

Department of Mathematics  
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# Jared Wunsch

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## Education

- 1998 **Ph.D., Mathematics**, *Harvard University*, Cambridge, MA.  
Advisor: Richard Melrose (MIT)
- 1993 **A.B., summa cum laude**, *Princeton University*, Princeton, NJ.

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## Appointments

- 2009–present **Professor**, *Northwestern University*, Evanston, IL.  
Department Chair, 2012–2015.
- 2005–2009 **Associate Professor**, *Northwestern University*, Evanston, IL.
- 2002–2005 **Assistant Professor**, *Northwestern University*, Evanston, IL.
- 2000–2002 **Assistant Professor**, *SUNY at Stony Brook*, Stony Brook, NY.
- 1999–2000 **VIGRE Assistant Professor**, *Columbia University*, New York, NY.
- 1998–1999 **NSF Postdoctoral Fellow**, *Columbia University*, New York, NY.
- Spring 1995 **Teaching Fellow**, *Harvard University*, Cambridge, MA.
- Summer 1993 **Visiting Research Fellow**, *Center for Communications Research*, La Jolla, CA.
- Summer 1992 **Visiting Research Fellow**, *Center for Communications Research*, Princeton, NJ.

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## Visiting Appointments

- Fall 2019 **Member**, *Mathematical Sciences Research Institute*, Berkeley, CA.
- February 2016 **“Research in Paris,” joint with D. Baskin**, *Institut Henri Poincaré*, Paris, France.
- January 2016 **Professeur Invité**, *Université de Paris 11*, Orsay, France.
- October 2015 **Professeur Invité**, *Université de Paris 6*, Paris, France.
- Fall 2015 **Member**, *Institut Henri Poincaré*, Paris, France.
- July 2013 **Professeur Invité**, *Université de Nantes*, Nantes, France.
- July 2009 **Visitor**, *Institut Henri Poincaré*, Paris, France.
- 2008–9 **Research Professor**, *Mathematical Sciences Research Institute*, Berkeley, CA.
- May–June, 2007 **Professeur Invité**, *Université de Paris Nord*, Paris, France.

- Feb.–March 2005 **Visiting Fellow**, *Mathematical Sciences Institute*, Australian National University, Australia.
- May 2004 **Maître de Conférence Invité**, *Université de Paris 11*, Orsay, France.

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### Awards and Honors

- 2021 **Simons Fellow in Mathematics**.
- 2013 **Fellow**, *American Mathematical Society*.
- 2011 **Distinguished Teaching Award**, WCAS, Northwestern University.
- 2008 **ASG Honor Roll**, *Northwestern University*.
- 1993 **Phi Beta Kappa**, *Princeton University*.
- 1993 **Sigma Xi**, *Princeton University*.
- 1993 **George B. Covington Prize**, *Senior Prize in Mathematics*, Princeton University.
- 1992 **Andrew H. Brown Prize**, *Junior Prize in Mathematics*, Princeton University.
- 1990–1992 **Goldwater Scholarship**, *Princeton University*.

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### Grant Support

- 1993–98 **Fannie and John Hertz Fellowship**, *Harvard University*.
- 1993 **NSF Graduate Fellowship**, (*declined*).
- 1993 **DoD Graduate Fellowship**, (*declined*).
- 1998–99 **NSF Postdoctoral Fellowship**, *Columbia University*.
- 2001–03 **NSF grant DMS-0100501**, *Linear Partial Differential Equations on Singular Spaces*.
- 2002–05 **NSF grant DMS-0323021**, *Linear Partial Differential Equations on Singular Spaces*.
- 2004–07 **NSF grant DMS-0401323**, *Linear Partial Differential Equations on Singular Spaces*.
- 2007–11 **NSF grant DMS-0700318**, *Linear Partial Differential Equations on Singular Spaces*.
- 2009 **Co-PI, NSF grant DMS-0935967**, *Conferences/Workshops on Partial Differential Equations and Related Analysis and Applications*.
- 2010–13 **NSF grant DMS-1001463**, *Linear Partial Differential Equations on Singular Spaces*.
- 2013–17 **NSF grant DMS-1265568**, *Linear Partial Differential Equations on Singular Spaces*.
- 2014 **NSF grant DMS-1420160**, *73rd Midwest PDE Seminar*.
- 2015–21 **Co-PI, NSF grant DMS-1502632**, *RTG: Analysis on Manifolds*.
- 2016 **NSF grant DMS-1600014**, *Conference: Evolution Equations on Singular Spaces*.
- 2016–2020 **NSF grant DMS-1600023**, *Linear Partial Differential Equations on Singular Spaces*.

- 2019–20 **NSF grant DMS-1830112**, *Conference on Microlocal Analysis and Applications*.
- 2019–22 **Simons Foundation Collaboration Grant 631302**, *Linear Partial Differential Equations on Singular Spaces*.
- 2021–24 **NSF grant DMS-2054424**, *Linear Partial Differential Equations on Singular Spaces*.
- 2022–27 **Co-PI, NSF grant DMS-2136217**, *RTG: Dynamics: Classical, Modern, and Quantum*.

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## Publications

- [1] *The Shields-Harary number for wheel and broken wheel graphs*, *Discrete Applied Mathematics* **59** (1995), 193–199.
- [2] *Propagation of singularities and growth for Schrödinger operators*, *Duke Math. J.*, **98** (1999), 137–186.
- [3] *The trace of the generalized harmonic oscillator*, *Ann. Inst. Fourier*, **49** (1999), 351–373.
- [4] *Distribution of resonances for asymptotically euclidean manifolds* (with Maciej Zworski), *J. Diff. Geom.*, **55** (2000), 43–82.
- [5] *The FBI transform on compact  $C^\infty$  manifolds* (with Maciej Zworski), *Trans. AMS*, **353** (2001), 1151–1167.
- [6] *Singularities and the wave equation on conic spaces* (with Richard Melrose), *Proceedings of the Centre for Mathematics and its Applications, Australian National University*, **39** (2001).
- [7] *Propagation of singularities for the wave equation on conic manifolds* (with Richard Melrose), *Inventiones Mathematicae*, **156** (2004), 235–299.
- [8] *A Poisson relation for conic manifolds*, *Math. Res. Lett.*, **9** (2002), 813–828.
- [9] *The Schrödinger propagator for scattering metrics* (with Andrew Hassell), *Annals of Mathematics*, **162** (2005), 487–523.
- [10] *On the structure of the Schrödinger propagator* (with Andrew Hassell), *Partial Differential Equations and Inverse Problems*, *Contemp. Math.* 362, Amer. Math. Soc., Providence RI, 2004.
- [11] *The radiation field is a Fourier integral operator* (with Antônio Sá Barreto), *Ann. Inst. Fourier*, **55** (2005) 213–227.
- [12] *A Strichartz inequality for the Schrödinger equation on non-trapping asymptotically conic manifolds* (with Andrew Hassell and Terence Tao), *Comm. PDE.*, **30** (2005), 157–205.
- [13] *Sharp Strichartz estimates on non-trapping asymptotically conic manifolds* (with Andrew Hassell and Terence Tao), *Amer. J. Math.* **128** (2006), 963–1024.

- [14] *Absence of super-exponentially decaying eigenfunctions on Riemannian manifolds with pinched negative curvature* (with András Vasy), *Math. Res. Lett.* **12** (2005), 673–684.
- [15] *Spreading of quasimodes in the Bunimovich stadium* (with Nicolas Burq and Andrew Hassell), *Proc. AMS* **135** (2007), 1029–1037.
- [16] *Spreading of Lagrangian regularity on rational invariant tori*, *Comm. Math. Phys.* **279** (2008), 487–496.
- [17] *The semiclassical resolvent and the propagator for nontrapping scattering metrics* (with Andrew Hassell), *Adv. Math.* **217** (2008), 586–682.
- [18] *Propagation of singularities for the wave equation on edge manifolds* (with Richard Melrose and András Vasy), *Duke Math. J.* **144** (2008), 109–193.
- [19] *Semiclassical second microlocal propagation of regularity and integrable systems* (with András Vasy), *J. Anal. Math.* **108** (2009), 119–157.
- [20] *Microlocal analysis and evolution equations*, in “Evolution Equations,” Ellwood, David, et al., eds. Vol. 17. American Mathematical Soc., 2013.
- [21] *Evolution Equations (Clay Mathematics Proceedings Vol. 17)*, edited volume with D. Ellwood, I Rodnianski, G. Staffilani, American Mathematical Soc., 2013.
- [22] *Diffraction of singularities for the wave equation on manifolds with corners* (with Richard Melrose and András Vasy), *Astérisque No. 351* (2013).
- [23] *Positive commutators at the bottom of the spectrum* (with András Vasy), *J. Func. Anal.* **259** 2, (2010), 503–523.
- [24] *Resolvent estimates for normally hyperbolic trapped sets* (with Maciej Zworski), *Ann. Henri Poincaré*, **12** (2011), 1349–1385.
- [25] *Non-concentration of quasimodes for integrable systems*, *Comm. PDE*, 37 (2012), no. 8, 1430–1444.
- [26] *Morawetz estimates for the wave equation at low frequency* (with András Vasy), *Math. Ann.*, 355 (2013), 1221–1254.
- [27] *Local smoothing for the Schrödinger equation with a prescribed loss* (with Hans Christianson), *Amer. J. Math.*, **135** (2013), 1601–1632.
- [28] *Erratum to Semiclassical second microlocal propagation of regularity and integrable systems* (with András Vasy), *J. Anal. Math.* **115** (2011), 389–391.
- [29] *From resolvent estimates to damped waves*, (with Hans Christianson, Emmanuel Schenck, and András Vasy), *J. Anal. Math.* **122** (2014), 143–162.
- [30] *Resolvent estimates with mild trapping*, Journées “Équations aux Dérivées Partielles,” 2012.

- [31] *Resolvent estimates and local decay of waves on conic manifolds* (with Dean Baskin), J. Diff. Geom. **95** (2013), 183–214.
- [32] *Strichartz estimates on exterior polygonal domains* (with Dean Baskin and Jeremy Marzuola), Contemp. Math., 630, Amer. Math. Soc., Providence, RI, 2014.
- [33] *Asymptotics of radiation fields in asymptotically Minkowski space* (with Dean Baskin and András Vasy), Amer. J. Math. **137** (2015) 1293–1364.
- [34] *The diffractive wave trace on manifolds with conic singularities* (with G. Austin Ford), Adv. Math. **304** (2017) 1330–1385.
- [35] *Sharp high-frequency estimates for the Helmholtz equation and applications to boundary integral equations* (with Dean Baskin and Euan Spence), SIAM J. Math. Anal. **48** (2016) 229–267.
- [36] *Periodic damping gives polynomial energy decay*, Math. Res. Lett. **24** (2017) 519–528.
- [37] *Asymptotics of scalar waves on long-range asymptotically Minkowski spaces* (with Dean Baskin and András Vasy), Adv. Math. **328** (2018) 160–216.
- [38] *Diffractive propagation on conic manifolds*, Séminaire Laurent Schwartz, 2016.
- [39] *On resonances generated by conic diffraction* (with Luc Hillairet), Ann. Inst. Fourier, to appear.
- [40] *Refined Weyl law for homogeneous perturbations of the harmonic oscillator* (with Moritz Doll and Oran Gannot), Commun. Math. Phys. **362** (2018), 269–294.
- [41] *Semiclassical diffraction by conormal potential singularities* (with Oran Gannot), Ann. Sci. Ecole Norm. Sup., to appear.
- [42] *On non-diffractive cones* (with Jeffrey Galkowski), J. Diff. Geom. **120** (2022) 505–518.
- [43] *Resonance-free regions for diffractive trapping by conormal potentials* (with Oran Gannot), Amer. J. Math., to appear.
- [44] *Optimal constants in non-trapping resolvent estimates and applications in numerical analysis* (with Jeffrey Galkowski and Euan Spence), Pure Appl. Anal. **2** (2020), no. 1, 157–202.
- [45] *For most frequencies, strong trapping has a weak effect in frequency-domain scattering* (with David Lafontaine and Euan Spence), Comm. Pure Appl. Math. **74** (2021), 2025–2063.
- [46] *A sharp relative-error bound for the Helmholtz  $h$ -FEM at high frequency* (with David Lafontaine and Euan Spence), Numerische Math., to appear.

- [47] *Caustics of weakly Lagrangian distributions* (with Sean Gomes), Ann. Henri Poincaré, to appear.
- [48] *Wavenumber-explicit convergence of the hp-FEM for the full-space heterogeneous Helmholtz equation with smooth coefficients* (with David Lafontaine and Euan Spence), Comput. Math. with Appl., 113 (2022), 59–69.
- [49] *Diffraction for the Dirac–Coulomb propagator* (with Dean Baskin), preprint (2020).
- [50] *Decompositions of high-frequency Helmholtz solutions via functional calculus, and application to the finite element method* (with David Lafontaine and Euan Spence), preprint (2021).
- [51] *Generalized Price’s law on fractional-order asymptotically flat stationary spacetimes* (with Katrina Morgan), Math Res. Lett., to appear.
- [52] *Mode solutions to the wave equation on a rotating cosmic string background* (with Katrina Morgan), Proc. AMS, to appear.
- [53] *Wavenumber-explicit parametric holomorphy of Helmholtz solutions in the context of uncertainty quantification* (with Euan Spence), preprint (2022).
- [54] *The hp-FEM applied to the Helmholtz equation with PML truncation does not suffer from the pollution effect* (with Jeffrey Galkowski, David Lafontaine, and Euan Spence), preprint (2022).
- [55] *Baroclinic Tidal Conversion: Note on a Paper of L. R. M. Maas* (with Carl Wunsch), *J. Fluid Mech.*, 946 (2022), A47.
- [56] *Newton polygons and resonances of multiple delta-potentials* (with Kiril Datchev and Jeremy Marzuola), preprint (2022).
- [57] *Wave propagation on rotating cosmic string spacetimes* (with Katrina Morgan), preprint (2022).

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## Book Reviews

- [1] Review of *Stalking the Riemann Hypothesis* by Daniel Rockmore, *Booklist*, Feb. 15, 2005, p.1045.
- [2] *Magic square and circles* (rev. of “Benjamin Franklin’s Numbers” by Paul Pasles) *Nature*, vol 450, 20/27 Dec. 2007, p.1162.

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## Professional Service

- 2023–27 **AMS Mathematical Surveys and Monographs Editorial Committee.**
- 2019–24 **AMS Prize Oversight Committee, Chair, 2019–2024.**
- 2009–10 **Representative to MSRI Sponsors Committee.**
- 2011–12 **AMS Central Section Program Committee.**
- 2010, 2012, 2017 **Service on National Science Foundation Panels, Washington, D.C..**

- 2012 **Proposal Reviewing**, *Institut Universitaire de France*, France.
- 2013 **Proposal Reviewing**, *EPSRC*, UK.
- 2015, 2018, 2020 **Proposal Reviewing**, *NSERC*, Canada.
- 2017 **Promotion Committee**, *University of Cyprus*, Cyprus.
- 1998–present **Reviewer for mathematics journals and book series.**  
Including *Trans. AMS*, *J. Func. Anal.*, *Duke Math J.*, *Comm. PDE*, *Comm. Math Phys.*, *Adv. Geom.*, *JAMS*, *Proc. Edinburgh Math. Soc.*, *Amer. J. Math.*, *Indiana Math. J.*, *J. Math. Anal. Applic.*, *Math. Res. Lett.*, *Ann. Sci. ENS*, *Ann. Math.*, *GAFA*, *Anal. PDE*, *SIAM J. Math. Anal.*, *Journal d'An. Math.*, *IMRN*, *Adv. Math.*, *Ann. Inst. Fourier.*, *AMS Grad. Studies.*, *Ann. Henri Poincaré*, *Ann. Henri Lebesgue*, *J. de l'École Polytechnique*

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## Conference Organization

- October 2004 **Geometric Partial Differential Equations**, *AMS Sectional Meeting*, Evanston, IL.
- May 2005 **Scattering Theory and Singular Spaces**, *Northwestern University*, Evanston, IL.
- April 2006 **Schrödinger Evolution Equations**, *Banff International Research Station*, Banff, Canada.
- June–July 2008 **Clay Mathematics Institute Summer School on Evolution Equations**, *ETH Zürich*, Zürich, Switzerland.  
Organizer and lecturer in 150 student summer school.
- Fall 2008 **Analysis on Singular Spaces**, *MSRI*, Berkeley, CA.  
Co-lead organizer of semester-long program with \$350,000 budget, 65 participants.
- October 2009 **Complex geometry: a conference in honor of Simon Donaldson**, *Northwestern University*, Evanston, IL.
- March 2010 **International Conference on Nonlinear PDE and Related Analysis/Applications**, *Northwestern University*, Evanston, IL.
- June 2010 **Local and Global Properties of Eigenfunctions**, *Northwestern University*, Evanston, IL.
- 2009–10 **Emphasis Year in PDE**, *Northwestern University*, Evanston, IL.
- October 2011 **Workshop on Microlocal Methods in Spectral and Scattering Theory**, *Northwestern University*, Evanston, IL.
- October 2011 **Workshop on Mathematics in the Geosciences**, *Northwestern University*, Evanston, IL.
- May 2012 **Workshop on Evolution Equations (in honor of Terence Tao)**, *Northwestern University*, Evanston, IL.
- 2011–12 **Emphasis Year in Microlocal Analysis**, *Northwestern University*, Evanston, IL.
- May 2014 **73rd Midwest PDE Seminar**, *Northwestern University*, Evanston, IL.
- May 2015 **May Midwestern Microlocal Meeting**, *Northwestern University*, Evanston, IL.

- April 2016 **Evolution Equations on Singular Spaces**, *CIRM Luminy*, France.
- May 2017 **May Midwestern Microlocal Meeting**, *Purdue University*, West Lafayette, IN.
- July–Aug. 2017 **Summer Northwestern Analysis Program**, *Northwestern University*, Evanston, IL.
- March 2019 **March Midwestern Microlocal Meeting (in honor of Plamen Stefanov)**, *Purdue University*, West Lafayette, IN.
- May 2019 **Microlocal Methods in Analysis and Geometry**, *CIRM Luminy*, France.
- June 2019 **Fudan Conference on Microlocal Analysis**, *Fudan University*, Shanghai, China.
- Aug. 2019 **Summer Northwestern Analysis Program**, *Northwestern University*, Evanston, IL.  
3 weeks, 119 participants
- June 2021 **Semiclassical Analysis Meets Numerical Analysis**, *University of Bath*, Bath, UK.
- Sept. 2022 **At the Interface between Semiclassical Analysis and Numerical Analysis of Wave Scattering Problems**, *MFO Oberwolfach*, Germany.

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## Curriculum Development

- 2004–5 **Development of new undergraduate courses in analysis**, *Northwestern University*.  
Now Math 321-1,2,3.
- 2010 **Development of new undergraduate course *Mechanics for Mathematicians***, *Northwestern University*.  
Now Math 327.

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## Undergraduate Theses Supervised

- 2006 **David Miller**, Northwestern University.
- 2007 **Sam Blinsein**, Northwestern University.
- 2007 **Matthew Gill**, Northwestern University.
- 2010 **Amy Danks**, Northwestern University.
- 2010 **Tae Eun Kim**, Northwestern University.
- 2015 **Erik Johnson**, Northwestern University.
- 2022 **Alain Kangabire**, Northwestern University.

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## Graduate Students

- 2006 **Drew Youngren**, *Ph.D.*, Northwestern University.
- 2009 **Randy Qian**, *Ph.D.*, Northwestern University.
- 2012 **Austin Ford**, *Ph.D.*, Northwestern University.
- 2015 **Rohan Kadakia**, *Ph.D.*, Northwestern University.
- 2020 **Peter Kleinhenz**, *Ph.D.*, Northwestern University.



2022 **Mengxuan Yang**, *Ph.D.*, Northwestern University.

2022 **Ruoyu Wang**, *Ph.D.*, Northwestern University.

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### Postdoctoral Fellows

2010–11 **Emmanuel Schenck**, *Boas Assistant Professor*, Northwestern University.

2010–14 **Dean Baskin**, *NSF Postdoctoral Fellow, Boas Assistant Professor*, Northwestern University.

2016–2019 **Oran Gannot**, *RTG Postdoctoral Fellow*, Northwestern University.

2017–2020 **Sean Gomes**, *Boas Assistant Professor*, Northwestern University.

2020–present **Katrina Morgan**, *NSF Postdoctoral Fellow*, Northwestern University.

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### Departmental and University Service

2000–2002 **Organizer of Partial Differential Equations Seminar**, *SUNY at Stony Brook*.

2002–present **Co-organizer of Analysis Seminar**, *Northwestern University*.

2004–present **Advisor for Mathematics Graduate School Applicants**, *Northwestern University*.

2004–7 **Gates Cambridge Committee**, *Northwestern University*.

2005 **Provost's Domain Dinner Presentation**, *Northwestern University*.

2006–8 **Rhodes/Marshall Committee**, *Northwestern University*.

2005–12 **Phi Beta Kappa Board of Advisors**, *Northwestern University*.

2007, 2008, **Mathematics Department Budget Committee**, *Northwestern University*.

2010, 2011, Also served Ex Officio 2013–15.

2017, 2018,

2020, 2021

2007–8 **Chair, Boas Hiring Committee**, *Northwestern University*.

2009–12 **President, Phi Beta Kappa Alpha Chapter of Illinois**, *Northwestern University*.

Chapter Chartered in 1890

2007–8 **Integrated Science Program Honors Committee**, *Northwestern University*.

2008 **WCAS Lecturer Promotion Committee**, *Northwestern University*.

2009–12 **Chair, Mathematics Department Personnel Committee**, *Northwestern University*.

2009–10, **Chair, Yamabe Lectures Committee**, *Northwestern University*.

2016–17

2009–10, **Chair, Pinsky Lectures Committee**, *Northwestern University*.

2016–17

2010–2014 **Hertz Fellowships Committee**, *Northwestern University*.

2009–11 **Chair, Mathematics Department Space Committee**, *Northwestern University*.

- 2011–12 **Co-Chair, Mathematics Department Emphasis Year Committee**, *Northwestern University*.
- 2011 **Completed Kellogg School of Management minicourse *Management Skills for Innovative University Leaders***, *Northwestern University*.
- 2012–15 **Chair, Northwestern University Department of Mathematics**, *Northwestern University*, Evanston, IL.
- 2012–13 **Committee for the Reform of the Ad Hoc Committee Process**, *WCAS, Northwestern University*.
- 2013–14 **WCAS Strategic Plan Committee**, *Northwestern University*.
- 2016–17 **Chair, Bellow Lectures Committee**, *Northwestern University*.
- 2018 **Nemmers Prize Committee**, *Northwestern University*.
- 2017–19 **Faculty Appeals Panel**, *Northwestern University*.
- 2018–20 **Executive Committee of Faculty Appeals Panel**, *Northwestern University*, Committee Chair, 2019–20.
- 2018–19 **Mathematics Department Program Review Liaison**, *Northwestern University*.
- 2021–22 **Mentor, Causeway Postbaccalaureate Program**, *Northwestern University*.

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### Panel Appearances

- 2008 **Postdoctoral Jobs for Math. Graduate Students**, *Northwestern University*.
- 2009 **Panel for Graduate Students on Job Applications**, *Northwestern University*.
- 2014 **Panel for Undergraduates on Math. Graduate Study**, *NUMS, Northwestern University*.
- 2014 **Third Annual Introduction to Graduate Study at Northwestern University**, *TGS, Northwestern University*.
- 2017 **Panel for Graduate Students on Job Applications**, *Northwestern University*.
- 2018 **Academic Job Forum/Panel Discussion**, *Northwestern University*.
- 2020 **Panel for Graduate Students on Job Applications**, *Northwestern University*.

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### Distinguished Addresses

- September 22, 2008 **MSRI Evans Lecture**, *MSRI/Berkeley, Berkeley, CA*.
- November 5, 2010 **AMS 2010 Fall Central Section Meeting**, *Notre Dame, South Bend, IN*.
- June 7, 2012 **Journées EDP 2012**,  *Biarritz, France*.
- January 26, 2016 **Séminaire Laurent Schwartz**, *IHES, Bures sur Yvette, France*.

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## Minicourses

- June–July 2008 **Clay Mathematics Institute Summer School on Evolution Equations**, *ETH Zürich*, Zürich, Switzerland.  
10 lectures.
- June–July 2014 **Chicago Summer School in Analysis**, *University of Chicago*, Chicago, IL.  
5 lectures.
- May 2016 **Oxford University Center for Doctoral Training in PDE**, *Oxford*, UK.  
3 lectures (4.5 hours).
- June 2017 **Microlocal Analysis and Applications**, *Cardiff*, UK.  
2 lectures.
- August 2017 **Summer Northwestern Analysis Program**, *Northwestern University*, Evanston, IL.  
4 lectures (6 hours).
- March 2018 **Graduate minicourse in Microlocal Analysis**, *Australian National University*, Canberra, Australia.  
2 hours
- December 2018 **PDE/Analysis Mini-School *Trapping, diffraction, and decay of waves***, *UNC*, Chapel Hill, North Carolina.  
4 lectures (principal lecturer)
- June 2019 **Fudan Conference on Microlocal Analysis**, *Fudan University*, Shanghai, China.  
2 lectures
- August 2019 **Summer Northwestern Analysis Program**, *Northwestern University*, Evanston, IL.  
4 lectures.

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## Invited Talks

- QMath15, UC Davis, 9/12/22  
Workshop on Microlocal Analysis and PDEs, University College London, 7/21/22  
Princeton Analysis Seminar, 3/28/22  
UC Irvine Inverse Problems Seminar (virtual), 3/17/22.  
Shanghai/Beijing Seminar on Microlocal Analysis and Applications (virtual), 3/10/22  
Beijing Institute of Technology Distinguished Lecture (virtual), 9/22/21  
Spectral Geometry in the Clouds (virtual), 5/3/21  
Texas A&M Mathematical Physics and Harmonic Analysis Seminar (virtual), 4/8/21  
Dalhousie University Analysis–Applied Math–Physics Seminar (virtual), 3/26/21  
London Analysis Seminar (virtual), 5/21/20  
MSRI Microlocal Analysis Seminar, 11/12/19  
Berkeley Analysis and PDE Seminar, 11/4/19  
Bay Area Microlocal Analysis Seminar, Berkeley, 4/12/19  
Stanford University Geometry Seminar, 4/10/19  
Ninth Ohio River Analysis Meeting, University of Cincinnati, 3/30/19  
Conference “Analysis of PDEs: unique continuation, stabilization, control and dispersive properties,” IHP Paris, 11/8/18

Banff International Research Station Workshop “Around Quantum Chaos,” 7/20/18  
 MIT PDE/Analysis Seminar, 5/1/18  
 UNC Analysis and PDE Seminar, 4/25/18  
 AMSI-ANU Workshop on Microlocal Analysis and its Applications, Murrumbidgee Australia, 3/23/18  
 “Spectral Geometry, Graphs and Semiclassical Analysis,” Aussois France, 12/14/17  
 79/80th Midwest PDE Seminar, UIC, 9/14/17  
 Third Symposium on Scattering and Spectral Theory, Florianópolis Brazil, 7/26/17  
 Calderón-Zygmund Analysis Seminar, Univ. of Chicago, 5/22/17  
 Operator Semigroups in Analysis: Modern Developments, Bedlewo Poland, 4/25/17  
 Bay Area Microlocal Analysis Seminar, Stanford, 3/20/17  
 University of Michigan Mathematics Colloquium, 2/7/17  
 CMO Oaxaca “Geometric and Spectral Methods in Partial Differential Equations,” 12/15/16  
 University of Cyprus, 11/16/16  
 Purdue University Mathematics Colloquium, 10/18/16  
 Oxford University Partial Differential Equations Seminar, 5/23/16  
 Analysis and Differential Equations Seminar, University of Bath (UK), 4/14/16  
 Séminaire Géométrie, EDP et Physique Mathématique, Université de Cergy-Pontoise, 4/4/16  
 Séminaire Équipe MIP, Institut des Mathématiques de Toulouse, 3/8/16  
 Séminaire de Physique Mathématique, Institut Fourier, Grenoble, 1/18/16  
 PDE and Fluid Mechanics Seminar, ICMAT Madrid, 1/13/16  
 Séminaire du MAPMO, Université d’Orléans, 12/10/15  
 Groupe de Travail Problèmes Spectraux et Physique Mathématique, Université Paris-Sud, 12/7/15  
 Oberseminar Analysis/Numerik, Carl von Ossietzky Universität, Oldenburg Germany, 12/3/15  
 Relativity Seminar, Institut Henri Poincaré, Paris, 11/4/15  
 London Analysis and Probability Seminar, University College London, 10/22/15  
 Séminaire “Problèmes Spectraux en Physique Mathématique”, IHP Paris, 10/19/15  
 Workshop on Analysis and PDE, Leibniz Universität Hannover, 9/29/15  
 Berkeley/Bonn/Paris Nord/Zürich PDE Video Seminar, 9/24/15  
 Erwin Schrödinger Institute for Mathematical Physics workshop “Semi-classical Analysis: Spectral Theory and Resonances,” 8/28/15  
 University of Toronto Analysis and Applied Mathematics Seminar, 4/10/15  
 Texas A&M Mathematical Physics and Harmonic Analysis Seminar, 3/27/15  
 UNC Analysis/PDE Seminar, 3/18/15  
 Duke/UNC Student Colloquium, 3/17/15  
 Temple University Analysis Seminar, 2/23/15  
 Stanford University Analysis and PDE Seminar, 11/17/14  
 Thematic Program on Nonlinear PDEs in Geometry and Physics, Notre Dame, 6/17/14  
 Montreal Analysis Seminar, McGill University, 5/23/14  
 Stanford University Analysis and PDE Seminar, 12/16/13  
 CIRM “HANDDY” (Hamiltonian and Dispersive Equations) conference Luminy France, 6/28/13  
 University of Illinois at Chicago Mathematics Colloquium, 2/15/13  
 Stanford University Analysis and PDE Seminar, 11/15/12  
 University of Michigan Differential Equations Seminar, 11/8/12  
 Conference on Spectral Invariants on Non-compact and Singular Spaces, CRM, Montreal, 7/25/12  
 A Conference on Partial Differential Equations Analytic and Geometric Aspects in honor of

Michael Taylor's 65th Birthday, 6/17/12  
 University of Illinois at Urbana-Champaign Colloquium, 11/17/11  
 Johns Hopkins Analysis Seminar, 11/7/11  
 Banff International Research Station Workshop "Self Adjoint Extensions and Singularity Resolution in String Theory and Quantum Gravity," 8/24/11  
 University of Kentucky NSF-CBMS conference on "Global Harmonic Analysis," 6/20/2011, 6/23/2011  
 CIRM Meeting "Analyse Géométrique," Luminy France, 1/21/2011  
 UNC Analysis/PDE Seminar, 12/1/10  
 MIT PDE/Analysis Seminar, 9/14/10  
 Banff International Research Station Workshop "Geometric Scattering Theory and Applications," 3/16/10  
 Calderón-Zygmund Analysis Seminar, Univ. of Chicago, 3/1/10  
 June Workshop, Institut Henri Poincaré Trimester: Nonlinear Waves and Dispersion, 6/23/09  
 Institut Henri Poincaré Séminaire: Problèmes Spectraux en Physique Mathématique, 6/15/09  
 MIT "Mini Micro Conference," 4/3/09  
 Southern California Analysis and PDE Meeting, UCLA, 2/7/09  
 U.C. Davis Mathematics Colloquium, 11/17/08  
 From Wave Propagation to K-theory: a Conference in Honour of the 60th Birthday of Richard Melrose, Stanford University, 10/25/08  
 MIT Casual Geometric Analysis Seminar, 4/30/08  
 University of Pennsylvania Analysis Seminar, 3/25/08  
 University of Rochester Analysis Seminar, 3/21/08  
 University of Kentucky PDE and Analysis Seminar, 3/10/08  
 U.C. Berkeley PDE/Analysis Seminar, 1/28/08  
 UCSD Real Analysis Seminar, 12/4/07  
 AMS special session on Wave Propagation from Mathematical and Numerical Viewpoints, Chicago, 10/6/07  
 MFO Oberwolfach Workshop "Analysis and Geometric Singularities," 8/23/07  
 Université de Paris Nord Seminar "Equations non linéaires," 6/1/07, 6/15/07  
 Princeton University Analysis Seminar, 4/9/07  
 University of Southern California Mathematics Colloquium, 3/21/07  
 AMS Special Session on Microlocal Analysis and Singular Spaces, New Orleans, 1/6/07  
 Purdue University Spectral and Scattering Theory Seminar, 10/26/06  
 Stanford University Mathematics Colloquium, 4/6/06  
 Johns Hopkins Analysis Seminar, 3/13/06  
 Osaka University PDE Seminar, 1/20/06  
 "Spectral and scattering theory and related topics" workshop, RIMS, Kyoto, 1/18/06  
 "Analysis of singularities of solutions to Schrödinger equation" workshop, University of Tokyo, 1/13/06, 1/14/06  
 Colloque d'Equations aux Dérivées Partielles, Hamammet, Tunisia, 9/9/05  
 University of Bordeaux Applied Mathematics Seminar, 6/23/05  
 AMS/DMV/ÖMG Special Session on Nonlinear Waves, Mainz, Germany, 6/16/05  
 Calderón-Zygmund Analysis Seminar, Univ. of Chicago, 5/23/05  
 The Australian National University Mathematics Colloquium, 3/3/05  
 The Australian National University PDE/Analysis Seminar, 2/28/05  
 Mathematics Colloquium, McMaster University, 10/8/04

Conference on Phase Space Analysis and Related Topics, Grado Italy, 9/16/04  
 Séminaire Equations aux Dérivées Partielles, University of Paris XI (Orsay), 5/25/04  
 Purdue Scattering and Spectral Theory Seminar, 4/7/04  
 Michigan State University PDE Seminar, 4/6/04  
 Fields Institute Workshop on Nonlinear Wave Equations, 3/17/04  
 MIT PDE/Analysis Seminar, 2/11/04  
 Short programme on analysis and resolution of singularities, CRM, Montreal, 9/4/03  
 Symposium on Scattering and Spectral Theory, Serrambi Brazil, 8/21/03  
 Calderón-Zygmund Analysis Seminar, Univ. of Chicago, 4/28/03  
 51st Midwest PDE Seminar, UIC, 4/13/03  
 UCLA Analysis Seminar, 3/14/03  
 The Australian National University PDE/Analysis Seminar, 3/3/03  
 PASI on PDE, Inverse Problems, and Non-Linear Analysis, Santiago de Chile, 1/14/03  
 CMS Special Session on Partial Differential Equations, Ottawa, 12/9/02  
 Recent Advances in Calculus of Variations and PDE's, Pisa, 11/7/02  
 MIT PDE/Analysis Seminar, 9/11/02  
 Northwestern University Colloquium, 3/4/02  
 CUNY Graduate Center Differential Geometry and Analysis Seminar, 2/27/02  
 McGill University Analysis Seminar, 1/11/02  
 Temple University Colloquium, 9/17/01  
 University of Potsdam workshop "Ellipticity and Parabolicity in Analysis and Geometry," 8/24/01  
 Erwin Schrödinger Institute for Mathematical Physics, Workshop in Scattering Theory, 5/21/01  
 MSRI Spectral Invariants Workshop, 5/7/01  
 AMS Special Session on Nonlinear Partial Differential Equations, New York, 11/4/00  
 Hyperbolic Equations and Scattering: A Conference in Honor of Gerard Friedlander, MIT, 9/30/00  
 University of New South Wales Pure Mathematics Colloquium, 7/14/00  
 The Australian National University PDE/Analysis Seminar, 7/10/00  
 The Australian National University, National Research Symposium on Geometric Analysis and Applications, 6/29/00  
 University of Bologna, 6/12/00, 6/13/00, 6/14/00  
 Princeton University Analysis Seminar, 2/28/00  
 University of Toronto Analysis and Applied Mathematics Seminar, 12/6/99  
 Columbia University Analysis and Geometry Seminar, 11/11/99  
 U.C. Berkeley Analysis and PDE Seminar, 9/3/99  
 CIRM Meeting "Théorie des résonances," Luminy France, 6/17/99  
 University of Bologna, 6/8/99  
 SUNY Stonybrook Colloquium, 2/25/99, 9/14/00  
 University of Pennsylvania Analysis Seminar, 10/20/98  
 U.C. Berkeley Analysis and PDE Seminar, 9/29/98  
 University of Bologna, 6/29/98  
 Erwin Schrödinger Institute for Mathematical Physics, Workshop in Spectral Geometry and its Applications, 6/18/98  
 The Ohio State University Analysis and Geometry Seminar, 3/13/98  
 University of British Columbia, 2/26/98  
 University of Washington Differential Geometry/PDE Seminar, 2/23/98  
 Columbia University Analysis and Geometry Seminar, 2/12/98

The Johns Hopkins University Partial Differential Equations/Geometric Analysis Seminar, 11/20/97  
Fields Institute Workshop on Microlocal Methods in Geometric Analysis and Mathematical Physics, 11/1/97  
Harvard University Differential Geometry Seminar, 10/7/97  
AMS Special Session on Geometric Analysis and Spectral Theory, Montreal, 9/27/97  
MIT PDE/Analysis seminar, 3/19/97, 9/11/02  
Universität Potsdam Arbeitsgruppe “Partielle Differentialgleichungen und Komplexe Analysis”  
Spring School, 2/26/97  
Brown University PDE seminar, 11/15/96