

Kabe Moen

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Positions

Associate Professor, University of Alabama	2016-present
Assistant Professor, University of Alabama	2011-2016
William Chauvenet Postdoctoral Lecturer, Washington University in Saint Louis Postdoctoral supervisor: Guido Weiss	2009-2011

Education

Ph.D. Mathematics, University of Kansas, Lawrence, KS Dissertation: "Linear and multilinear fractional operators: weighted inequalities, sharp bounds, and other properties" Advisors: Carlos Pérez and Rodolfo Torres	2009
M.A. Mathematics, University of Kansas, Lawrence, KS Thesis: "Radial basis functions and the numerical solution of partial differential equations"	2005
B.A. Mathematics, William Jewell College, Liberty, MO	2002

Research Interest

Harmonic Analysis, wavelets, signal analysis, analysis on metric spaces, and partial differential equations.

External Funding

- Weighted estimates in harmonic analysis and PDE, Simons Foundation: Collaboration Grants in Mathematics, \$35,000 2016-2021.
- Weights in multilinear harmonic analysis and PDE, National Science Foundation, Analysis Program, Principal Investigator DMS 1201504 \$102,629 2012-2015

Publications

Journal articles published while at University of Alabama

1. Weighted estimates for bilinear fractional operators and their commutators, with Cong Hoang, *Indiana University Mathematics Journal*, **67** (2018) 397-428.
2. On the harmonic and geometric maximal operators associated to a general basis, with Linden Anne Duffee, *Mathematical Inequalities and Applications*, **21** (2018) 265-286.
3. Muckenhoupt-Wheeden conjectures for sparse operators, with Cong Hoang, *Archive der Mathematik (Basel)*, **109** (2017) 49-58.
4. Matrix A_p weights, degenerate Sobolev spaces, and mappings of finite distortion, with David Cruz-Uribe and Scott Rodney, *Journal of Geometric Analysis*, **26** (2016) 2797-2830.
5. Regularity results for weak solutions of elliptic PDEs below the natural exponent, with David Cruz-Uribe and Scott Rodney, *Annali di Matematica Pura ed Applicata* **195** (2016), 725-740.
6. Unions of Lebesgue spaces and A_1 majorants, with Greg Knese and John M^cCarthy, *Pacific Journal of Mathematics* **280** (2016), 411-432.
7. Compactness properties of commutators of bilinear fractional integrals, with Árpád Bényi, Wendolin Damien, and Rodolfo H. Torres, *Mathematische Zeitschrift* **280** (2015) 569-582.
8. Sharp weighted inequalities for multilinear fractional maximal operators and fractional integrals, with Kangwei Li and Wenchang Sun, *Mathematische Nachrichten* **288** (2015) 619-632.
9. Compact bilinear commutators: the weighted case, with Árpád Bényi, Wendolin Damien, and Rodolfo H. Torres, *Michigan Mathematical Journal* **64** (2015), 39-51.
10. Logarithmic bump conditions for Calderon-Zygmund operators on spaces of homogeneous type, with Theresa C. Anderson and David Cruz-Uribe, *Publicaciones Matemáticas* **59** (2015), 17-43.
11. The sharp weighted bound for multilinear maximal functions and Calderón-Zygmund operators, with Kangwei Li and Wenchang Sun, *Journal of Fourier Analysis and Applications*, **20** (2014) 751-765.
12. New weighted estimates for bilinear fractional integrals, *Transactions of the American Mathematical Society* **366** (2014) 627-646.
13. Higher-order multilinear Poincaré and Sobolev inequalities in Carnot groups, with Virginia Naibo, *Potential Analysis* **40** (2014) 231-245. DOI 10.1007/s11118-013-9347-8.
14. Bilinear Sobolev-Poincaré inequalities and Leibniz-type rules, with F. Bernicot, D. Maldonado, and Virginia Naibo, *Journal of Geometric Analysis*, **24**, (2014) 1144-1180. DOI 10.1007/s12220-012-9367-4.
15. One and two weight norm inequalities for Riesz potentials, with David Cruz-Uribe, *Illinois Mathematics Journal* **57** (2013), 627-646.
16. Mixed A_p - A_∞ estimates with one supremum, with Andrei Lerner, *Studia Mathematica* **219** (2013) 247-267.
17. A fractional Muckenhoupt-Wheeden theorem and its consequences, with David Cruz-Uribe, *Integral Equations and Operator Theory*, **76**, (2013) 421-446.
18. Regularity of solutions to degenerate p -Laplacian equations, with David Cruz-Uribe and V. Naibo, *Journal of Mathematical Analysis and Applications*, **401** (2013) 458-478.

19. Sharp weighted bounds without testing or extrapolation, *Archiv der Mathematik*, **99**, (2012) 457-466.
20. A panorama of sampling theory, with Hrvoj Šikić, Guido Weiss, and Edward N. Wilson, Excursions in Harmonic Analysis: The February Fourier Talks at the Norbert Wiener Center, Applied and Numerical Harmonic Analysis Book Series.
21. Sharp norm inequalities for commutators of classical operators, with David Cruz-Urbe, *Publicaciones Matemáticas*, **56**, (2012) 147-190.

Accepted

1. Extrapolation in the scale of generalized reverse Hölder weights, with Theresa C. Anderson and David Cruz-Urbe, to appear in *Revista Matemática Complutense*.
2. A multilinear reverse Hölder inequality with applications to multilinear weighted norm inequalities, with David Cruz-Urbe, to appear in *Georgian Mathematical Journal*.
3. The boundedness of multilinear Calderón-Zygmund operators on weighted and variable Hardy spaces, with David Cruz-Urbe and Hanh Nguyen, to appear in *Publicaciones Matemáticas*.
4. Two weight bump conditions for matrix weights, with Joshua Isralowitz and David Cruz-Urbe, to appear in *Integral Equations and Operator Theory*.

Preprints

1. Matrix weights weighted Poincaré inequalities and applications to degenerate elliptic systems, with Josh Isralowitz, preprint.
2. Boundedness results for commutators with BMO functions via weighted estimates: a comprehensive approach, with Árpád Bényi, José Maria Martell, Eric Stachura and Rodolfo H. Torres, preprint.

Journal articles published before coming to University of Alabama

1. Weighted multilinear Poincaré inequalities for vector fields of Hörmander type, with D. Maldonado and V. Naibo, *Indiana University Mathematics Journal* **60**, (2011) 473-506.
2. Multiparameter weights with connections to Schauder bases, *Journal of Mathematical Analysis and Applications* **371** (2010) 266-281 .
3. Sharp weighted bounds for fractional integral operators, with M. Lacey, C. Pérez, and R.H. Torres *Journal of Functional Analysis* **259** (2010) 1073-1097.
4. Sharp one-weight and two-weight bounds for maximal operators, *Studia Mathematica* **194** (2009) 163-180.
5. Weighted inequalities for multilinear fractional integral operators, *Collectanea Mathematica* **60** (2009) 213-238.

Expository writings

1. A two weight inequality for the Hilbert transform assuming an energy hypothesis, after M. Lacey, E. Sawyer, and I. Uriarte-Tuero (expository), Summer/Fall school, Lake Arrowhead, California (2010).
2. The Brascamp-Lieb inequalities: finiteness, structure and extremals after J. Bennett, A. Carbury, M. Christ and T. Tao, Summer school on harmonic analysis, Carleson theorems, and multilinear analysis, Snowbird, Utah (2009).

Honors and Awards

- Blunden Lecture. *Hearing the shape of a drum* Opening and one of three main speakers for the Science Atlantic Conference at Cape Breton University in Nova Scotia Canada October 2016
- Lewis Parker Lecture. *When does a function belong to the union of Lebesgue spaces?* To help promote the mathematical research environment in Alabama, Drs. F. A. Lewis of The University of Alabama and William Vann Parker of Auburn University established a lecture series attached to the Alabama Association of College Teachers of Mathematics meeting to honor a mathematician in Alabama. 2015
- Florence-Blackman Award for excellence in teaching, University of Kansas 2008
- John Bunce Memorial Award. for outstanding graduate student, University of Kansas 2008
- Walker-Mitchell Scholarship. for summer support, University of Kansas Summers 2006, 2007

Colloquia

- *When does a function belong to the union of Lebesgue spaces?*, Dalhousie University, Halifax, Nova Scotia, Canada, October 17, 2016
- *When does a function belong to the union of Lebesgue spaces?*, University of Kansas, Lawrence, KS, September 19, 2013
- *When does a function belong to the union of Lebesgue spaces?*, Western Washington University, Bellingham, WA, March 14 (π -day), 2013.
- *Recent progress in weighted norm inequalities*, New Mexico State University, Las Cruces, NM, April 21, 2011.

Conference Talks

- *Degenerate Sobolev spaces, elliptic equations, and matrix A_p weights*, International Workshop on Operator Theory and its Applications (IWOTA), Washington University in St. Louis, MO, July 18-22 2016. Invited 20 min talk.
- *Poincaré inequalities and estimates for fractional operators on matrix weighted spaces with applications to PDE* AMS sectional meeting Special session in Harmonic Analysis, Athens, GA March 5-6 2016. Invited 20 minute talk.
- *Degenerate Sobolev spaces, elliptic equations, and matrix A_p weights*, AMS sectional meeting, Huntsville Alabama, March 27-29 2015. Invited 20 minute talk.
- *Regularity result for weak solutions of elliptic PDE below the natural exponent*, Southeastern Analysis Meeting, University of Georgia, March 8-10 2015. 20 minute talk.
- *Regularity result for weak solutions of elliptic PDE below the natural exponent*, AMS sectional meeting, Dalhousie University, Halifax, Nova Scotia, Canada, October 18-19, 2014. Invited 20 minute talk.
- *Unions of L^p spaces and A_1 majorants*, Special session on weighted norm inequalities and related topics, AMS spring western sectional meeting, University of New Mexico, Albuquerque NM, April 5-6, 2014. Invited 20 minute talk.

- *New weighted estimates for bilinear fractional integrals*, Special session on harmonic analysis, Joint international meeting between the AMS and Romanian mathematics society, Sibiu, Romania, June 27-30, 2013. Invited 20 minute talk.
- *New weighted estimates for singular integrals and Riesz potentials*, Fluid Mechanics and Singular integrals, Universidad de Sevilla, Sevilla, Spain, June 17-21, 2013. Invited 50 minute talk.
- *Regularity of solutions to degenerate p -Laplacian equations*, Summer meeting of the Canadian Mathematical Society, Dalhousie University, Halifax, Nova Scotia, Canada, June 4-7, 2013. Invited 30 minute talk.
- *Improved weighted estimates for classical operators*, Congreso de la Real Sociedad Matemática Española, Universidad de Santiago, Santiago de Compostella, Spain, January 21-24, 2013. Invited 50 minute talk.
- *New weighted estimates for bilinear fractional integral operators*, Special functions, partial differential equations and harmonic analysis, a conference in honor of Calixto P. Calderón, Roosevelt University, Chicago, IL November 16-18, 2012. 20 minute talk.
- *Abstract sampling theory*, Workshop on Harmonic Analysis and Spectral Theory, Texas A&M, College Station, TX, August 6-10, 2012. Invited 20 min talk.
- *Regularity of solutions to degenerate p -Laplacian equations*, AMS spring central sectional meeting, University of Kansas, Lawrence, KS, March 30-April 1, 2012. Invited 20 minute talk.
- *Sharp norm inequalities for commutators of classical operators*, AMS western sectional meeting fall 2010, University of California Los Angeles, Los Angeles CA, October 9-10. Invited 20 minute talk.
- *A two weight inequality for the Hilbert transform assuming an energy hypothesis* after M. Lacey, E. Sawyer, and I. Uriarte-Tuero, Summer School in Analysis University of California Los Angeles, Lake Arrowhead CA, October 4-9. Two 45 minute talks.
- *Sharp weighted bounds for fractional integral operators and other related inequalities*, International Functional Analysis Meeting in Valencia on the Occasion of the 80th Birthday of Professor Manuel Valdivia, Valencia, Spain, June 7-11, 2010. Invited 50 minute talk.
- *Sharp weighted bounds for fractional integral operators*, AMS Spring Western Section meeting, special session on dyadic and non-dyadic harmonic analysis, University of New Mexico, Albuquerque, NM, April 17-18, 2010. Invited 20 minute talk.
- *Multilinear Poincaré inequalities for vector fields of Hörmander type*, AMS Spring Southeastern Section meeting, special session on function theory, harmonic analysis, and PDE, University of Kentucky, Lexington, KY, March 27-28, 2010. Invited 20 minute talk.
- *Multilinear Poincaré inequalities for vector fields of Hörmander type*, Workshop on Fourier and Harmonic analysis, Wayne State University, Detroit, MI, November 14-15, 2010. 20 minute talk.
- *Multilinear Poincaré inequalities for vector fields of Hörmander type*, Ninth Prairie Analysis Seminar, Kansas State University, Manhattan, KS, October 2010. 20 minute talk.
- *A summary of the Brascamp-Lieb inequalities*, Mathematics Research Communities summer school on Harmonic analysis, Carleson theorems, and multilinear analysis, Snowbird, UT, June/July 2009. Two 50 minute talks.
- *Sharp weighted bounds for fractional integral operators*, Arkansas Spring Lecture Series, University of Arkansas, Fayetteville, AR, April 2009. 20 minute talk.

- *Weighted inequalities for multilinear fractional integral operators*, Twelfth New Mexico Analysis Seminar, University of New Mexico, Albuquerque, NM, April 2009. 20 minute talk.
- *Weighted inequalities for multilinear fractional integral operators*, AMS-MAA Joint Mathematics Meetings Washington, DC, January 2009. Invited 20 minute talk.
- *Sharp one weight and two weight bounds for maximal operators*, Eighth Prairie Analysis Seminar, Lawrence, KS, November 2008. 20 minute talk.
- *Weighted inequalities for multilinear fractional integral operators*, Eighth International Conference on Harmonic Analysis and Partial Differential Equations El Escorial (Madrid), Spain June 16-20 2008. 20 minute talk.

Seminar Talks

- *Matrix weighted Poincaré inequalities and applications to PDE*, Washington University in St. Louis MO, March 21, 2016.
- *Can one hear the shape of a drum?*, expository undergraduate talk for University of Alabama chapter of pi-mu-epsilon, Tuscaloosa AL, April 2, 2014.
- *Degenerate elliptic PDE and mappings of finite distortion*, Trinity College, Hartford, CN, August 15, 2012.
- *Degenerate p -Laplace equations*, Georgia Institute of Technology, Atlanta, GA, April 26, 2012.
- *Summing p -series with $p = 2$* , Graduate seminar University of Alabama, Tuscaloosa, AL, November 2011.
- *Weighted inequalities in multilinear harmonic analysis*, Michigan State analysis seminar, East Lansing, MI, March 2011.
- *Recent progress in weighted inequalities for singular integrals*, Washington University analysis seminar, Saint Louis, MO, September 2010.
- *Sharp weighted bounds for classical operators*, Washington University analysis seminar, Saint Louis, MO, April 2010.
- *Rectangular weights on the torus, with connections to Schauder bases for weighted Lebesgue spaces, principle shift invariant spaces, and Gabor systems*, Washington University wavelet seminar, September 2009.
- *Sharp bounds for fractional integral operators*, Kansas State University analysis seminar, Manhattan, KS March 2009.
- *Maximal operators: one weight, two weight, and sharp bounds*, University of Kansas analysis seminar Lawrence, KS September 2008.
- *Weighted inequality for classical operators on mixed Lebesgue spaces*, University of Kansas analysis seminar Lawrence, KS March 2007.

Other Conferences and Workshops Attended

- Workshop on Sparse domination, American Institute of Mathematics, San Jose, CA, October 8-13 2017.
- Thirteenth New Mexico Analysis Seminar, University of New Mexico, Albuquerque NM, April 3-4 2014.
- Bauer grant writing workshop, by David Bauer, University of Alabama, Tuscaloosa, AL, January 19 2012, 15 month ongoing training program.
- Mapping theory in metric spaces, American Institute of Mathematics, Palo Alto, CA, January 9-13, 2012.
- Weighted estimates for singular integrals, American Institute of Mathematics, Palo Alto, CA, October 10-14, 2011.
- Harmonic Analysis and Applications - A conference in honor of the 70th birthday of Richard Wheeden, Sevilla, Spain, June 14-18, 2010. Presented the poster, *Higher-order multilinear Poincaré inequalities on Carnot Groups*.
- AMS-MAA Joint Mathematics Meetings, San Francisco, CA, January 2010.
- Workshop on Multilinear Harmonic Analysis and Weights, Centre de Recerca Matemàtica (CRM), Bellaterra, Barcelona, Spain, May 2009.
- Tenth New Mexico Analysis Seminar, New Mexico University, Albuquerque, NM, October 2007.
- Sixth Prairie Analysis Seminar, University of Kansas, Lawrence, KS, October 2006.

Teaching Activities

University of Alabama

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| • Math 681: Graduate Real Analysis II | Spring 2014, 2016, 2018 |
| • Math 145: Honors Calculus I | Fall 2015, Spring 2018 |
| • Math 580: Graduate Real Analysis I | Fall 2013, 2015, 2017 |
| • Math 125: Calculus I | Fall 2013, 2014, 2015 Spring 2014 Summer 2012, 2017 |
| • Math 405: Geometry for teachers | Spring 2015 |
| • Math 247: Honors Calculus III | Spring 2013, 2015 |
| • Math 686: Functional Analysis | Fall 2014 |
| • Math 580: Graduate Real Analysis I | Fall 2013 |
| • Math 486: Real Analysis I | Fall 2012, 2013 |
| • Math 499: Topics in Fourier Analysis | Spring 2013 |
| • Math 247: Honors Calculus III | Spring 2013 |
| • Math 355: Theory of Probability | Spring 2013, Fall 2017 |

- Math 126: Calculus II Fall 2012
- Math 485: Complex Calculus Summer 2012
- Math 588: Theory of Differential Equations I Spring 2012
- Math 238: Applied Differential Equations Spring 2012
- Math 227: Calculus III Fall 2011

Washington University in Saint Louis

- Introduction to Lebesgue Integration Spring 2011
- Introduction to Analysis Fall 2010
- Differential Equations Fall 2010, Fall 2009
- Matrix Algebra Spring 2010
- Calculus I Spring 2010

University of Kansas

- Vector Calculus Spring 2009, Fall 2008
- Calculus I Fall 2007, Spring 2007, Fall 2006
- Business Calculus II Instructor Spring 2006
- Precalculus Fall 2005, Spring 2004
- Kansas Algebra Program Summers 2004, 2005
- Precalculus Fall 2003
- College Algebra Spring 2003
- Pre-Algebra Fall 2002

Outreach

- Tuscaloosa Magnet School Elementary. Rocket project. March 2015.
- Partner with Tuscaloosa Magnet School Elementary. With Anne Duffee and Cong Hoang we meet once per week to provide additional enrichment to gift 4th grade students. September 2014, ongoing.
- Main Organizer, 32nd annual Statewide Math Tournament at the University of Alabama. University of Alabama, Tuscaloosa, AL, November 16, 2013. Organized the statewide contest featuring over 200 students from over 20 different high schools in Alabama.
- Presenter, Math Circle, *Celestial calculations*, 90 minute activity for 6th-8th grade students. Washington University, Saint Louis, MO, October 2010.
- Volunteer, SciFest 2010, International Science Festival at the Saint Louis Science center. Saint Louis, MO, October 2010.
- Presenter, Math Circle, 90 minute activity for 6th-8th grade students. Washington University, Saint Louis, MO, October 2009.

- Coach, MATHCOUNTS, enrichment and competition program for 6th-8th grade students. West Junior High, Lawrence, KS 2008-2009.
- Coach, American Mathematics Competition 10, competitive testing program for 8th-9th grade student. West Junior High, Lawrence, KS 2008.
- Presenter, KU math Awareness Day, 15 minute activity for 4th-5th grade students. University of Kansas, April 2007.

Mentoring, Advising, and Dissertation Committees

- Ph.D. Advisor, Cong Hoang, *Sparse technology in weighted harmonic analysis* University of Alabama. Defended March 22, 2017. Visiting Lecturer at George Mason University.
- Ph.D. Advisor, *On the harmonic and geometric maximal operators*, Linden Anne Duffee, University of Alabama. Defended March 23, 2016. Accepted a visiting assistant professorship at Sewanee University.
- Ph.D. Chair, Soumyadip Acharyya. *A difference of composition operators on Bergman space*, Ph.D. dissertation, University of Alabama. Defended on April 28, 2015. Currently has a tenure track position at Embry Riddle Aeronautical University.
- Ph.D. Dissertation Committee, Yuanyuan Song, University of Alabama. December 1, 2014.
- Masters Advisor, Bernadette Bucher, *Mathematically Modeling the Spread of Methamphetamine Use*, Master Thesis, University of Alabama. Defended on March 20, 2014.
- Faculty Mentor, Team Participation (Bernadette Bucher, Joseph Aicher, and Rustem Bilyalov) in the international mathematical contest in modeling administered by the Consortium for Mathematics and Its Applications (COMAP), January 2013.
- Undergraduate Honor Thesis Supervisor, Bernadette Bucher, *The Navier-Stokes Equations*, University of Alabama, Spring 2013 through University of Alabama Honors College.
- Ph.D. Dissertation Committee, Matthew Bledsoe, Ph.D. in Mathematics, University of Alabama Birmingham, March 8, 2013.
- Faculty Mentor, Healthy Living and Recreation BLOC: Mentoring 25 students that share a common interest and live together on the same floor of the student residence. Washington University 2010–2011.
- Ph.D. Dissertation Committee, Nicholas Sedlock, Ph.D. in Mathematics, Washington University, April 2010.

Professional Activities

- Co-organizer (with Leonid Slavin and Alexander Stokolos), AMS Sectional Meeting, Special Session on Sharp estimates and Bellman functions in Harmonic Analysis, Athens, GA March 2016 (Upcoming).
- Co-organizer (with Betsy Stovall and Richard Oberlin, UCLA), AMS-MAA Joint Mathematics Meetings, Special Session on Harmonic Analysis, San Francisco, CA January 2010.

- **Journal Referee:** *Bulletin of the London Mathematical Society, Canadian Journal of Mathematics, Collectanea Mathematica, Indiana University Mathematics Journal, Journal of Fourier Analysis and Applications, Journal of Functional Analysis, Journal of Geometric Analysis, Journal of the London Mathematical Society, Journal of Mathematical Analysis and Applications, Mathematical Inequalities and Applications, Mathematische Nachrichten, Manuscripta Mathematica, New York Journal of Mathematics, Potential Analysis, Proceedings of the American Mathematical Society, Proceedings of the Edinburgh Mathematical Society, Publicaciones Matemáticas, Transactions of the American Mathematical Society, and Studia Mathematica.*

Last updated: April 12, 2018