

**DAVID W. McLAUGHLIN**

**PROVOST, NEW YORK UNIVERSITY  
SILVER PROFESSOR OF MATHEMATICS AND NEURAL SCIENCE**

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**PERSONAL DATA:**

Married: Wife – Ruth Ann

Children: Richard, Kenneth, Erin-Rose, Alisan

**EDUCATION:**

Creighton University, B.S., 1966

Indiana University, M.S., 1969

Indiana University, Ph.D., 1971

**EMPLOYMENT:**

1970-1972 Assistant Professor, Mathematics, New York University

1972-1974 Assistant Professor, Mathematics, Iowa State University

1974-1979 Associate Professor, Mathematics, University of Arizona

1979-1989 Professor, Mathematics, University of Arizona

1989-1994 Professor, Mathematics, Princeton University

1994-2000 Professor, Mathematics, New York University

2000- Professor, Mathematics and Neural Science, New York University

2000-2001 Adjunct Professor of Biomathematics, Mount Sinai Medical School

2002- Provost, New York University

2014- Silver Professor, Mathematics and Neural Science, New York University

**APPOINTMENTS:**

1986-1989 Chairman, Program in Applied Mathematics, University of Arizona

1986-1989 Co-director of Arizona AFOSR, Center of Mathematical Sciences

1992-1994 Director, Program in Applied and Computational Mathematics, Princeton

1994-2002 Director, Courant Institute of Mathematical Sciences

**HONORS:**

1966-70 NDEA Title IV Fellow  
1969-70 NSF National Fellowship  
1976 Lester Ford Award by American Mathematics (with J. B. Keller)  
1978 "The Soliton - A New Concept in Applied Science"  
Acknowledged by Citation Index as a "Citation Classic"  
1979 Member, US-USSR Academy Exchange on Solitons  
1992 Plenary Address SIAM Conf. on Dynamical Systems (Snowbird)  
1994 Invited Address, International Congress of Mathematicians, Zurich  
1995 IX David Alcaraz Spinola Award, Univ. Mexico  
2000 Elected, Fellow of the American Academy of Arts and Sciences  
2003 Elected, National Academy of Sciences  
2003 Elected, Fellow of the American Association for the Advancement of Science  
2009 Elected, Fellow of the Society for Industrial and Applied Mathematics (SIAM-  
Inaugural Class of Fellows)  
2010 Alumni Merit Award, Creighton University, College of Arts and Sciences  
2013 Fellow of the American Mathematical Society (AMS Inaugural Class of Fellows)  
2014 Silver Professorship, New York University

**SERVICE:**

2001-2003 Chairman, SIAM Activity Group on Dynamical Systems  
2003-2005 Chairman, Board of Mathematical Sciences and their Applications, National  
Academy of Sciences  
2011-2013 Member, Founding Board of Trustees, Institute for Computational and  
Experimental Research (ICERM), Brown University  
2011-2016 Member, Division Committee on Engineering and Physical Sciences of the National  
Academies (DEPSCOM)  
2011- Member, Creighton University, College of Arts and Sciences Alumni  
Advisory Board

**GRANTS:**

1972-2006 National Science Foundation  
1983-2004 Air Force Office of Scientific Research  
1996-2005 Sloan Foundation (with R. Shapley)  
2000-2003 National Science Foundation VIGRE Program – Courant Institute  
2002-2004 National Science Foundation Mathematical Biology (with D. Cai)  
2005-2009 National Science Foundation Mathematics and Neuroscience  
2006-2008 Schwartz Foundation (with D. Cai)- Program in Neurobiology  
2006-2009 NIH-NIE (with R. Shapley)

**AFFILIATIONS:**

American Academy of Arts and Sciences  
American Association for the Advancement of Science  
American Mathematical Society  
National Academy of Sciences  
New York Academy of Sciences

Society for Industrial and Applied Mathematicians (SIAM)

**SPECIALIZATION:**

Mathematical neuroscience; applied mathematics; nonlinear waves

**CURRENT RESEARCH INTERESTS:**

Modeling of the primary visual cortex

**PH.D. STUDENTS:**

1975-1978 E.A. Overman, (Co-director with F.A. Hopf) 1975-  
1979 M.G. Forest  
1984-1988 H. Adachihara, (Co-director with A. Newell)  
1987-1991 S. Jin (Co-director with D. Levermore)  
1987-1991 C. Schober  
1988-1991 H. Roitner (Co-director with N. Ercolani)  
1989-1991 O. Wright  
1989-1993 Y. Li  
1989-1997 Y. Chen  
1990-1994 J. Bronski  
1995-1999 R. Goodman (Co-director with A. Majda)  
1996-2000 D. Nykamp (Co-director with R. Shapley)  
2005-2009 M. Patel (Co-director with D. Cai and A. Rangan)

**POSTDOCTORAL ADVISEES:**

1990-1993 D. Muraki  
1993-1994 X. Wang  
1993-1996 T. Ueda  
1997-2000 D. Cai  
1997-2000 J. Wielaard  
1999-2003 L. Tao  
2001-2003 A. Guillamon  
2003-2006 A. Rangan  
2010-2013 J. Zhang

**PUBLICATIONS:**

1. Zhou, D.; Rangan, A; McLaughlin, D; Cai, D. Spatiotemporal Dynamics of Neuronal Population Response in the Primary Visual Cortex *PNAS* 110 (2013), no. 23 9517-9522.
2. Cai, D.; Tao, L.; Shkarayev, M.; Rangan, A; McLaughlin, D.; Kovacic, G. The Role of Fluctuations in Coarse-Grained Descriptions of Neuronal Networks. *Comm. Math. Sci.* 10 (2012), no. 1, 307-354.
3. Cai, D.; Rangan, A.; McLaughlin, D. Quantifying Neuronal Network Dynamics through Coarse- Grained Event-Trees. *PNAS*, 105 (2008), no. 31, 10990-10995.
4. Cai, D.; Rangan, A.; McLaughlin, D. Neuronal Information Encoding and Reduction of Dimension Network Dynamics. *SIAM*, 40 (2007), no. 2.

5. Cai, D.; Tao, L.; Rangan, A.; McLaughlin, D. Kinetic Theory for Neuronal Network Dynamics. *Comm. Math. Sci.* 4 (2006), no. 1, 97-127.
6. Guillamon, A.; McLaughlin, D.; Rinzel, J. Estimation of Synaptic Conductances. *J. Physiology-Paris* 100 (2006), no. 1-3, 31-42.
7. Tao, L.; Cai, D.; McLaughlin, D.; Shelley, M. J.; Shapley, R. Orientation Selectivity in Visual Cortex by Fluctuation-Controlled Criticality. *PNAS* 103 (2006), no. 34, 12911-12916.
8. Cai, D.; Rangan, A.; McLaughlin, D. Architectural and synaptic mechanisms underlying coherent spontaneous activity in V1. *PNAS* 102 (2005), no. 16, 5868- 5873.
9. Rangan, A.; Cai, D.; McLaughlin, D. Modeling the spatiotemporal cortical activity associated with the line-motion illusion in primary visual cortex. *PNAS* 102 (2005), no. 52, 18793-18800.
10. Cai, D.; Tao, L.; McLaughlin, D. An Embedded Network Approach for Scale-Up of Fluctuation- Driven Systems with Preservation of Spike Information. *PNAS* 101 (2004), no. 39, 14288-14293.
11. Cai, D.; Tao, L.; Shelley, M.; McLaughlin, D. An effective kinetic representation of fluctuation-driven neuronal networks with application to simple and complex cells in visual cortex. *PNAS* 101 (2004), no. 20, 7757-7762.
12. Tao, L.; Shelley, M.; McLaughlin, D.; Shapley, R. An egalitarian network model for the emergence of simple and complex cells in visual cortex. *PNAS* 101 (2004), no. 1, 366-371.
13. McLaughlin, D.; Shapley, R.; Shelley, M. Large-scale modeling of the primary visual cortex: influence of cortical architecture upon neuronal response. *J. Physiol. Paris* 97 (2003), no. 2-3, 237- 252.
14. McLaughlin, D.; Shapley, R.; Shelley, M.; Jin, J. High Conductance Dynamics of the Primary Visual Cortex. *Perspectives and Problems in Nonlinear Science: A celebratory volume in honor of Lawrence Sirovich*. Springer-Verlag, New York, 2003.
15. Cai, D.; McLaughlin, D.; McLaughlin, K. T. R. The Nonlinear Schrödinger Equation as both a PDE and a Dynamical System. *Handbook of Dynamical Systems, vol. 2*, 599-678. North-Holland, Amsterdam, 2002.
16. Shapley, R.; McLaughlin, D.; Shelley, M. Orientation Selectivity: models and neural mechanisms. *The Handbook of Brain Theory and Neural Networks*, 2nd ed. MIT Press, Cambridge, Mass., 2002.
17. Shelley, M.; McLaughlin, D. Coarse-grained reduction and analysis of a network model of Cortical Response: I. Drifting Grating Stimuli. *J. Comput. Neurosci.* 12 (2002), no. 2, 97-122.
18. Shelley M.; McLaughlin D.; Shapley R.; Wielaard J. States of high conductance in a large-scale model of the visual cortex. *J. Comput. Neurosci.* 13 (2002), no. 2, 93-109.

19. Cai, D.; Majda, A. J.; McLaughlin, D. W.; Tabak, E. G. Dispersive Wave Turbulence in One Dimension. *Physica D* 152-153 (2001), 551-572.
20. Cai, D.; McLaughlin, D.; Shatah, J. Spatiotemporal Chaos in Spatially Extended Systems. *Math. Comput. Simulation* 55 (2001), no. 4-6, 329-340.
21. Goodman, R.; Majda, A.; McLaughlin, D. Modulations in the Leading Edges of Midlatitude Storm Tracks. *SIAM J. Appl. Math.* 62 (2001), no. 3, 746-776.
22. McLaughlin, D.; Shapley, R.; Shelley, M.; Tao, L. Complex Cells in a Simple Cell Network Model of V1 Cortex. *Soc. Neurosci. (Abs)* 27 (2001).
23. Shapley, R.; McLaughlin, D.; Shelley, M.; Wielaard, J. Lateral Inhibition Generates Simple Cells in a Model of V1 Cortex. *Invest. Ophthalmol. Vis. Sci.* 42 (2001), Supp. #3901.
24. Wielaard, D.J.; Shelley, M.; McLaughlin, D.; Shapley, R. How Simple Cells are Made in a Nonlinear Network Model of the Visual Cortex. *J. Neurosci.* 21 (2001), no. 14, 5203-5211.
25. Cai, D.; McLaughlin, D. Chaotic and Turbulent Behavior of Unstable 1-D Nonlinear Dispersive Waves. *J. Math. Phys.* 41 (2000), no. 6, 4125-4153.
26. Chen, Y.; McLaughlin, D. Diffraction Effects on Diffusive Bistable Optical Arrays. *Physica D* 138 (2000), 163-195.
27. Forest, M. G.; Wright, O.; McLaughlin, D.; Muraki, D. Non-Focusing Instabilities in Coupled, Integrable Nonlinear Schrödinger PDE's. *Journal of Nonlinear Science* 10 (2000), 291-331.
28. Kim, S.; McLaughlin, D.; Potasek, M. Propagation of the Electromagnetic Field in Optical Limiting Reverse Saturable Absorbers. *Phys. Rev. A* 61 (2000), 025801-1 - 025801-4.
29. McLaughlin, D.; Shapley, R.; Shelley, M.; Wielaard, J. A Neuronal Network Model of the Macaque Primary Visual Cortex V1: Orientation Tuning and Dynamics in the Input Layer 4C. *Proc. Nat. Acad.* 97 (2000), no. 14, 8087-8092.
30. Potasek, M.; Kim, S.; McLaughlin, D. All Optical-Power Limiting. *J. Nonlinear Opt. Phys. Mater.* 9 (2000), 343-364.
31. Cai, D.; Majda, A.; McLaughlin, D.; Tabak, E. Spectral Bifurcations in Dispersive Wave Turbulence. *PNAS* 96 (1999), 14216-14221.
32. Cai, D.; McLaughlin, D.; Shatah, J. Spatial-Temporal Chaos and Effective Stochastic Dynamics for a Near Integrable Nonlinear System. *Phys. Lett. A* 253 (1999), 280-86.
33. Chen, Y.; McLaughlin, D. Focusing-Defocusing Effects for Diffusion Dominated Bistable Optical Arrays. *J. Opt. Soc. Am. B* 16 (1999), no. 7, 1087-1098.
34. Jin, S.; Levermore, D.; McLaughlin, D. The Semiclassical Limit of the Defocusing NLS Hierarchy. *Comm. Pure Appl. Math.* 52 (1999), no. 5, 613-654.

35. McLaughlin, D.; Shapley, R.; Shelley, M.; Wielaard, J. Modeling of Orientation Dynamics in Visual Cortex. *Soc. Neurosci. (Abs)* 25 (1999).
36. McLaughlin, D.; Shelley, M. Point Neuron and Mean Firing Rate Models of an Input Layer of the Primary Visual Cortex. Preprint, 1999.
37. McLaughlin, D. W.; Shatah, J. Homoclinic orbits for PDE's. *Recent advances in partial differential equations (Venice 1996)*, 281-299. Proceedings of Symposia in Applied Mathematics, 54. American Mathematical Society, Providence, R.I., 1998.
38. Bronski, J. C.; McLaughlin, D.; Shelley, M. On the Stability of Time-Harmonic Localized States in a Disordered Nonlinear Medium. *J. Statist. Phys.* 88 (1997), no. 5-6, 1077-1115.
39. Li, Y.; McLaughlin, D. Homoclinic Orbits and Chaos in Discretized Perturbed NLS Systems. I. Homoclinic Orbits. *J. Nonlinear Sci.* 7 (1997), no. 3, 211-269.
40. Majda, A.; McLaughlin, D. W.; Tabak, E. A One-Dimensional Model for Dispersive Wave Turbulence. *J. Nonlinear Sci.* 7 (1997), no. 1, 9-44.
41. Li, Y.; McLaughlin, D. W.; Shatah, J.; Wiggins, S. Persistent homoclinic orbits for a perturbed nonlinear Schrödinger equation. *Comm. Pure Appl. Math.* 49 (1996), no. 11, 1175--1255.
42. McLaughlin, D.; Muraki, D. J.; Shelley, M. Self-Focused Optical Structures in a Nematic Liquid Crystal. *Physica D* 97 (1996), no. 4, 471-497.
43. McLaughlin, D. W.; Overman, E. A., II; Wiggins, S.; Xiong, C. Homoclinic orbits in a four-dimensional model of a perturbed NLS equation: a geometric singular perturbation study. *Dynamics reported*, 190-287. Dynamics Reported: Expositions in Dynamical Systems (New Series), 5. Springer, Berlin, 1996.
44. McLaughlin, D.; Shatah, J. Melnikov Analysis for PDE's. *Dynamical systems and probabilistic methods in partial differential equations (Berkeley, CA, 1994)*, 51—100. Lectures in Applied Mathematics, 31. American Mathematical Society, Providence, RI, 1996.
45. Calini, A.; Ercolani, N. M.; McLaughlin, D.; Schober, C. M. Melnikov Analysis of Numerically Induced Chaos in the Nonlinear Schrödinger Equation. *Physica D* 89 (1995), 227-260.
46. McLaughlin, D. W. Whiskered tori and chaotic behavior in nonlinear waves. *Proceedings of the International Congress of Mathematicians, Vol. 1, 2 (Zürich, 1994)*, 1484—1493. Birkhäuser, Basel, 1995.
47. McLaughlin, D.; Muraki, D.; Shelley, M.; Wang, X. A Paraxial Model for Optical Self-Focusing in a Nematic Liquid-Crystal. *Physica D* 88 (1995), no. 1, 55-81.
48. McLaughlin, D. W.; Overman, E. A. Whiskered Tori for Integrable PDEs: Chaotic Behavior in Near Integrable PDEs. *Surveys in Applied Mathematics, vol. 1*, 83-203. Plenum, New York, 1994.

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52. McLaughlin, D. W.; Strain, J. A. Computing the weak limit of KdV. *Comm. Pure Appl. Math.* 47 (1994), no. 10, 1319-1364.
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54. Ercolani, N.; Forest, M. G.; McLaughlin, D.; Sinha, A. Strongly Nonlinear Modal Equations for Nearly Integrable PDEs. *J. Nonlinear Science* 3 (1993), 393-426.
55. McLaughlin, D. W. Whiskered tori for NLS equations. Important developments in soliton theory, 537-558. Springer Series in Nonlinear Dynamics. Springer, Berlin, 1993.
56. McLaughlin, D.; Ercolani, N.; Roitner, H. Attractors and transients for a perturbed periodic KdV equation: a nonlinear spectral analysis. *J. Nonlinear Sci.* 3 (1993), no. 4, 477-539.
57. McLaughlin, D.; Muraki, D. J.; Shelley, M. J. Light Interacting with Liquid Crystals. *Physica D* 68 (1993), no. 1, 116-126.
58. Ercolani, N.; Forest, M. G.; McLaughlin, D. W. Notes on Melnikov Integrals for Models of the Driven Pendulum Chain. Unpublished, 1992.
59. McLaughlin, D. W.; Schober, C. Chaotic and Homoclinic Behavior for Numerical Discretization of Nonlinear Schrödinger. *Physica D* 57 (1992), no. 3-4, 447-465.
60. Ercolani, N. M.; McLaughlin, D. W. Toward a topological classification of integrable PDEs. *The geometry of Hamiltonian systems (Berkeley, CA, 1989)*, 111-129. *Mathematical Sciences Research Institute Publications*, 22. Springer, New York, 1991.
61. McLaughlin, D. W.; Pironneau, O. Some Notes on Beltrami Fields in Cartesian Geometry. *J. Math. Phys.* 32 (1991), no. 3, 797-804.
62. Bishop, A. R.; Flesch, R.; Forest, M. G.; McLaughlin, D.; Overman, E. A. Correlations between Chaos in a Perturbed Sine-Gordon Equation and a Truncated Model System. *SIAM J. Math. Anal.* 21 (1990), 1511-1536.
63. Bishop, A. R.; Forest, M. G.; McLaughlin, D.; Overman, E. A. A Modal Representation of Chaotic Attractors for the Driven, Damped Pendulum Chain. *Phys. Lett. A* 144 (1990), no. 1, 17- 25.

64. Ercolani, N.; Forest, M. G.; McLaughlin, D.W. Geometry of the Modulational Instability. III. Homoclinic Orbits for the Periodic sine-Gordon Equation. *Physica D* 43 (1990), no. 2-3, 348-384.
65. Terrones, G.; McLaughlin, D. W.; Overman, E. A.; Pearlstein, A. J. Stability and Bifurcation of Spatially Coherent Solutions of the Damped-Driven NLS Equations. *SIAM J. Appl. Math.* 50 (1990), no. 3, 791-818.
66. Bishop, A.; McLaughlin, D.; Salerno, M. Global Coordinates for the Breather-Kink (Antikink) Sine-Gordon Phase Space: An Explicit Separatrix as a Possible Source of Chaos. *Phys. Rev. A* (3) 40 (1989), no. 11, 6463-6469.
67. Adachihara, H.; McLaughlin, D. W.; Moloney, J. V.; Newell, A. C. Solitary Waves as Fixed Points of Infinite Dimensional Maps in an Optical Bistable Ring Cavity: Analysis *J. Math. Phys.* 29 (1988), no. 1, 63-85.
68. Bishop, A.; Forest, M. G.; McLaughlin, D.; Overman, E. Quasiperiodic Route to Chaos in a Near-Integrable PDE: Homoclinic Crossings. *Phys. Lett. A* 127 (1988), no. 6-7, 335-340.
69. Chierchia, L.; Ercolani, N.; McLaughlin, D. On the Weak Limit of Rapidly Oscillating Waves. *Duke Math. J.* 55 (1987), 759-764.
70. Ercolani, N.; Forest, M. G.; McLaughlin, D. W.; Montgomery, R. Hamiltonian Structure for the Modulation Equations of a Sine-Gordon Wavetrain. *Duke Math. J.* 55 (1987), no. 4, 949-983.
71. Aceves, A.; Adachihara, H.; Jones, C.; Lerman, J. C.; McLaughlin, D. W.; Moloney, J. V.; Newell, A. C. Chaos and coherent structures in partial differential equations. (Santa Barbara, Calif., 1985) *Physica D* 18 (1986), no. 1-3, 85-112.
72. Bishop, A. R.; Forest, M. G.; McLaughlin, D. A Quasi-Periodic Route to Chaos in a Near-Integrable pde. (with A. R. Bishop, M. G. Forest, and E. A. Overman), *Physica* 23 D (1986), 293- 328.
73. Bishop, A.; Mavor, A.; McLaughlin, D. Phase-Pulling and Space-Time Complexity in an AC Driven Damped One-Dimensional Sine-Gordon System. *Phys. Lett. A* 119 (1986), no. 6, 273-279.
74. Bishop, A. R.; McLaughlin, D.; Overman, E. A. Coherence and Chaos in the Driven Damped Sine-Gordon Equation: Measurement of the Soliton Spectrum. *Physica D* 19 (1986), no. 1, 1-41.
75. Ercolani, N.; Forest, M. G.; McLaughlin, D. The Origin and Saturation of Modulational Instabilities Santa Barbara, Calif., 1985). *Physica D* 18 (1986), no. 1-3, 472-474.
76. Ercolani, N.; Forest, M. G.; McLaughlin, D. Modulational Instabilities of Periodic Sine-Gordon Waves: A Geometric Analysis. Nonlinear systems of partial differential equations in applied mathematics, Part 1 (Santa Fe, N.M., 1984), 149-166. Lectures in Applied Mathematics, 23. American Mathematical Society, Providence, R.I., 1986.

77. Ercolani, N.; Forest, M. G.; McLaughlin, D. Oscillations and Instabilities in Near Integrable PDEs. *Nonlinear systems of partial differential equations in applied mathematics, Part 1 (Santa Fe, N.M., 1984)*, 3-46. Lectures in Applied Mathematics, 23. American Mathematical Society, Providence, R.I., 1986.
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83. Cushman-Rosin, B.; Papanicolaou, G.; McLaughlin, D. W. Interactions Between Mean Flow and Finite-Amplitude Mesoscale Eddies in a Barotropic Ocean. *Geophys. Astrophys. Fluid Dynamics*, 29 (1984), no. 4, 333-353.
84. Ercolani, N.; Forest, M. G.; McLaughlin, D. Modulational Stability of Two Phase Sine Gordon Wavetrains. *Studies in Appl. Math.* 71 (1984), no. 2, 91-101.
85. Forest, M. G.; McLaughlin, D. W. Modulations of Perturbed KdV Wavetrains. *SIAM J. Appl. Math.* 44 (1984), no. 2, 287-300.
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