Christoph Thiele

Academic career

1995	PhD, Yale University, New Haven, CT, USA
1995 - 1998	Assistant, University of Kiel
1998 - 2000	Assistant Professor, University of California, Los Angeles, CA, USA
1999	Habilitation, Kiel
2000 - 2002	Associate Professor, University of California, Los Angeles, CA, USA
2002	Professor, University of California, Los Angeles, CA, USA
2003 - 2005	Graduate Vice Chair, Department of Mathematics, University of California, Los Angeles, CA, USA
2006 - 2009	Chair, Department of Mathematics, University of California, Los Angeles, CA, USA
2010 - 2011	Visiting Professor, University of Bonn
Since 2012	Hausdorff Chair (W3), Bonn

Honours

1987	Participant of the International Physics Olympiad, Jena, GDR
1987	Bundeswettbewerb Mathematik, Germany, 1. Prize
1989 - 1993	Scholarship of the German National Scholarship Foundation
2000	Salem Prize
2005	Faculty/Staff Partnership Award
2010	Humboldt Research Award

Invited Lectures

2002	Invited speaker, International Congress of Mathematicians, Beijing, China
2004	Invited speaker, AMS Western Sectional Meeting, Los Angeles, CA, USA
2004	CBMS conference series, main lecturer, May, Atlanta, GA, USA
2011	Stein Conference, Prinecton, NJ, USA
2014	EMS Summer School, Santalo, Spain
2015	IMPA Conference on Current Trends in Analysis & PDEs, Rio de Janeiro, Brazil
2017	Harmonic Analysis and Related Areas, Clay Research Workshop, Oxford, England, UK

Research Projects and Activities

Project "Multilinear estimates in geometric Fourier Analysis",
within Collaborative Research Center SFB 1060 "The Mathematics of Emergent Effects"
Principal Investigator
Annual summer schools on topics in analysis
Organizer, since 2000
DFG Cluster of Excellence "Hausdorff Center for Mathematics"
Principal Investigator

Research profile

My research revolves around basic inequalities in harmonic analysis, in particular inequalities which either possess a large amount of symmetries or have some semblance of such symmetries. Singular integrals and many maximal operators relate to translation and dilation symmetries. Many objects appearing in my work have in addition modulation symmetries, which necessitates to study them with a tool called time frequency analysis. Early examples of this

theory are Carleson's theorem on almost everywhere convergence of Fourier series and Lp bounds on the bilinear Hilbert transform. More recently, time frequency analysis was recognized as closely connected with an Lp theory of outer measures.

In recent years I have developed with collaborators twisted technology, a new tool to estimate multi parameter singular integrals with generalized modulation symmetries. A recent highlight of this theory was a result on quantitative norm convergence of ergodic averages relative to two commuting transformations.

Another focus in recent years was on directional operators such as the directional Hilbert transform and directional maximal operators. Major conjectures in the field are named after Stein and Zygmund. With my research group we have studied a multi-parameter approach to these problems, which relates them with time frequency anaylsis.

A beautifully symmetric and very difficult object in higher dimensions is the simplex Hilbert transform, the smallest non-trivial example being the triangular Hilbert transform. Lp bounds for these transforms are a major open problem, such bounds would unify many results in harmonic analysis. It appears that one needs to develop a multi-scale analysis for arbitrary frames, I expect that the recent breakthrough on the circle of ideas of the Kadison Singer and Feichtinger conjectures might help with that.

Further topics of my interest include nonlinear Fourier analysis and Fourier restriction theorems.

Editorships

- Illinois Journal of Mathematics (Editor, 2003 - 2009)
- Mathematical Research Letters (Editor, 2004 - 2006)
- Collectanea Mathematica (Editor, since 2006)
- Mathematische Zeitschrift (Editor, since 2014)

Research Area A Analysis means understanding objects as built up from elementary building

blocks. In Harmonic Analysis, these building blocks are elementary wave forms. Most of my work is on scaling critical problems in harmonic analysis, where blocks at all possible length scales are present and equally strong. In time frequency analysis, waves at all frequencies are of equal strength as well. My research in time frequency analysis has applications in abstract questions in harmonic analysis as well as in the related areas of differential equations, scattering theory, and ergodic theory, and - since harmonic analysis is very foundational science - more vague connections to a host of other areas in mathematics.

Supervised theses

Master theses: 4
PhD theses: 11, currently 4

Selected PhD students

Stephanie Molnar (2005): "Sharp Growth Estimates for T(b) Theorems",
now Associate Professor and Chair, University of Portland, OR, USA
Silvius Klein (2005): "Spectral Theory for Discrete One-Dimensional Quasi-Periodic Schrödinger Operators",
now Assistant Professor, PUC, Rio de Janeiro, Brasil
Victor Lie (2009): "Relational Time-frequency Analysis",
now Assistant Professor, Purdue University, IN, USA
Yen Do (2010): "A nonlinear stationary phase method for oscillatory Riemann-Hilbert problems",
now Assistant Professor, University of Virginia, VA, USA
Vjekoslav Kovac (2011): "Applications of the Bellman Function Technique in Multilinear and Nonlinear Harmonic Analysis",
now Assistant Professor, University of Zagreb, Croatia
Shaoming Guo (2015): "Hilbert transforms and maximal operators along planar vector fields",
now Postdoc, Indiana University, Bloomington, IN, USA
Polona Durcik (2017): "The continuous analysis of entangled multilinear forms and applications",

now Postdoc, California Institute of Technology, CA, USA

Gennady Uraltsev (2017): "Time-Frequency Analysis of the Variational Carleson Operator using outer-measure Lp spaces",

now Postdoc, Cornell University, NY, USA

Joris Roos (2017): "Singular integrals and maximal operators related to Carleson's theorem and curves in the plane",

now Postdoc, UW Madison, WI, USA

Habilitations

Mariusz Mirek (2016)

Selected publications

[1] P. Durcik, V. Kovac, and C. Thiele. Power-type cancellation for the simplex hilbert transform. *to appear in J. Anal. Math.*, 2017.

[2] Yen Do and Christoph Thiele. L^p theory for outer measures and two themes of lennart carleson united. *Bull. Amer. Math. Soc. (N.S.)*, 52(2):249–296, 2015.

[3] Michael Bateman and Christoph Thiele. L^p estimates for the hilbert transforms along a one-variable vector field. *Anal. PDE*, 6(7):1577–1600, 2013.

[4] Richard Oberlin, Andreas Seeger, Terence Tao, Christoph Thiele, and James Wright. A variation norm carleson theorem. *J. Eur. Math. Soc. (JEMS)*, 14(2):421–464, 2012.

[5] Ciprian Demeter, Michael T. Lacey, Terence Tao, and Christoph Thiele. Breaking the duality in the return times theorem. *Duke Math. J.*, 143(2):281–355, 2008.

[6] Michael Christ, Xiaochun Li, Terence Tao, and Christoph Thiele. On multilinear oscillatory integrals, nonsingular and singular. *Duke Math. J.*, 130(2):321–351, 2005.

[7] Camil Muscalu, Jill Pipher, Terence Tao, and Christoph Thiele. Bi-parameter paraproducts. *Acta Math.*, 193(2):269–296, 2004.

[8] Camil Muscalu, Terence Tao, and Christoph Thiele. Multi-linear operators given by singular multipliers. *J. Amer. Math. Soc.*, 15(2):469–496, 2002.

[9] Christoph Thiele. A uniform estimate. *Ann. of Math. (2)*, 156(2):519–563, 2002.

[10] Michael Lacey and Christoph Thiele. L^p estimates on the bilinear hilbert transform for 2¡p¡∞. *Ann. of Math. (2)*, 146(3):693–724, 1997.