

# Tanya Christiansen

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## Research Interests

Partial differential equations, especially scattering theory.

## Education

**Ph.D. in Mathematics**, 1993

Massachusetts Institute of Technology, Cambridge, Massachusetts

**B.A. in Mathematics**, Summa Cum Laude, 1989

Rice University, Houston, Texas

## Experience

Professor, University of Missouri, Columbia, Missouri	2006-present
Research Professor, MSRI, Berkeley, California	Fall 2009
Associate Professor, University of Missouri, Columbia, Missouri	2000-2006
Assistant Professor, University of Missouri, Columbia, Missouri	1995-2000
NSF Postdoctoral Fellow, The Johns Hopkins University, Baltimore, Maryland	1994-1995
Instructor, University of Pennsylvania, Philadelphia, Pennsylvania	1993-1994

## Publications

*Inverse obstacle problems with backscattering or generalized backscattering data in one or two directions.* Asymptotic Analysis **81** (2013), no. 3-4, 315-335.

*Schrödinger operators and the distribution of resonances in sectors,* Analysis and PDE **5** no. 5 (2012), 961-982.

*Resonances for manifolds hyperbolic at infinity: optimal lower bounds on order of growth* (with D. Borthwick, P. D. Hislop, and P. Perry). Int. Math. Research Notices 2011, no. 19, 4431-4470.

*Probabilistic Weyl laws for quantized tori* (with M. Zworski). Comm. Math. Phys. **299** (2010), 305-334.

*Inverse problems for obstacles in a waveguide* (with Michael Taylor). Comm. PDE **35**, Issue 2 (2010) 328-352.

*Maximal order of growth for the resonance counting functions for generic potentials in even dimensions* (with PD Hislop). Ind. Univ. Math. J **59** (2010), 621-660.

- A Mathematical formulation of the Mahaux-Weidenmuller formula for the scattering matrix* (with M. Zworski). *J. Phys. A: Math. Theor.* **42** (2009) 415202.
- Sojourn times, manifolds with infinite cylindrical ends, and an inverse problem for planar waveguides*, *J. Anal. Math.* **107** (2009), 79–106.
- Resonances and balls in obstacle scattering with Neumann boundary conditions*. *Inverse Probl. Imaging* **2** (2008), no. 3, 335–340.
- Isophasal, isopolar, and isospectral Schrödinger operators and elementary complex analysis*. *Amer. J. Math.* **130** (2008), no. 1, 49–58.
- Several complex variables and the order of growth of the resonance counting function in Euclidean scattering*. *International Mathematics Research Notices* **2006** (2006), Art. ID 43160, 36 pp.
- Schrödinger operators with complex-valued potentials and no resonances*, *Duke Math Journal* **133**, no. 2 (2006), 313–323.
- Resonances for steplike potentials: forward and inverse results*, *Trans. Amer. Math. Soc.* **358** (2006), 2071–2089.
- Several complex variables and the distribution of resonances for potential scattering*, *Commun. Math. Phys* **259** (2005), 711–728.
- The resonance counting function for Schrödinger operators with generic potentials*, with P.D. Hislop. *Math Research Letters*, **12** (6) (2005), 821–826.
- Asymptotics for a resonance-counting function for potential scattering on cylinders*. *Journal of Functional Analysis* **216** No. 1 (2004), 172–190.
- Pseudospectra in automorphic scattering*, with M. Zworski. *Forum Mathematicum* **16** No. 5 (2004), 681–694.
- Scattering on stratified media: the microlocal properties of the scattering matrix and recovering asymptotics of perturbations*, with M.S. Joshi. *Ann. Inst. Fourier* **53**, No. 2 (2003), 565–624.
- Some upper bounds on the number of resonances for manifolds with infinite cylindrical ends*. *Annales Henri Poincaré* **3** No. 5 (2002), 895–920.
- Weyl asymptotics for the Laplacian on manifolds with asymptotically cusp ends*. *Journal of Functional Analysis* **187** (2001), 211–226.
- Resonance wave expansions: two hyperbolic examples*, with M. Zworski. *Comm. Math. Phys.* **212** No. 2 (2000), 323–336.
- Higher order scattering on asymptotically Euclidean manifolds*, with M. Joshi. *Canadian J. Math.* **52** No. 5 (2000), 897–919.
- Recovering asymptotics at infinity of perturbations of stratified media*, with M. Joshi. *Journées “Équations aux Dérivées Partielles,”* (La Chapelle sur Erdre, 2000), Exp. No. II, 9 pp., Univ. Nantes, Nantes, 2000.

*Some lower bounds on the number of resonances in Euclidean scattering*, Mathematical Research Letters **6** (1999), 203-211.

*Weyl asymptotics for the Laplacian on asymptotically Euclidean spaces*. Amer. J. Math. **121** (1999), 1-22.

*Scattering theory for perturbed stratified media*. Journal d'Analyse Mathématique **76** (1998), 1-44.

*Spectral asymptotics for compactly supported perturbations of the Laplacian on  $\mathbf{R}^n$* . Comm. Partial Differential Equations **23**, 5&6 (1998), 933-948.

*Harmonic functions of polynomial growth on certain complete manifolds*, with Maciej Zworski. Geom. Funct. Anal. **6** No. 4, (1996), 619-627.

*Spectral asymptotics for manifolds with cylindrical ends*, with Maciej Zworski. Annales de l'Institut Fourier **45**, 1 (1995), 251-263.

*Scattering theory for manifolds with asymptotically cylindrical ends*. Journal of Functional Analysis **131**, 2, (1995), 499-530.

## Preprints

*Some remarks on resonances in even-dimensional Euclidean scattering*, with P. Hislop. Submitted.

*Lower bounds for resonance counting functions for Schrödinger operators with fixed sign potentials in even dimensions*. To appear, Journal of Spectral Theory.

**Thesis:** *Scattering theory on compact manifolds with boundary*, written under the supervision of Richard B. Melrose.

## Research Funding

NSF Grant DMS-1001156, 2010-2013

NSF Grant DMS-0500267, 2005-2008

NSF Grant DMS-0088922, 2000-2003

University of Missouri Summer Research Fellowship, 1999

University of Missouri Research Board Grant, 1998

University of Missouri Summer Research Fellowship, 1997

University of Missouri Research Board Grant, 1996-1997

NSF Postdoctoral Fellowship, 1994-1997

NDSEG Fellowship, 1989-1992

## Additional Support of Research Travel

AWM Travel Grant, to attend the conference "Théorie des Résonances" in Luminy, France, June 1999

Support through London Mathematical Society to visit M. Joshi, University of Cambridge, June 1999

## Talks

- Conference “Quantum chaos, resonances and semi-classical measures” Roscoff, France, June 17-21, 2013.
- Analysis/PDE seminar, University of North Carolina, Chapel Hill, North Carolina, April 2013
- Invited speaker, Ohio River Analysis Meeting, Cincinnati, Ohio, March 2013
- Invited address, AMS Sectional meeting, Akron, Ohio, October 2012.
- Spectral invariants on non-compact and singular spaces conference, CRM, Montreal, July 2012.
- Microlocal methods in spectral and scattering theory conference, Northwestern University, October 2011
- NSF-CBMS Conference “Global Harmonic Analysis,” June 2011 (Complementary talk and tutorial talk)
- MIT PDE/Analysis seminar, April 2011
- MSRI Workshop, Connections for Women: Inverse Problems and Applications, August 2010 (two expository talks)
- Banff International Research Station, Conference “Geometric scattering theory and applications,” March 2010
- Northwestern University Analysis Seminar, February 2010
- Stanford University Analysis and PDE Seminar, February 2009
- Resonances in Physics and Mathematics, CIRM, Luminy, France, January 2009
- MSRI Evans Lecture, UC Berkeley, CA, December 2008
- Elliptic and hyperbolic equations on singular spaces conference, MSRI, Berkeley, CA, October 2008
- Introduction to spectral and scattering theory (four lectures, joint with M. Zworski), Introductory Workshop – Analysis on Singular Spaces Program, MSRI, Berkeley, CA, September 2008
- Broader Connections– Analysis on Singular spaces, MSRI, Berkeley, CA, August 2008
- Midwest PDE Seminar, Lexington, Kentucky, March 2007
- Special session on scattering theory and wave propagation, AMS meeting, Fayetteville, Arkansas, November 2006
- PDE and Analysis Seminar, MIT, Cambridge, MA December 2005
- Special session on Scattering and Spectral Problems in Geometry, AMS meeting, Lincoln, Nebraska, October 2005
- PDE Seminar, University of Kentucky, April 2005
- Colloquium, University of California, Berkeley, March 2005
- Special Session on Inverse Spectral Geometry, Joint Winter Meeting, Atlanta, January 2005

Special Session on Partial Differential Equations, CMS Winter Meeting, Ottawa, Ontario, December 2002

Research talk, Workshop on Inverse Spectral Geometry, Lexington, Kentucky, June 2002

Two survey lectures on resonances and the scattering phase, Workshop on Inverse Spectral Geometry, Lexington, Kentucky, June 2002

Colloquium, Indiana University, February 2002

Geometry Seminar, Stanford University, February 2002

Partial Differential Equations Conference, Nantes, France, June 2000.

“Harmonic Analysis and Zeta Function” conference, Göttingen, Germany, May 2000.

Midwest PDE Conference, Purdue University, March 2000.

Salt Lake City AMS Meeting Special Session “Microlocal Analysis and its Applications,” September 1999.

“Théorie des Résonances” conference, CIRM Marseille-Luminy, France, June 1999.

Texas Geometry and Topology Conference, Lubbock, Texas, February 1999.

Analysis and PDE Seminar, University of California, Berkeley, October 1998.

“Microlocal methods in geometric analysis” workshop, Fields Institute, Toronto, Canada, October 1997.

Analysis Seminar, University of Cambridge, Cambridge, United Kingdom, May 1997.

Geometry Seminar, University of Nantes, Nantes, France, June 1996.

PDE seminar, Stanford University, May 1996.

PDE seminar, M.I.T., May 1996.

Analysis seminar, University of Toronto, March 1996.

Colloquium, Texas A&M, February 1995.

Colloquium, Oklahoma State University, February 1995.

Analysis seminar, University of Chicago, January 1995.

Conference: “Analysis und Geometrie singulärer Räume,” Oberwolfach, July 1994.

Brooklyn AMS Meeting Special Session, April 1994.

Analysis seminar, Purdue University, February 1994.

Analysis seminar, The Johns Hopkins University, October 1993.

Workshop on degenerate elliptic operators, Stanford University, August 1993.

Colloquium, University of Arizona, March 1993.

## Reviewing and Refereeing

Referee for Analysis and PDE, Archiv der Mathematik, Asymptotic Analysis, Canadian Journal of Math, Communications in Partial Differential Equations, IMA Journal of Applied Mathematics, Journal of Functional Analysis, Letters in Mathematical Physics, Mathematical Research Letters, Pacific Journal of Mathematics, Proceedings of the American Mathematical Society, Conference Proceedings, the National Science Foundation, FONDECYT (Chile)

Reviewer for Math Reviews

## Other Service

Member of the Mathematics Department Executive Committee (2009-2012), Business math coordinator search committee (2013-14), Awards Committee (2002-2003, 2006-2008, 2011-13, Chair 2012-13 ), Library Committee (2009-2010), Space and Resource Allocation Committee (2006-2008), Curriculum Committee (2005-2008, 2009-present), Qualifying Examination Committee (1998-2002, 2009-2011), International Students Screening (2002-2008, 2009-present; **chair** 2004-2005, **co-chair** 2006-2008), Graduate and Undergraduate Recruiting Committee (1998-2001), Doctoral faculty review committee (2004-2005, 2010-11), Excellence in Teaching Committee (2000-2008; 2013-present; **chair** 2005-2007), Graduate Selection and Evaluation Committee (1998-2000), Promotion of Good Teaching Committee (1998-2000), Colloquium Committee (1998-1999), Annual Review Committee for Assistant Professors (2001-2003, 2011-2012), Undergraduate Advising Committee (1995-2001)

Member of the MU Arts and Science Promotion and Tenure Committee, 2012-15; **Chair** 2013-14.

Member of MU Middlebush Chair selection committees, fall 2012 and fall 2013

Member of the MU Honorary Degrees Committee, 2010-13.

Organized, with P. Hislop and P. Perry, the Special Session on Spectral, Scattering, and Inverse Scattering Theory at the AMS meeting in Akron, Ohio, October 2012.

Chair of the Geometric analysis/differential geometry/nonlinear PDE search committee, academic year 2010-11

Organized, with A. Malcolm, S. Moskow, C. Tsogka, and G. Uhlmann, the workshop “Connections for Women: Inverse Problems and Applications,” MSRI August 2010

Member of an NSF panel, 2007, 2012, 2014

Organized, with R. Froese and M. Zworski, the meeting “Mathematical Theory of Resonances,” BIRS, October 2008

Organized, with A. Vasy, the Special Session on Scattering Theory and Wave Propagation at the AMS meeting in Fayetteville, Arkansas, November 2006

Member of the Calculus Coordinator and Business Math Coordinator Search Committees (2006)

Member of the A&S Undergraduate Scholarship Committee (2006-2007)

Organizer of the M.U. Partial Differential Equations Seminar (1996-2003)

Member of the A&S Committee on the Status of Women (2002-2003)

Member of the M.U. Research Council (Fall 2002)

Math 61 Coordinator (Fall 1999)

Member of the Physics Department Junior Theory Search Committee (1997-1998)

Advisor to undeclared Arts and Science students (1998-2002)

Member of the M.U. Arts and Science Committee on Faculty Responsibility (1998-1999)