*Resume: January 15, 2016*

# Carl L. Gardner

*Academic Positions*

Arizona State University
Professor of Mathematics (1997–present)
Associate Professor of Mathematics (1994–97)
Duke University
Associate Professor of Computer Science (1990–94)
Assistant Professor of Computer Science (1986–90)
Courant Institute of Mathematical Sciences, New York University
Associate Research Scientist (1984–86)
Bowdoin College
Assistant Professor of Physics (1982–84)
Massachusetts Institute of Technology & Wellesley College
Physics Instructor (MIT) &
Assistant Professor of Physics (Wellesley) (1981/82)

*Visiting Academic Positions*

Rush University Medical College (Chicago)
Visiting Professor of Molecular Biophysics (nonresident, 1998–2008)
Physics and Astronomy Department, Arizona State University
CLAS Interdisciplinary Fellowship (Spring 2000)

*Education*

Massachusetts Institute of Technology
Ph.D. in Physics (1981), with minor in Mathematics
Graduate study in Physics & Mathematics (1976–81)
Duke University
Graduate study in Physics & Mathematics (1975)
University of Heidelberg
Fulbright Scholarship in Mathematics (1973/74)
Duke University
B.A. with Honors in Mathematics (1973)

*Major Grants*

National Science Foundation DMS-8804592, PI: David Schaeffer, Co-PIs: Robert Behringer and Carl Gardner, "Multidimensional Dynamic Problems in Plasticity," $447,000, January 1, 1989–December 31, 1991

National Science Foundation DMS-8905872, PI: Carl Gardner, "The Hydrodynamic Model for Semiconductor Devices: Theory and Computations," $37,000, August 1, 1989–January 31, 1992

Army Research Office DAAL03-91-G-0146, PI: Carl Gardner, "The Quantum Hydrodynamic Model for Semiconductor Devices," $89,700, May 1, 1991–October 31, 1994

National Science Foundation DMS-9201034, PI: David Schaeffer, Co-PIs: Robert Behringer, Carl Gardner, Tomasz Hueckel, and John Trangenstein, "Multidimensional Problems in Dynamic Plasticity," $334,000, October 1, 1992–September 30, 1995

National Science Foundation DMS-9204189/DMS-9496342, PI: Carl Gardner, "The Hydrodynamic Model for Semiconductor Devices: Theory, Computations, and Parallel Algorithms," $82,300, November 15, 1992–October 31, 1996

Army Research Office DAAH04-95-1-0122, PI: Carl Gardner, "The Quantum Hydrodynamic Model for Semiconductor Devices: Theory and Computations," $136,000, March 1, 1995–February 28, 1998

National Science Foundation INT-9603253, PI: Christian Ringhofer, Co-PI: Carl Gardner, "U.S.–German Cooperative Research: Quantum Fluid Dynamical Approaches to Solid State Transport Modeling," $24,000, May 1, 1997–April 30, 2000

National Science Foundation DMS-9706792, PI: Carl Gardner, Co-PI: Christian Ringhofer, "Numerical Simulation of Quantum Transport in Semiconductor Devices," $144,294, August 1, 1997–July 31, 2001

Rush University Medical College, PI: Carl Gardner, "Modeling of Biological Channels," $10,099, August 15, 2003–June 30, 2004

Space Telescope Science Institute (NASA) HST-GO-09863.06, PI: John Krist, Co-Is: Carl Gardner, Kevin Healy, Jeff Hester, Karl Stapelfeldt, and Alan Watson, "Evolution of Young Stellar Outflows: XZ Tauri and HH 30," $60,600, January 1, 2004–December 31, 2005.

National Science Foundation Division of Mathematical Sciences Infrastructure Program DMS-0421846, PIs: Renate Mittelmann and Rosemary Renaut, Co-PIs: Carl Gardner, Anne Gelb, Hans Mittelmann, and Christian Ringhofer, "Scientific Computing Research Environments in the Mathematical Sciences," $80,298, August 16, 2004–August 16, 2007

National Science Foundation DMS-0718308, PI: Steven Baer, Co-PIs: Sharon Crook, Carl Gardner, and Christian Ringhofer, "Multiscale Modeling of the Neural Subcircuits in the Outer-Plexiform Layer of the Retina," $300,000, September 1, 2007–August 31, 2011

National Science Foundation DMS-0703587, PI: Eric Kostelich, Co-PIs: Dieter Armbruster, Sharon Crook, Carl Gardner, Anne Gelb, Zdzislaw Jackiewicz, Don Jones, Juan Lopez, Alex Mahalov, Christian Ringhofer, and Bruno Welfert, "CSUMS: Undergraduate Research Experiences for Computational Math Sciences Majors at ASU," $1,100,000, 2007–2012.

*Ph.D. Students*

Michael Johnson (Mathematics), "Numerical Methods for Semiconductor Process Simulation in Two Spatial Dimensions: A Nonlinear Diffusion Problem with a Free Boundary," Duke University, May 1991

Feng Wang (Mathematics, with David Schaeffer), "Numerical Study of Granular Flow in a Converging Hopper," Duke University, May 1991

Freda Locklear (Mathematics, with Michael Reed), "A Numerical Study of Propagation of Singularities in Semilinear Hyperbolic Systems," Duke University, September 1991

Youngsoo Ha (Mathematics), "Numerical Methods for Supersonic Astrophysical Jets," Arizona State University, May 2003

Shaojie Chang (Mathematics, with Steven Baer), "Computational Study of the Cone-Horizontal Cell Feedback Mechanism in the Outer-Plexiform Layer of Cat Retina," Arizona State University, May 2012

Jeremiah Jones (Mathematics), "Numerical Simulation of the Ephaptic Effect in the Triad Synapse of the Retina," Arizona State University, May 2013

*Masters Students with Thesis*

Dina Selim (Computer Science), "Tensor Product Grid Implementation for PREDICT2," Duke University, May 1990

Justin Hernandez (Mathematics), "CLAWPACK Simulation of the Classical Hydrodynamic Model for Semiconductor Devices," Arizona State University, December 1999

*Major Service at Arizona State University*

Associate Director for Graduate Programs, SoMSS, July 2013–June 2015

Applied Mathematics Coordinator, Fall 2011–Spring 2013

Computer Committee, Fall 1994–Spring 1995, Fall 2003–Spring 2005, Fall 2011–Fall 2015

CSUMS Grant and Seminar, Fall 2007–Spring 2013

Graduate Committee, Fall 1997–Spring 1998, Fall 2011–Spring 2015; *Chair* Fall 2013–Spring 2015

Personnel and Budget Committee, Fall 1996–Spring 1997, Fall 1998–Spring 2000, Fall 2008–Spring 2011

Undergraduate Committee, Fall 2001–Spring 2003, Fall 2005–Spring 2008

*Conference/Workshop Organizer*

Fourth International Workshop on Computational Electronics, Tempe, AZ, October 30–November 1, 1995. Organizers: Carl Gardner, David Ferry, and Christian Ringhofer

International Workshop on Quantum Kinetic Theory, Breckenridge, Colorado, August 4–15, 1997. Organizers: Carl Gardner and Paul Zweifel

Minisymposium on Electrodiffusion Model of Cell Membrane Ionic Channels, SIAM Annual Meeting, San Diego, July 9, 2001. Organizers: Carl Gardner and Bob Eisenberg

Minisymposium on Modern Hyperbolic Methods for Semiconductor Device Modeling, SIAM Annual Meeting, San Diego July 13, 2001. Organizers: Carl Gardner and Anne Gelb

Minisymposium on Modern Hyperbolic Methods for Semiconductor Device Modeling and Astrophysical Jets, SIAM Conference on Computational Science & Engineering, San Diego, February 13, 2003. Organizer: Carl Gardner

CSCAMM (Center for Scientific Computation and Mathematical Modeling) Program on Analysis and Numerics for Modeling Semiconductor Devices and Biological Channels, University of Maryland, May 19–23, 2003. Organizers: Carl Gardner, Hailaing Liu, Peter Markowich, and Eitan Tadmor

Minisymposium on Electrical and Reaction-Diffusion Modeling of Biological Cells, SIAM Annual Meeting, San Diego, July 9, 2008. Organizer: Carl Gardner

Minisymposium on Electrodiffusion Modeling of Ionic Flows in Biological Cells, ICIAM Meeting, Vancouver, July 21, 2011. Organizer: Carl Gardner

Minisymposium on Modeling Ionic Flows in Biological Cells, Society for Mathematical Biology Annual Meeting, Tempe, AZ, June 10, 2013. Organizer: Carl Gardner

Minisymposium on Hierarchy of Models for Computational Neuroscience, SIAM Computational Science & Engineering Conference, Salt Lake City, March 16, 2015. Organizer: Carl Gardner

*Invited Talks While at ASU*

"Quantum Hydrodynamic Simulation of the Resonant Tunneling Diode," International Conference on Hyperbolic Conservation Laws, State University of New York, Stony Brook (6-12-94)

"The Smooth Effective Potential for the Quantum Hydrodynamic Model," First International Workshop on Quantum Kinetic Theory, University of Victoria (8-28-95)

"The Quantum Hydrodynamic Smooth Effective Potential," International Workshop on Computational Electronics, Arizona State University (10-30-95)

"The Smooth Quantum Hydrodynamic Model for Semiconductor Devices," Invited Minisymposium on Mesoscopic Modelings and Simulations of Hydrodynamic Phenomena, SIAM Annual Meeting, Kansas City (7-26-96)

"The Classical and Quantum Hydrodynamic Models for Semiconductor Devices," Mathematics Seminar, University of Delaware (2-18-97)

"The Smooth Quantum Hydrodynamic Model for Semiconductor Devices," ARO Principal Investigators Conference, Army Research Office, Research Triangle Park, NC (2-26-97)

"Smooth Quantum Hydrodynamic Model Simulation of the Resonant Tunneling Diode," International Workshop on Computational Electronics, University of Notre Dame (5-29-97)

"Theory and Simulation of the Smooth Quantum Hydrodynamic Model," Second International Workshop on Quantum Kinetic Theory, Breckenridge, CO (8-11-97)

"The Smooth Quantum Hydrodynamic Model (for Semiconductor Devices)," Mathematics Seminar, Northwestern University (12-2-97)

"Electrodiffusion Model of Rectangular Current Pulses in the Cellular Membrane Channel," Applied Mathematics Seminar, University of Texas, Austin (2-5-98)

"The Smooth Quantum Hydrodynamic Model (for Semiconductor Devices)," Applied Mathematics Seminar, University of Texas, Austin (2-6-98)

"Electrodiffusion Model of Rectangular Current Pulses in the Cellular Membrane Channel," Biophysical Society Annual Meeting, Kansas City (2-26-98)

"The Smooth Quantum Hydrodynamic Model for Semiconductor Devices," Fifth International Workshop on Mathematical Aspects of Fluid and Plasma Dynamics, Wailea, Maui (June 28–July 3, 1998) (7-2-98)

"Numerical Simulation of Rectangular Current Pulses in Ionic Channels of Cellular Membranes," Mathematics Seminar, Northwestern University (10-5-98)

"The Smooth Quantum Hydrodynamic Model (for Semiconductor Devices)," Mathematics Seminar, University of California, Santa Barbara (1-15-99)

"Modeling and Simulation of Resonant Tunneling Diodes," SIAM Mathematics in Industry Workshop, Claremont Colleges (6-18-99)

"Hyperbolic Conservation Laws for Quantum Transport (in Semiconductor Devices)," Applied Mathematics Seminar, Stanford University (10-29-99)

"Applications of Compressible Fluid Dynamics: Electron Flow in Semiconductor Devices, Ion Flow in Biological Channels, and Gasdynamical Flows in Astrophysics," Mathematics Colloquium, University of California, San Diego (3-2-00)

"Electrodiffusion Model Simulation of Rectangular Current Pulses in a Voltage-Biased Biological Channel," Applied Mathematics Seminar, Northwestern University (4-7-00)

"Dispersive/Hyperbolic Hydrodynamic Models for Quantum Transport (in Semiconductor Devices)," IMA Program on Dispersive Corrections to Transport Equations, Institute for Mathematics and its Applications, University of Minnesota (5-1-00)

"Simulation of Rectangular Current Pulses in a Voltage Biased Biological Channel," Minisymposium on Electrodiffusion Model of Cell Membrane Ionic Channels, SIAM Annual Meeting, San Diego (7-9-01)

"The Electrogasdynamics Model for Semiconductor Devices," Minisymposium on Modern Hyperbolic Methods for Semiconductor Device Modeling, SIAM Annual Meeting, San Diego (7-13-01)

"A Comparison of Modern Finite-Difference Hyperbolic Methods for Nonlinear Conservation Laws, with Applications to Astrophysical Jets and Semiconductor Devices," Scientific Computing Seminar, Department of Applied Mathematics, Brown University (4-19-02)

"An Overview of Semiconductor Device Modeling and Astrophysical Jets," Minisymposium on Modern Hyperbolic Methods for Semiconductor Device Modeling and Astrophysical Jets, SIAM Conference on Computational Science & Engineering, San Diego (2-13-03)

"Recent Results for (1) The Smooth Quantum Hydrodynamic Model for Semiconductor Devices, & (2) An Electrodiffusion Model of the Biological Channel," CSCAMM Program on Analysis and Numerics for Modeling Semiconductor Devices and Biological Channels, University of Maryland (5-19-03)

"Hydrodynamic vs. Kinetic Theory Approaches to Semiconductor Device Modeling," CSCAMM Program on Analysis and Numerics for Modeling Semiconductor Devices and Biological Channels, University of Maryland (5-20-03)

"Electrodiffusion Model Simulation of Ionic Channels," Gating in Biological Channels Workshop, Rush University Medical Center (8-19-03)

"Electrodiffusion Model Simulation of Ionic Channels," Workshop on Channels: A Specific Inverse Problem in Molecular Biology, Institute for Pure and Applied Mathematics, UCLA (10-24-03)

"Electrodiffusion Model Simulation of Ionic Channels," Workshop on Quantum and Many Body Effects in Nanoscale Devices, Arizona State University (10-25-03)

"Numerical Simulation of High Mach Number Astrophysical Jets," Conference on Analysis, Modeling and Computation of Hyperbolic PDE and Multiphase Flow, University at Stony Brook (8-4-04)

Chi-Wang Shu and Carl Gardner, "High Order Weighted Essentially Non-Oscillatory (WENO) Schemes and Their Application in Cosmological Simulations," IPAM Workshop I: Astrophysical Fluid Dynamics, UCLA (4-9-05)

Carl Gardner and Christian Ringhofer, "Applications of Maximum Entropy Closures to Device Simulation," SEMIC 2006, Recent Advances in Modeling and Simulation of Semiconductor Devices, Technical University of Vienna (2-16-06)

"Electrodiffusion Model Simulation of Ionic Channels," Institute Seminar, Indiana University (10-25-06)

"Numerical Methods for Electro-Reaction-Diffusion Modeling of Biological Cells," Minisymposium on Electrical and Reaction-Diffusion Modeling of Biological Cells, SIAM Annual Meeting, San Diego (7-9-08)

"Electrodiffusion Modeling and the Retina," Minisymposium on Electrodiffusion in Biophysics: Mathematical Modeling and Numerical Simulations, SIAM Annual Meeting, Denver (7-10-09)

"Modeling Ionic Flow in Biological Cells," Applied Mathematics Seminar, Northwestern University (2-12-10)

"Modeling Ionic Flow in the Retina," Minisymposium on Electrodiffusion Modeling of Ionic Flows in Biological Cells, ICIAM Meeting, Vancouver (7-21-11)

"Simulation of the Ephaptic Effect in the Cone-Horizontal Cell Synapse of the Retina," Applied Mathematics Modeling and Computation Seminar, University of Arizona (10-11-12)

"Simulation of the Ephaptic Effect in the Cone-Horizontal Cell Synapse of the Retina," Minisymposium on Modeling Ionic Flows in Biological Cells, Society for Mathematical Biology Annual Meeting, Tempe, AZ (6-10-13)

"Numerical Simulation of High Mach Number Astrophysical Jets with Radiative Cooling," Mathematics Department Colloquium, University of Arizona (10-2-14)

Carl Gardner and Jeremiah Jones, "Simulation of the Ephaptic Effect in the Cone-Horizontal Cell Synapse of the Retina," Minisymposium on A Hierarchy of Models for Computational Neuroscience, SIAM Computational Science & Engineering Conference, Salt Lake City (3-16-15)

"Drift-Diffusion Simulation of the Ephaptic Effect in the Triad Synapse of the Retina," IMA Hot Topics Workshop on Mathematics of Biological Charge Transport: Molecules and Beyond, Institute for Mathematics and its Applications, University of Minnesota (7-23-15)

## *Refereed Publications*

*Edited Volumes*

*VLSI Design* **6**, Numbers 1–4 (1998) 1–412. Special Issue on Computational Electronics.

*VLSI Design* **9**, Number 4 (1999) 315–434. Special Issue on Quantum Kinetic Theory.

*VLSI Design* **10**, Number 4 (2000) 335–529. Special Issue on Semiconductor Device Modeling and Simulation.

*VLSI Design* **15**, Number 4 (2002) 679–759. Special Issue on Semiconductor Device Modeling.

*Refereed Articles*

(1) "The 't Hooft-Polyakov Monopole Near the Prasad-Sommerfield Limit," C. L. Gardner, *Annals of Physics* **146** (1983) 129–148.

(2) "Stable Grand-Unified Monopoles With Multiple Dirac Charge," C. L. Gardner and J. A. Harvey, *Physical Review Letters* **52** (1984) 879–882.

(3) "Self-Dual SU(5) Monopole Solutions," C. L. Gardner, *Physics Letters B* **142** (1984) 379–382.

(4) "Supersonic Interface Instabilities of Accelerated Surfaces and Jets," C. L. Gardner, *Physics of Fluids* **29** (1986) 690–695.

(5) "A Study of Chaos and Mixing in Rayleigh-Taylor and Richtmyer-Meshkov Unstable Interfaces," C. L. Gardner, J. Glimm, J. Grove, O. McBryan, R. Menikoff, D. H. Sharp, and Q. Zhang, *Nuclear Physics B* **2** (1987) 441–452.

(6) "The Dynamics of Bubble Growth for Rayleigh-Taylor Unstable Interfaces," C. L. Gardner, J. Glimm, O. McBryan, R. Menikoff, D. H. Sharp, and Q. Zhang, *Physics of Fluids* **31** (1988) 447–465.

(7) "Numerical Methods for the Hydrodynamic Device Model: Subsonic Flow," C. L. Gardner, J. W. Jerome, and D. J. Rose, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* **8** (1989) 501–507.

(8) "Two Dimensional Process Simulation Using Verified Phenomenological Models," R. B. Fair, C. L. Gardner, M. J. Johnson, S. W. Kenkel, D. J. Rose, J. E. Rose, and R. Subrahmanyan, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* **10** (1991) 643–651.

(9) "Numerical Simulation of a Steady-State Electron Shock Wave in a Submicrometer Semiconductor Device," C. L. Gardner, *IEEE Transactions on Electron Devices* **38** (1991) 392–398.

(10) "Simulation of a Steady-State Electron Shock Wave in a Submicron Semiconductor Device Using High-Order Upwind Methods," E. Fatemi, C. L. Gardner, J. W. Jerome, S. Osher, and D. J. Rose, in *Computational Electronics: Semiconductor Transport and Device Simulation*, pp. 27–32. Boston: Kluwer Academic Publishers, 1991.

(11) "A Parallel Block Iterative Method for the Hydrodynamic Device Model," C. L. Gardner, P. J. Lanzkron, and D. J. Rose, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* **10** (1991) 1187–1192.

(12) "Upwind Simulation of a Steady-State Electron Shock Wave in a Submicron Semiconductor Device," C. L. Gardner, in *Viscous Profiles and*

*Numerical Methods for Shock Waves*, pp. 21–31. Philadelphia: SIAM, 1991.

(13) "Steady-State Computations of Granular Flow in an Axisymmetric Hopper," F. Wang, C. L. Gardner, and D. G. Schaeffer, *SIAM Journal on Applied Mathematics* **52** (1992) 1076–1088.

(14) "An Interface Method for Semiconductor Process Simulation," M. J. Johnson and C. L. Gardner, in *Semiconductors*, IMA Volumes in Mathematics and its Applications, Volume 58, pp. 33–47. New York: Springer-Verlag, 1993.

(15) "Shock Waves in the Hydrodynamic Model for Semiconductor Devices," C. L. Gardner, in *Semiconductors*, IMA Volumes in Mathematics and its Applications, Volume 59, pp. 123–134. New York: Springer-Verlag, 1993.

(16) "Hydrodynamic and Monte Carlo Simulation of an Electron Shock Wave in a One Micrometer $n^+ - n - n^+$ Diode," C. L. Gardner, *IEEE Transactions on Electron Devices* **40** (1993) 455–457.

(17) "The ENO Method for the Hydrodynamic Model for Semiconductor Devices," C. L. Gardner, J. W. Jerome, and C.-W. Shu, in *High Performance Computing, 1993: Grand Challenges in Computer Simulation*, pp. 96–101. San Diego: The Society for Computer Simulation, 1993.

(18) "The Classical and Quantum Hydrodynamic Models," C. L. Gardner, in *Proceedings of the International Workshop on Computational Electronics*, pp. 25–36. Leeds: University of Leeds, 1993.

(19) "The Quantum Hydrodynamic Model for Semiconductor Devices," C. L. Gardner, *SIAM Journal on Applied Mathematics* **54** (1994) 409–427.

(20) "Numerical Simulation of Uniaxial Compression of a Granular Material with Wall Friction," C. L. Gardner and D. G. Schaeffer, *SIAM Journal on Applied Mathematics* **54** (1994) 1676–1692.

(21) "Resonant Tunneling in the Quantum Hydrodynamic Model," C. L. Gardner, *VLSI Design* **3** (1995) 201–210.

(22) "Quantum Hydrodynamic Simulation of Hysteresis in the Resonant Tunneling Diode," Z. Chen, B. Cockburn, C. L. Gardner, and J. W. Jerome, *Journal of Computational Physics* **117** (1995) 274–280.

(23) "Smooth Quantum Potential for the Hydrodynamic Model," C. L. Gardner and C. Ringhofer, *Physical Review E* **53** (1996) 157–167.

(24) "The Quantum Hydrodynamic Smooth Effective Potential," C. L. Gardner and C. Ringhofer, *VLSI Design* **6** (1998) 17–20.

(25) "Approximation of Thermal Equilibrium for Quantum Gases with Discontinuous Potentials and Application to Semiconductor Devices," C. L. Gardner and C. Ringhofer, *SIAM Journal on Applied Mathematics* **58** (1998) 780–805.

(26) "Smooth Quantum Hydrodynamic Model Simulation of the Resonant Tunneling Diode," C. L. Gardner and C. Ringhofer, *VLSI Design* **8** (1998) 143–146.

(27) "Theory and Simulation of the Smooth Quantum Hydrodynamic Model," C. L. Gardner, *VLSI Design* **9** (1999) 351–356.

(28) "Electrodiffusion Model of Rectangular Current Pulses in Ionic Channels of Cellular Membranes," C. L. Gardner, J. W. Jerome, and R. S. Eisenberg, *SIAM Journal on Applied Mathematics* **61** (2000) 792–802.

(29) "Numerical Simulation of the Smooth Quantum Hydrodynamic Model for Semiconductor Devices," C. L. Gardner and C. Ringhofer, *Computer Methods in Applied Mechanics and Engineering* **181** (2000) 393–401.

(30) "Resonant Tunneling in the Smooth Quantum Hydrodynamic Model for Semiconductor Devices," C. L. Gardner and C. Ringhofer, *Transport Theory and Statistical Physics* **29** (2000) 563–570.

(31) "The Chapman-Enskog Expansion and the Quantum Hydrodynamic Model for Semiconductor Devices," C. L. Gardner and C. Ringhofer, *VLSI Design* **10** (2000) 415–435.

(32) "Electrodiffusion Model Simulation of Rectangular Current Pulses in a Voltage Biased Biological Channel," C. L. Gardner, J. W. Jerome, and R. S. Eisenberg, *Journal of Theoretical Biology* **219** (2002) 291–299.

(33) "Primordial Inflation and Present-Day Cosmological Constant from Extra Dimensions," C. L. Gardner, hep-th/0105295, *Physics Letters B* **524** (2002) 21–25.

(34) "A Comparison of Modern Hyperbolic Methods for Semiconductor Device Simulation: NTK Central Scheme vs. CLAWPACK," C. L. Gardner, A. Gelb, and J. Hernandez, *VLSI Design* **15** (2002) 721–728.

(35) "Electrodiffusion Model Simulation of Rectangular Current Pulses in a Biological Channel," C. L. Gardner, J. W. Jerome, and R. S. Eisenberg, *Journal of Computational Electronics* **1** (2002) 347–351.

(36) "A Comparison of Resonant Tunneling Based on Schrödinger's Equation and Quantum Hydrodynamics," N. Ben Abdallah, O. Pinaud, C. L. Gardner, and C. Ringhofer, *VLSI Design* **15** (2002) 695–700.

(37) "Effective Potentials and Quantum Fluid Models: A Thermodynamic Approach," C. Ringhofer, C. L. Gardner, and D. Vasileska, *International Journal of High Speed Electronics and Systems* **13** (2003) 771–801.

(38) "Semiconductor Device Simulation: The Hydrodynamic Model," C. L. Gardner, *IEEE Potentials* **22** (2003) 17–19.

(39) "Cosmological Variation of the Fine Structure Constant from an Ultra-Light Scalar Field: The Effects of Mass," C. L. Gardner, astro-ph/0305080, *Physical Review D* **68** (2003) 043513.

(40) "Dispersive/Hyperbolic Hydrodynamic Models for Quantum Transport (in Semiconductor Devices)," C. L. Gardner and C. Ringhofer, in *Dispersive Transport Equations and Multiscale Models*, IMA Volumes in Mathematics and its Applications, Volume 136, pp. 91–106. New York: Springer-Verlag, 2004.

(41) "Electrodiffusion Model Simulation of Ionic Channels: 1D Simulations," C. L. Gardner, W. Nonner, and R. S. Eisenberg, *Journal of Computational Electronics* **3** (2004) 25–31.

(42) "Smooth Quantum Hydrodynamic Model vs. NEMO Simulation of Resonant Tunneling Diodes," C. L. Gardner, G. Klimeck, and C. Ringhofer, *Journal of Computational Electronics* **3** (2004) 95–102.

(43) "Numerical Simulation of High Mach Number Astrophysical Jets with Radiative Cooling," Y. Ha, C. L. Gardner, A. Gelb, and C.-W. Shu, *Journal of Scientific Computing* **24** (2005) 29–44.

(44) "Quintessence and the Transition to an Accelerating Universe," C. L. Gardner, astro-ph/0407604, *Nuclear Physics B* **707** (2005) 278–300.

(45) "Positive Scheme Numerical Simulation of High Mach Number Astrophysical Jets," Y. Ha and C. L. Gardner, *Journal of Scientific Computing* **34** (2008) 247–259.

(46) "A Multi-Epoch *HST* Study of the Herbig-Haro Flow from XZ Tauri," J. E. Krist, K. R. Stapelfeldt, J. J. Hester, K. Healy, S. J. Dwyer, and C. L. Gardner, arXiv:0809.2073, *The Astronomical Journal* **136** (2008) 1980–1994.

(47) "Numerical Simulation of the XZ Tauri Supersonic Astrophysical Jet," C. L. Gardner and S. J. Dwyer, *Acta Mathematica Scientia* **29B** (2009) 1677–1683.

(48) "Electrodiffusion Model Simulation of the Potassium Channel," C. L. Gardner and J. R. Jones, *Journal of Theoretical Biology* **291** (2011) 10–13.

(49) "Numerical Simulation of Axion Quintessence," C. L. Gardner, arXiv: 1001.2221, *Advances in Mathematical Physics* (2012) 368121.

(50) "A Simple Spatiotemporal Rabies Model for Skunk and Bat Interaction in Northeast Texas," R. K. Borchering, H. Liu, M. C. Steinhaus, C. L. Gardner, and Y. Kuang, *Journal of Theoretical Biology* **314** (2012) 16–22.

(51) "Simulation of the Ephaptic Effect in the Cone-Horizontal Cell Synapse of the Retina," C. L. Gardner, J. R. Jones, S. M. Baer, and S. Chang, *SIAM Journal on Applied Mathematics* **73** (2013) 636–648.

(52) "Drift-Diffusion Simulation of the Ephaptic Effect in the Triad Synapse of the Retina," C. L. Gardner, J. R. Jones, S. M. Baer, and S. M. Crook, *Journal of Computational Neuroscience* **38** (2015) 129–142.

(53) "Numerical Simulation of the SVS 13 Micro-Jet and Bow Shock Bubble," C. L. Gardner, J. R. Jones, and K. W. Hodapp, *The Astrophysical Journal*, under revision.

(54) "A Computational Study of Background-Induced Flicker Enhancement and Feedback Mechanisms in Vertebrate Outer Retina: Temporal Properties," S. M. Baer, S. Chang, S. M. Crook, C. L. Gardner, J. R. Jones, R. F. Nelson, C. Ringhofer, and D. Zela, submitted.