Dr. David Alexander Sher

RTG Post-doctoral Assistant Professor, Department of Mathematics, University of Michigan

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Educational Background:

B.A. and M.A. in Mathematics, Johns Hopkins University, 2007 (double-degree program). GPA 4.00/4.00.

Ph. D. in Mathematics, Stanford University, June 2012. Dissertation title: "Conic Degeneration and the Determinant of the Laplacian". Advisor: Dr. Rafe Mazzeo.

Post-doctoral appointment (CRM-ISM fellowship), McGill University/Centre de Recherches Mathématiques, August 2012-August 2013.

RTG Post-doctoral Assistant Professor, University of Michigan, September 2013-present.

Publications:

1. Johnson, Charles R.; Duarte, António Leal; Saiago, Carlos M.; Sher, David. Eigenvalues, multiplicities and graphs. Algebra and its applications, 167--183, Contemp. Math., 419, Amer. Math. Soc., Providence, RI, 2006.

2. Johnson, Charles R.; Jordan-Squire, Christopher; Sher, David A. Eigenvalue Assignments and The Two Largest Multiplicities in an Hermitian Matrix Whose Graph is a Tree. Discrete Applied Mathematics 158 (2010), pp. 681-691.

3. Sher, David A. The heat kernel on an asymptotically conic manifold. Analysis & PDE 6, no. 7, 1755-1991 (2013).

4. Sher, David A. Conic degeneration and the determinant of the Laplacian. Journale d'Analyse Mathematique 126, no. 1, p. 175-226 (2015). DOI 10.1007/s11854-015-0015-3.

5. Sher, David A. The determinant on flat conic surfaces with excision of disks. Proc. Amer. Math. Soc. 143, no. 3, p. 1333-1346 (2015).

6. Iosif Polterovich and David A. Sher. Heat invariants of the Steklov problem. Journal of Geometric Analysis 25, no. 2, p. 924-950 (2015). DOI 10.1007/s12220-013-4951-4.

7. Colin Guillarmou and David A. Sher. Low energy resolvent for the Hodge Laplacian: Applications to Riesz transform, Sobolev estimates and analytic torsion. Int. Math. Res. Not., p. 1-75 (2014). DOI 10.1093/imrn/rnu119.

8. Alexandre Girouard, Leonid Parnovski, Iosif Polterovich, and David A. Sher. The Steklov spectrum of surfaces: asymptotics and invariants. Math. Proc. Camb. Phil. Soc., 157, no. 3, p. 379-389 (2014). DOI 10.1017/S030500411400036X.

9. Pierre Albin, Frederic Rochon, and David A. Sher. Resolvent, heat kernel, and torsion under degeneration to fibered cusps. Preprint, arXiv:1410.8406, p. 1-101.

10. Pierre Albin, Frederic Rochon, and David A. Sher. Analytic torsion and R-torsion of Witt

representations on manifolds with cusps. Preprint, arXiv:1411.1105, p. 1-45.

11. Iosif Polterovich, David A. Sher, and John A. Toth. Nodal length of Steklov eigenfunctions on real-analytic Riemannian surfaces. Preprint, arXiv:1506.07600, p. 1-26.

Ongoing Projects:

a) Work with I. Polterovich on mixed Steklov-Neumann ("sloshing") problems.

b) Work with I. Polterovich and J. Toth on Steklov eigenfunctions on real analytic manifolds.

c) Work with P. Albin and F. Rochon towards a Cheeger-Muller theorem on manifolds with conic singularities.

d) Work with A. Uribe and C. Villegas on pseudospectra of Schrodinger operators.

Previous Research Experience:

REU program in mathematics, College of William and Mary, summer 2004. Advisor: Dr. Charles Johnson. Topic: matrix analysis.

REU program in experimental particle physics, University of Rochester, summer 2005. Advisor: Dr. Steve Manly. Topic: analysis of particle accelerator data.

REU program in mathematics, College of William and Mary, summer 2006. Advisor: Dr. Charles Johnson. Topic: matrix analysis, continuation of 2004 program.

Invited Talks:

"The determinant on conic surfaces with excision of disks." Special Session on Spectral and Scattering Theory, AMS sectional meeting, Akron OH, October 20-21, 2012.

"The determinant of the Laplacian on moduli space." Differential Geometry seminar, University of Illinois, March 12, 2013.

"Heat invariants of the Steklov eigenvalue problem." Special Session on Complex Geometry and Microlocal Analysis, AMS sectional meeting, Chestnut Hill MA, April 6-7, 2013.

"Heat invariants of the Steklov eigenvalue problem." PDE/Analysis seminar, University of Kentucky, April 16, 2013.

"Heat invariants of the Steklov eigenvalue problem." CIRGET seminar, Montreal, April 19th, 2013.

"Heat invariants of the Steklov problem." Workshop on Spectral Theory and Geometry, Universite de Neuchatel (Switzerland), June 3-7, 2013.

"Heat invariants and inverse spectral theory for the Dirichlet-to-Neumann operator." Geometry seminar, University of Michigan, September 27, 2013.

"Heat invariants and inverse spectral theory for the Dirichlet-to-Neumann map." Inverse Problems seminar, University of Michigan, October 9, 2013.

"Heat invariants of the Steklov problem." Special Session on Geometric and Spectral Analysis, AMS sectional meeting, Philadelphia PA, October 12-13, 2013.

"Inverse spectral problems for the Dirichlet-to-Neumann map." Geometry seminar, Stanford

University, March 5, 2014.

"Inverse spectral problems for the Dirichlet-to-Neumann map." Analysis seminar, Northwestern University, April 28, 2014.

"Inverse spectral problems for the Dirichlet-to-Neumann map." Geometric Analysis Day, CRM (Montreal), June 6, 2014.

"A Cheeger-Müller theorem on manifolds with cusps." BIRS Workshop, "Geometric scattering theory and applications", November 3, 2014.

"Spectral geometry and the heat equation." Colloquium, University of Kentucky, January 15, 2015.

"Spectral geometry and the heat equation." Colloquium, Wesleyan University, January 26, 2015.

"The Steklov spectrum of surfaces." Geometry/topology seminar, Dartmouth College, April 30, 2015.

"Spectral geometry and the heat equation." Colloquium, Dartmouth College, April 30, 2015.

"Spectral geometry: an introduction." Guest lecture (undergraduate talk, second-year audience), Lawrence University, May 20, 2015.

"Nodal length of Steklov eigenfunctions." "Geometric Spectral Theory" conference, Lisbon (Portugal), June 9, 2015.

"The Steklov spectrum of surfaces." CRM-SMS summer school on "Geometric and Computational Spectral Theory", Montreal, June 16, 2015.

Selected other invited conferences:

"Analysis and geometric singularities", MFO (Oberwolfach), May 6-12, 2012.

Upcoming invited talk: "Dirichlet-to-Neumann Maps: Spectral Theory, Inverse Problems and Applications", BIRS Workshop, Oaxaca, Mexico, May 29-June 3, 2016.

Service:

Served as referee for several journals, including Analysis & PDE, Proceedings of the CRM, Revista Matematico Iberoamericana, Communications in PDE, Journal of Geometric Analysis, and Pacific Journal of Mathematics.

Extensive curriculum development for Math 217 (proof-based linear algebra) at the University of Michigan: creation and sharing of daily in-class worksheets, creation and extensive revision of online WebWorK problems.

Participated in the inquiry-based learning (IBL) program in the Department of Mathematics at the University of Michigan, involving several meetings per semester. Also helped to create supplementary end-of-course survey for the department's IBL courses.

Letters of recommendation written for: graduate school in mathematics, Goldwater Scholarship (successful), various fellowships and programs at the University of Michigan.

Assisted at Wayne County Mathematics Teachers Circle workshops, fall 2015.

Teaching Experience:

Lead instructor (teaching evaluations for completed courses available upon request):

Math 217 (linear algebra and introduction to proofs, taught in a modified inquiry-based style), University of Michigan, Fall 2014, Winter 2014, and Fall 2015.

Math 433 (introduction to differential geometry, taught in a lecture style), University of Michigan, Winter 2014.

Math 285 (honors multivariable calculus, taught in a lecture style with some inquiry-based components), University of Michigan, Fall 2013.

Math 399 (independent study, multivariable analysis), one student, University of Michigan, Summer 2014. Unpaid and not part of required teaching duties.

Stanford Summer Engineering Academy, calculus and linear algebra, Summer 2011. One-month program to help prepare incoming freshmen from disadvantaged backgrounds for engineering or science at Stanford.

Awards/honors:

Centennial TA award, 2011; this award is given to three Stanford mathematics graduate student TAs every two years.

George Polya Teaching Award, 2012; this award is given to one graduating Ph. D. student in mathematics at Stanford per year.

Education conferences attended:

MAA PREP Workshop on Inquiry-Based Learning, Portland, OR, August 3-6, 2014.

The IBL Conference, Austin, TX, June 25-27, 2015.

Teaching Assistant positions (student evaluations for the Stanford positions are available upon request):

Math 102 (integral calculus), Johns Hopkins University, Spring 2007.

Math 41 (differential calculus), Stanford University, Fall 2008.

Math 52 (multivariable integral calculus), Stanford University, Winter 2010.

Math 42 (integral calculus), Stanford University, Winter 2011.

Course Assistant (office hours/grading only) positions:

Math 171 (honors real analysis), Stanford, Fall 2007.

Math 103 (linear algebra), Stanford, Spring 2008.

Math 115 (analysis), Stanford, Winter 2009.

Math 205A (graduate level real analysis), Stanford, Fall 2009.

Other:

Teaching assistant/staff at Stanford University Mathematics Camp (SUMaC), Summer 2009.

TA Mentor, Stanford Math Department, Winter 2011.

Miscellaneous:

Basic knowledge of C, C++, and Perl. Extensive experience with WebWorK online homework system.

Phi Beta Kappa academic honor society, inducted spring 2006.