

# Jacob Zell Shapiro

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CV updated December 2023

## Research interests

Partial differential equations, microlocal analysis, scattering theory

## Employment

August 2020-Present    Assistant Professor, University of Dayton  
July 2018-August 2020    Postdoctoral fellow, Australian National University  
Mentors: Jesse Gell-Redman and Andrew Hassell  
Fall 2019    Postdoctoral fellow, MSRI microlocal analysis program  
Mentor: Maciej Zworski

## Education

2012-2018    PhD    Mathematics, Purdue University  
Thesis advisor: Kiril Datchev  
Thesis topic: Semiclassical resolvent estimates and wave decay in low regularity  
2010-2012    MA    Mathematics, Miami University (OH)  
2006-2010    BA    Mathematics and Physics, Denison University

## Publications

13. *Semiclassical resolvent bounds for short range  $L^\infty$  potentials with singularities at the origin*, to appear in *Asymptot. Anal.* arXiv 2306.00748
12. *Regularity of the scattering matrix for nonlinear Helmholtz eigenfunctions*, with Jesse Gell-Redman and Andrew Hassell. *J. Spectr. Theory.* 13(2) (2023), 395–425
11. *Exponential time-decay for a one dimensional wave equation with coefficients of bounded variation*, with Kiril Datchev. *Math. Nachr.* 296(11) (2023), 4978–4994
10. *Semiclassical resolvent bounds for compactly supported radial potentials*, with Kiril Datchev and Jeffrey Galkowski. *J. Funct. Anal.* 284(7), paper no. 109835 (2023), 28 pp.
9. *Semiclassical resolvent bounds for long range Lipschitz potentials*, with Jeffrey Galkowski. *Int. Math. Res. Not. IMRN* 2022(18) (2022), 14134–14150
8. *Semiclassical resolvent bounds for weakly decaying potentials*, with Jeffrey Galkowski. *Math. Res. Lett.* 29(2) (2022), 373–398
7. *On the interaction of metric trapping and a boundary*, with Kiril Datchev, Jason Metcalfe, and Mihai Tohaneanu. *Proc. Amer. Math. Soc.* 149(9) (2021), 3801–3812
6. *Existence and asymptotics of Nonlinear Helmholtz eigenfunctions*, with Jesse Gell-Redman, Andrew Hassell and Junyong Zhang. *SIAM J. Math. Anal.* 52(6) (2020), 6180–6221
5. *Semiclassical resolvent bound for compactly supported  $L^\infty$  potentials*. *J. Spectr. Theory.* 10(2) (2020), 651–672
4. *Semiclassical estimates for scattering on the real line*, with Kiril Datchev. *Comm. Math. Phys.* 376(3) (2020), 2301–2308
3. *Semiclassical resolvent bounds in dimension two*. *Proc. Amer. Math. Soc.* 147(5) (2019), 1999–2008
2. *Local energy decay for Lipschitz wavespeeds*. *Comm. Partial Differential Equations* 43(5) (2018), 839–858
1. *Electron Affinity of Arsenic and the Fine Structure of  $\text{As}^-$  Measured using Infrared Photodetachment Threshold Spectroscopy*, with C.W. Walter, N.D. Gibson, R.L. Field III, A.P. Snedden, C.M. Janczak, D. Hanstorp, *Physical Review A* 80(1) (2009), 014501

## Preprints

1. *Semiclassical estimates for measure potentials on the real line*, with Andrés Larraín-Hubach, submitted. arXiv 2303.17722

## Fellowships and grants

NSF DMS 2204322	2022-2025	\$131,985
MATRIX-Simons Travel Grant	2023	2,500 AUD
UD Research Council seed grant	2023	\$6,500
Fulbright Postdoctoral Fellowship Australia	2023	19,500 AUD
Air Force Research Lab Summer Faculty Fellowship	2022	\$22,530
UD Catholic intellectual tradition research grant	2022	\$5,000
MAA Project NExT Fellow	2021-2022	
UD Schraut faculty research award	2021-2022	\$1,200
AMS travel grant, 2021 MCA	2021	\$330
UD Research Council seed grant	2021	\$5,150
ANU MSI research visitor grant	2020	2,500 AUD
ANU University House early career academic fellowship	2019-2020	3,600 AUD
AMS-Simons travel grant	2018-2020	\$4,000
Purdue Graduate Student Government travel grant	2018	\$250
Purdue College of Science international travel grant	2017	\$800
Bilsland dissertation fellowship	2017	\$10,000
Purdue Research Foundation research assistantship	2016-2017	\$18,000

## Teaching

Fall 2023	MTH 219 Applied Differential Equations	Instructor	UD
Fall 2023	MTH 169 Calculus II (two sections)	Instructor	UD
Fall 2022	MTH 169 Calculus II (two sections)	Instructor	UD
Spring 2022	MTH 556 Numerical PDE	Instructor	UD
Spring 2022	MTH 168 Calculus I (two sections)	Instructor	UD
Fall 2021	MTH 168 Calculus I (two sections)	Instructor	UD
Fall 2021	MTH 310 Linear Algebra	Instructor	UD
Spring 2021	MTH 168 Calculus I (two sections)	Instructor	UD
Fall 2020	MTH 168 Calculus I (two sections)	Instructor	UD
Fall 2020	MTH 148 Applied Calculus I	Instructor	UD
Semester 1 2020	MATH 3062 Fractal Geometry and Chaotic Dynamics	Instructor	ANU
Summer 2019	Scattering theory minicourse	TA	Northwestern
Semester 1 2019	MATH 3062 Fractal Geometry and Chaotic Dynamics	Instructor	ANU
Semester 2 2018	MATH 1115 Analysis and Linear Algebra	Instructor	ANU
Fall 2015	MA 161 Active Learning Calculus I	TA	Purdue
Summer 2015	MA 162 Calculus II	Co-instructor	Purdue
Fall 2014	MA 161 Calculus I	TA	Purdue
Spring 2012	MTH 151 Calculus I	Instructor	Miami OH
Fall 2011	MTH 123 Precalculus	Instructor	Miami OH
Fall 2010	MTH 104 Precalculus with Algebra	Instructor	Miami OH

## Research talks

14. *Exponential time-decay for a one dimensional wave equation with coefficients of bounded variation*  
 January 2023 Catholic Intellectual Tradition Symposium, University of Dayton  
 November 2022 Analysis and PDE Seminar, University of North Carolina
13. *Semiclassical resolvent bounds for compactly supported radial potentials*  
 April 2022 Ohio River Analysis Meeting 11, University of Kentucky  
 March 2022 AMS Central Sectional meeting, virtual  
 March 2022 Analysis and PDE Seminar, UC Berkeley  
 March 2022 Analysis and PDE Seminar, Stanford  
 March 2022 Math Research Seminar, University of Dayton  
 February 2022 Analysis and PDE Seminar, University of Kentucky
12. *Semiclassical resolvent bounds for long range Lipschitz potentials*

- April 2022 Joint Mathematics Meetings, virtual
- October 2021 AMS Central Sectional Meeting, virtual
- September 2021 Spectral and Scattering Theory Seminar, Purdue University
- July 2021 Mathematical Congress of the Americas, virtual
- June 2021 Great Lakes Mathematical Physics Meeting 5, virtual
- March 2021 Ohio River Analysis Meeting 10, virtual
- March 2021 Math Research Seminar, University of Dayton
- 11. *Semiclassical resolvent bounds for short range Hölder continuous potentials*
  - January 2020 Spectral and Scattering Theory Seminar, Purdue University
  - November 2019 Harmonic Analysis and DE Seminar, UC Berkeley
- 10. *Semiclassical estimates for scattering on the real line.*
  - April 2021 Student Analysis and PDE Seminar, University of Kentucky
  - June 2020 Analysis and PDE Seminar, Australian National University
  - September 2019 Microlocal Analysis Seminar, MSRI
- 9. *Standing wave solution for the nonlinear Schrödinger equation on a Riemannian scattering manifold.*
  - February 2019 Analysis and PDE Seminar, University of North Carolina
  - January 2019 Spectral and Scattering Theory Seminar, Purdue University
- 8. *Semiclassical resolvent estimates in low regularity*
  - October 2023 Air Force Research Laboratory
  - September 2023 MATRIX Workshop, Creswick, Australia
  - March 2023 Analysis Seminar, University of Melbourne
  - December 2020 Math Research Seminar, University of Dayton
  - December 2020 Math Colloquium, Air Force Institute of Technology
  - April 2019 Analysis, PDE and Geometry Seminar, Monash University
  - November 2018 Mathematics Seminar, University of Melbourne
  - August 2018 Analysis and PDE Seminar, Australian National University
  - June 2018 Analysis Seminar, UC Berkeley
  - March 2018 AMSI-ANU Workshop on Microlocal Analysis, South Durras, Australia
- 7. *Resolvent estimates with application to wave decay*
  - February 2018 Differential Equations Seminar, University of Missouri
  - November 2017 PDE mini-school, University of North Carolina
  - October 2017 Analysis and PDE Seminar, Stanford
  - October 2017 Analysis and PDE Seminar, University of Kentucky
  - September 2017 Spectral and Scattering Theory Seminar, Purdue University
  - July 2017 Third Symposium on Spectral and Scattering Theory, Florianópolis, Brazil
- 6. *Local energy decay for Lipschitz wavespeeds*
  - June 2017 Great Lakes Mathematical Physics Meeting 2, Michigan State
- 5. *Semiclassical resolvent bounds in dimension two*
  - November 2016 Graduate research day, Purdue University
  - June 2016 Great Lakes Mathematical Physics Meeting 1, Michigan State
  - April 2016 AMS sectional meeting, North Dakota State University
  - March 2016 Ohio River Analysis Meeting 6, University of Kentucky
  - February 2016 15th New Mexico Analysis Seminar, University of New Mexico
- 4. *Scattering resonances with applications to wave decay*
  - September 2017 Graduate student colloquium, Purdue University
  - January 2016 Graduate student colloquium, Purdue University
- 3. *Improving performance of investment portfolio optimization*
  - October 2016 Mathematics department seminar, Rose-Hulman Institute of Technology
- 2. *Exploring mathematical opportunities in industry: Math-to-Industry Boot Camp II*
  - January 2017 Graduate student colloquium, Purdue University
- 1. *Knot mosaics 101: an introduction to knot mosaics*
  - May 2010 MathFest, Pittsburgh, PA

### Poster presentations

- 1. *Wave propagation in rough media*
  - February 2023 Fulbright Scholar Showcase, Canberra, Australia

### Student projects supervised

1. John Nichols (undergraduate UD), UD Dean's Summer Fellowship 2023  
Project: Representing Music Theory in the Duodecimal Number System

### Awards and scholarships

Andrews Assistantship, Purdue August 2012  
 Zoltners Scholarship, Purdue Augsut 2012  
 Faculty Prize, Miami OH May 2012  
 John L. Gilpatrick Mathematics Award, Denison May 2010

### Service

#### Referee for

*Asymptot. Anal.*, *Commun. PDE*, *Commun. Pure Appl. Anal.*,  
*J. Fourier Anal. Appl.*, *Pure Appl. Anal.*, *SIAM J. Math. Anal.*

#### Reviewer for

AMS Math Reviews and zbMath

#### Conferences and seminars organized

Organizer, Great Lakes Mathematical Physics Meeting 7, Oberlin College 2023  
 Organizer, Great Lakes Mathematical Physics Meeting 6, Michigan State 2022  
 Organizer, Great Lakes Mathematical Physics Meeting 5, virtual meeting 2021  
 Organizer, MSRI microlocal analysis seminars Fall 2019  
 Organizer, ANU Analysis and PDE seminar 2019-2020

#### Advocacy, mentoring, and outreach

Facilitator, UD mathematics department TA training 2022-2023  
 Speaker for one UD Math Club meeting Spring 2022  
 Instructor for one session of Berkeley Math Circle October 2019  
 Purdue mathematics department graduate student representative 2016-2017  
 New student mentor, Association for Women in Mathematics 2015-2016, 2018  
 New student mentor, Purdue College of Science Fall 2016

#### Committees

UD committee to review calculus contact hours policy Fall 2022  
 UD committee to review assessment policy for calculus I Fall 2022  
 UD committee to craft math help center staffing policy Spring 2022  
 UD committees to hire mathematics tenure-track faculty 2021-2024  
 UD committees to craft math department hiring plan Spring 2021, Fall 2023  
 UD committees to revise math department tenure and promotion policy 2021-2024,  
 UD committee to review sabbatical proposal Fall 2020  
 Student representative, Purdue committee for graduate curriculum 2017-2018