Andrew W. Lawrie

CONTACT INFORMATION

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Department of Mathematics
Massachusetts Institute of Technology
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APPOINTMENTS

Massachusetts Institute of Technology
Assistant Professor, Fall 2016–present
The University of California, Berkeley
NSF Postdoctoral Fellow, 2013–2016

EDUCATION

The University of Chicago Ph.D., Mathematics, 2013
Advisor: Professor Wilhelm Schlag
Columbia University, B.A., Mathematics, 2007

RESEARCH

Publications

30. Bubble decomposition for the harmonic map heat flow in the equivariant case with J. Jendrej; *arXiv E-print* 2022,

29. Soliton resolution for the energy-critical nonlinear wave equation in the radial case with J. Jendrej; *arXiv E-print* 2022.

28. Soliton resolution for equivariant wave maps in the equivariant case with J. Jendrej; preprint 2021, to appear in *J. Amer. Math. Soc. (JAMS)*

27. Continuous time soliton resolution for two-bubble equivariant wave maps with J. Jendrej; preprint 2020, to appear in *Math. Res. Lett.*

26. Uniqueness of two-bubble wave maps in high equivariance classes. with J. Jendrej; preprint 2020, to appear in *Comm. Pure Appl. Math. (CPAM)*

25. An asymptotic expansion of two-bubble wave maps in high equivariance classes. with J. Jendrej; preprint 2020, to appear in *Analysis & PDE*

24. Dynamics of strongly interacting kink-antikink pairs for scalar fields on a line. with J. Jendrej and M. Kowalczyk. to appear in *Duke Math. J.*

23. Asymptotic stability of harmonic maps on the hyperbolic plane under the Schrödinger maps evolution. with J. Lührmann, S.-J. Oh and S. Shahshahani. *Comm. Pure Appl. Math. (CPAM)*, to appear.

22. Dynamics of bubbling wave maps with prescribed radiation with J. Jendrej and C. Rodriguez. *Ann. Sci. Éc. Norm. Supér.*, to appear

21. Scattering for defocusing energy subcritical nonlinear wave equations with B. Dodson, D. Mendelson, and J. Murphy. *Analysis & PDE* 13 (2020), no. 7, 1995–2090

20. Local smoothing estimates for Schrödinger equations on hyperbolic space with J. Lührmann, S.-J. Oh, and S. Shahshahani. *Mem. Amer. Math. Soc.*, to appear

19. Two bubble dynamics for threshold solutions to the wave maps equation with J. Jendrej. *Invent. Math.,* 213 (2018) no. 3, 1249–1325

18. Conditional stable soliton resolution for a semi-linear Skyrme equation with C. Rodriquez. *Ann. PDE* 5 (2019), no. 2, Paper No. 15, 59 pp.

17. The Cauchy problem for wave maps on hyperbolic space in dimensions $d \geq 4$. w/ S.-J Oh and S. Shahshahani. *Int. Math. Res. Not.* Vol. 2018, No.7, 1954–2051

16. Equivariant wave maps on the hyperbolic plane with large energy. with S.-J Oh and S. Shahshahani. *Math. Res. Lett.* 24 (2017) no. 2, 449–479.

15. A refined threshold theorem for (1+2)-dimensional wave maps into surfaces. with S.-J. Oh. *Comm. Math. Phys. (CMP)* 342 (2016) no. 3, 989–999.

14. Gap eigenvalues and asymptotic dynamics of geometric wave equations on hyperbolic space. w/ S.-J. Oh and S. Shahshahani. *J. Funct. Anal.* 271 (2016), no.11, 3111–3161.

13. Profile decompositions for wave equations on hyperbolic space with applications. with S.-J. Oh and S. Shahshahani. *Math. Ann.* 365 (2016), no. 1-2, 707–803.

12. Stable soliton resolution for exterior wave maps in all equivariance classes. with C. Kenig, B. Liu, and W. Schlag. *Advances in Math.* 285 (2015), 235–300.

11. Channels of energy for the linear radial wave equation. with C. Kenig, B. Liu, and W. Schlag. *Advances in Math.* 285 (2015), 877–936.

10. Scattering for radial, semi-linear, super-critical wave equations with bounded critical norm. with B. Dodson. *Arch. Ration. Mech. Anal. (ARMA)* 218 (2015) no. 3, 1459–1529.

9. Scattering for the radial $3d$ cubic wave equation. with B. Dodson. *Analysis & PDE.* 8 (2015) no. 2, 467–497.

8. Stability of stationary equivariant wave maps from the hyperbolic plane. with S.-J. Oh and S. Shahshahani. *Amer. J. Math.* 139 (2017) no. 4, 1085–1147.

7. Profiles for the radial focusing 4d energy-critical wave equation. with R. Côte, C. Kenig, and W. Schlag. *Comm. Math. Phys. (CMP)* 357 (2018), no. 3, 943–1008.

6. Conditional global existence and scattering for a semi-linear Skyrme equation with large data. *Comm. Math. Phys. (CMP)* 334 (2015) no. 2, 1025–1081.

5. Relaxation of wave maps exterior to a ball to harmonic maps for all data. with C. Kenig, and W. Schlag. *Geom. Funct. Anal. (GAFA).* 24 (2014), no. 2, 610–647.

4. Characterization of large energy solutions of the equivariant wave map problem: I. with R. Côte, C. Kenig, and W. Schlag. *Amer. J. Math.* 137 (2015) no. 1, 139–207.

3. Characterization of large energy solutions of the equivariant wave map problem: II. with R. Côte, C. Kenig, and W. Schlag. *Amer. J. Math.* 137 (2015) no. 1, 209–250.

2. Scattering for wave maps exterior to a ball. with W. Schlag. *Advances in Math.*. 232 (2013) no. 1, 57–97.

1. The Cauchy problem for wave maps on a curved background. *Calc. Var. Partial Differential Equations.* 45 (2012), no. 3–4, 505–548.

Thesis

- On the global behavior of wave maps. *Ph.D. Thesis.* The University of Chicago. 2013.

Proceedings and Reports

- Stable soliton resolution for equivariant wave maps exterior to a ball. *Seminairé Laurent Schwartz–EDP et applications.* (2014-2015) Exp. No. 3, 11 p.
- Soliton resolution for exterior wave maps. *Oberwolfach Reports* Volume 10, Issue 3, (2013), 2321–2374.
- Scattering for equivariant wave maps. *Oberwolfach Reports* Volume 9, Issue 2, (2012), 1563–1637.

Grants and Awards

- **Solomon Buchsbaum Research Fund**, MIT, 2020
- **NSF Analysis grant** DMS-1954455, 2020-2023
- **Sloan Research Fellowship** 2019
- **Edmund F Kelly Research Award** MIT, 2019
- **NSF Analysis grant** DMS-1700127, 2017-2020
- **NSF Postdoctoral Fellowship** DMS-1302782, 2013-2016
- **Wirszup Research Prize** UChicago, 2013

Selected Lectures

Colloquia

- Courant Colloquium, Fall 2021
- Stony Brook Math Colloquium, Oct. 2015
- Séminaire Laurent Schwartz, EDP et applications. IHES, Bures-sur-Yvette, France. Oct. 2014

Conference Lectures

- Long Time Behavior and Singularity Formation in PDEs - Part IV, SITE Research Center, Abu Dhabi 2022
- Princeton FRG conference. Princeton, NJ October 2017
- Fluids, dispersion and blow-up. Institut Henri Poincar, Paris, France July 2017
- Nonlinear Dispersive Equations in Valdivia. Valdivia, Chile. Dec. 2016
- MIT FRG conference. Cambridge, MA, September 2016
- IHES Trimester on Nonlinear Waves; International conference. IHES, Bures-sur-Yvette, France. June 2016
- Nonlinear Evolution Problems. Mathematisches Forschungsinstitut Oberwolfach, Germany. May 2016
- Singularity formation and long-time behavior in dispersive PDEs. The Mathematical Institute of the University of Bonn, Germany. Mar. 2016
- Focus Program on 100 years of General Relativity: Nonlinear waves equations and their numerical study. The Fields Institute, Toronto, Canada. June 2015
- Asymptotics for Nonlinear Geometric PDEs. Centro di Ricerca Matematica Ennio De Giorgi, Pisa, Italy. Nov. 2014
- Dynamics in Geometric Dispersive Equations and the Effects of Trapping, Scattering and Weak Turbulence. Banff International Research Station, Alberta, Canada. May 2014
- Nonlinear Waves and Dispersive Equations. Mathematisches Forschungsinstitut Oberwolfach, Germany. Aug. 2013
- Nonlinear Evolution Problems. Mathematisches Forschungsinstitut Oberwolfach, Germany. May 2012

Selected Research Seminars

- UC San Diego Analysis and PDE seminar, 2022

- Princeton Analysis and PDE seminar, 2021
- Yale Analysis seminar, 2021
- Stanford Analysis and PDE seminar, 2021
- U. Chile Analysis and PDE seminar, 2020
- Courant Analysis Seminar, 2020
- Yale Analysis Seminar, 2020
- Texas A&M PDE Seminar, 2020
- U. Kentucky Analysis and PDE Seminar, 2020
- UChicago – Calderón-Zygmund Analysis Seminar, 2020
- UNC, Chapel Hill – Analysis/PDE Seminar, 2020
- Johns Hopkins University, Analysis seminar, March 2018
- University of Pittsburgh, Analysis seminar, Nov. 2017
- KIAS seminar – Seoul, S. Korea, June 2017
- UMass, Amherst – Analysis Seminar, October 2016
- MIT – PDE/Analysis Seminar Sept 2016
- UC Berkeley – Analysis and PDE Seminar, Feb. 2015
- Université Paris 13, Paris – Séminaire Équations aux Dérivées Partielles non-linéaires, Oct. 2014
- UNC, Chapel Hill – Analysis/PDE Seminar, Oct. 2013
- Northwestern University – Analysis Seminar, June 2013
- Rutgers University – Nonlinear Analysis Seminar, Apr. 2013
- UChicago – Calderón-Zygmund Analysis Seminar, Feb. 2013
- NYU – Courant Institute Analysis Seminar, Nov. 2012
- MIT – Analysis and PDE Seminar, Nov. 2012
- The University of Chicago – Calderón-Zygmund Analysis Seminar, Nov. 2012
- UC Berkeley – Analysis and PDE Seminar, Oct. 2012
- Johns Hopkins University – Analysis and PDE Seminar, Sept. 2012
- UIUC– Harmonic Analysis and PDE Seminar, Feb. 2012
- UChicago – Calderón-Zygmund Analysis Seminar, Jan. 2012
- UChicago – Calderón-Zygmund Analysis Seminar, May 2011

Service

Seminar Organizer

- The Analysis and PDE seminar, UC Berkeley, 2013
- Lunch seminar for graduate students, MIT, Spring 2017 – present

Conference Organizer

- AMS special session at joint meetings, Atlanta, GA, 2017
- AMS special session at sectional meeting, Boston, MA, 2018

Referee

- Advances in Differential Equations, The American Journal of Mathematics, Analysis and PDE, Annals of Mathematics, Annals of PDE, Annales de l'Institut Henri Poincaré/Analyse non lineaire, Annales Scientifiques de l'ENS, Bulletin de la Société Mathématique de France, Calculus of Variations and PDE, Communications in Mathematical Physics, Communications in PDE, Communications on Pure and Applied Analysis, GAFA, International Mathematical Research Notices, Inventiones Mathematicae, Journal of Differential Equations, Journal of the European Mathematical Society, Journal of Functional Analysis, JMPA, Memoirs of the AMS, Nonlinearity, Proceedings of the AMS, Selecta Mathematica, and Transactions of the AMS.

Teaching

MIT

- 18.103: Fourier Analysis. Fall 2016, Fall 2017
- 18.100B: Real Analysis. Spring 2017, Spring 2018
- 18.156: Differential Analysis II, Graduate Course, Spring 2018

The University of California, Berkeley

- Math 104: Introduction to Analysis. Spring 2014
- Math 185: Complex Analysis. Fall 2013 and Fall 2015
- Math 204: ODE and Dynamical Systems, Graduate Course, Spring 2016

The University of Chicago
University Instructor 2009 - 2013
- Math 131, 132, 133: Calculus 1, 2, 3, Fall 2009, Winter 2010, Spring 2011.
- Math 152, 153: Calculus 2, 3, Fall 2010, Winter 2011 .
- Math 195: Multivariable Calculus, Fall 2011, Spring 2012, Fall 2012, Spring 2013
- Math 196: Linear Algebra, Winter 2012, Winter 2013