
- L^2*-theory and ellipticity*
  Microlocal Analysis Learning Seminar, Aalto University/University of Helsinki, October 2023
- *Analysis on Bruhat-Tits buildings*
  Geometry Seminar, University of Michigan, February 2023
- *Geometry of Bruhat-Tits buildings*
  RTG Geometry, Dynamics and Topology Seminar, University of Michigan, February 2023
- *Quantum ergodicity in the Benjamini-Schramm limit*
  RTG Geometry, Dynamics and Topology Seminar, University of Michigan, February 2023
- *The Harish-Chandra isomorphism and the Satake isomorphism for* $\mathrm{SL}(2)$
  RTG Representation Theory Seminar, University of Michigan, March 2022
- *Applications of representation theory of* $\mathrm{SL}(2,\mathbb{R})$ *to dynamics*
  RTG Representation Theory Seminar, University of Michigan, December 2021

- *The Fell topology*
  Student Dynamics/Geometry/Topology Seminar, University of Michigan, March 2021
- *Quantum ergodicity on graphs*
  Student Analysis Seminar, University of Michigan, March 2021
- *Some analogies between hyperbolic surfaces and regular graphs*
  Student Dynamics/Geometry/Topology Seminar, University of Michigan, November 2020
- *What is quantum ergodicity?*
  Student Analysis Seminar, University of Michigan, October 2020
- *General relativity for mathematicians*
  Student Geometry/Topology Seminar, University of Michigan, November 2019
- *Coxeter groups and buildings*
  Student Geometry/Topology Seminar, University of Michigan, February 2019
- *Spectral graph theory*
  Student Combinatorics Seminar, University of Michigan, September 2018
- *Introduction to Ehrhart theory*
  Student Combinatorics Seminar, University of Michigan, March 2018

Outreach Talks

- *The Poincare series of a Coxeter group and its applications*
  Paderborn/Bielefeld CRC Graduate Seminar, Paderborn University, May 2024
- *Quantum ergodicity on manifolds and graphs*
  Physics Graduate Student Symposium, University of Michigan, July 2021
- *Crofton's formula, Buffon's needle, and the isoperimetric inequality*
  Michigan Undergraduate Math Club, University of Michigan, April 2019
- *Exotic number systems*
  Michigan Math Circle, February 2019 (two part talk)
- *Cohn's irreducibility criterion*
  Michigan Undergraduate Math Club, University of Michigan, March 2018

Other Conferences/Workshops Attended

- Integral Structures in Geometry and Representation Theory
  Paderborn University, September 2024
- Building Bridges: 6th EU/US Summer School & Workshop on Automorphic Forms and Related Topics
  CIRM, September 2024
- Automorphic Forms in Budapest 2024
  Réyni Institute, August 2024
- Zeta Functions, Dynamics, and Analytic Number Theory
  Göttingen University, March 2024
- New Perspectives in the Analytic Theory of Automorphic Forms
  Clay Math Institute, University of Oxford, September 2023
- Durham Symposium 2023: Spectral Gaps
  Durham University, August 2023
- Summer School on High-Dimensional Expanders
  Ghent University, May 2023
- Dynamics, Rigidity and Arithmetic in Hyperbolic Geometry
  ICERM, Brown University, May 2023

- Laplacians on Random Hyperbolic Surfaces and on Random Graphs
  Northwestern University, May 2022
- Spectra and Dynamics on (Locally) Symmetric Spaces
  Universität Paderborn, February 2022
- Microlocal Analysis: Theory and Applications
  University of Montreal, Summer 2021 (MSRI virtual summer school)
- Dynamics and Geometry Online Summer School
  Heilbronn Institute, Bristol University, June 2021 (virtual summer school)
- Midwest Dynamical Systems Conference
  University of Illinois at Chicago, November 2019
- Regional Workshop in Quantitative Geometry & Topology
  The Ohio State University, April 2019
- Graduate Student Topology and Geometry Conference
  University of Illinois at Urbana-Champaign, April 2019
- Park City Math Institute Undergraduate Summer School on Random Matrix Theory
  Park City, Utah, July 2017

Awards

Cofund MathInGreaterParis Fellowship	Fall 2023 - Fall 2025 (fellowship only used Fall 2024 - Fall 2025)
Arthur Herbert Copeland, Sr. Memorial Scholarship	Summer 2021
Highest Honors in Budapest Semesters in Mathematics	Fall 2015, Spring 2016
MAA Outstanding Presentation Award	August 2015
John Alan Lewis Summer Research Fellowship	Summer 2015

Teaching Experience

Paderborn University

I designed and was the sole instructor for a Master's course titled Buildings and the Structure of p-adic Groups during the summer term of 2024. The class met 3 hours per week for 14 weeks.

University of Michigan

Winter 2023	Calculus II	Primary Instructor
Fall 2022	Calculus II	Primary Instructor
Fall 2021	Calculus III	Lab Instructor (MATLAB)
Fall 2020	Calculus II	Primary Instructor
Fall 2019	Calculus III	Lab Instructor (MATLAB)
Fall 2019	Lie Algebras	Grader
Spring 2019	Ordinary Differential Equations	Lab Instructor (MATLAB)
Winter 2019	Calculus II	Primary Instructor
Fall 2018	Calculus II	Primary Instructor
Winter 2018	Calculus I	Primary Instructor
Fall 2017	Calculus I	Primary Instructor

Outreach & Service

- Admissions Committee for Lab of Geometry at Michigan (LoG(M)) REU Winter 2019 – Fall 2022
  - Lab of Geometry at Michigan (LoG(M)) is a Research Experience for Undergraduates for University of Michigan students which takes place during the Fall and Winter semesters. I served on the admissions committee every term between Winter 2019 and Fall 2022.
- Mentor for Directed Reading Program Fall 2019
  - The Directed Reading Program pairs graduate students with undergraduates, whom they mentor as they work through more advanced mathematical material. I mentored an undergraduate on a project on differential geometry of curves and surfaces.
- Speaker at Michigan Math Circle February 2019
  - Michigan Math Circle is an enrichment program for middle and high school students to get exposed to math outside of the K-12 curriculum. I designed and led two 90 minutes sessions on Zeckendorf decompositions and related topics for high school students.
- Speaker at Michigan Undergraduate Math Club March 2018, April 2019
  - I gave two talks to the University of Michigan undergraduate math club: one on Cohn's irreducibility criterion and the other on integral geometry (Crofton's formula and related topics).
- Co-mentor for LoG(M) REU project Fall 2018
  - I co-mentored three undergraduates on a research project related to translation surfaces along with another graduate student (Matt Stevenson) and a faculty member (Alex Wright, who proposed the project). Here is the final poster for the project.