

## Gideon Simpson

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### Citizenship

USA

### Current Position

Assistant Professor, Drexel University, Department of Mathematics, September 2013 – Present

### Previous Positions

- PIRE/DOE Postdoctoral Fellow, University of Minnesota, School of Mathematics, August 2011 – August 2013
- Visitor, University of Warwick, Mathematics Institute, September 2012 – December 2012
- Postdoctoral Fellow, University of Toronto, Department of Mathematics, July 2008 – June 2011

### Research Interests

- Nonlinear Wave Equations – Solitary Waves, Stability, Singularity Formation
- Multiscale Methods – Homogenization, Accelerated Dynamics
- Scientific Computing – Direct Numerical Simulation, Algorithms
- Applications – Fluid Mechanics, Geophysics, Nonlinear Optics, Materials Science

### Education

- Columbia University, Graduate School of Arts and Sciences (GSAS)  
Ph.D., Applied Mathematics, October 2008  
Thesis Advisors: Marc Spiegelman & Michael I. Weinstein  
Thesis Title: *The Mathematics of Magma Migration*
- Columbia University, GSAS  
M. Phil., Applied Physics, May 2006
- Columbia University, School of Engineering and Applied Science (SEAS)  
M.S., Applied Physics, May 2004
- Cornell University, College of Arts and Sciences  
B.A., Summa Cum Laude, Mathematics, May 2003

### External Support

- **Title** Gene Golub Summer School on Stochastic Differential Equations and Wave Propagation at Drexel University  
**Agency** SIAM  
**Role** Co-PI; Lead PI – D. Ambrose, Drexel University  
**Duration** 06/01/2016 – 09/30/2016  
**Award Amount** \$94,120
- **Title** Computational and Analytical Challenges in Nonlinear Dispersive Wave Equations  
**Agency** National Science Foundation (NSF)

**Role** PI

**Duration** 09/01/2014 – 07/31/2018

**Initial Award Amount** \$146,118

**Supplementary Award Amount** \$5,000 for REU support

- **Title** Theory and Computation for Mesoscopic Materials Modeling
- Agency** US Department of Energy (DOE), Subcontract from University of Minnesota
- Role** Co-PI; Lead PI – M. Luskin, School of Mathematics, University of Minnesota
- Duration** 08/01/2014 – 08/14/2018
- Award Amount Total/ Drexel** \$549,513 / \$88,715

### Honors & Awards

- Simon Prize Recipient, Columbia University, 2009
- NSF Graduate Research Fellowship Honorable Mention, 2005
- NSF IGERT Fellow, Columbia University, 2003
- Phi Beta Kappa, Cornell University, 2003

### Published Peer Reviewed Journal Articles

Asterisks (\*) indicates that co-author was an undergraduate or graduate student.

1. J.L. Marzuola, S.G. Raynor, G. Simpson. Nonlinear Bound States in a Schrödinger–Poisson System with External Potential, *SIAM Journal on Applied Dynamical Systems*, 16(1), 2017.
2. A.D. Jones\*, G. Simpson, W. Wilson\*. Conservative Integrators for a Toy Model of Weak Turbulence, *Journal of Computational and Applied Mathematics*, 325, 113-124, 2017
3. Y. Cher\*, G. Simpson, C. Sulem. Local Structure of Singular Profiles for a Derivative Nonlinear Schrödinger Equation, *SIAM Journal on Applied Dynamical Systems*, 16(1), 514-545, 2017
4. D. Aristoff, S.T. Chill, G. Simpson. Analysis of estimators for adaptive Kinetic Monte Carlo, *Communications in Applied Mathematics and Computational Science*, 11(2), 171-186, 2016.
5. R. Côte, C. Muñoz, D. Pilod, G. Simpson. Asymptotic Stability of high-dimensional Zakharov-Kuznetsov solitons. *Archive for Rational Mechanics and Analysis*, 220(2), 639-710, 2016.
6. M. Luskin, G. Simpson, D.J. Srolovitz. A Theoretical Examination of Diffusive Molecular Dynamics, *SIAM Journal on Applied Mathematics*, 76(6), 2176-2196, 2016.
7. D. Olson\*, S. Shukla\*, G. Simpson, D. Spirn. Petviashvili’s Method for the Dirichlet Problem. *Journal of Scientific Computing*, 66(1), 297-320, 2016.
8. F.J. Pinski, G. Simpson, A.M. Stuart, H. Weber. Algorithms for Kullback-Leibler Approximation of Probability Measures in Infinite Dimensions. *SIAM Journal on Scientific Computing*, 37(6), A2733-A2757, 2015.
9. F.J. Pinski, G. Simpson, A.M. Stuart, H. Weber. Kullback-Leibler approximation for probability measures on infinite dimensional spaces. *SIAM Journal on Mathematical Analysis*, 47(6), 4091-4122, 2015.
10. D.M. Ambrose, G. Simpson. Local Existence Theory for Derivative Nonlinear Schrödinger Equations with Non-Integer Power Nonlinearities. *SIAM Journal on Mathematical Analysis*, 47(3), 2241-2264, 2015.
11. A. Binder\*, T. Lelièvre, G. Simpson. A Generalized Parallel Replica Dynamics. *Journal of Computational Physics*, 284, 595-616, 2015.
12. D. Aristoff, T. Lelièvre, G. Simpson. The parallel replica method for simulating long trajectories of markov chains. *AMRX*, 2014(2), 332-352, 2014.

13. J.L. Marzuola, S. Raynor, G. Simpson. Dynamics near a minimal mass soliton of a generalized Korteweg-de Vries equation. *Dynamical Systems*, 29 (2), 285-299, 2014.
14. D. Ginsberg\*, G. Simpson. Analytical and Numerical Results on the Positivity of Steady State Solutions of a Thin Film Equation. *Discrete and Continuous Dynamics Systems-B*, 18(5):1305-1321, 2013.
15. G. Simpson, M. Luskin. Numerical Analysis of Parallel Replica Dynamics. *ESAIM:M2AN*, 47:1287-1314, 2013.
16. X. Liu\*, G. Simpson, C. Sulem. Stability of solitary waves for a generalized derivative nonlinear Schrödinger equation. *Journal of Nonlinear Science*, 23:557-583, 2013.
17. X. Liu\*, G. Simpson, C. Sulem. Focusing singularity in a derivative nonlinear Schrödinger equation. *Physica D*, 262:48-58, 2013.
18. J.E. Colliander, J.L. Marzuola, T. Oh, G. Simpson. Behavior of a model dynamical system with applications to weak turbulence. *Experimental Mathematics*, 22(3):250-264, 2013.
19. D.M. Ambrose, G. Simpson, J.D. Wright, D.G. Yang. Ill-Posedness of Degenerate Dispersive Equations. *Nonlinearity*, 25(9): 2655–2680, 2012.
20. D.E. Pelinovsky, G. Simpson, M.I. Weinstein. Polychromatic Solitary Waves in a Periodic and Nonlinear Maxwell System. *SIAM Journal on Applied Dynamical Systems*, 11(1):478–506, 2012.
21. G. Simpson, M.I. Weinstein. Coherent Structures and Carrier Shocks in the Nonlinear Periodic Maxwell Equations. *Multiscale Modeling & Simulation*, 9(3):955–990, 2011.
22. G. Simpson, I. Zwiars\*. Vortex Collapse for the L2-Critical Nonlinear Schrödinger Equation. *Journal of Mathematical Physics*, 52(8):083503, 2011.
23. R. Asad\*, G. Simpson. Embedded Eigenvalues and the Nonlinear Schrödinger Equation. *Journal of Mathematical Physics*, 52(3):033511, 2011.
24. G. Simpson, M. Spiegelman. Solitary Wave Benchmarks in Magma Dynamics. *Journal of Scientific Computing*, 49(3):268–290, 2011.
25. J.L. Marzuola, G. Simpson. Spectral Analysis for Matrix Hamiltonian Operators. *Nonlinearity*, 24:389-429, 2011.
26. J. Colliander, G. Simpson, and C. Sulem. Numerical simulations of the energy-supercritical nonlinear Schrödinger equation. *Journal of Hyperbolic Differential Equations*, 7:279–296, 2010.
27. J.L. Marzuola, S. Raynor, and G. Simpson. A System of ODEs for a Perturbation of a Minimal Mass Soliton. *Journal of Nonlinear Science*, 20:425–461, 2010.
28. G. Simpson, M. Spiegelman, and M.I. Weinstein. A Multiscale Model of Partial Melts 2: Numerical Results. *Journal of Geophysical Research – Solid Earth*, 115, B04411, 2010.
29. G. Simpson, M. Spiegelman, and M.I. Weinstein. A Multiscale Model of Partial Melts 1: Effective Equations. *Journal of Geophysical Research – Solid Earth*, 115, B04410, 2010.
30. G. Simpson, C. Sulem, and P.L. Sulem. Arrest of Langmuir wave collapse by quantum effects. *Physical Review E*, 80:5, 056405, 2009.
31. G. Simpson and M.I. Weinstein. Asymptotic stability of ascending solitary magma waves. *SIAM Journal on Mathematical Analysis*, 40:1337–1391, 2008.
32. G. Simpson, M.I. Weinstein and P. Rosenau. On a Hamiltonian PDE arising in magma dynamics. *Discrete and Continuous Dynamics Systems-B*, 10:903–924, 2008.
33. G. Simpson, M. Spiegelman, and M.I. Weinstein. Degenerate dispersive equations arising in the study of magma dynamics. *Nonlinearity*, 20:21–49, 2007.

## Invited Presentations

- 2017** University of British Columbia, July 2017  
University of Edinburgh, June 2017  
George Washington University, April 2017  
University of Massachusetts, February 2017
- 2016** MIT, December 2016  
Gene Golub Summer School, Drexel University, July 2016  
London Mathematical Society Workshop, Durham University, July 2016  
Frontiers in Applied and Computational Mathematics Conference, NJIT, June 2016  
INI Workshop, Cambridge University, April 2016  
University of Pennsylvania, March 2016  
University of Cincinnati, January 2016
- 2015** Fordham University, November, 2015  
Workshop on Multiscale Modeling and Analysis in Materials Science Shanghai Jiao Tong University, August 2015  
University of Chicago, April, 2105  
SIAM Workshop on Dimension Reduction, Penn State, March 2015  
University of Cincinnati, January 2015
- 2014** Wake Forest University, December 2014  
Colorado State University, October 2014  
BIRS Workshop on Multiscale Models of Crystal Defects, September 2014
- 2013** Warwick University Maths Institute Workshop, December 2013  
University of Delaware, November 2013  
Binghamton University, October 2013  
Midwest Partial Differential Equations Seminar, May 2013  
University of New Mexico, February 2013  
Drexel University, February 2013  
University of California, San Diego, January 2013  
Warwick University, January 2013  
Miami University, January 2013
- 2012** University of Maryland, December 2012  
Sandia National Laboratories, CSRI, August 2012  
Warwick University, June 2012  
Georgia Southern University, March 2012  
NJIT, February 2012  
Columbia University, February 2012
- 2011** Drexel University, October 2011  
OxMOS Meeting, Oxford University, September 2011  
CNA Workshop on Macroscopic Modeling of Materials with Fine Structure, Carnegie Mellon University, may 2011  
AMS Spring Southeastern Section Meeting, Georgia Southern University, March 2011  
Florida International University, March 2011  
Wayne State University, March 2011  
Oregon State University, February 2011  
Claremont McKenna College, February 2011  
Michigan State University, February 2011  
Ohio River Analysis Meeting, University of Cincinnati, January 2011
- 2010** Fields Institute, November 2010  
University of North Carolina–Chapel Hill, October 2010  
Drexel University, April 2010
- 2009** McMaster University, March 2009

**2008** NJIT, April 2009  
University of Toronto, February 2009  
University of Chicago, February 2009

### Other Presentations

**2017** IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, University of Georgia, March 2017  
AMS Spring Sectional Meeting, College of Charleston, March 2017

**2016** Multiscale Materials Modeling Conference, October 2016  
SIAM Conference on Nonlinear Waves, August 2016  
SIAM Conference on Materials Science, May 2016

**2015** DelMar, US Naval Academy, May 2015  
SIAM Workshop on Dimension Reduction, Penn State, March 2015  
AMS Spring Sectional Meeting, Michigan State University, March 2015

**2014** AMS Fall Western Sectional Meeting, San Francisco State University, October 2014  
American Institute of Mathematical Conferences the 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain, July 2014  
DelMar, University of Maryland, Baltimore County, May 2014

**2013** SIAM Conference on Partial Differential Equations, December 2013  
SIAM Conference on Materials Science, June 2013  
Midwest Partial Differential Equations Seminar, May 2013

**2012** SIAM Annual Meeting, July 2012

**2011** CMS Winter Meeting, Ryerson University, December 2011  
AMS Fall Southeastern Section Meeting, Wake Forest University, September 2011  
IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, March 2011  
AMS Spring Southeastern Section Meeting, Georgia Southern University, March 2011

**2010** SIAM Conference on Nonlinear Waves and Coherent Structures, August 2010  
Canadian Math Society(CMS) Summer Meeting, University of New Brunswick, June 2010  
Frontiers in Applied and Computational Mathematics Conference, NJIT, May 2010

**2009** American Geophysical Union(AGU) Fall Meeting, December 2009  
BIRS Workshop on analysis of nonlinear wave equations and applications in engineering, August 2009  
SIAM Snowbird Conference on Applications of Dynamical Systems, May 2009  
American Math Society(AMS) Eastern Sectional Meeting, Worcester Polytechnic Institute , April 2009

**2006** SIAM Conference on Nonlinear Waves and Coherent Structures, University of Central Florida, September 2006  
Recent advances in nonlinear partial differential equations and applications: A workshop in honor of Peter D. Lax and Louis Nirenberg, June 2006

**2005** NSF IGERT Project Meeting, May 2005

### Teaching

- Graduate Numerical Analysis (Math 521), Winter 2017
- Differential Equations (Math 210), Fall 2016
- Graduate Numerical Analysis (Math 520) , Fall 2016
- Numerical Analysis (Math 301), Winter 2016
- Numerical Analysis (Math 300), Fall 2015

- Numerical Mathematics (Math 540), Spring 2015
- Numerical Analysis (Math 301), Winter 2015
- Partial Differential Equations (Math 323), Winter 2014

### **Undergraduate Students**

- Aquil Jones, BS student at Drexel University, 2017
- William Wilson, BS student at Drexel University, 2016
- Soumitra Shukla, BA student at University of Minnesota, 2015
- Reza Asad, BA student at University of Toronto, 2013
- Daniel Ginsberg, BA student at University of Toronto, 2013

### **Graduate & Postgraduate Students**

- Brittan Farmer, Postdoctoral Researcher at Drexel University, 2016
- Felix Jones, PhD student at Drexel University, 2020
- Daniel Watkins, MS student at Drexel University, 2015

### **Departmental & University Service**

#### **2016 – 2017** Departmental Service:

- Graduate Admissions Committee
- PDE & Applied Mathematics Seminar Organizer

#### University Service:

- Admitted Undergraduate Student Open House
- Commencement
- University Research Computing Facility – Board Member

#### **2015 – 2016** Departmental Service:

- Graduate Admissions Committee
- PDE & Applied Mathematics Seminar Organizer

#### University Service:

- Convocation

#### **2014 – 2015** Departmental Service:

- Graduate Admissions Committee
- PDE & Applied Mathematics Seminar Organizer
- Strategic Hiring Committee

#### University Service:

- Admitted Undergraduate Students Open House
- Convocation

#### **2013 – 2014** Departmental Service:

- Graduate Admissions Committee
- PDE & Applied Mathematics Seminar Organizer
- Library Liaison

University Service:

- Admitted Undergraduate Students Open House
- Convocation

### Conference & Seminar Organization

- Gene Golub Summer School co-organizer, Drexel University, 2016: Stochastic Differential equations and Wave Propagation
- Frontiers in Applied and Computational Mathematics Conference co-organizer, NJIT, 2016.
- Isaac Newton Institute Workshop co-organizer, Cambridge University, 2016: From the Grain to the Continuum: Two Phase Dynamics of a Partially Molten, Polycrystalline Aggregate
- Minisymposia co-organizer, SIAM Conference on Partial Differential Equations, 2015: Coherent Structures in Hamiltonian PDE
- Workshop co-organizer, Waves, Spectral Theory, and Applications: A workshop celebrating the research of Michael Weinstein, 2015
- Minisymposia co-organizer, SIAM Conference on Partial Differential Equations, 2013: Recent Advances in Nonlinear Dispersive Partial Differential Equations
- Minisymposia co-organizer, SIAM Conference on Mathematical Aspects of Materials Science, 2013: Computational Tools for Metastable Systems
- Special Session co-organizer, AMS Fall 2011 Southeastern Section Meeting, Special Session on Nonlinear Dispersive Equations
- Minisymposia co-organizer, SIAM Conference on Nonlinear Waves and Coherent Structures, 2010:
  - Modulation of Nonlinear Solutions of in Dispersive Partial Differential Equations
  - Patterns and Coherent Structures in the Solid Earth: Magma Dynamics
- Applied Math & Analysis Seminar co-organizer, University of Toronto, 2009–2010

### Referee Service

**Peer Reviewed Journals** Journal of Computational Physics, Journal of Fluid Mechanics, Journal of Mathematical Physics A, Nonlinearity, Nonlinear Analysis, Numerische Mathematik, Revista Matemática Complutense, Physica D, SINUM, Multiscale Modeling & Simulation, Journal of Uncertainty Quantification, SIAM Review, Journal of Differential Equations