

Andrew S. Raich

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Citizenship: U.S.A.

Current Position

Assistant Professor, University of Arkansas

Fall 2008-

Past Positions

Visiting Assistant Professor, Texas A&M University

Fall 2005-Spring 2008

Visiting Fellow, Isaac Newton Institute, Cambridge

May 2007

Visiting Fellow, The Erwin Schrödinger International Institute, Vienna

Oct. 2005, Nov. 2006

Nov. 2009, Dec. 2010

Education

Ph.D. Mathematics, University of Wisconsin-Madison

May 2005

Thesis: *Heat Equations in $\mathbb{R} \times \mathbb{C}$*

Advisor: Alexander Nagel

Minor: Probability

M.A. Mathematics, University of Wisconsin-Madison

May 2000

B.A. Mathematics and Physics, Williams College

May 1998

Magna Cum Laude with Highest Honors

Senior Thesis: *\mathbb{Z}^2 Actions, Flows, and Ergodicity*

Advisor: Cesar Silva

Research Areas

Several complex variables, partial differential equations, harmonic analysis.

Publications

1. “Div-curl type inequalities for higher order operators”, with Loredana Lanzani, in preparation.
2. “Sobolev spaces and elliptic theory on unbounded domains in \mathbb{R}^n ”, with Phillip Harrington, in preparation.
3. “Heat kernels, smoothness estimates and exponential decay”, with Albert Boggess, submitted. (arXiv:1004.0193)
4. “Green’s function asymptotics near the internal edges of spectra of periodic elliptic operators. Spectral edge case.”, with Peter Kuchment, submitted. (arXiv:1110.0225)

5. “Defining functions for unbounded C^m domains”, with Phillip Harrington, submitted. (arXiv:1111.4177)
6. “Fundamental solutions to \square_b on certain quadrics”, with Albert Boggess, submitted. (arXiv:1110.5804)
7. “Closed range for $\bar{\partial}$ and $\bar{\partial}_b$ on bounded hypersurfaces in Stein manifolds”, with Phillip Harrington, submitted. (arXiv:1106.0629)
8. “An Aronsson type approach to extremal quasiconformal mappings”, with Luca Capogna, submitted. (arXiv:1011.2988)
9. “Heat equations and the weighted $\bar{\partial}$ -problem”, to appear *Commun. Pure Appl. Anal.* (arXiv:0704.2768)
10. “The \square_b -heat equation on quadric manifolds”, with Albert Boggess, *J. Geom. Anal.* **21**:256-275, 2011.
11. “Regularity results for $\bar{\partial}_b$ on CR-manifolds of hypersurface type”, with Phillip Harrington, *Comm. Partial Differential Equations.* **36**:134-161, 2011.
12. “Compactness of the complex Green operator on CR-manifolds of hypersurface type”, *Math. Ann.* **348**:81-117, 2010.
13. “A simplified calculation for the fundamental solution to the heat equation on the Heisenberg group”, with Albert Boggess, *Proc. Amer. Math. Soc.* **137**:937-944, 2009.
14. “Compactness of the complex Green operator”, with Emil J. Straube, *Math. Res. Lett.*, **15**(4): 761-778, 2008.
15. “Pointwise estimates for relative fundamental solutions of heat equations in $\mathbb{R} \times \mathbb{C}$ ”, *Math. Z.*, **256**:193-220, 2007.
16. “Heat equations in $\mathbb{R} \times \mathbb{C}$ ”, *J. Funct. Anal.*, **240**:1-35, 2006.
17. “One-parameter families of operators in \mathbb{C} ”, *J. Geom. Anal.*, **16**(2):353-374, 2006.
18. “Infinite ergodic index \mathbb{Z}^d -actions in infinite measure” with E. J. Muehlegger, C. E. Silva, M. P. Toulountzis, B. Narasimhan and W. Zhao. *Colloq. Math.* **82**:167-190, 1999.
19. “Lightly mixing on dense algebras” with E. J. Muehlegger, C. E. Silva and W. Zhao. *Real Analysis Exchange* **23**:259-265, 1997/1998.

Grants and Fellowships

NSF grant DMS-0963810 (\$85,762), University of Arkansas	2010-2012
Principal Investigator. This grant supports the 2010 and 2011 Spring Lecture Series.	
NSF grant DMS-0855822 (\$95,602), University of Arkansas	2009-2012
Principal Investigator. This is an individual research grant to support my research in several complex variables.	
Vertical Integration of Research and Education (VIGRE) Fellowship UW-Madison	2001
L&S Teaching Fellow, College of Letters and Sciences	Fall 2001 - Spring 2002

UW-Madison, one of eighteen chosen from a pool of over 1000 candidates

Awards and Honors

You've Made a Difference , Univeristy of Arkansas	Fall 2011
Identified by a first-year student on the MAP-Works survey through University Housing as having helped the most in his/her college success during the first few weeks of school.	
2009 Conner Faculty Fellowship , University of Arkansas	2009
New Faculty Commendation for Teaching Commitment , University of Arkansas	2009
Sustained Excellence in Teaching and Service Award	Spring 2001
Department of Mathematics, UW-Madison, an award given to one graduate student each year	
Excellence in Teaching Award	Spring 2000
Department of Mathematics, UW-Madison	
"Superior" rating in TA evaluations, UW-Madison	Fall 1998, 1999, 2000, 2002
	Spring 1999, 2000, 2002
Phi Beta Kappa , Williams College	Spring 1998
Sigma Xi , Williams College	Nominated spring 1998
Morgan Prize for Teaching and/or Applied Math, Williams College	Spring 1998

Professional Experience

Intern , National Security Agency, Ft. Meade, MD	Summer 1997
SMALL participant , Williams College Research Experience for Undergraduates (REU)	Summer 1996

Teaching Experience

Functional Analysis , University of Arkansas
Calculus II , University of Arkansas
Partial Differential Equations , University of Arkansas
Ordinary Differential Equations , University of Arkansas
Differential Equations , Texas A&M University,
Business Mathematics I , Texas A&M University
Engineering Mathematics III , Texas A&M University
Engineering Mathematics II , Texas A&M University
Business Calculus II , Texas A&M University
Calculus & Analytic Geometry , University of Wisconsin-Madison
Arithmetical Problem Solving , University of Wisconsin-Madison

Invited Talks (International)

1. Talk Topic Undecided, Workshop: CR-Geometry and PDEs - IV, Levico Terme, Trento, Italy, June 5-8, 2012.
2. "Gaussian estimates for \square_b -heat kernels and quantitative smoothness estimates", The $\bar{\partial}$ -

Neumann problem: Analysis, Geometry, and Potential Theory. International Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, Dec. 2010

3. “Heat kernel decay via the Fourier transform”, Spectral Theory of Operators in Analytic Functions Spaces. Centre International de Recontres Mathématique, Marseilles, France, April 2010
4. “Closed range of $\bar{\partial}_b$ on CR-manifolds of hypersurface type”, The $\bar{\partial}$ -Neumann Problem: Analysis, Geometry and Potential Theory. International Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, Nov. 2009
5. “Compactness of the Complex Green Operator on CR Manifolds of Hypersurface Type”, First Joint International Meeting of the AMS with CMS, Special Session on Several Complex Variables and Applications, Shanghai, China, Dec. 2008
6. “Pointwise heat kernel estimates with applications to complex analysis”. Complex Analysis, Operator Theory, and Applications to Mathematical Physics – Followup Fall 2006, International Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, Nov. 15, 2006.
7. “Pointwise Estimates for Relative Fundamental Solutions of Heat Equations in $\mathbb{R} \times \mathbb{C}$.” International Conference in PDE, Complex Analysis, and Differential Geometry, Notre Dame University, June 13, 2006.
8. “Estimates of heat kernels for the $\square_{\tau p}$ heat equation in $\mathbb{R} \times \mathbb{C}$,” Program in Complex Analysis, Operator Theory, and Applications to Mathematical Physics: Workshop: Complex Analysis and Partial Differential Equations, International Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, Oct. 27, 2005

Invited Talks (Domestic)

1. “Defining functions on unbounded domains in \mathbb{R}^n ” AMS 2012 Spring Central Section Meeting #1081, Special Session on Interplay between Geometry and Partial Differential Equations in Several Complex Variables, Lexington, KY, Mar. 2012.
2. “Part 1: The Mathematics and Statistics Graduate Program at the University of Arkansas. Part 2: Convergence of Power Series – Think You’re An Expert? Think Again!”, Colloquium, University of Arkansas-Fort Smith, Nov. 2011.
3. “An Aronsson type approach to extremal quasiconformal mappings”, AMS 2011 Fall Eastern Sectional Meeting #1072, Special Session on Geometric Aspects of Analysis and Measure Theory, Ithaca, NY, Sep. 2011.
4. “Heat kernels, Gaussian decay and the Fourier transform”, Several Complex Variables Seminar, Texas A&M University, Feb. 2011.
5. “How to study for graduate math classes and conduct research in mathematics”, Graduate Student Seminar, University of Arkansas, Aug. 2010.
6. “Applying for academic jobs in the mathematical sciences”, Graduate Student Seminar, University of Arkansas, Mar. 2010.

7. “The \square_b -heat kernel on quadric manifolds”, Mathematics Colloquium, Georgetown University, Oct. 2009.
8. “Compactness of the complex Green operator”, Mathematics Colloquium, Notre Dame University, April 2009.
9. “Compactness of the complex Green operator on CR manifolds of hypersurface type”, AMS Spring Central Sectional Meeting #1047, Special Session on Holomorphic and CR Mappings (Code: SS 9A), Urbana, IL, Mar. 2009.
10. “The weighted $\bar{\partial}$ -heat equation with applications”, Analysis and PDE Seminar, Johns Hopkins University, Nov. 2008.
11. “On A Class of Integral Operators Related to the Weighted $\bar{\partial}$ -equation in C ”, AMS Southeastern Sectional Meeting #1037, Special Session on Harmonic Analysis and Partial Differential Equations in Real and Complex Domains, Baton Rouge, LA, Mar. 2008.
12. “Compactness of the complex Green operator II”, AMS Eastern Sectional Meeting #1031, Special Session on Geometric Analysis of Complex Laplacians, New Brunswick, NJ, Oct. 6, 2007.
13. “Heat Kernel Estimates with Applications to Complex Analysis.” AMS Spring Central Section Meeting #1025, Special Session on PDE Methods in Several Complex Variables, Miami University, Oxford, OH, Mar. 17, 2007.
14. “Pointwise Estimates for Heat Kernels in $\mathbb{R} \times \mathbb{C} \times \mathbb{C}$.” AMS Southeastern Sectional Meeting #1022, S3A - Special Session on Boundary Operators in Real and Complex Domains, University of Arkansas-Fayetteville, Nov. 3, 2006.
15. “Pointwise estimates on kernels of a family of heat equations in $\mathbb{R} \times \mathbb{C}$ with applications to several complex variables.”
 - Analysis Seminar, University of Georgia, May 3, 2006.
 - Several Complex Variables Seminar, Texas A&M University, April 26, 2006.
16. “An introduction to the spectral theorem with an application to PDEs”, VIGRE Seminar, University of Georgia, May 2, 2006.
17. “Scaling and PDEs – how to solve a differential equation without doing any work”, Pi Mu Epsilon Undergraduate Math Club Talk, Texas A&M University, April 24, 2006.
18. “The magic of conditional convergence.” Math Week, Madison East High School, May 2005.
19. “Heat equations in $\mathbb{R} \times \mathbb{C}$.”
 - Several Complex Variables Seminar, University of Illinois at Urbana-Champaign, Apr. 19, 2005.
 - Several Complex Variables Seminar, Texas A&M University, Apr. 8, 2005.
20. “Heat equations and the $\bar{\partial}$ -problem on weighted L^2 spaces in \mathbb{C} .” Special Session: Complex and Functional Analysis II, Joint Mathematical Meetings, Atlanta, Georgia, Jan. 8, 2005.
21. “Heat kernels and the weighted $\bar{\partial}$ -equation on \mathbb{C} .”

- Real and Complex Analysis Seminar, Ohio State University, Nov. 16, 2004.
- Several Complex Variables Seminar, University of Michigan, Oct. 25, 2004.
- Analysis Seminar, UW-Madison, Oct. 19, 2004.

Service and Committee Work

Organizer: U. of Arkansas Spring Lecture Series in the Mathematical Sciences 2010, 2011, 2014.

Article Referee: Illinois Journal of Mathematics, Journal of Geometric Analysis, Journal of Mathematical Analysis and Applications, Mathematische Nachrichten, Proceedings of the American Mathematical Society, Transactions of the American Mathematical Society

Project Evaluator: Università degli Studi di Milano, Università degli Studi di Padova

M-SEA Instructor Summer 2011

My colleague Janet Woodland and I organized a session for the Mathematics, Science and Engineering Academy (M-SEA) run by the Cooperative Developmental Energy Program (CDEP) at Fort Valley State University. CDEP is a program whose goal is to increase the number of women and minorities in the geosciences. Fort Valley offers a 3-2 program – earn a B.S. at Fort Valley in three years and a second B.S. at a partner institution in two years. The University of Arkansas is one of the partner institutions. The M-SEA is a program that identifies and prepares talented girls and minorities to enter CDEP. The students enroll in eighth grade and their summers are spent at Fort Valley and the partner institutions receiving education and training. Dr. Woodland and I developed a class in which we had the students derive a discrete version of Fick’s Law of Diffusion and model lake pollution. We then pointed out that the mathematical underpinnings of Fick’s Law of Diffusion are the same as Newton’s Law of Cooling, Fourier’s Law of Heat Conduction, and Ohm’s Law of Electrical Conduction.

Graduate Committee, University of Arkansas Fall 2010-current

Reviewer: Mathematical Reviews (for the American Mathematical Society) Fall 2008-current

MASC Library Representative Fall 2009-current

Mathematical Sciences Hiring Committee Fall 2008

Volunteer Instructor, Summer Educational Enrichment in Math June 2006, July 2007
Planned and led three 2.5 hour workshops titled “How Google Works” for incoming 6th, 7th, and 8th graders. SEE-Math is a yearly program run by the Texas A&M Mathematics Department.

Organizer, Several Complex Variables Seminar, Texas A&M University June 2006-May 2008