

Christopher D. Sogge

Education

A.B, 1982, University of Chicago

Ph.D. in Mathematics, 1985, Princeton University

Positions

Dickson Instructor, University of Chicago 10/85-9/87

Assistant Professor, University of Chicago 10/87-9/89

Associate Professor, UCLA 10/89-7/93

Professor, UCLA 7/93-7/96

Professor, Johns Hopkins University 7/96-

Chair, Department of Mathematics, JHU 7/2002-7/2005

J. J. Sylvester Professor of Mathematics JHU, 2009-

Visiting Positions

I.H.E.S., Winter Quarter 1987

MSRI, Winter Quarter 1988

Princeton University, 1988-89

University of Minnesota, Ordway Visitor, 2003

Simons Visiting Professor, MSRI 2005

Zhejiang University, Distinguished Overseas Professor, 2010-13

Honors

NSF Postdoctoral Fellowship, 1985

Sloan Fellowship, 1988

Presidential Young Investigator Award, 1988

Invited speaker, International Congress of Mathematicians, Zurich, 1994

Guggenheim Fellow, 2005

Johns Hopkins Diversity Recognition Award, 2007

Simons Fellow, 2012-13

Fellow, American Mathematical Society, 2013

Professor of the Year, JHU Mathematics Department, 2014

Service

Editor-in-Chief, American Journal of Mathematics, 2005-

Editor, Forum Mathematicum, 2004-

Editor, Discrete and Continuous Dynamical Systems – Series S, 2009-

Editor, Electronic Research Announcements in Mathematical Sciences, 2013-

Moderator, Analysis of Partial Differential Equations, arXiv, 2000-

Associate Editor, American Journal of Mathematics, 2000-2005

Editor, Proceedings of the American Mathematical Society, 1994-2005

AMS-IMS-SIAM Committee on Joint Summer Research Conferences in Mathematical Sciences 2004-2008

Co-chair, “Nonlinear dispersive equations” program MSRI, Fall Semester 2005

Chair JAMI year Johns Hopkins 2006-2007

Co-chair, Microprogram in “Nonlinear Partial Differential Equations”, MSRI, July-August 2007

NSF DMS Committee of Visitors 2010

Ph.D. Students

D. Grieser 1992

A. Iosevich 1993

L. Di Carli 1993

J. Metcalfe 2003

X. Xu 2004

A. Stewart 2006

J. –C. Jiang 2009

X. Yu 2011

S. Ariturk 2012

X. Chen 2013

P. Shao 2013

H. Sun 2014

Papers

- 1) (with E. M. Stein) *Averages of functions over hypersurfaces in R^n* , Invent. Math. **82** (1985), 543-556.
- 2) *Oscillatory integrals and spherical harmonics*, Duke Math. J. **53** (1986), 43-65.
- 3) *On restriction theorems of maximal type*, Pacific J. Math. **123** (1986), 441-446.
- 4) (with E. M. Stein) *Averages over hypersurfaces II*, Invent. Math. **86** (1986), 233-242.
- 5) (with C. Kenig and A. Ruiz) *Remarks on unique continuation theorems*, Seminarios U.A.M. Madrid **3** (1986), 89-95.
- 6) *On the almost everywhere convergence to L^p data for higher order hyperbolic operators*, Proc. Amer. Math. Soc. **100** (1987), 99-104.
- 7) *A sharp restriction theorem for degenerate curves in R^2* , Amer. J. Math. **109** (1987), 223-228.
- 8) *On maximal functions associated to hypersurfaces and the Cauchy problem for strictly hyperbolic operators*, Trans. Amer. Math. Soc. **304** (1987), 733-749.
- 9) (with B. Barcelo, C. Kenig, and A. Ruiz) *Weighted Sobolev inequalities and unique continuation for the Laplacian plus lower order terms*, Ill. J. Math. **32** (1988), 230-245.
- 10) (with C. Kenig and A. Ruiz) *Uniform Sobolev inequalities and unique continuation for second order constant coefficient differential operators*, Duke Math. J. **55** (1987), 329-349.
- 11) *Concerning the L^p norm of spectral clusters for second order elliptic operators on compact manifolds*, J. Functional Analysis **77** (1988), 123-134.
- 12) *On the convergence of Riesz means on compact manifolds*, Annals of Math **126** (1987), 439-447.
- 13) (with C. Kenig) *A note on unique continuation for Schrödinger's operator*, Proc. Amer. Math. Soc. **103** (1988), 543-546.
- 14) (with F.M. Christ) *The weak type L^1 convergence of eigenfunction expansions for pseudodifferential operators*, Invent. Math. **94** (1988), 421-453.
- 15) (with F.M. Christ) *On the L^1 behavior of eigenfunction expansions and singular integral operators*, Proceedings of the Miniconference on Harmonic Analysis and Operator Algebras, Australian National University (1988), 29-50.
- 16) *Remarks on L^2 restriction theorems for Riemannian manifolds*, in "Analysis at Urbana I," (E. Berkson, N. Peck and J. Uhl, eds.) London Math. Soc. Lecture Note Series **137**, Cambridge University Press, Cambridge (1989), 416-422.
- 17) (with E.M. Stein) *Averages over hypersurfaces--Smoothness of generalized Radon transforms*, J. Analyse

Math. **54** (1990), 165-188.

- 18) *Oscillatory integrals and unique continuation for second order elliptic differential equations*, J. Amer. Math. Soc. **2** (1989), 491-516.
- 19) (with A. Seeger) *On the boundedness of functions of (pseudo-) differential operators on compact manifolds*, Duke Math. J. **59** (1989), 709-736.
- 20) *Strong uniqueness theorems for second order elliptic differential equations*, Amer. J. Math. **112** (1990), 943-984.
- 21) (with A. Seeger) *Bounds for eigenfunctions of differential operators*, Indiana Math. J. **38** (1989), 669-682.
- 22) *A unique continuation theorem for second order parabolic differential operators*, Arkiv för Mat. **28** (1990), 159-182.
- 23) (with J.-L. Journé and A. Soffer) $L^p \rightarrow L^{p'}$ estimates for time dependent Schrödinger operators, Bull. Amer. Math. Soc. **23** (1990), 519-524.
- 24) (with A. Seeger and E.M. Stein) *Regularity properties of Fourier integral operators*, Annals of Math. **134** (1991), 231-251.
- 25) (with J.-L. Journé and A. Soffer) *Decay estimates for Schrödinger operators*, Comm. Pure Appl. Math. **44** (1991), 573-604.
- 26) *Uniqueness in Cauchy problems for hyperbolic differential operators*, Trans. Amer. Math. Soc. **333** (1992), 821-834.
- 27) (with Y. Pan) *Oscillatory integrals associated to folding canonical relations*, Colloquium Mathematicum **60** (1990), 413-419.
- 28) *Propagation of singularities and maximal functions in the plane*, Invent. Math. **104** (1991), 349-376.
- 29) (with G. Mockenhaupt and A. Seeger) *Wave front sets, local smoothing and Bourgain's circular maximal theorem*, Annals of Math. **136** (1992), 207-218.
- 30) (with G. Mockenhaupt and A. Seeger) *Local smoothing of Fourier integral operators and Carleson-Sjölin estimates*, J. Amer. Math. Soc. **6** (1993), 65-130.
- 31) (with D. Jerison and Z. Zhou) *Sobolev estimates for the wave operator on compact manifolds*, Comm. Partial Diff. Equations **17** (1992), 1867-1888.
- 32) *Maximal operators associated to hypersurfaces with one nonvanishing principal curvature*, in "Fourier analysis and partial differential equations," (J. Garía-Cuerva et al. ed.) CRC Press, Boca Raton (1995), 317-323.
- 33) (with H. F. Smith) L^p regularity for the wave equation with strictly convex obstacles, Duke Math. J. **73** (1994), 97-155.
- 34) *On local existence for nonlinear wave equations satisfying variable coefficient null conditions*, Comm. Partial Diff. Equations **18** (1993), 1795-1823.
- 35) L^p estimates for the wave equation and applications, Journées Équations aux Dérivées Partielles, Saint Jean de Monts, Exp. No. XV, 12 pp., Ecole Polytech, Palaiseau, 1993.
- 36) (with H. Lindblad) *On existence and scattering with minimal regularity for semilinear equations*, J. Functional

Analysis **130** (1995), 357-426.

- 37) (with H. F. Smith) *On the critical semilinear wave equation outside convex obstacles*, J. Amer. Math. Soc. **8** (1995), 879-916.
- 38) *Smoothing estimates for the wave equation with applications*, in "Proceedings of the ICM, Zürich 1994," Birkhäuser Verlag AG, Basel 1995, 896-906.
- 39) (with H. F. Smith) *On Strichartz and eigenfunction estimates for low regularity metrics*, Math. Research Letters **1** (1994), 729-737.
- 40) (with H. Lindblad) *About small-power semilinear wave equations*, in "Partial Differential Equations and Mathematical Physics. The Danish-Swedish Analysis Seminar, 1995" (L. Hörmander and A. Melin, eds.) Birkhäuser, Boston (1996), 211-225.
- 41) (with H. Lindblad) *Long-time existence for small amplitude semilinear wave equations*, Amer. J. Math. **118** (1996), 1047-1135.
- 42) (with H. Lindblad) *Restriction theorems and semilinear Klein-Gordon equations in (1+3) -dimensions*, Duke Math. J. **85** (1996), 227-252.
- 43) (with W. Schlag) *Local smoothing estimates related to the circular maximal theorem*, Math. Research Letters **4** (1997), 1-15.
- 44) (with V. Georgiev and H. Lindblad) *Weighted Strichartz estimates and global existence for semilinear wave equations*, Amer. J. Math. **119** (1997), 1291-1319.
- 45) *Fourier integral operators and nonlinear wave equations*, in "Mathematical Theory of Gravity", Banach Center Publications (1997), 91-108.
- 46) (with W. P. Minicozzi II) *Negative results for Nikodym maximal functions and related oscillatory integrals in curved space*, Math. Research Letters **4** (1997), 221-237.
- 47) *Concerning Nikodym-type sets in 3-dimensional curved spaces*, J. Amer. Math. Soc. **12** (1999), 1-31.
- 48) (with D. Oberlin and H. Smith) *Averages over curves with torsion*, Math. Research Letters **5** (1998), 535-539.
- 49) (with H. Smith) *Null form estimates for $(1/2, 1/2)$ symbols and local existence for a quasilinear Dirichlet-wave equation*, Annales Scientifiques L'École Normale Supérieure, **33** (2000), 485-506.
- 50) (with M. Keel and H. Smith) *On global existence of nonlinear wave equations outside of convex obstacles*, Amer. J. Math **122** (2000), 805-842.
- 51) (with H. Smith) *Global Strichartz estimates for nontrapping perturbations of the Laplacian*, Comm. Partial Diff. Equations, Comm. PDE., **25** (2000), 2171-2183.
- 52) *Riemannian manifolds with maximal eigenfunction growth*. Séminaire: Équations aux Dérivées Partielles, 2000--2001, Exp. No. XXIV, 18 pp.
- 53) (with M. Keel and H. Smith) *Global existence for a quasilinear wave equation outside of star-shaped domains*, J. Funct. Anall., **189** (2002), 155-226.
- 54) (with S. Zelditch) *Riemannian manifolds with maximal eigenfunction growth*, Duke Math. J., **114** (2002), 387-437.
- 55) (with M. Keel and H. Smith) *Almost global existence for some semilinear wave equations*, Journal d'Analyse,

- 87** (2002), 265-279, 265-279.
- 56) *Eigenfunction and Bochner Riesz estimates on manifolds with boundary*, Math. Research Letters, **9** (2002), 205–216.
- 57) Global existence for nonlinear wave equations with multiple speeds, in “Harmonic analysis at Mount Holyoke”, 2001, Contemp. Math., 320, (2003) Amer. Math Soc., Providence, 355-366.
- 58) (with M. Keel and H. Smith) *Almost global existence for quasilinear wave equations in three space dimensions*, J. Amer Math. Soc., **17** (2004), 109—153.
- 59) (with J. Metcalfe) *Hyperbolic trapped rays and global existence of quasilinear wave equations*, Invent. Math, **159** (2005), 75-117.
- 60) *Estimates for the Dirichlet-wave equation and applications to nonlinear wave equations*, RIMS Report 1388, Harmonic Analysis and Nonlinear Partial Differential Equations, Kyoto University (2004), 34—53.
- 61) (with M. Nakamura and J. Metcalfe) *Global existence of solutions to multiple speed systems of quasilinear wave equations in exterior domains*, Forum Mathematicum **17** (2005), 133-168..
- 62) *Lectures on eigenfunctions of the Laplacian*, in “Topics in Analysis”, World Scientific, New Jersey, 2008, 337—360.
- 63) (with J. Metcalfe and A. Stewart) *Nonlinear hyperbolic equations in infinite homogeneous waveguides*, Comm. Partial Diff. Equations, **30** (2005), 643–661.
- 64) (with J. Metcalfe) *Global existence for Dirichlet-wave equations with quadratic nonlinearities in high dimensions*, Math. Ann., **336** (2006), 391—420.
- 65) (with J. Metcalfe), *Long time existence of quasilinear wave equations exterior to star-shaped obstacles via energy methods*, SIAM J. Math. Anal., **38** (2006), 188-209.
- 66) (with H. Smith), *On the L^p norm of spectral clusters for compact manifolds with boundary*, Acta Math. **198** (2007), 107—153.
- 67) (with J. Metcalfe), *Global existence of null-form wave equations in exterior domains*, Math. Z. **256** (2007), 521-549.
- 68) (with M. Blair and H. Smith), *On Strichartz estimates for Schrödinger operators in compact manifolds with boundary*, Proc. Amer. Math. Soc., **138** (2008) 247—256.
- 69) (with M. Blair and H. Smith), *On multilinear spectral cluster estimates for manifolds with boundary*, Math. Research Letters, **15** (2008), 419—426.
- 70) (with Y. Du, J. Metcalfe and Y. Zhou), *Concerning the Strauss conjecture and almost global existence for nonlinear Dirichlet-wave equations*, Comm. Partial Differential Equations, **33** (2008), 1487—1506.
- 71) (with K. Hidano, J. Metcalfe, H. Smith and Y. Zhou), *On abstract Strichartz estimates and the Strauss conjecture for nontrapping obstacles*, Trans. Amer. Math. Soc., **362** (2010), 2789—2809.
- 72) (with M. Blair and H. F. Smith), *Strichartz estimates for the wave equation on manifolds with boundary*, Annales de l'Institut Henri Poincare, **26** (2009), 1817—1829.
- 73) (with C. Wang), *Concerning the Wave equation on Asymptotically Euclidean Manifolds*, Journal d'Analyse, **112** (2010), 1—32.
- 74) *Kekeya-Nikodym averages and L^p -norms of eigenfunctions*, Tohoku Math J. (centennial edition) **63** (2011),

519—538.

- 75) (with J. A. Toth and S. Zelditch), *About the blowup of quasimodes on Riemannian manifolds*, J. Geometric Analysis, **21** (2011), 150—173.
- 76) (with J. Metcalfe), *Global existence for high dimensional quasilinear wave equations exterior to star-shaped obstacles*, Discrete and continuous Dynamical Systems, **28** (2010), 1589—1601.
- 77) (with M. Blair and H. Smith) *Strichartz estimates and the nonlinear Schrodinger equation in exterior domains*, Math. Ann., **354** (2012), 1397—1430.
- 78) (with S. Zelditch) *Lower bounds on the Hausdorff measure of nodal sets*, Math. Research Letters, **18** (2011), 25—37.
- 79) (with S. Zelditch) *Concerning the L^4 norms of typical eigenfunctions on compact surfaces*, Recent Development in Geometry and Analysis, ALM 23, Int. Press, Beijing-Boston (2012), 407—423.
- 80) (with H. Smith and C. Wang) *Strichartz estimates for Dirichlet-wave equations in two dimensions with applications*, Trans. Amer. Math. Soc., **364** (2012), 3329—3347.
- 81) (with H. Hezari) *A natural lower bound for the size of nodal sets*, Analysis and PDE, **5** (2012), 1133—1137.
- 82) (with S. Zelditch) *On eigenfunction restriction estimates and L^4 -bounds for compact surfaces with nonpositive curvature*, Advances in Analysis: The Legacy of Elias M. Stein, Princeton Mathematical Series, Princeton Univ. Press, 2014, 447—461.
- 83) (with J. Bourgain, P. Shao and X. Yao) *On L^p -resolvent estimates and the density of eigenvalues for compact Riemannian manifolds*, Comm. Math. Physics, to appear.
- 84) (with S. Zelditch) *Lower bounds on the Hausdorff measure of nodal sets II*, Math. Research Letters, **19** (2012), 1361—1364.
- 85) (with H. Lindblad and M. Nakamura) *Remarks on global existence for nonlinear wave equations under the standard null conditions*, J. Differential Equations **254** (2013), 1396—1436.
- 86) (with X. Chen) *A few endpoint geodesic restriction estimates for eigenfunctions*, Comm. Math. Physics, **329** (2014), 435—459.
- 87) (with M. D. Blair) *On Kakeya-Nikodym averages, L^p -norms and lower bounds for nodal sets of eigenfunctions in higher dimensions*, JEMS, to appear.
- 88) (with X. Chen) *On integrals of eigenfunctions over geodesics*, Proc. Amer. Math. Soc., **143** (2015), 151—161.
- 89) (with H. Lindblad, J. Metcalfe, M. Tohaneanu and C. Wang) *The Strauss conjecture on Kerr black hole backgrounds*, Math Ann., **359** (2014), 637—661.
- 90) (with S. Zelditch) *Focal points and sup-norms of eigenfunctions*, Rev. Mat. Iberoam., to appear.
- 91) (with S. Zelditch) *A note on L^p -norms of quasi-modes*, Some topics in harmonic analysis and applications, Int. Press, Beijing-Boston, to appear.
- 92) (with S. Huang) *Concerning L^p resolvent estimates for simply connected manifolds of constant curvature*, J. Funct. Anal., **267** (2014), 4635—4666.
- 93) (with M. D. Blair) *Refined and microlocal Kakeya-Nikodym bounds for eigenfunctions in two dimensions*,

preprint.

- 94) (with S. Zelditch) *Focal points and sup-norms of eigenfunctions on Riemannian manifolds II: the two-dimensional case*, Rev. Mat. Iberoam., to appear.
- 95) (with S. Zelditch) *Sup norms of Cauchy data of eigenfunctions on manifolds with concave boundary*, preprint.

Books

1. *Fourier integrals in classical analysis*, Cambridge Tracts in Mathematics **105**, Cambridge University Press, Cambridge, New York, 1993.
2. *Lectures on nonlinear wave equations*, International Press, Cambridge, 1995
3. *Lectures on nonlinear wave equations, Second Edition*, International Press, Cambridge 2008.
4. *Hangzhou lectures on eigenfunctions of the Laplacian*, Annals of Math Studies **188**, Princeton University Press, 2014.

Books Edited

1. (with A. Nahmod, X. Zhang and S. Zheng) *Recent advances in Partial Differential Equations and Harmonic Analysis*, Contemporary Mathematics **581**, Amer. Math. Soc., 2012.