

Alexis Drouot

adrouot@uw.edu

<https://sites.math.washington.edu/~adrouot/>

Research interests

Mathematical physics, Partial differential equations, Semiclassical analysis.

Employment

Assistant Professor, University of Washington	2020 –
Postdoctoral Researcher, Columbia University	2017 – 2020
Graduate Student Instructor/Researcher, UC Berkeley	2014 – 2017

Education

<i>Ph.D. Mathematics</i> , UC Berkeley	2014 – 2017
Dissertation advisor: Maciej Zworski	
<i>M.S. Mathematics</i> , Université Paris 7	2011 – 2012
<i>B.S. Mathematics</i> , École Normale Supérieure de Paris	2009 – 2011

Awards and Honors

NSF Standard Grant Award DMS-2054589 (PI)	2021 – 2024
NSF Standard Grant Award DMS-1800086 (PI)	2018 – 2022
NSF Conference Grant Award DMS-1804339 (Co-PI)	2018
Herb Alexander Prize (Outstanding dissertation in Mathematics), UC Berkeley	2017
Outstanding Graduate Student Instructor Award, UC Berkeley	2017

Research papers

- [19] *Topological insulators in semiclassical regime.*
Submitted; [arXiv:2206.08238](https://arxiv.org/abs/2206.08238).
- [18] *Magnetic slowdown of topological edge states*, with G. Bal and S. Becker.
To appear in Communications in Pure and Applied Mathematics; [arXiv:2201.07133](https://arxiv.org/abs/2201.07133).
- [17] *Edge states along curved interfaces*, with Bal, Becker, Fermanian, Lu and Watson.
To appear in SIAM Journal on Mathematical Analysis; [arXiv:2106.00729](https://arxiv.org/abs/2106.00729).
- [16] *The bulk-edge correspondence for continuous dislocated systems.*
Annales de l'Institut Fourier **71**(2021), 1185–1239; [arXiv:1810.10603](https://arxiv.org/abs/1810.10603).
- [15] *Microlocal analysis of the bulk-edge correspondence.*
Communications in Mathematical Physics **383**(2021), 2069–2112. [arXiv:1909.10474](https://arxiv.org/abs/1909.10474).
- [14] *Ubiquity of conical points in topological insulators.*
Journal de l'École polytechnique **8**(2021), 507–532; [arXiv:2004.07068](https://arxiv.org/abs/2004.07068).
- [13] *Defect states for dislocated periodic media*, with C. L. Fefferman and M. I. Weinstein.
Communications in Mathematical Physics **377**(2020), 1637–1680. [arXiv:1810.05875](https://arxiv.org/abs/1810.05875).
- [12] *Edge states and the valley Hall effect*, with M. I. Weinstein.
Advances in Mathematics **368**(2020), 107142; [arXiv:1910.03509](https://arxiv.org/abs/1910.03509).

- [11] *The bulk-edge correspondence for continuous honeycomb lattices.*
Communications in PDEs **44**(2019), 1406–1430; [arXiv:1901.06281](#).
- [10] *Characterization of edge states in perturbed honeycomb structures.*
Pure and Applied Analysis **1**(2019), 385–445; [arXiv:1811.08218](#).
- [9] *Resonances for random highly oscillatory potentials.*
Journal of Mathematical Physics **59**(2018), 101506, 34 pp; [arXiv:1703.08140](#).
- [8] *Bound states for rapidly oscillatory Schrödinger operators in dimension 2.*
SIAM Journal on Mathematical Analysis **50**(2018), 1471–1484; [arXiv:1609.00757](#).
- [7] *Scattering resonances for highly oscillatory potentials.*
Annales Scientifiques de l'ENS **51**(2018), no. 4, 865–925.; [arXiv:1509.04198](#).
- [6] *Pollicott–Ruelle resonances via kinetic Brownian motion.*
Communications in Mathematical Physics **356**(2017), 357–396; [arXiv:1607.03841](#).
- [5] *A quantitative version of Hawking radiation.*
Annales Henri Poincaré **18**(2017), 757–806; [arXiv:1510.02398](#).
- [4] *Quantitative form of certain k -plane transform inequalities.*
Journal of Functional Analysis **268**(2015), 1241–1276; [arXiv:1205.3251](#).
- [3] *Existence and non-existence of extremizers for k -plane transform inequalities.*
Unpublished note, [arXiv:1412.4876](#).
- [2] *Sharp constant for a k -plane transform inequality.*
Analysis & PDE **7**(2014), 1237–1252; [arXiv:1111.5061](#).
- [1] *A quantitative version of the Catlin–D’Angelo–Quillen theorem, with M. Zworski.*
Analysis and Mathematical Physics **3**(2013), 1–19; [arXiv:1205.3248](#).

Invitations to research talks

Edge states in complex geometries

Conference on Subwavelength physics, ETH Zurich	July 2024
Analysis and PDE conference, University Paris XI	May 2024
AMS “Mathematical Physics and Future Directions”, San Francisco	January 2024
International congress of applied mathematics, Waseda University, Tokyo	August 2023

Topological insulators in semiclassical regime

Conference “Great Lakes Mathematical Physics Meeting”, Oberlin College	June 2023
Probability seminar, University of Washington	June 2023
PDE seminar, UC Berkeley	November 2022
Conference “QMath 15”, UC Davis	September 2022
Conference “Harmonic Analysis and Linear and Nonlinear Waves”, UW	August 2022

Dirac operators and topological insulators

Condensed matter physics for mathematicians, U. Washington	October 2022
Conference “Spectral theory of ergodic quantum systems”, held online	March 2022
Rainwater seminar, University of Washington	February 2022
Analysis seminar, University of Kentucky	February 2022
Informal Moiré seminar, UC Berkeley	October 2021
Séminaire “Analyse, géométrie et dynamique”, Université de Nice	September 2021
Conference “Solid Math 2020”, École des Ponts, Paris	August 2021
Analysis seminar, University College, London	June 2021

Edge states in topological insulators

Student harmonic analysis and PDE seminar, UC Berkeley	April 2021
PDE seminar, U. Maryland	July 2021
Mathematical physics and operator algebras seminar, MSU	April 2021
The hypoelliptic Laplacian and noncommutative geometry seminar,	April 2021
38th Annual Western states mathematical physics meeting	February 2021
Differential geometry and PDE seminar, University of Washington	October 2020
Conference SIAM, Texas A&M University	October 2020
Wave working group, Columbia University	April 2020

Mathematical mysteries behind topological insulators

Analysis and PDE seminar, UC Berkeley	February 2021
Applied mathematics seminar, Auburn University	November 2020
Séminaire analyse et EDP, Université Cergy–Pontoise	December 2020
Problèmes spectraux en physique mathématique, IHP	November 2020
Analysis seminar, Northwestern University	February 2020
Colloquium, University of Chicago	February 2020
Colloquium, University of Washington	January 2020

Microlocal analysis of the bulk-edge correspondence

Workshop “Theory and Computation for 2D Models”, IPAM	January 2020
Conference SIAM, “Analysis of PDEs”, Palm Spring	December 2019
Wave working group, Columbia University	November 2019
Analysis seminar, Binghamton SUNY	November 2019
Microlocal analysis seminar, MSRI	October 2019

Edge states in near-honeycomb structures

Conference SIMA “Spectral properties for periodic operators”, Nantes	May 2019
ICMAS conference “Nonlinear Evolution Equations”, UG Athens	April 2019
Conference “Partial differential equations”, Himeji	March 2019
Analysis and PDE seminar, UC Berkeley,	February 2019
Analysis seminar, University of Pennsylvania	January 2019

Topologically protected states in dislocated medias

Wave working group, Columbia University	October 2018
1st Simons Society of Fellows Alumni Symposium	October 2018
SIAM Southeastern meeting, UNC at Chapel Hill	March 2018
Analysis and PDE seminar, UC Berkeley	February 2018
Conference “Spectral geometry, graphs and semiclassical analysis”	December 2017

A quantitative version of Hawking radiation

Conference “Quantum fields, scattering and spacetime horizons”, Les Houches	May 2018
Student harmonic analysis and PDE seminar, UC Berkeley	April 2014

Eigenvalues for Schrödinger operators with random oscillatory potentials

Probability seminar, Columbia University	April 2018
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Center for Non-linear Analysis seminar, Carnegie Mellon University	November 2017
AMS meeting “Microlocal Analysis and Spectral Theory”, WSU Pullman	April 2017
Student Harmonic Analysis and PDE seminar, UC Berkeley	February 2017
Probability seminar, Université de Rennes	December 2016
Harmonic Analysis seminar, UC Berkeley	December 2016
<i>Pollicott–Ruelle spectrum via kinetic Brownian motion</i>	
PDEs and Numerical Analysis seminar, Université Paris XI	December 2017
Workshop “Resonances: Geometric Scattering and Dynamics”, CIRM	March 2017
Analysis and PDEs seminar, UCLA	January 2017
Workshop “PDEs and Mathematical Physics”, Tokyo University	January 2017
Analysis seminar, Massachusetts Institute of Technology	September 2016
Analysis and Geometry seminar, Université de Nice	June 2016
<i>Scattering resonances for highly oscillatory potentials</i>	
PDE mini-school, UNC at Chapel Hill	November 2017
Analysis seminar, Courant Institute	October 2017
Analysis/Geometry seminar, Columbia University	November 2016
Student Harmonic Analysis and PDE seminar, UC Berkeley	September 2016
Bay Area Microlocal Analysis seminar, Stanford University	November 2015
<i>Existence and non-existence of extremizers for the k-plane transform</i>	
Conference in Harmonic Analysis in honor of M. Christ, UW Madison	May 2016
Student Harmonic Analysis and PDE seminar, UC Berkeley	November 2014
<i>Sharp constant and quantitative stability of a k-plane transform inequality</i>	
Summer school in sharp inequalities, Universität Bonn	September 2015
Workshop in Mathematical Physics, Institut Fourier, Grenoble	March 2013
Student Harmonic Analysis and PDE seminar, UC Berkeley	March 2012
<i>Semiclassical analysis for a theorem of Quillen</i>	
Student Harmonic Analysis and PDE seminar, UC Berkeley	December 2013

Teaching positions

Instructor for Topology (Math 441), UW	Fall 2023
Instructor for Complex Analysis II (Math 428), UW	Spring 2023
Instructor for Calculus III (Math 126), UW	Winter 2023
Instructor for Fundamental Concepts of Analysis (Math 426), UW	Spring 2022
Instructor for Semiclassical Analysis (Math 582), UW	Winter 2022
Instructor for Advanced Linear Algebra (Math 340), UW	Winter 2021
Instructor for Fundamental Concepts of Analysis (Math 424), UW	Spring 2021
Instructor for Complex Analysis I (Math 427), UW	Winter 2021
Instructor for Linear Algebra (Math UN2010), Columbia University	Spring 2020
Instructor for Real Analysis I (Math GU4061), Columbia University	Fall 2018
Instructor for Analysis and Optimization (Math V2500), Columbia University	Spring 2018

GSI for Linear Algebra (Math 54), UC Berkeley	Spring 2016
GSI for Analytic Calculus (Math 16B), UC Berkeley	Spring 2015
GSI for Calculus II (Math 1B), UC Berkeley	Fall 2014

Mentoring

<i>Ph.D. advisor</i> for C. Lyman (general exam passed in March 2023).	
<i>Undergraduate directed reading</i> for C. Zhao, Complex analysis	Summer 2023.
<i>Undergraduate directed reading</i> for S. Millard, Semiclassical analysis	Fall 2022.
<i>Undergraduate directed reading</i> for A. Yusaini and C. Zhao, Real analysis	Summer 2022.
<i>Graduate directed reading</i> for C. Lyman, Spectral theory	Spring 2022.
<i>Graduate directed reading</i> for C. Lyman, Spectral theory	Winter 2022.
<i>Graduate directed reading</i> for C. Lyman, Symplectic geometry	Fall 2021.
<i>Undergraduate student research</i> , “Mathematics of twistronics”	Fall 2020.
<i>Undergraduate directed reading</i> for Z. Zhou, Minimal surfaces	Summer 2019.

Conference and seminars organized

<i>Condensed matter physics for mathematicians</i> University of Washington.	Fall 2022
<i>Waves in topological materials</i> Mathematical aspects of materials science, Bilbao (with A. Watson).	May 2021
<i>Transport and localization in random media: theory and applications</i> Columbia University (with I. Corwin, H. Shen and M. Weinstein).	May 2018
<i>Harmonic Analysis and Differential Equations Student seminar</i> UC Berkeley (with C. Gavrus and K. O’Neill).	2014–2016

Additional Service

UW committees: Appointment (2023-2024), Graduate admission, Speakers, Math Across Campus (2022-2023), Graduate program, Speakers, Math Across Campus (2021-2022), Undergraduate program, Math Across Campus (2020-2021).

Referee for A. H. Lebesgue, Analysis and PDE, A. Henri Poincaré, Asian J. of Mathematics, Comm. Mathematical Physics, Comm. PDEs, J. Spectral Theory, Letters in Mathematical physics, Mathematical Research Letters, Probability and Mathematical Physics, and Pure and Applied Analysis.