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## Mark C. Lammers

Department of Mathematics

lammersm@uncw.edu

University of North Carolina at Wilmington (910)962-3958 (Office)

Wilmington, NC 28403

<http://people.uncw.edu/lammersm/>

**Education:** 1997 Ph.D. Mathematics University of Missouri.

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## UNCW Appointments

- 2017-Present Professor, Director of the MS in Data Science Program,  
UNC General Administration Faculty Fellow .
- 2013-2017 Professor and Mathematics Graduate Coordinator.
- 2012- 2013 Associate Professor and Mathematics Graduate Coordinator.
- 2006- 2012 Associate Professor.
- 2003-2006 Assistant Professor.
- 1997-1999 Visiting Assistant Professor.

## Other Positions

- 2001-2003 Western Washington University: Assistant Professor.
- 1999-2001 The University of South Carolina: Visiting Assistant Professor.

## Research Interests

Computational engineering: time-frequency/Gabor analysis, frame theory, machine learning, compressed sensing, analog to digital algorithms and signal processing.

## Refereed Articles and Proceedings

### [Elsivier Scopus Profile](#)

- 19 Travis Bemrose, Peter G. Casazza, Karlheinz Grochenig, Mark C. Lammers, Richard G. Lynch, [Weaving Frames](#), Operators and Matrices. Volume 10, Number 4 (2016), 10931116
- 18 M.C. Lammers and Simon Stampe(UNCW Grad Student), [The Finite Balian-Low Conjecture](#), Sampling Theory and Applications (SampTA), 2015 International Conference on, May 25-29 (2015), Pages 139-143
- 17 Mark Lammers *The Finite Fractional Zak Transform* IEEE Signal Processing Letters. Volume 21 (2014) issue 9,1064-1067 ([Article featured on journal cover](#))
- 16 C.S. Gunturk, M.C. Lammers, A. Powell, S. Y. Rayan, and O. Yilmaz, [Sobolev Duals for Random Frames and Sigma-Delta Quantization of Compressed Sensing](#)

- Measurements* Foundations of Computational Mathematics. Volume 13 (2013) issue 1,1-36.
- 15 C.S. Gunturk, M.C. Lammers, A. Powell, S. Y. Rayan, and O. Yilmaz, *Sobolev Duals for Compressed Sensing*, SampTA 2011, May 2-6, 2011 Singapore
  - 14 M.C. Lammers, and A. Maeser(UNCW Grad Student),*An Uncertainty Principle for Finite Frames*. Journal of Mathematical Analysis and Applications. Volume 373,(2011) no.1, 242-247
  - 13 C.S. Gunturk, M.C. Lammers, A. Powell, S. Y. Rayan, and O. Yilmaz, *Sigma Delta Quantization for Compressed Sensing*, Proc. 2010 Conf. on Inform. Sciences and Systems (CISS 2010), Princeton Univ., 17-19 Mar., 2010.
  - 12 C.S. Gunturk, M.C. Lammers, A. Powell, S. Y. Rayan, and O. Yilmaz, *Sobolev Duals of Random Frames*, Proc. 2010 Conf. on Inform. Sciences and Systems (CISS 2010), Princeton Univ., 17-19 Mar., 2010.
  - 11 J. Blum, M. C. Lammers, A. Powell, O. Yilmaz, *Sobolev duals in frame theory and Sigma-Delta quantization*. J. Fourier Anal. Appl. . Volume 16, (2010) no. 3,365-381.
  - 10 M.C. Lammers, Alex Powell O. Yilmaz, *Alternative dual frames for digital-to-analog conversion in Sigma-Delta quantization*. Advances in Computational Mathematics. Volume 32, (2010) no. 1,73-102.
  - 9 M. C. Lammers, Alexander M. Powell, and O. Yilmaz *On quantization of finite frame expansions: sigma-delta schemes of arbitrary order*. SPIE Proceedings Vol. 6701 Wavelets XII, Dimitri Van De Ville; Vivek K. Goyal; Manos Papadakis, Editors, 670108 Date: 20 September 2007
  - 8 P.G. Casazza, G. Kutyniok, and M.C. Lammers. *Duality principles, localization of frames, and Gabor theory*.SPIE Proceedings Vol. 5914 Wavelets XI, Manos Papadakis; Andrew F. Laine; Michael A. Unser, Editors, 591418 Date: 17 September 2005
  - 7 M.C. Lammers, *Convolution for Gabor systems and Newton's method.*, Contemp. Math., 345,237–251, Amer. Math. Soc., Providence, RI, (2004).
  - 6 P.G. Casazza, Gitta Kutyniok and M.C. Lammers, *Duality principles in frame theory*, J. Fourier Anal. Appl., 10, (2004), no. 4, 383-408.
  - 5 P.G. Casazza and M.C. Lammers, *Bracket products for Weyl-Heisenberg Frames*. In H.G. Feichtinger and T.Strohmer, eds, *Advances in Gabor Analysis*. Birkhauser, Boston (2003).
  - 4 P.G. Casazza, O. Christensen and M.C. Lammers, *Perturbations of Weyl-Heisenberg frames*, Hokkaido Math. J., Volume 31, (2002) no. 3, 539-553 .
  - 3 P.G. Casazza and M.C. Lammers, *Analyzing the Weyl-Heisenberg frame identity*, Appl. Comput. Harmon. Anal. 12 (2002), no. 2, 171-178.
  - 2 P.G. Casazza and M.C. Lammers, *Classifying characteristic functions giving Weyl-Heisenberg frames*. SPIE Proceedings Vol. 4119 Wavelet Applications in

Signal and Image Processing VIII, Akram Aldroubi; Andrew F. Laine; Michael A. Unser, Editors, pp.142-152 Date: 4 December 2000

- 1 P.G. Casazza and M.C. Lammers, *Genus  $n$  Banach Spaces*, Illinois J. Math, **43**(1999), 307-323.

## Research Presentations

- 44 March 2017, AMS Sectional Meeting. [Uncertainty Principles and Finite Gabor Systems](#). Jointly with student Kyle Bowman. College of Charleston.
- 43 May 2015, SampTa. [The Finite Balian Low Conjecture](#), American University.
- 42 May 2014, 5th International Conference on Computational Harmonic Analysis. [Diagonalizing the finite Zak Transform and the finite Balian-Low Theorem](#)
- 41 February 2013, The Department of Mathematics and Statistics Colloquium. American University. [Localized Dual Frames and Applications to Sigma Delta Quantization](#)
- 40 January 2013, UNCW Colloquium. Title: [A Time Frequency Localization measure for and Finite frames](#).
- 39 April 2012, University of Missouri Analysis Seminar. Title: [Sigma-Delta Quantization for Compressed Sensing](#)
- 38 April 2012, University of Missouri Frame Seminar. Title: A Time Frequency Localization measure for and Finite frames
- 37 March 2012, SIAM-SEAS 2012, University of Alabama Huntsville. Title: [A Time Frequency Localization measure for and Finite frames](#).
- 36 May 2010, Norbert Wiener Center at the University of Maryland, College Park: From Banach Spaces to Frame Theory and Applications In Honor of Professor Pete Casazza's 65th Birthday. Title: Localization and Finite frames.
- 35 March 2009, Banff International Research Station: Error Correction, Symmetry Goals and Numerical Efficiency. Title: Uncertainty in Finite Frames with application to Quantization.
- 34 May 2007, The 31st SIAM-SEAS conference Special Session "Wavelets and Frames", University of Memphis. Sigma Delta and Alternate duals.
- 33 April 2007, University of Utah: Applied Math Seminar Sigma Delta and Alternate Dual Frames for Reconstruction.
- 32 March 2006, Banff International Research Station: Coarsely Quantized Redundant Representations of Signals, Title: Alternate dual frames for Sigma Delta Quantization.
- 31 October 2005, University of South Carolina, Analysis Seminar, Title: Frames and Alternate Duals.
- 30 September 2005, UNCW Mathematics and Statistics Seminar, Title: Analog to Digital conversion: Alternate Duals for reconstruction.
- 29 June 2005 Universit de Franche-Comt. Besancon France, Functional Analysis Seminar Title: Frames and Applications.

- 28 May 2005 International Conference “Modern Methods of Time-Frequency Analysis”, Strobl Austria Title: Alternate Duals For Sigma Delta Quantization.
- 27 December 2004, University of Maryland. Harmonic Analysis Seminar. Title: Norm Bounded Canonical Duals.
- 26 May 2004, Second International Conference on Computational Harmonic Analysis, Vanderbilt University. Title: Duality Principles in Frame Theory.
- 25 February 2004, UNCW Mathematics and Statistics Seminar, Title: Uncertainty principles and Time-Frequency Analysis.
- 24 March 2003, Frames, Wavelets and Tomography Special Session at the AMS Sectional Meeting, Baton Rouge, Title: Bracket Products for Weyl-Heisenberg (Gabor) Frames.
- 23 January 2003, Wavelets, Frames and Operator Workshop University of Maryland, Title: Computing the Canonical dual with Newton’s Method.
- 22 January 2003, Wavelets, Frames and Operator Theory Special Session at the AMS National Meeting, Baltimore, Title: Wilson Bases and Convolution.
- 21 October 2002, Colloquium, Western Washington University, Title: Non-orthogonal expansions and Time-Frequency analysis.
- 20 July 2002, Concentration Week on Wavelets, Frames and Operator Theory, Texas A&M University, Title: Modular Convolutions.
- 19 March 2002, Banach Space Applications Special Session at the AMS Sectional, Georgia Tech University, Title: Banach Algebras and Gabor Frames.
- 18 February 2002, New Mexico State Analysis Seminar, Title: Gabor Frames and Hilbert  $C^*$ -Modules.
- 17 January 2002, Colloquium, Western Washington University, Title: A Newton’s Method for Frames.
- 16 April 2001, Industrial Mathematics Institute Seminar, University of South Carolina, Title: Gabor Algebras and Dual Frames.
- 15 March 2001, Banach Space Theory Special Session at the AMS Sectional, University of South Carolina, Title: Gabor Systems and Function-Valued Inner Products.
- 14 February 2001, Colloquium, University of Western Washington, Title: Frames, Hilbert  $C^*$ -Modules and an Application to Wireless Communications.
- 13 April 2000, Frame Seminar, University of South Carolina, Title: A Hilbert  $C^*$ -Module for Gabor Systems and Wavelets.
- 12 March 2000, Colloquium, University of St. Louis, Title: Oversampled Gabor systems.
- 11 February 2000, Frame Seminar, University of South Carolina, Title: Generalized Zak Transforms and Oversampled Gabor Systems.
- 10 October 1999, Frame Seminar, University of South Carolina, Title: Weyl-Heisenberg Frames IV: Compressing the Frame Operator.

- 9 October 1999, Frame Seminar, University of South Carolina, Title: Weyl-Heisenberg Frames III: Riesz Representation for Bracket Products.
- 8 September 1999, Frame Seminar, University of South Carolina, Title: Weyl-Heisenberg Frames II: The Bracket Product.
- 7 September 1999, Frame Seminar, University of South Carolina, Title: Weyl-Heisenberg Frames I: Introduction.
- 6 May 1999, Graduate Student Seminar, University of North Carolina - Wilmington, Title: Bases and Frames.
- 5 April 1999, Applied Analysis Seminar, University of North Carolina - Wilmington, Title: Weyl-Heisenberg Frames and Operators.
- 4 March 1998, Banach Space Theory Special Session at the AMS Sectional, Louisville, Kentucky, Title: Genus  $n$  Banach Spaces.
- 3 January 1998, Applied Analysis Seminar, University of North Carolina - Wilmington, Title: Combinatorial Applications to Banach Spaces.
- 2 October 1997, Applied Analysis Seminar, University of North Carolina - Wilmington, Title: Banach Spaces and Permutatively Equivalent Bases.
- 1 May 1997, Banach Space Seminar Talk, University of Missouri, Title: Unique Unconditional Bases.

### Other Professional Meetings Attended

- 15 April 2017 [SAS Data Science and Advanced Analytics Forum](#) SAS Institute, Cary NC.
- 15 June 2016, [Data Matters](#), UNC Chapel Hill.
- 14 February 2016, [Norbert Wiener Center](#):February Fourier Talks. University of Maryland, College Park.
- 13 February 2013, [Norbert Wiener Center](#):February Fourier Talks. University of Maryland, College Park.
- 12 February 2010, [Norbert Wiener Center](#):February Fourier Talks. University of Maryland, College Park.
- 11 May 2005, [Erwin Schrödinger Institute](#): Modern Methods of Time-Frequency Analysis, Vienna Austria.
- 10 April 2005, The Center for Scientific Computation and Mathematical Modeling (CSCAMM), Oversampling and Coarse Quantization for Signals, University of Maryland College Park.
- 9 October, 2003, Workshop of the NSF Focused Research Group: Wavelets, Frames and operator Theory, Georgia Institute of Technology.
- 8 May, 2000, CBMS-NSF Regional Conference in Applied Mathematics, University of Missouri-St. Louis.
- 7 October 1999, AMS Sectional Meeting, University of North Carolina-Charlotte.
- 6 January 1999, AMS-MAA Joint Meeting, San Antonio, Texas.

- 5 October 1997, AMS Sectional Meeting, Georgia Institute of Technology, Atlanta, Georgia.
- 4 December 1996, Conference on Modern Banach Space Theory, Kent State University, Kent, Ohio.
- 3 February 1996, Concentration in Infinite Dimensional Convex Geometry, MSRI, Berkeley, California.
- 2 October 1996, AMS Sectional Meeting, University of Missouri, Columbia, Missouri.
- 1 May 1994, Interaction Between Functional Analysis, Harmonic Analysis, and Probability, University of Missouri, Columbia, Missouri.

### Honors, Grants and Travel Awards

- University of North Carolina General Assemble Faculty Fellowship. Title: Data Analytics in Academia. Begins Spring 2017.
- 2016 NOAA, CIOERT Reefs in Space and Time (A cross-cutting program to document and predict trajectories of coral reefs using new spatial data). Individuals included on the grant are Blum, Brown, Lammers, McNamara and Cortale, **Funded \$ 64,289.**
- 2014 Exploration of UNCW Enrollment Data. **DIVE Group:** Blum, Brown, Lammers and McNamara. **Funded: \$40,000.**
- 2011 Exemplary Post Tenure Review
- 2010 Faculty Research Reassignment Award.
- 2010 IMA Participating Institution Conference: From Banach Spaces to Frames and Applications: A Conference in Honor of the 65th Birthday of Peter G. Casazza \$5,000.00, Funded
- 2009, Invitation only. [Banff International Research Station. Error Correction, Symmetry Goals and Numerical Efficiency.](#) Title: [Uncertainty in Finite Frames with application to Quantization.](#) Travel support. One week lodging and meals.
- 2006 Invitation only. [Banff International Research Station: Coarsely Quantized Redundant Representations of Signals,](#) Title: [Alternate dual frames for Sigma Delta Quantization.](#) Travel support. One week lodging and meals.
- 2005 Cahill Grant: Modern Methods of Time-Frequency Analysis, University of North Carolina at Wilmington. Award Amount: \$2,500.
- 2005 International Conference “Modern Methods of Time-Frequency Analysis”, Strobl Austria Travel support 900 EURO from the Erwin Schrödinger Institute.
- 2004 Summer Research Grant, University of North Carolina at Wilmington: Duality Principles in Frame Theory, June-August. Award Amount: \$3,000.
- 2002 Summer Research Grant, Bureau of Faculty Research, Western Washington University: Wavelet Frames, June-August. Award Amount: \$5,000.
- 1998 Recognized as one of Graham/Hewlett Halls’ “Favorite Faculty” (UNCW)

## Theses, Honors Projects and Undergraduate Research Directed

- Kyle Bowman, Masters Thesis 2016 :Numerical Methods and the Finite Balian-Low Conjecture.
- Victoria Livinski, Masters Project 2014 The Discrete Fractional Fourier Transform.
- Tommy Siddons, Masters Project 2013 Acoustic Modeling of Wave Equations.
- Zac Carnevale, Masters Project UNCW 2010-2011: Fractional Transforms
- Zac Carnevale, Honors Project UNCW 2010-2011: The Zak Transform
- Simon Stampe, Masters Thesis Mathematics UNCW 2011: A finite Heisenberg sum.
- Anna Maeser, Masters Thesis Mathematics UNCW 2009: Optimal duals for the time frequency noise shaper.
- Will Morgan, Masters Project UNCW 2008, Frames of Translates.
- Anna Maeser, Undergraduate research UNCW 2008: Day trading with Fourier. Presented: The 6<sup>th</sup> Annual Colonial Academic Alliance (CAA) Undergraduate Research Symposium. April 2008, Boston.
- Michael Zichy, Masters Thesis Mathematics UNCW 2006: Complex scheme for Sigma-Delta Quantization .
- Adam Key, Masters Thesis Mathematics UNCW 2006: Finite Frames and the Heisenberg Uncertainty Principle.
- Seth Rittenhouses, Masters Project Mathematics WWU 2003: Self-Adjoint Operators and Applications to Quantum Transport Theory.(WWU)

## Computer Skills

- Matlab, SAS, Maple, Python, SQL,. . .

## Professional Membership and Service

- Faculty Senate
- Member of NC Coast Clinical Research Initiative Statistics Team
- Member of IEEE
- Member of AMS
- Member of SIAM
- Referee for:
  - Advances in Computational Mathematics
  - Applied and Computational Harmonic Analysis
  - Complex Analysis and Operator Theory
  - Contemporary Mathematics
  - EURASIP Journal on Applied Signal Processing Math
  - IEEE Signal Processing Letters
  - IEEE Transactions on Information Theory

- Journal of Fourier Analysis and Applications
- Journal of Mathematical Analysis and Applications
- Studia Mathematica
- SAMPTA proceedings
- Rocky Mountain Journal of Math
- Reviewer for the American Mathematical Society