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## EDUCATION

- **Princeton University**, 1977-81; **Ph.D.**, 1981; advisor: E.M. Stein.
- **University of Chicago**, 1973-77; Mathematics, **B.A.**, **S.M.**, 1977.

## POSITIONS

- **University of Rochester: Professor**, 1997 -; **Chair**, 2011 - 14. (Asst./Assoc. Prof., 1983-97)
- **M.S.R.I.**, Berkeley: **Member**, Fall 1987, 2010, 2019; **Co-organizer**, Spring 2017 Program.
- **University of Washington**: Visiting Associate Professor, 1990 - 1991.
- **M.I.T.**: NSF Postdoctoral Research Fellow, 1981 - 1983.

## RESEARCH INTERESTS

Harmonic and microlocal analysis, inverse problems, cloaking and transformation optics.

## AWARDS & HONORS

- **Simons Foundation Fellowship**, 2015–2016.
- **Fellow of the AMS**, Class of 2015.
- **Primary lecturer** for NSF-CBMS Regional Research Conference on *Mathematical Foundations of Transformation Optics*, 10 lectures at Howard University, June, 2014.
- **Sloan Research Fellowship**, Sept. 1990 - Sept. 1992.
- **NSF Postdoctoral Research Fellowship**, July, 1981 - June, 1983.

## SELECTED PROFESSIONAL ACTIVITIES

- Co-PI for **Northeast Analysis Network (NAN)**, a series of 4 conferences, 2019-2023?. **NAN2023** scheduled for Rochester, Sept., 2023.
- **Honors degrees examiner**, Swarthmore College, Spring, 2020.
- Served on **NSF grant review panels**: 2016, 2019, 2020, 2021.
- Co-organizer, **MSRI Program on Harmonic Analysis**, Jan.- May 2017.
- Associate editor, *Inverse Problems and Imaging*, 2016 - .
- At-large member, **Council of the A.M.S.**, Feb. 2013 - Jan. 2016.
- Member, **A.M.S. Committee on the Profession**, 2013- 2016 ; **Chair**, Feb. 2014- Jan. 2016.
- Co-organizer, **Fields Institute Program on Inverse Problems and Imaging**, Jan.-Aug. 2012.
- Co-organizer, **Math. Research Community in Inverse Problems**, Snowbird, UT, June, 2009.

## RECENT AND UPCOMING LECTURES AND COLLOQUIA

- BIRS workshop on Leveraging Model- and Data-driven Methods in Medical Imaging (June, 2023)
- RIMS Conference on Inverse Problems, Japan (January, 2023)
- Inverse problems in analysis and geometry, University of Helsinki (covideclined, August, 2022)
- Inverse Problems: Modelling&Simulation (Zoom), May, 2022
- 2020 El Escorial Conf. on Harmonic Analysis and PDE (invited but covideclined, 2022)
- Univ. of California-Santa Cruz, Colloquium (Zoom), Feb. 2022
- Geom. Tomography & Microlocal Analysis, Canad. Math. Soc. Meeting (Zoom), Dec. 2021
- Séminaire de Math. Supér. Summer School Microlocal Analysis (3 lectures, Zoom), June, 2021
- Advances in electromagnetic scattering in complex media, SIAM MS2021, May, 2021
- University of Limerick, Departmental Seminar (Zoom), February, 2021
- Dalhousie University Analysis/Applied Math/Physics Seminar (Zoom), Jan. 2021
- International Zoom Inverse Problems Seminar, October, 2020
- Colloquium, Ohio State University, January, 2020
- UK Inverse Problems Research Network, University of Manchester, Dec. 2019
- Introductory Workshop + Seminar, MSRI Program on Microlocal Analysis (2 talks), Sept. 2019
- Applied Inverse Problems, Grenoble, July, 2019 (2 talks)

## RESEARCH ARTICLES AND PREPRINTS

1. Bilinear operators arising in linearized seismic imaging (w/ R. Felea, R. Gaburro and C. Nolan), *in preparation*.
2. Nonempty interior of configuration sets via microlocal partition optimization (w/ A. Iosevich and K. Taylor), arXiv:2209.02084 (Sept. 2022), *submitted*.
3. Bilinear generalized Radon transforms in the plane (w/ A. Iosevich, B. Krause, A. Liu), in *Combinatorial and Additive Number Theory V (2022)*, M. Nathanson, ed., ISBN 978-3-031-10795-5, pp. 179–198.
4. Microlocal analysis of borehole seismic data (w/ R. Felea, R. Gaburro and C. Nolan), *Inverse Prob. and Imaging* **16** (2022), no. 6, 1543–1570; doi:10.3934/ipi.2022026.
5. On  $k$ -point configuration sets with nonempty interior (w/ A. Iosevich and K. Taylor), *Mathematika* **68** (2022), no. 1, 163–190; <https://doi.org/10.1112/mtk.12114>.
6. Configuration sets with nonempty interior (w/ A. Iosevich and K. Taylor), *J. Geometric Analysis* **31** (2021), no. 7, 6662–6680; doi:10.1007/s12220-019-00288-y.
7. Existence of similar point configurations in thin subsets of  $\mathbb{R}^d$  (w/ A. Iosevich and S. Mkrtychyan), *Math. Zeitschrift* **297** (2021), no. 1–2, 855–865.; doi:10.1007/s00209-020-02537-1.
8. Microlocal analysis of Doppler Synthetic Aperture Radar (w/ R. Felea, R. Gaburro and C. Nolan), *Inverse Prob. and Imaging* **13-6** (2019), 1283–1307; doi: 10.3934/ipi.2019056.
9. Propagation and recovery of singularities in the inverse conductivity problem (w/ M. Lassas, M. Santacesaria, S. Siltanen, G. Uhlmann), *Analysis & PDE*, **11-8** (2018), 1901–1943.
10. An elementary approach to simplexes in thin subsets of Euclidean space (w/ A. Iosevich, B. Liu and E. Palsson), <https://arxiv.org/abs/1608.04777> (unpublished).
11. Superdimensional metamaterial resonators (w/ H. Kettunen, Y. Kurylev, M. Lassas, G. Uhlmann), *SIAM Jour. Appl. Math.*, **78** (2018), no. 1, 437–456.
12. On necklaces inside thin subsets of  $\mathbb{R}^d$  (w/ A. Iosevich, M. Pramanik), *Math. Research Lett.*, **24** (2017), no. 2, 347–362.
13. A group-theoretic viewpoint on Erdős-Falconer problems and the Mattila integral (w/ A. Iosevich, B. Liu, E. Palsson), *Revista Mat. Iberoamer.*, **31** (2015), no. 3, 799–810.
14. Restricted convolution inequalities, multilinear operators and applications, (w/ D. Geba, A. Iosevich, E. Palsson, E. Sawyer), *Math. Research Lett.*, **20** (2013), 675–694.
15. Multilinear generalized Radon transforms and point configurations, (w/ L. Grafakos, A. Iosevich, E. Palsson), *Forum Math.*, **27** (2015), no. 4, 2323–2360.
16. On volumes determined by subsets of Euclidian space (w/ A. Iosevich, M. Mourgoglu), *Forum Math.*, **27** (2015), no. 1, 635–646.
17. A multi-dimensional resolution of singularities with applications to analysis (w/ T. Collins, M. Pramanik), *Amer. Jour. of Math.*, **135** (2013), 1179–1252.

18. Cloaked electromagnetic, acoustic and quantum amplifiers via transformation optics (w/ Y. Kurylev, M. Lassas, U. Leonhardt, G. Uhlmann), *Proc. Nat. Acad. Sci.*, **109** (2012), 10169–10174.
19. Three point configurations determined by subsets of the Euclidian plane, a bilinear operator and applications to discrete geometry (w/ A. Iosevich), *Analysis & PDE*, **5-2** (2012), 397–409.
20. An FIO calculus for marine seismic imaging, II: Sobolev estimates (w/ R. Felea, M. Pramanik), *Math. Annalen*, **352** (2012), 293-337.
21. Cloaking a sensor via transformation optics, (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Physical Review E*, **83** (2011), 016603.
22. Approximate quantum and acoustic cloaking (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Jour. of Spectral Theory*, **1** (2011), 27-80.
23. Fourier integral operators with open umbrellas and seismic inversion for cusp caustics (w/ R. Felea), *Math. Research Lett.*, **17** (2010), 867-886.
24. Approximate quantum cloaking and almost trapped states (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Phys. Rev. Lett.*, **101** (2008), 220404.
25. Isotropic transformation optics: approximate and quantum cloaking (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *New Jour. Phys.*, **10**, 115024.
26. Electromagnetic wormholes via handlebody constructions, (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Comm. Math. Phys.*, **281** (2008), 369-385.
27. An FIO calculus for marine seismic imaging: folds and cross-caps (w/ R. Felea), *Comm. in P.D.E.*, **33** (2008), 45-77.
28. Comment on “Scattering theory derivation of a 3D acoustic cloaking shell”, (w/ Y. Kurylev, M. Lassas, and G. Uhlmann), <http://arxiv.org/abs/0801.3279> (Jan. 2008), unpublished.
29. Electromagnetic wormholes and virtual magnetic monopoles from metamaterials, (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Phys. Rev. Lett.*, **99** (2007), 183901. Featured as an Editors’ Suggestion. (302 citations on scholar.google).
30. Improvement of cylindrical cloaking with the SHS lining, (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Optics Express* **15** (2007), 12717-12734.
31. Full-wave invisibility of active devices at all frequencies (w/ Y. Kurylev, M. Lassas, G. Uhlmann), *Comm.. Math. Phys.*, **275** (2007), 749-789. (281 citations on scholar.google)
32. Ultrasound attenuation and thermo/photo/opto-acoustic tomography: theoretical foundation (w/ S. Patch), *Proc. SPIE* **6437**, *Photons Plus Ultrasound: Imaging and Sensing 2007*, 643726 (February 13, 2007); doi:10.1117/12.701161.
33. Oscillatory integral operators with homogeneous polynomial phases in several variables (w/ M. Pramanik, W. Tang), *Jour. Func. Analysis*, **244** (2007), 444-487.
34. Average decay for Fourier transforms of measures supported on curves (w/ L. Brandolini, G. Gigante, A. Iosevich, A. Seeger, G. Travaglini), *Jour. Geom. Analysis*, **17** (2007),15-40.
35.  $L^p - L^{p'}$  estimates for overdetermined Radon transforms (w/ L. Brandolini and G. Travaglini), *Trans. A.M.S.*, **359** (2007), 2559-2575.

36. On nonuniqueness for Calderón's inverse problem (w/ M. Lassas, G. Uhlmann), *Math. Research Lett.*, **10** (2003), 685-693. (491 citations on scholar.google)
37. Anisotropic conductivities that cannot be detected by EIT (w/ M. Lassas, G. Uhlmann), *Physiological Meas.*, **24** (2003), 413-419. (410 citations on scholar.google)
38. The Calderón problem for conormal potentials, I: Global uniqueness and reconstruction (w/ M. Lassas, G. Uhlmann), *Comm. Pure Applied Math.*, **55** (2003), 328-352.
39. Oscillatory and Fourier integral operators with degenerate canonical relations (w/ A. Seeger), in *Proc. of the 6th Int. Conf. on Harmonic Analysis and PDE (El Escorial 2000)*, P. Cifuentes, et al., eds., Barcelona, 2002.
40. Oscillatory integral operators with low-order degeneracies (w/ A. Seeger), *Duke Math. Jour.*, **112** (2002), 397-420.
41. Local uniqueness for the Dirichlet-to-Neumann map via the two-plane transform (w/ G. Uhlmann), *Duke Math. Jour.*, **108** (2001), 599-617.
42. Characteristic space-time estimates for the wave equation (w/ G. Uhlmann), *Math. Zeit.*, **236** (2001), 113-131.
43. Estimates for generalized Radon transforms in three and four dimensions (w/ A. Seeger and S. Wainger), in *Analysis, Geometry, Number Theory: The Mathematics of Leon Ehrenpreis*, Contemp. Math. **251**, Amer. Math. Soc., Providence, 2000.
44. On oscillatory integral operators with folding canonical relations (w/ A. Seeger), *Studia Math.*, **132** (1999), 125-239.
45. On X-ray transforms for rigid line complexes and integrals over curves in  $\mathbb{R}^4$ , (w/ A. Seeger, S. Wainger), *Proc. Amer. Math. Soc.*, **127** (1999), 3533-45.
46. Fourier integral operators with cusp singularities (w/ A. Seeger), *Amer. Jour. Math.*, **120** (1998), 1077-1119.
47. The modified Radon transform of Lax and Phillips in scattering theory (w/ G. Uhlmann), in *75 Years of Radon Transform*, S. Gindikin and P. Michor, eds., Int. Press, 1994.
48. Fourier integral operators with fold singularities (w/ A. Seeger), *Jour. Reine u. Angew. Math.*, **455** (1994), 35-56.
49. Recovering singularities of a potential from singularities of scattering data (w/ G. Uhlmann), *Comm. Math. Phys.*, **157** (1993), 549-572.
50. Microlocal analysis of the 2-plane transform (w/ G. Uhlmann), *Contemp. Math.* **140** (1992), 65-71.
51. Composition of some singular Fourier integral operators and estimates for restricted X-ray transforms, II (w/ G. Uhlmann), *Duke Math. Jour.*, **64** (1991), 415-444.
52. Microlocal techniques in integral geometry (w/ G. Uhlmann), in *Contemp. Math.* **113** (1990), 121-136.
53. Composition of some singular Fourier integral operators and estimates for restricted X-ray transforms (w/ G. Uhlmann), *Annales de l'Institut Fourier* **40** (1990), 443-466.
54. Estimates for singular Radon transform and pseudodifferential operators with singular symbols (w/ G. Uhlmann), *Jour. Func. Anal.*, **89** (1990), 202-232.

55. Nonlocal inversion formulas for the X-ray transform (w/ G. Uhlmann), *Duke Math. Jour.* **58** (1989), 205-240.
56. Singular integrals with conical singularities, unpublished manuscript, 1985.
57. The first eigenvalue of a CR manifold, *Comm. in P.D.E.*, **10** (1985), 191-217.
58. Pointwise convergence of singular convolution operators, *Duke Math. Jour.*, **50** (1983), 1171-1199.
59. Principal curvature and harmonic analysis, *Indiana Univ. Math. Jour.*, **30** (1981), 519-538.

## LECTURE NOTES, SURVEY ARTICLES, BOOK REVIEWS

1. Invisibility and Inverse Problems (w/ Y. Kurylev, M. Lassas, and G. Uhlmann), *Bulletin of the A.M.S.*, **46** (2009), 55-97.
2. Cloaking Devices, Electromagnetic Wormholes and Transformation Optics (w/ Y. Kurylev, M. Lassas, and G. Uhlmann), *SIAM Review*, **51** (2009), 3-33.
3. Review of "Fourier integrals in classical analysis" by Christopher Sogge, *Bulletin of the A.M.S.*, **30** (1994), 255-258.
4. Extensions of the Calderón-Zygmund theory of singular integrals, in *DIALEXIS*, Publications of the University of Crete, 1987, 11-39.

## PH.D. STUDENTS SUPERVISED

1. Spherical Maximal Operators with Multidimensional Parameter Sets, Young-Hwa Ha, May 1987; published in *Proc. Amer. Math. Soc.* **105** (1989), 401-412.
2.  $L^p$  Estimates for the Restricted X-ray transform, Hann-Tzong Wang, June 1987; published in *Trans. Amer. Math. Soc.*, **332** (1992), 793-822.
3.  $L^2$  Estimates for Some Kakeya-type Maximal Operators, Jose Barrionuevo, October 1990; published in *Trans. Amer. Math. Soc.* **335** (1993), 667-682.
4. Microlocal Analysis of Some Isospectral Manifolds, Francisco Marhuenda, October 1990; published in *Trans. Amer. Math. Soc.* **343** (1994), 245-275.
5. The Ambrose Symbol of Fourier Integral Operators, Yong-Jia Ma, May 1993.
6. Oscillatory Integral Operators Related to the Two-Plane Transform, Shieh-Shun Fu; June 1997; published in *Forum Math.*, **11** (1999), 513-541.
7. Composition of Fourier integral operators with fold and blowdown singularities, Raluca Felea, April 2004; published in *Comm. P.D.E.* **30** (2005), 1717-1740, and *Inverse Prob.*, **23** (2007), 1519-1531.
8. Decay rates of oscillatory integral operators, Wan Tang, June 2004; published in *Forum Math.*, **18** (2006), 427-444.

9.  $L^p$  norm estimates of eigenfunctions restricted to submanifolds, Rui Hu, May 2007; published in *Forum Math.* **21** (2009), 1021-1052. (31 citations on scholar.google)
10. Calderón's problem for Lipschitz piecewise smooth conductivities, Sung Eun Kim, May, 2007; published in *Inverse Prob.*, **24** (2008), 055016.
11. Fourier integral operators on Colombeau spaces, Emanuel Palsu-Andriescu, October, 2008.
12. Microlocal analysis of scattering data for nested conormal potentials, Suresh Eswarathasan, May, 2011; published in *Jour. Funct. Anal.* **262** (2012), 2100-2141.
13. Numerical and microlocal analysis of inverse problems with internal data, Denitza Straub, May, 2016; published in *J. Pseudo-Differential Operators Appl.* **8** (2017), no. 3, 485-519.
14. Fourier integral operators with elliptic umbilic singularities, Carlos Rojas Mena, July, 2022.

## EXTERNAL SUPPORT

- **PI:** NSF-DMS-2204943, 7/2022-6/2025

Previous support:

DMS-1906186, 7/2019-6/2022  
 DMS-1362271, 7/2014-6/2018;  
 DMS-0853892, 7/2009 - 6/2014;  
 DMS-0551984, 7/2006 - 6/2009;  
 DMS-0138167, 7/2002 - 12/2005;  
 DMS-9877101, 7/1999 - 6/2002;  
 DMS-9531806, 7/1996 - 6/1999;  
 DMS-9301064, 7/1993 - 6/1996;  
 DMS-9101298, 7/1991 - 6/1993;  
 DMS-8821711, 7/1989 - 6/1991;  
 DMS-8601534, 7/1986 - 6/1988.

- **Co-PI:** DMS-1900128 for Northeast Analysis Network (NAN), 7/2019-6/2023;  
 Previous: DMS-1346808 for CBMS-NSF Regional Research Conf. at Howard Univ., 2/2014 -1/2015.
- **Amer. Inst. Math. SQuaRE (Structured Quartet Research Ensemble)**, supporting three week-long meetings w/co-PIs M. Cheney, R. Felea, R. Gaburro, C. Nolan, 2016-2018.
- **Simons Foundation Fellowship:** 7/2015 - 6/2016.
- **Sloan Research Fellowship:** 9/1990 - 9/1992.