

Roy Howard Goodman  
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Associate Professor  
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# Roy Goodman

## Education

### *Formal*

- 1994–1999** • Courant Institute of Mathematical Sciences, New York University, New York, NY  
**Ph.D.** Mathematical Sciences (David W. McLaughlin, dissertation advisor)
- 1990–1994** • University of Michigan, Ann Arbor, MI  
**B.S.** Mathematics (honors option), with highest honors

### *Additional*

- 7/1996** • Summer School on Nonlinear Waves, Patterns, and Oscillations (Cork, Ireland)

## Research Interests

- Linear and nonlinear wave propagation, PDE
- Dynamical Systems, Invariant Manifold Computations
- Mathematical modeling and asymptotic analysis of physical systems
- Vortex dynamics
- Nonlinear phenomena in optics
- Numerical Simulation

## Professional Experience

- 2008–** • **Associate Professor (Tenured)** New Jersey Institute of Technology
- 2002–2008** • **Assistant Professor** New Jersey Institute of Technology
- 2001–2002** • **Visiting Assistant Professor** New Jersey Institute of Technology
- 1999–2001** • **Visiting Research Fellow** Princeton University and Bell Laboratories (Lucent), under NSF University-Industry Cooperative Research Program in the Mathematical Sciences (advisors Philip Holmes, Princeton and Michael Weinstein, Bell Labs)

## Visiting Positions

- 2018–2019** • **Long Term Visitor** Department of Mechanical Engineering, NYU Tandon School of Engineering
- Fall 2016** • **Long Term Visitor** Institute for Mathematics and Applications, University of Minnesota
- 2010–2011** • **Visiting Associate Professor** Department of Mathematics, Technion Israel Institute of Technology

# Scholarly Activities

## Refereed Journal Papers

- 2021 • J. Adriaola and R. H. Goodman, *An optimal control approach to gradient-index design for beam reshaping*, submitted.
- 2022 • J. Adriaola and R. H. Goodman, *A reduction-based strategy for optimal control of Bose-Einstein condensates*, Phys. Rev E 105, 025311
- 2020 • T. E. Faver, R. H. Goodman, and J. D. Wright, *Solitary waves in mass-in-mass lattices*, ZAMP 71, 197.
- 2020 • A. Sagiv, A. Ditkowski, R. H. Goodman, and G. Fibich, *Loss of physical reversibility in reversible systems*, Phys. D 404, 132515.
- 2019 • B. M. Behring and R. H. Goodman, *Stability of leapfrogging vortex pairs: A semi-analytic approach*, Phys. Rev. Fluids 4, 124703.
- 2019 • R. H. Goodman and M. Porfiri, *Topological features determining the error in the inference of networks using transfer entropy*, Math. in Engineering 2, 34–54.
- 2019 • A. Kairzhan, D. E. Pelinovsky, and R. H. Goodman, *Instability drift of shifted states on balanced star graphs*, SIAM J. Appl. Dyn. Sys. 18, 1723–1755
- 2019 • R. H. Goodman, *NLS Bifurcations on the bowtie combinatorial graph and the dumbbell metric graph*, Disc. Cont. Dyn. Syst. 30, 2203–2232.
- 2017 • R. H. Goodman, *Bifurcations of relative periodic orbits in NLS/GP with a triple-well potential*, Phys. D 359, 39–59.
- 2015 • R. H. Goodman, P. G. Kevrekidis, R. Carretero, *Dynamics of vortex dipoles in anisotropic Bose-Einstein condensates*, SIAM J. Appl. Dyn. Sys. 14, 699–709.
- 2015 • R. H. Goodman, A. Rahman, M. Bellanich, C. Morrison, *A mechanical analog of the two-bounce resonance of solitary waves: Modeling and experiment*, Chaos 25, 043109
- 2015 • R. H. Goodman, J. L. Marzuola, and M. I. Weinstein, *Self-trapping and Josephson tunneling solutions to the nonlinear Schrödinger / Gross-Pitaevskii Equation*, Disc. Cont. Dyn. Sys. 35, 225–246.
- 2013 • J. K. Wróbel and R. H. Goodman, *High-order Adaptive Method for Computing Two-dimensional Invariant Manifolds of 3-D Maps*, Comm. Nonlin. Sci. and Num. Simul., 18 1734–1745.
- 2011 • R. H. Goodman, *Hamiltonian Hopf bifurcations and dynamics of NLS/GP standing-wave modes*, J. Phys. A: Math. Theor. 44 425101 (28pp).
- 2011 • R. H. Goodman and J. K. Wróbel, *High-order Bisection Methods for Computing Invariant Manifolds of 2-D Maps*, Int. J. Bifurcations and Chaos, 21, 2017–2042.
- 2009 • J. Bławdziewicz, R. H. Goodman, N. Khurana, E. Wajnryb, and Y.-N. Young, *Nonlinear hydrodynamic phenomena in the Stokes flow regime*, Phys. D, 239, 1214–1224.
- 2008 • Y.-N. Young, J. Bławdziewicz, V. Cristini, and R. H. Goodman, *Hysteretic and chaotic dynamics of viscous drops in creeping flows with rotation*, J. Fluid Mech., 607, 209–234.
- 2008 • R. H. Goodman, *Chaotic scattering in solitary wave interactions: A singular iterated-map description*, Chaos, 18, 023113.
- 2008 • R. H. Goodman and M. I. Weinstein, *Stability and instability of nonlinear defect states in the coupled mode equations—analytical and numerical study*, Phys. D, 237, 2731–2760.
- 2007 • R. H. Goodman and R. Haberman, *Chaotic Scattering and the n-bounce Resonance in Solitary Wave Interactions*, Phys. Rev. Lett., 98, 104103 1–4.
- 2005 • R. H. Goodman and R. Haberman, *Kink-antikink collisions in the  $\phi^4$  equation: The n-bounce resonance and the separatrix map*, SIAM J. Appl. Dyn. Sys., 4, 1195–1128.
- 2005 • R. H. Goodman and R. Haberman, *Vector soliton interactions in birefringent optical fibers*, Phys. Rev. E 71, 056606.
- 2004 • R. H. Goodman, R. Haberman, *Interaction of sine-Gordon kinks with defects: The two-bounce resonance*, Phys. D, 195, 303–323.
- 2004 • R. H. Goodman, P.J. Holmes, and M.I. Weinstein, *Strong NLS soliton-defect interactions*, Phys. D, 192, pp 215–248.
- 2002 • R. H. Goodman, R. E. Slusher, and M.I. Weinstein, *Stopping light on a defect*, J. Opt. Soc. Am. B., 19, pp. 1635–1652.
- 2002 • R. H. Goodman, P.J. Holmes, and M.I. Weinstein, *Interaction of sine-Gordon kinks with defects: Phase space transport in a two-mode model*, Physica D 161, pp. 21–44.
- 2001 • R. H. Goodman, A.J. Majda, and D.W. McLaughlin, *Modulations in leading edges of midlatitude storm tracks* SIAM J. Appl. Math 62, pp. 746–776.
- 2001 • R. H. Goodman, M.I. Weinstein, and P.J. Holmes, *Nonlinear propagation of light in one-dimensional periodic structures*, Journal of Nonlinear Science, 11, pp 123–168.

## Scholarly Activities (continued)

- 1995 • R. H. Goodman, D.S. Graff, L.M. Sander, P. Leroux-Hugon, and E. Clement, *Trigger waves in a model for catalysis* Phys. Rev. E. **52**, pp. 5904–5909.

### Book Chapters

- 2019 • R. H. Goodman, *Mathematical analysis of fractal kink-antikink collisions in the  $\phi^4$  model* in **A dynamical perspective on the  $\phi^4$  model**, Springer, P. G. Kevrekidis and J. Cuevas-Maraver, eds.

### Unrefereed Proceedings Publications

- 2005 • R. H. Goodman, R. E. Slusher, M.I. Weinstein and M. Klaus, *Trapping light with grating defects* **Mathematical Methods for Nonlinear Wave Propagation**, Contemp. Math **379**, (2005), pp. 83–92.
- 2005 • P.J. Holmes, R. H. Goodman and M.I. Weinstein, *Trapping of kinks and solitons by defects: Phase space transport in finite dimensional models*, Proceedings of the International Conference on Progress in Non-linear Science dedicated to Alexander Andronov, Nizhny Novgorod, Russia, July 2001.

### Book Reviews

- 2017 • Review of *Methods of Mathematical Modeling* by Witelski and Bowen, SIAM Review **60** (2018), pp. 215–216.

### Other Unrefereed Writing

- 2019 • Four Decades of Kink Interactions in Nonlinear Klein-Gordon Models: A Crucial Typo, Recent Developments and the Challenges Ahead, to appear on DSWeb, a website of the SIAM Activity Group in Dynamical Systems
- 2019 • *Markdown: A Writing Tool for Every Applied Mathematician's Toolbox*, SIAM News, May 2019.

### Teaching Publications

- 2007 • B. Bukiet and R. H. Goodman, *Methods of Applied Mathematics (sample honors syllabus)*, Honors in Practice, 3, (2007) 171–175.

### Conference Presentations, invited

- 5/2021 • SIAM Conference on Applications of Dynamical Systems, Online, minisymposium speaker
- 12/2019 • Canadian Mathematical Society Winter Meeting, Toronto, ON, invited speaker in session on Symmetry in Dynamical Systems
- 4/2019 • The Eleventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, minisymposium speaker
- 10/2018 • AMS Sectional Conference, Ann Arbor, MI, special session speaker
- 6/2018 • SIAM Conference on Nonlinear Waves and Coherent Structures, Anaheim, CA, minisymposium speaker
- 8/2017 • Applied Mathematics, Modeling and Computational Science (AMMCS), Waterloo ON, minisymposium speaker
- 5/2017 • SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, minisymposium speaker
- 10/2016 • Workshop on Mathematical and Physical Models of Nonlinear Optics, Institute for Mathematics and applications, Minneapolis, MN, invited speaker
- 6/2016 • Coherent Structures in PDEs and Their Application, Oaxaca, MX, invited speaker
- 7/2015 • Workshop on Pattern Formation, Dalhousie University, Halifax, NS, invited speaker
- 6/2015 • International Conference on Mathematics of Nonlinearity in Neural and Physical Science, Shanghai, China, invited speaker
- 8/2014 • SIAM Conference on Nonlinear Waves and Coherent Structures, Cambridge, UK, minisymposium speaker
- 5/2013 • Frontiers in Applied Mathematics, Newark, NJ, minisymposium speaker
- 5/2013 • SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, featured minisymposium speaker
- 7/2012 • 2nd Conference on Localized Excitations in Nonlinear Complex Systems (LENCOS'12), Seville, Spain

## Scholarly Activities (continued)

- 4/2012 • Nonlinear Waves: Asymptotic Theory and Applied Mathematics, Mexico City, MX, invited presentation
- 11/2011 • SIAM Conference on Analysis of Partial Differential Equations, San Diego, CA, invited minisymposium speaker
- 8/2010 • SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA, minisymposium speaker
- 8/2009 • Analysis of nonlinear wave equations and applications in engineering, Banff International Research Station, Alberta, Canada, invited participant and speaker in 5-day workshop
- 5/2008 • Seventh AIMS Conference on Dynamical Systems and Differential Equations, Arlington, TX, minisymposium speaker
- 3/2008 • AMS Sectional Meeting, New York, NY, minisymposium speaker
- 5/2007 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, minisymposium speaker
- 4/2007 • AMS Sectional Meeting, Hoboken, NJ, minisymposium speaker
- 12/2006 • CMS Winter Meeting, Toronto, ON, minisymposium speaker
- 9/2006 • SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, minisymposium speaker
- 7/2006 • SIAM Annual Meeting, Boston, MA, minisymposium speaker
- 5/2005 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, minisymposium speaker
- 4/2005 • IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, minisymposium speaker
- 10/2004 • SIAM Conference on Nonlinear Waves and Coherent Structures, Orlando, FL, minisymposium speaker
- 7/2004 • Workshop on Mathematical Ideas in Nonlinear Optics, Edinburgh, UK, invited 30-minute talk.
- 10/2003 • AMS Sectional Meeting, Chapel Hill, NC, minisymposium speaker
- 7/2002 • SIAM 50th anniversary Conference, Philadelphia, PA, minisymposium speaker

### *Conference Presentations, Contributed*

- 6/2012 • SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, contributed talk
- 7/2011 • 10th International Conference on the Mathematical and Numerical Aspects of Waves, Vancouver, BC, contributed talk (refereed)
- 5/2010 • Frontiers in Applied Mathematics, Newark, NJ, minisymposium speaker and poster
- 5/2009 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, poster with graduate student J. Wróbel
- 2/2009 • SIAM Conference on Computational Science and Engineering, Miami, FL, poster with graduate student J. Wróbel
- 7/2008 • SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy, contributed talk
- 5/2007 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
- 5/2006 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
- 10/2005 • International Workshop on Applied Dynamical Systems. Centre des Recherches Mathématiques, Montreal, QC, Canada, poster
- 5/2005 • Frontiers in Applied and Computational Mathematics, Newark, NJ, contributed poster
- 10/2004 • Conference in honor of D. McLaughlin's 60th birthday, Chapel Hill, NC, poster
- 5/2004 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
- 1/2004 • Dynamics Days, Chapel Hill, NC, poster
- 5/2003 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, contributed talk
- 5/2002 • NSF-CBMS Regional Research Conference on Mathematical Methods for Nonlinear Wave Propagation, North Carolina A&T State University, poster.

### *Other Significant Talks*

- 10/2020 • Mathematical Physics Seminar, Yeshiva University
- 2/2020 • Applied Mathematics Colloquium, New Jersey Institute of Technology
- 3/2019 • Applied Math Seminar, Drexel University
- 10/2018 • Analysis and PDE Seminar, University of North Carolina
- 4/2018 • Mathematics Seminar, University of Vermont
- 2/2017 • AIMS Seminar, University of Michigan
- 9/2016 • IMA Visitors Seminar, University of Minnesota
- 3/2015 • Math Department Seminar, Southern Methodist University

## Scholarly Activities (continued)

- 5/2014 • Dynamical Systems Seminar, Mechanical Engineering, NYU Polytechnic Institute
- 4/2014 • Mathematics Seminar, Montclair State University
- 4/2014 • Computational and Applied Mathematics Seminar, Rutgers University
- 3/2013 • Center for Computational Science Seminar, Tulane University
- 1/2013 • Applied Math Seminar, Drexel University
- 3/2012 • Center for Applied Mathematics Seminar, University of Massachusetts
- 12/2010 • Solid State Center Colloquium (Physics), Technion Israel Institute of Technology
- 11/2010 • Applied Math Seminar, Weizmann Institute, Rehovot Israel
- 10/2010 • Applied Math Colloquium, Tel Aviv University
- 10/2010 • Applied Math and PDE Seminar, Technion Israel Institute of Technology
- 3/2009 • Mathematics Colloquium, University at Buffalo
- 1/2009 • Dynamical Systems Seminar, Drexel University
- 12/2007 • Lefschetz Center for Dynamical Systems seminar, Brown University
- 11/2007 • Dynamical Systems and Nonlinear Science Colloquium, Georgia Tech
- 2/2007 • Dynamical Systems and Nonlinear Science Seminar, Princeton University
- 11/2006 • Applied Mathematics Colloquium, Columbia University
- 2/2004 • Dynamical Systems and Nonlinear Science Seminar, Princeton University
- 9/2004 • Mathematics Colloquium, University of Vermont
- 10/2002 • Mathematics Colloquium, Southern Methodist University
- 2/2002 • Mathematics Colloquium, Worcester Polytechnic Institute
- 1/2002 • Mathematics Colloquium, Drexel University
- 12/2001 • Mathematics Colloquium, University of Maryland Baltimore County
- 11/2001 • Lefschetz Center for Dynamical Systems seminar, Brown University
- 10/2001 • Applied Mathematics Colloquium, NJIT

### ***Conferences & Minisymposia Organized***

- 5/2021 • Minisymposium, SIAM Conference on Application of Dynamical Systems, online
- 10/2017 • Waves, Spectral Theory & Applications—Part 2, Chapel Hill, NC
- 9/2015 • Organizing Committee, Conference on Waves, Spectral Theory & Applications, Princeton, NJ
- 5/2014 • Organizing Committee & 2 Minisymposia, Frontiers in Applied & Computational Mathematics, Newark, NJ
- 5/2013 • Minisymposium, Frontiers in Applied & Computational Mathematics, Newark, NJ
- 8/2010 • Organizing Committee, SIAM Conference on Nonlinear Waves & Coherent Structures, Philadelphia, PA
- 8/2010 • Minisymposium, SIAM Conference on Nonlinear Waves & Coherent Structures, Philadelphia, PA
- 5/2010 • Special Session, AMS Spring Eastern Meeting, Newark, NJ
- 3/2008 • Special Session, AMS Spring Eastern Meeting, New York, NY
- 5/2007 • Minisymposium, SIAM Conference on Application of Dynamical Systems, Snowbird, UT
- 5/2007 • Minisymposium, Frontiers in Applied & Computational Mathematics, Newark, NJ
- 5/2005 • Minisymposium, SIAM Conference on Application of Dynamical Systems, Snowbird, UT
- 5/2005 • Minisymposium, Frontiers in Applied & Computational Mathematics, Newark, NJ
- 4/2005 • Minisymposium, IMACS International Conference on Nonlinear Evolution Equations & Wave Phenomena, Athens, GA
- 10/2004 • Organizer, Conference in honor of D. McLaughlin's 60th birthday, Chapel Hill, NC
- 5/2004 • Minisymposium, Frontiers in Applied & Computational Mathematics, Newark, NJ

### ***Other Workshop Participation***

- 2014 • The Thirtieth Annual Workshop on Mathematical Problems in Industry, NJIT, Newark, NJ, June, 2014

## Grants

- 2008–2013 • Principal Investigator, Nonlinear waves and dynamical systems, NSF DMS–0807284, \$199,881
- 2007–2009 • Co-Principal Investigator, **CSUMS**: Research and Education in Computational Mathematics for Undergraduates in the Mathematical Sciences at NJIT, NSF DMS-0639270, \$536,696
- 2005–2008 • Principal Investigator, Mathematical methods for wave interactions, NSF DMS-0506495, \$85,000

## Grants (continued)

- 2004-2007** • Investigator, Acquisition of computer cluster for the Center of Applied Mathematics and Statistics at NJIT, NSF DMS-040590, Major Research Instrumentation grant, \$270,870
- 2002-2005** • Principal Investigator, Pulse propagation and capture in Bragg grating optical fibers, NSF DMS-0204881, \$73,001

## Patents Awarded

- 10/5/2004** • R. H. Goodman, M. I. Weinstein and R. E. Slusher, Trapping light pulses at controlled perturbations in periodic optical structures, Patent No. US 6801685

## Teaching

### ***At NJIT***

- Undergraduate** • Calculus I, Honors Calculus 2, Calculus 3A, Differential Equations, Intermediate Differential Equations (Dynamical Systems), Linear Algebra, Honors Linear Algebra, Applied Numerical Methods, Advanced Applied Numerical Methods, Mathematical Methods for Scientists and Engineers, Mathematical Analysis I, Honors Methods of Applied Mathematics 1 & 2 (Capstone course), Mathematical Modeling, Complex Analysis, Partial Differential Equations
- Masters** • Numerical Methods for Computation
- Ph.D.** • Asymptotic Methods I, Advanced Ordinary Differential Equations, Wave Propagation, Special Topics: Dynamical Systems

### ***At NYU***

- Undergraduate** • Precalculus Mathematics

### ***Ph.D. Dissertation Advisor***

- 2017-2021** • Jimmie Adriaola  
Dissertation: *Coherent Control of Dispersive Waves*
- 2016-2020** • Brandon Behring  
Dissertation: *Dances and Escape of the Vortex Quartet*
- 2013-2016** • Casayndra Basarab  
Dissertation: *Hamiltonian Bifurcations in Schrödinger Trimers*
- 2008-2011** • Jacek Wróbel  
Dissertation *High-order Adaptive Method for Computing Invariant Manifolds of Maps*

### ***Other Student Supervision***

- 2021** • Noah Roselli, Undergraduate Research Project
- 2010** • Kyle Mahady, Graduate Summer Research Project
- 2009-2010** • Casayndra Basarab and Priyanka Shah, CSUMS Undergraduate Research Project
- 2007-2008** • Matthew Peragine and Fatima Elgammal, CSUMS Undergraduate Research Project
- 2007** • Xiaoni Fang, Graduate Summer Research Project
- 2006** • Maciej Malej, Undergraduate Summer Research Project
- 2004-** • Member of dissertation committees for A. Anurag, D. Cargill, M. Chabane, Y. Chen, G. Conte (UNC-Chapel Hill), I. Jancigova, Y. Joshi, Y. Mileyko, A. Rahman, B. Ren

## Service

### *University*

- 2019–2022** • Member, Faculty Senate
- 2015–2018** • Member Honors College Bauder Scholarship Committee
- 2014–2017** • Member, University Senate Committee on Campus Life
- 2002–2004** • Advisor to undecided CSLA freshmen
- 2003–2005** • Member, NJIT committee on Health and Safety

### *Department*

- 2021–** • Chair, Computation in the Curriculum Committee
- 2020–** • Chair, then member, Online Instruction Committee
- 2008–** • Applied Math Undergraduate Advisor
- 2002–2003, 2011–2018** • Applied Mathematics Minor Advisor
- 2003–2010** • Undergraduate Math Club and Pi Mu Epsilon Honor Society Advisor
- 2007–2010** • Organizer, Wave Propagation Seminar

### *Peer reviewing activity*

- **Panelist**, NSF Division of Mathematical Sciences (3 panels)
- **Tenure Reviewer** One review
- **Grant Reviewer**, individual grants, NSF-DMS, Israel Science Foundation, MITACS (Canada)
- **Referee**, AIMS Mathematics, Analysis and Applications Annales Henri Lebesgue, Applied Mathematics Letters, Chaos, Chaos Solitons & Fractals, Communications in Nonlinear Science and Numerical Simulation, Discrete and Continuous Dynamical Systems B, Europhysics Letters, European Physics Journal Plus, IMA Journal of Applied Mathematics, International Journal of Theoretical Physics, Journal of Computational and Applied Mathematics, Journal of Computational Physics, Journal of Engineering Mathematics, Journal of High Energy Physics, Journal of Lightwave Technology, Journal of Low Temperature Physics, Journal of Marine Science and Engineering, Journal of Modern Optics, Journal of Nonlinear Science, Journal of the Optical Society of America B, Journal of Physics A, Mathematics, Mathematics and Computers in Simulation, Nonlinearity, Numerical Methods in PDE, Optics Express, Optics Letters, Physica D, Physical Review A, Physical Review D, Physical Review E, Physical Review Fluids, Physical Review Letters, PLOS One, Proceedings of the American Mathematical Society, Proceedings of the Royal Society A—Mathematical and Physical, SIAM Journal of Applied Dynamical Systems, SIAM Journal of Applied Mathematics, SIAM Journal of Mathematical Analysis, SIAM Textbook Publishing, Studies in Applied Mathematics, Water, Wave Motion

### *Professional Societies*

- AMS
- 2017–2018** • SIAM Nonlinear Waves SIAG Martin Kruskal Lecturer Selection Committee
- SIAM, Society for Industrial and Applied Mathematics (member)
- SIAM, SIAG for Dynamical Systems Activity Group (member)
- SIAM, SIAG for Nonlinear Waves and Coherent Structures (member)
- 2009–2010** • SIAM, SIAG Nonlinear Waves and Coherent Structures (Secretary)

## References

- **Prof. M. Gregory Forest**  
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- **Prof. David W. McLaughlin**  
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Courant Institute of Mathematical Sciences  
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