

# Robert E. Rudd

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## EXPERIENCE

- Physicist**, Lawrence Livermore National Laboratory, Livermore, CA 2000-now  
Conducting theoretical and numerical research on mesoscopic elastic dynamics and multiscale simulation of the mechanics of materials. Research focuses on the mechanical behavior of sub-micron MEMS, nanoscale plasticity and fracture, and cell mechanics. (Indefinite career appointment, 2004-now) LLNL LDRD/ER/SI committee member, 2004-now (Chair, 2007-now). **Deputy Group Leader**, 2002-2011. **Academic Director**, CCMS Summer Institute, 2002-2004. **Group Leader**, 2011-now.
- Departmental Lecturer in Modelling of Materials**, Oxford University, Oxford, UK 1998-2000  
(Also Senior Research Fellow at Linacre College) Conducted theoretical and numerical research on mesoscopic elastic dynamics and multiscale simulation of the mechanics of materials. Gave lecture courses and tutorials on undergraduate materials science and computing. Served on the Governing Body of Linacre College and the Steering Committee of the Materials Modelling Laboratory.
- Research Physicist** (Consultant), SFA, Inc. at Naval Research Lab, Washington DC 1996-98  
Conducted theoretical research on micromachines and superconductivity. Invented Coarse-Grained Molecular Dynamics, extending atomistic simulation through a coupling of length scales (with J.Q.Broughton). Developed multiscale materials simulations using parallel (MPI) codes on IBM SP2s. Developed the theory of Single Spin Superconductivity, the superconducting state of half-metallic antiferromagnets (with W.E.Pickett). Prepared critical reviews of theoretical nuclear physics proposals.
- Post-Doctoral Fellow in Physics**, Rutgers University, Piscataway, NJ 1992-95  
Developed new analytic and exact hybrid numerical/analytic techniques for the strong (nuclear) interactions in the low-energy confined phase. Proposed the topological QCD string. Studied the behavior of ultra-strong gravitational shock waves using an exact string calculation. Computed anomalous correlations in 2D turbulence.
- Research and Teaching Assistant**, Princeton University, Princeton, NJ 1990-92  
Conducted string theory research. Assisted in Quantum Mechanics and E&M courses.
- Consultant**, Solid State Theory Group, Naval Research Lab, Washington, DC 1987  
Computed metal oxide LAPW band structures under extreme pressure. (Summer job)
- Summer Intern**, Surface Physics Group, Night Vision Lab, Ft. Belvoir, VA 1982-83  
Studied narrow band gap semiconductors using Auger and Hall effect methods. 1985-86  
Co-discovered the aluminum oxide passivation technique for Mercad Telluride.
- Consultant**, PRC at NASA Headquarters, Washington, DC 1984  
Assisted in graphics development and VAX systems programming. (Summer job)

## EDUCATION

- Ph.D. in Physics Princeton University Advisor: David J. Gross 1992  
M.A. in Physics Princeton University 1989  
B.S. in Physics and Math University of Virginia (Highest Distinction, GPA 4.0) . 1987

## REFEREED PUBLICATIONS

1. R. F. Smith, J. H. Eggert, **R. E. Rudd**, D. C. Swift, C. A. Bolme, and G. W. Collins, “[High strain-rate plastic flow in Al and Fe](#),” *J. Appl. Phys.* **110**, 123515 (2011).
2. B. Lee and **R. E. Rudd**, “[Size-dependent Si nanowire mechanics are invariant to changes in the surface state](#),” *Phys. Rev. B* **84**, 161303(R) (2011).
3. **R. E. Rudd**, T. C. Germann, B. A. Remington, and J. S. Wark, “[Metal Deformation and Phase Transitions at Extremely High Strain Rates](#),” *MRS Bull.* **35**, 999-1006 (2010), cover article.
4. B. Lee, **R. E. Rudd**, J. E. Klepeis, “[Using alloying to promote the subtle rhombohedral phase transition in vanadium](#),” *J. Phys: Condens. Matter* **22**, 465503 (2010).
5. H.-S. Park, K. T. Lorenz, R. M. Cavallo, S. M. Pollaine, S. T. Prisbrey, **R. E. Rudd**, R. C. Becker, J. V. Bernier, and B. A. Remington, “[Reply to comment on Viscous Rayleigh-Taylor Instability Experiments at High Pressure and Strain Rate](#),” *Phys. Rev. Lett.* **105**, 179602 (2010).
6. H.-S. Park, B. A. Remington, R. C. Becker, J. V. Bernier, R. M. Cavallo, K. T. Lorenz, S. M. Pollaine, S. T. Prisbrey, **R. E. Rudd**, and N. R. Barton, “[Strong Stabilization of the Rayleigh-Taylor Instability by Material Strength at Megabar Pressure](#),” *Phys. Plasmas* **17**, 056314 (2010).
7. J.-H. P. Klepeis, H. Cynn, W. J. Evans, **R. E. Rudd**, L. H. Yang, H. P. Liermann, and W. Yang , “[Diamond Anvil Cell Measurement of High-Pressure Yield Strength of Vanadium using In-Situ Thickness Determination](#),” *Phys. Rev. B* **81**, 134107 (2010).
8. H.-S. Park, K. T. Lorenz, R. M. Cavallo, S. M. Pollaine, S. T. Prisbrey, **R. E. Rudd**, R. C. Becker, J. V. Bernier, and B. A. Remington, “[Viscous Rayleigh-Taylor Instability Experiments at High Pressure and Strain Rate](#),” *Phys. Rev. Lett.* **104**, 135504 (2010).
9. M. J. Allen, **R. E. Rudd**, M. W. McElfresh, and R. Balhorn, “[Time-Dependent Measure of a Nano-Scale Force-Pulse Driven by the Axonemal Dynein Motors in Individual Live Sperm Cells](#),” *Nanomedicine* **6**, 510-515 (2010), and cover.
10. **R.E. Rudd**, “[Void Growth in BCC Metals Simulated with Molecular Dynamics using the Finnis-Sinclair Potential](#),” *Philos. Mag.* **89**, 3133-3161 (2009). [arXiv:0906.0619](#)
11. M. Barham, D. White, D. J. Steigmann, and **R. E. Rudd**, “[Finite Element Modeling of the Deformation of a Thin Magnetoelastic Film Compared to a Membrane Model](#),” *IEEE Trans. Magnetics* **45**, 4124-4127 (2009).
12. **R. E. Rudd**, “[High-rate Plastic Deformation of Nanocrystalline Tantalum to Large Strains: Molecular Dynamics Simulation](#),” *Mater. Sci. Forum* **633-634**, 3-19 (2010). [arXiv:0902.4491](#)
13. D. K. Bradley, J. H. Eggert, R. F. Smith, S. T. Prisbrey, D. G. Hicks, D. G. Braun, J. Biener, A. V. Hamza, **R. E. Rudd**, and G. W. Collins, “[Diamond at 800 GPa](#),” *Phys. Rev. Lett.* **102**, 075503 (2009).
14. **R. E. Rudd** and J. E. Klepeis, “[Multiphase Improved Steinberg-Guinan Model for Vanadium](#),” *J. Appl. Phys.* **104**, 093528 (2008).
15. M. Barham, D. J. Steigmann, M. McElfresh, and **R. E. Rudd**, “[Limit-point instability of a magnetoelastic membrane in a stationary magnetic field](#),” *Smart Materials and Structures* **17**, 055003 (2008).
16. B. W. Reed, M. Kumar, R. W. Minich, and **R. E. Rudd**, “[Fracture Roughness Scaling and its Correlation with Grain Boundary Network Structure](#),” *Acta Mater.* **56**, 3278-3289 (2008).
17. B. Lee, **R. E. Rudd**, J. E. Klepeis, and R. Becker, “[Elastic constants and volume changes associated with two high-pressure rhombohedral phase transformations in vanadium](#),” *Phys. Rev. B* **77**, 134105 (2008). [arXiv:0711.4383](#)
18. **R. E. Rudd** and B. Lee, “[Mechanics of Silicon Nanowires: Size-dependent elasticity from](#)

- first principles," Mol. Sim. **34**, 1-8 (2008).
- 19. **R. E. Rudd**, E. T. Seppala, L. M. Dupuy and J. Belak, "Void Coalescence Processes Quantified through Atomistic and Multiscale Simulation," J. Computer-Aided Mater. Design **14**, 425-434 (2007).
  - 20. B. Lee, **R. E. Rudd**, J. E. Klepeis, P. Soderlind, and A. Landa, "Theoretical confirmation of a high-pressure rhombohedral phase in vanadium metal," Phys. Rev. B **75**, 180101(R) (2007).
  - 21. B. Lee and **R. E. Rudd**, "First-principles calculation of mechanical properties of Si <001> nanowires and comparison to nanomechanical theory," Phys. Rev. B **75**, 195328 (2007) [cond-mat/0702531](#). (also featured in Virtual Journal of Nanoscale Science & Technology, June 4, 2007).
  - 22. M. Barham, D. J. Steigmann, M. McElfresh and **R. E. Rudd**, "Finite deformation of a pressurized magnetoelastic membrane in a stationary dipole field," Acta Mech. **191**, 1-19 (2007).
  - 23. B. Lee and **R. E. Rudd**, "First principles study of the Young's modulus of Si <001> nanowires," Phys. Rev. B **75**, 041305(R) (2007).
  - 24. **R. E. Rudd**, G.A.D. Briggs, A.P. Sutton, G. Medieros-Ribiero and R.S. Williams, "Equilibrium Distributions and the Nanostructure Diagram for Epitaxial Quantum Dots," J. Comput. Theor. Nanosci. **4**, 335-347 (2007). (invited)
  - 25. **R. E. Rudd**, D. R. Mason and A. P. Sutton, "Lanczos and Recursion Techniques for Multiscale Kinetic Monte Carlo Simulations," Prog. Mater. Sci. **52**, 319-332 (2007).
  - 26. E. M. Bringa, K. Rosolankova, **R. E. Rudd**, B.A. Remington, J. S. Wark, M. Duchaineau, D. H. Kalantar, J. Hawreliak, and J. Belak, "Shock deformation of face-centred-cubic metals on subnanosecond time scales," Nature Materials **5**, 805-809 (2006), and cover.
  - 27. J. S. Wark, **R. E. Rudd** et al., "Picosecond x-ray diffraction studies of shocked single crystals," Proc. SPIE **6261**, 62610T (2006).
  - 28. J. W. Tringe, D. S. Clague, J. V. Candy, A. K. Sinensky, C. Lee, **R. E. Rudd**, A. K. Burnham, "Model-based Processing of Microcantilever Sensor Arrays," IEEE JMEMS **15**, 1379-1391 (2006).
  - 29. A. Arsenlis, N. R. Barton, R. Becker and **R. E. Rudd**, "Generalized in situ adaptive tabulation for constitutive model evaluation in plasticity," Computer Methods in Applied Mechanics and Engineering **196**, 1-13 (2006).
  - 30. L. M. Dupuy and **R. E. Rudd**, "Surface identification, meshing and analysis during large molecular dynamics simulations," Modelling Simul. Mater. Sci. Eng. **14**, 229-251 (2006), and cover illustration.
  - 31. T. V. Ratto, **R. E. Rudd**, K. C. Langry, R. L. Balhorn and M. W. McElfresh, "Nonlinearly Additive Forces in Multivalent Ligand Binding to a Single Protein Revealed with Force Spectroscopy," Langmuir **22**, 1749-1757 (2006).
  - 32. **R. E. Rudd** and J. Q. Broughton, "Coarse-grained molecular dynamics: Nonlinear finite elements and finite temperatures," Phys. Rev. B **72**, 144104 (2005). [cond-mat/0508527](#)
  - 33. K. C. Langry, T. V. Ratto, **R. E. Rudd** and M. W. McElfresh, "The AFM Measured Force Required to Rupture the Dithiolate Linkage of Thioctic Acid to Gold Is Less than the Rupture Force of a Simple Gold-Alkyl Thiolate Bond," Langmuir **21**, 12064-12067 (2005).
  - 34. E. T. Seppala, J. Belak, and **R. E. Rudd**, "Three-dimensional molecular dynamics simulations of void coalescence during dynamic fracture of ductile metals," Phys. Rev. B **71**, 064112 (2005).
  - 35. E. T. Seppala, J. Belak, and **R. E. Rudd**, "The onset of void coalescence during dynamic fracture of ductile metals," Phys. Rev. Lett. **93**, 245503 (2004).
  - 36. E. M. Bringa, J. U. Cazamias, P. Erhart, J. Stolken, N. Tanushev, B. D. Wirth, **R. E. Rudd**

- and M. J. Caturla, “[Atomistic shock Hugoniot simulation of single-crystal copper](#),” *J. Appl. Phys.* **96**, 3793-3799 (2004).
37. **R. E. Rudd**, “[Coarse-grained molecular dynamics for computer modeling of nanomechanical systems](#),” *Intl. J. on Multiscale Comput. Engin.* **2**, 203-220 (2004) (invited).
38. C. Adelmann, B. Daudin, R. A. Oliver, G. A. D. Briggs and **R. E. Rudd**, “[Nucleation and growth of GaN/AlN quantum dots](#),” *Phys. Rev. B* **70**, 125427 (2004).
39. D. R. Mason, **R. E. Rudd** and A. P. Sutton, “[Atomistic modelling of diffusional phase transformations with elastic strain](#),” *J. Phys.: Condens. Matter* **16**, S2679-S2697 (2004).
40. D. R. Mason, **R. E. Rudd** and A. P. Sutton, “[Stochastic Kinetic Monte Carlo algorithms for long-range Hamiltonians](#),” *Computer Physics Comm.* **160**, 140-157 (2004).
41. B. W. Reed, R. W. Minich, **R. E. Rudd** and M. Kumar, “[The Structure of the Cubic Coincident Site Lattice Rotation Group](#),” *Acta Cryst. A* **60**, 263-277 (2004).
42. E. T. Seppala, J. Belak, and **R. E. Rudd**, “[Effect of stress-triaxiality on void growth in dynamic fracture of metals: a molecular dynamics study](#),” *Phys Rev B* **69**, 134101 (2004).
43. T. V. Ratto, K. C. Langry, **R. E. Rudd**, R. L. Balhorn, M. J. Allen, M. W. McElfresh, “[Force Spectroscopy of the Double-Tethered Concanavalin-A Mannose Bond](#),” *Biophys. J.* **86**, 2430-2437 (2004).
44. E. T. Seppala, B. W. Reed, M. Kumar, R. W. Minich, and **R. E. Rudd**, “[Roughness Scaling of Fracture Surfaces in Polycrystalline Materials](#),” *Mater. Research Soc. Symp. Proc.* **819**, N1.4.1-6 (2004).
45. **R. E. Rudd**, G.A.D. Briggs, A.P. Sutton, G. Medieros-Ribiero and R.S. Williams, “[Equilibrium model of bimodal distributions of epitaxial island growth](#),” *Phys. Rev. Lett.* **90**, 146101 (2003).
46. D.H. Kalantar, **R. E. Rudd**, et al, “[High-pressure, high-strain-rate lattice response of shocked materials](#),” *Phys. of Plasmas* **10**, 1569-76 (2003).
47. D. Steigmann, E. Baesu, **R. E. Rudd**, J. Belak, and M. McElfresh, “[On the variational theory of cell-membrane equilibria](#),” *Interfaces and Free Boundaries* **5**, 357-66 (2003).
48. E. Baesu, **R. E. Rudd**, J. Belak and M. McElfresh, “[Continuum Modeling of Cell Membranes](#),” *Intl. J. Non-linear Mech.* **39**, 369-77 (2003).
49. J. A. Moriarty, J. F. Belak, **R. E. Rudd**, P. Soderlind, F. H. Streitz and L. H. Yang, “[Quantum-based atomistic simulation of materials properties in transition metals](#),” *J. Phys.: Condens. Matter* **14**, 2825-57 (2002), and cover illustration.
50. M. McElfresh, E. Baesu, R. Balhorn, M. J. Allen, J. Belak and **R. E. Rudd**, “[Combining Constitutive Materials Modeling with Atomic Force Microscopy to Understand the Mechanical Properties of Living Cells](#),” *Proc. Natl. Acad. Sci.* **99**, 6493-7 (2002).
51. **R. E. Rudd**, “[Coarse-Grained Molecular Dynamics: Dissipation due to Internal Modes](#),” *Mater. Res. Soc. Symp. Proc.* **695**, T10.2.1-6 (2002), pp.499-504.
52. **R. E. Rudd** and J. F. Belak, “[Void Nucleation and Associated Plasticity in Dynamic Fracture of Polycrystalline Copper: An atomistic simulation](#),” *Comput. Mater. Sci.* **24**, 148-153 (2002).
53. **R. E. Rudd**, “[Concurrent Multiscale Modeling of Embedded Nanomechanics](#),” *Mat. Res. Soc. Symp. Proc.* **677**, AA1.6.1-12 (2001).
54. **R. E. Rudd**, “[The Atomic Limit of Finite Element Modeling in MEMS: Coupling of Length Scales](#),” *J. on Analog Integ. Circuits and Signal Proc.* **29**, 17-26 (2001).
55. S. C. Erwin, A. A. Baski, L. J. Whitman and **R. E. Rudd**, “[Frenkel-Kontorova Model of Vacancy-Line Interactions on Ga/Si\(112\)](#),” *Phys. Rev. Lett.* **83**, 1818-21 (1999).
56. **R. E. Rudd** and J. Q. Broughton, “[Concurrent Coupling of Length Scales in Solid State Systems](#),” *Phys. Stat. Sol. (b)* **217**, 251-91 (2000) (invited).
57. **R. E. Rudd** and J. Q. Broughton, “[Atomistic Simulation of MEMS Resonators through the](#)

- [Coupling of Length Scales](#),” J. Model. Simul. Microsys. **1**, 29-38 (1999).
58. **R. E. Rudd** and J. Q. Broughton, “[Coarse-grained molecular dynamics and the atomic limit of finite elements](#),” Phys. Rev. B **58**, R5893-6 (1998).
59. **R. E. Rudd** and W. E. Pickett, “[Single-spin superconductivity: Formulation and Ginzburg-Landau theory](#),” Phys. Rev. B **57**, 557 (1998).
60. **R. E. Rudd** and W. E. Pickett, “[The Josephson Effect in Single Spin Superconductors](#),” J. Phys. Chem. Solids **59**, 2074-2077 (1998).
61. **R. E. Rudd**, “[Light-Cone Gauge Quantization of 2D Sigma Models](#),” Nuclear Physics **B427**, 81 (1994).
62. **R. E. Rudd**, “[Compactification Propagation](#),” Nuclear Physics **B352**, 489 (1991).

### BOOK CHAPTERS

1. **R. E. Rudd**, “Coarse-grained molecular dynamics: Concurrent Multiscale Simulation at Finite Temperature,” in *Bridging the Scales in Science and Engineering*, J. Fish, ed. (Oxford University Press, 2010), Ch. 5, pp. 134-164.
2. D. R. Mason, **R. E. Rudd** and A. P. Sutton, “Including long-range interactions in atomistic modeling of diffusional phase changes,” Ch. 27 in *Computer Simulation Studies in Condensed-Matter Physics XVII* (Proceedings of the Seventeenth Workshop, Athens, GA, USA), Springer Proceedings in Physics, Vol. 103, D. P. Landau, S. P. Lewis, H.-B. Schaeftler (Eds.), 2005.
3. **R. E. Rudd**, “Concurrent Multiscale Simulation at Finite Temperature,” Handbook of Materials Modeling 2.12 (2004).
4. M. McElfresh, E. Baesu, R. Balhorn, M. J. Allen, J. Belak and **R. E. Rudd**, “[Combining Constitutive Materials Modeling with Atomic Force Microscopy to Understand the Mechanical Properties of Living Cells](#),” in *Nanoscience: Underlying Concepts and Phenomena* (National Academy Press, Washington, DC, 2002), pp. 43-47.
5. **R. E. Rudd** and J.Q. Broughton, “Coupling of Length Scales in Solid State Systems,” in *Computer Simulation of Materials at Atomic Level*, P. Deak, T. Frauenheim, M.R. Pederson, eds. (VCH Verlagsgesellschaft Mbh, Berlin, 2000).

### OTHER PAPERS

1. **R. E. Rudd**, A. J. Comley, J. Hawreliak, B. R. Maddox, H.-S. Park, and B. A Remington, “Theory and Simulation of 1D to 3D Plastic Relaxation in Tantalum,” APS Shock Compression of Condensed Matter (SCCM) Proceedings, to appear (2011). LLNL-CONF-491785
2. J. L. Belof, R. M. Cavallo, R. T. Olson, R. S. King, G. T. Gray III, D. B. Holtkamp, S.-R. Chen, **R. E. Rudd**, N. R. Barton, A. Arsenlis, B. A. Remington, H.-S. Park, S. T. Prisbrey, P. A. Vitello, G. Bazan, K. O. Mikaelian, A. J. Comley, “Rayleigh-Taylor Strength Experiments of the Pressure-Induced alpha-epsilon-alpha' Phase Transition in Iron,”APS Shock Compression of Condensed Matter (SCCM) Proceedings, to appear (2011).
3. B. A. Remington, **R. E. Rudd**, N. R. Barton, R. M. Cavallo, Hye-Sook Park, J. Belof, A. J. Comley, B. R. Maddox, M. J. May, S. M. Pollaine, S. T. Prisbrey, “Interpretation of Laser-Driven V and Ta Rayleigh-Taylor Strength Experiments,” APS Shock Compression of Condensed Matter (SCCM) Proceedings, to appear (2011).
4. H.-S. Park, N. R. Barton, J. L. Belof, K. J. M. Blobaum, R. M. Cavallo, A. J. Comley, B. R. Maddox, M. J. May, S. M. Pollaine, S. T. Prisbrey, B. A. Remington, **R. E. Rudd**, D. W. Swift, R. J. Wallace, M. J. Wilson, A. Nikroo and E. Giraldez, “Experimental Results of Ta Material Strength at High Pressure and High Strain Rate,” APS Shock Compression of Condensed Matter (SCCM) Proceedings, to appear (2011).

5. H.-S. Park, N.R. Barton, R. C. Becker, J. V. Bernier, R. M. Cavallo, K.T. Lorenz, S. M. Pollaine, B. A. Remington, and **R. E. Rudd**, "Experimental tests of vanadium strength models at high pressures and strain rates," Proc. First TMS-ABM International Materials Congress, Rio de Janeiro, Brazil, July 26-30, 2010 (2010).
6. **R. E. Rudd**, "Plasticity and Failure in Nanocrystalline BCC Metals via Molecular Dynamics Simulation," Proc. 16<sup>th</sup> USNCTAM (State College, PA, June 27-July 2, 2010). LLNL-PROC-457795.
7. **R. E. Rudd**, "Void Growth and Coalescence in Dynamic Fracture from the Atomistic Level," Proc. 16<sup>th</sup> USNCTAM (State College, PA, June 27-July 2, 2010).
8. B.A. Remington, H.-S. Park, S.T. Prisbrey, S.M. Pollaine, R.M. Cavallo, **R.E. Rudd**, K.T. Lorenz, R. Becker, J.V. Bernier, N. Barton, A. Arsenlis, S.G. Glendinning, A.V. Hamza, D. Swift, A.F. Jankowski, and M.A. Meyers, "[Progress towards materials science above 1000 GPa \(10 Mbar\) on the NIF laser](#)," Proc. DYMAT 2009, vol. 1/2, pp. 3-9 (2009).
9. J.N. Glosli, K.J. Caspersen, D.F. Richards, **R.E. Rudd**, F.H. Streitz, and J.A. Gunnels, "[Micron-scale Simulations of Kelvin-Helmholtz Instability with Atomistic Resolution](#)," in Proc. Supercomputing 2007 (SC07), Reno, NV, Nov. 2007. UCRL-CONF-230679
10. **R. E. Rudd** and B. Lee, "Mechanics of Silicon Nanowires: Size-Dependent Elasticity from First Principles," in Proc. Intl. Conf. Comput. Nanoscience (Nanotech/ICCN'07), Santa Clara, CA, May 2007, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2007), pp. 524-527.
11. J. S. Wark, J. F. Belak, G. W. Collins, J. D. Colvin, H. M. Davies, M. Duchaineau, J. H. Eggert, T. C. Germann, J. Hawrelia, A. Higginbotham, B. L. Holian, K. Kadau, D. H. Kalantar, P. S. Lomdahl, H. E. Lorenzana, M. A. Meyers, B. A. Remington, K. Rosolankova, **R. E. Rudd**, M. S. Schneider, J. Sheppard, and J. S. Stolken, "[Picosecond x-ray diffraction from laser-shocked copper and iron](#)," in SHOCK05, 14th APS Topical Conference on Shock Compression of Condensed Matter, AIP Conf. Proc. **845**, 286-291 (2006).
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15. **R. E. Rudd** and D. Jefferson, "[Toward On-the-fly Multiscale Modeling of Damage Localization](#)," Proc. 2<sup>nd</sup> Intl. Conf. Multiscale Materials Modeling, N.M. Ghoniem, ed. (UCLA, Oct 11-15, 2004) pp. 129-131.
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- 19. J. Belak, J. Cazamias, M. Fivel, D. Haupt, J. Kinney, M. Kumar, R. Minich, **R. Rudd**, and A. Schwartz, “[Microstructural Origins of Dynamic Fracture in Ductile Metals](#),” LLNL Technical Report UCRL-TR -202447 (Feb. 2004).
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  - 21. E. T. Seppala, J. Belak, and **R. E. Rudd**, “[Molecular Dynamics Study of void growth and dislocations in dynamic fracture of FCC and BCC metals](#),” in Dislocations, Plasticity and Metal Forming, edited by Akhtar S. Khan (NEAT Press, Maryland, 2003).
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  - 23. T. V. Ratto, K.C. Langry, **R. E. Rudd**, R. L. Balhorn and M. W. McElfresh, “[Mono and Multivalency in Tethered Protein-Carbohydrate Bonds](#),” Biophys. J. **86**, 322A (2004).
  - 24. **R. E. Rudd**, “Coarse-Grained Molecular Dynamics for Design of Nanomechanical Systems,” in Proc. Intl. Conf. Comput. Nanoscience (Nanotech/ICCN’03), San Francisco, CA, February 2003, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2003), V.3, pp. 500-503.
  - 25. **R. E. Rudd**, M. McElfresh, R. Balhorn, M. J. Allen and J. Belak, “[Modeling AFM Induced Mechanical Deformation of Living Cells](#),” in Proc. Intl. Conf. Comput. Nanoscience (Nanotech/ICCN’03), San Francisco, CA, February 2003, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2003), V.1, pp.138-141.
  - 26. E. T. Seppala, J. Belak, and **R. E. Rudd**, “A Molecular Dynamics Study of the Effect of Triaxiality on Void Growth in Dynamic Fracture,” in *Advances in Computational Engineering and Sciences 2002*, (Proc. ICES’02, Reno, NV, August 2002), S. N. Atluri and F. W. Brust, eds., (Tech Science Press, Palmdale, CA, 2002).
  - 27. **R. E. Rudd**, M. McElfresh, E. Baesu, R. Balhorn, M. J. Allen and J. Belak, “[Modeling of the Deformation of Living Cells Induced by Atomic Force Microscopy](#),” in Proc. Intl. Conf. Comput. Nanoscience (ICCN’02), San Juan, Puerto Rico, April 2002, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2002), pp. 73-6.
  - 28. **R. E. Rudd**, “Coarse-Grained Molecular Dynamics and Multiscale Modeling of NEMS,” in Proc. Intl. Conf. Comput. Nanoscience (ICCN’02), San Juan, Puerto Rico, April 2002, M. Laudon and B. Romanowicz, eds. (Computational Pub, Boston, 2002), pp. 173-6.
  - 29. **R. E. Rudd**, “A Unified Atomistic and Finite Element Model of the Dynamics and Thermodynamics of Silicon Microsystems,” in *Advances in Computational Engineering and Sciences 2000*, (Proc. ICES’2K, Los Angeles, CA, August 21-25, 2000), S. N. Atluri and F. W. Brust, eds., (Tech Science Press, Palmdale, CA, 2000), pp. 1932-7.
  - 30. **R. E. Rudd**, “Coupling of Length Scales in MEMS Modeling: the atomic limit of finite elements,” in Proc. DTIP2000, Paris, France, B Courtois, et al, eds. (SPIE, Bellingham WA, 2000), Vol. 4019, pp.16-25.
  - 31. **R. E. Rudd**, “[Multiscale Modeling of MEMS Dynamics and Failure](#),” Proc. 4th International Conference on Modeling and Simulation of Microsystems, Hilton Head Island, SC, March 19 - 21, 2001 UCRL-JC-140752
  - 32. **R. E. Rudd**, “The Atomic Limit of Finite Elements in the Simulation of Micro-Resonators,” in Proc. MSM 2000, San Diego, CA, M. Laudon and B. Romanowicz, eds (Computational Pub, Boston, 2000), pp. 465-8.

33. **R. E. Rudd** and J.Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. DTM '99, Paris, France, B Courtois, et al, eds. (SPIE, Bellingham WA, 1999), Vol. 3680, pp.104-13.
34. D. Hess, N. Bernstein, **R. E. Rudd** and F.F. Abraham, "Coupling of Length Scales in Cracks and Micromachines," in Proc. DoD HPC Users Group Conf., Monterey CA, June 1999.
35. **R. E. Rudd** and J. Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. DoD HPC Users Group Conf., Houston TX, June 1998.
36. **R. E. Rudd** and J. Q. Broughton, "Coupling of Length Scales and Atomistic Simulation of a MEMS Device," in Proc. MSM '98, Santa Clara, CA, B Romanowicz, et al, eds (Computational Pub, Boston, 1998), pp. 287-91.
37. **R. E. Rudd**, "The String Partition Function for QCD on the Torus," Los Alamos archive: [hep-th/9407176](https://arxiv.org/abs/hep-th/9407176), Rutgers preprint RU-94-58.
38. **R. E. Rudd**, "Light-Cone Gauge Quantization of Bosonic String Theories with Dilatons," Princeton Ph.D. Thesis, 1992.
39. M. J. Mehl, R.E. Cohen, H. Krakauer and **R. E. Rudd**, "LAPW Study of the High Pressure Behavior of Stoichiometric FeO," Proc. Mtg of Am. Geophys. Union, San Francisco, CA, 6-11 Dec 1987.
40. **R.E. Rudd**, "The Plasma Oxidation Mechanism in Mercury Cadmium Telluride," Night Vision Laboratory Internal Report, 1985

#### PREPRINTS FOR PUBLICATION

1. **R. E. Rudd**, W. H. Cabot, K. J. Caspersen, J. A. Greenough, D. F. Richards, F. H. Streitz, and P. L. Miller, "Self-Diffusivity and Interdiffusivity of Molten Aluminum-Copper Alloys under Pressure, Derived from Molecular Dynamics," submitted to Phys. Rev. E (2011). LLNL-JRNL-455401.
2. M. Chu, **R. E. Rudd**, M. P. Blencowe, "The Role of Reconstructed Surfaces in the Intrinsic Dissipative Dynamics of Silicon Nanoresonators," [arXiv:0705.0015](https://arxiv.org/abs/0705.0015).

**COMPUTER SKILLS**

C, C++, Fortran, Java, MPI, Unix, Linux, WindowsXP, AVS, Mathematica, Maple, LaTeX, etc.

**HONORS AND AWARDS**

LLNL WCI Certificate of Appreciation for NIF Experiments	2011
LLNL Science & Technology Award	2008
<b>Gordon Bell Prize in Supercomputing</b>	2007
LLNL Phys. & Adv. Tech. Directorate Award for BG/L simulations	2007
LLNL Phys. & Adv. Tech. SPOT Award for web site development	2007
LLNL CMS Publication Award	2006
<i>Molecular Simulation</i> Regional Editor, Editorial Board	2005-
<b>Fellow of the Institute of Physics (FInstP)</b>	2004
<i>Modelling and Simulation in Materials Science and Engineering</i> Editorial Board	2002-
LLNL CMS AD Distinguished Service Award	2004
LLNL Physical Data Research Program Award	2002
LLNL Physics Research Award	2001
Invited Participant, Isaac Newton Institute Program on Multiscale Microstructure	1999
Master of Arts by decree, University of Oxford	1998
National Science Foundation Graduate Fellowship	1987-90
Joseph Henry Prize (Princeton University)	1987
Elkins Prize in Physics (University of Virginia)	1987
McShane Prize in Math (University of Virginia)	1987
U.S. Government Incentive Award for Excellence in Research	1986
First Place, Putnam Math Exam, Mid-Atlantic Region	1986
Phi Beta Kappa	1985
Echols Scholar (University of Virginia)	1983-87
National Merit Scholarship	1983-84

**AFFILIATIONS**

American Chemical Society	2003-
Materials Research Society	2000-
US Association for Computational Mechanics	1999-
Sigma Xi	1998-
American Physical Society (DCMP, DCOMP)	1992-

**PROFESSIONAL SERVICE****Conference Organization:**

- Amer. Phys. Soc. DCOMP, March Meeting 2000, Minneapolis MN, March 2000.  
Materials Modelling Laboratory Workshop, MML'99, Oxford England, Sept 1999.\*  
Materials Modelling Laboratory Workshop, MML2000, Oxford England, Sept 2000.\*  
Internat'l. Conf. on Comput. Nanoscience (ICCN2001/MSM2001), Hilton Head SC, March 2001.  
Modeling and Simulation of Microsystems, MSM'01, Hilton Head, April 2001.  
Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2001), Cannes France, May 2001.

Atomically Controlled Surfaces, Interf. & Nanostruct. (ACSin 2001), Lake Tahoe, July 2001.  
LLNL Summer Institute, Livermore, CA, June-August 2001.\*

Modeling and Simulation of Microsystems, MSM'02, San Juan, PR, April 2002.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2002), Cannes France, May 2002.  
LLNL Summer Institute, Livermore, CA, June-August 2002.\*

Modeling and Simulation of Microsystems, MSM'03, San Francisco, CA, Feb 2003.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2003), Cannes France, May 2003.  
LLNL Summer Institute, Livermore, CA, June-August 2003.\*

5<sup>th</sup> EUROMECH Solid Mechanics Conf., Thessaloniki, Greece, August 2003.

2<sup>nd</sup> Intl. Workshop on Multiscale Modeling of Strength & Fracture, Berkeley, Jan 2004.

NanoTech2004, Boston, MA, March 2004.

MRS Spring Meeting Nanomechanics Symposium, April 2004.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2004), Montreaux, Switz. May 2004.  
LLNL Summer Institute, Livermore, CA, June-August 2004.\*

MRS Spring Meeting Linking of Scales Symposium, March 2005.

NanoTech2005, Anaheim, CA, April 2005.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2005), Montreaux, Switz. June 2005.  
LLNL Summer Institute, Livermore, CA, CA, June-August 2005.

NanoTech2006, Boston, MA, April 2006.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2006), Maggiore, Italy April 2006.  
LLNL Summer Institute, Livermore, CA, June-August 2006.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2007), Maggiore, Italy April 2007.  
NanoTech2007, Santa Clara, CA, May 2007.

LLNL Summer Institute, Livermore, CA, June-August 2007.

Materials Research Society (Grad Student Award Comm.), San Francisco, CA, March 2008.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2008), Nice, France April 2008.  
NanoTech2008, Boston, MA, June 2008.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2009), Rome, Italy, April 2009.  
NanoTech2009, Houston, TX, May 2009.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2010), Seville, Spain, May 2010.  
NanoTech2010, Anaheim, CA, June 2010.

Plasticity 2011, Puerto Vallarta, Mexico, January 2011.

Design, Test, Int. and Packaging of MEMS/MOEMS (DTIP2011), Aix-en-Provence, France,  
May 2011.

NanoTech2011, Boston, MA, June 2011.

NanoTech2012, Santa Clara, CA, June 2012.

\*Principal organizer/Director.

**Conference Session Chair:**

MRS Spring Meeting Linking of Scales Symposium, March 2005 (4 sessions chaired).  
2004 ASME Mechanical Engineering Congress, Anaheim, CA, Nov 2004.

2<sup>nd</sup> Intl. Conf. Multiscale Materials Modeling, UCLA, Los Angeles, Oct. 2004.

Materials Research Society Spring Meeting, San Francisco, CA, April 2004.

2<sup>nd</sup> Intl. Workshop on Multiscale Modeling of Strength & Fracture, Berkeley, Jan 2004.

Modeling and Simulation of Microsystems, MSM'03, San Francisco, CA, Feb 2003.

Amer. Phys. Soc., March Meeting 2000, Austin TX, March 2003.  
Amer. Phys. Soc. DCOMP, March Meeting 2000, Minneapolis MN, March 2000.  
Materials Modelling Laboratory Workshop, MML'99, Oxford England, Sept 1999.  
Materials Modelling Laboratory Workshop, MML2000, Oxford England, Sept 2000.  
European Materials Research Society Meeting (EMRS01), Strasbourg, June 2001.  
Atomically Controlled Surfaces, Interf. & Nanostruct. (ACSIN 2001), Lake Tahoe, July 2001.

### **BOOKS AND BOOK SERIES**

Oxford Series on Materials Modelling, R.E. Rudd and A.P. Sutton, eds., Oxford University Press

*Nanoscale Materials and Modeling – Relations among processing, microstructure and mechanical properties*, P. M. Anderson, T. Foecke, A. Misra and R. E. Rudd, eds. (MRS Symposium Proceedings Vol. 821, MRS, Warrendale, PA, 2004).

*Linking of Length Scales in Mechanical Behavior of Materials*, R. E. Rudd, J. Balk, W. Windl, eds. (MRS Symposium Proceedings Vol. 882E, MRS, Warrendale, PA, 2005). (online only)

**INVITED TALKS**

1. "Simulation and Theory of High-Rate Plastic Deformation of Polycrystalline BCC Metals," Mechanics & Materials Engineering Seminar, UCSD, Oct. 24, 2011.
2. "Simulation and Theory of High-Rate Plastic Deformation of Polycrystalline BCC Metals," International Symposium on Plasticity (Plasticity'11), Puerto Vallarta, Mexico, Jan 7, 2011.
3. "Plasticity and Failure in Nanocrystalline BCC Metals via MD Simulation," 16th Annual National Congress of Theoretical and Applied Mechanics (USNCTAM) Penn State, PA, July 1, 2010.
4. "Void Growth and Coalescence in Dynamic Fracture from the Atomistic Level," 16th Annual National Congress of Theoretical and Applied Mechanics (USNCTAM) Penn State, PA, July 1, 2010.
5. "Theory of rhombohedral vanadium at high pressure," T-1 Division Seminar, LANL, Los Alamos, NM, May 11, 2010.
6. "Nanomechanics to Megajoules," Mechanical Engineering Industry Seminar, UC Berkeley, Berkeley CA, March 17, 2010.
7. "Simulation of High-Rate Plastic Deformation of Nanocrystalline BCC Metals," International Symposium on Plasticity (Plasticity'10), St. Kitts, Jan 6, 2010.
8. "Molecular Dynamics Simulation of Void Nucleation and Growth in Solids," US-Japan Bilateral Workshop, Berkeley CA, Sept 25, 2008.
9. "Atomistic and Multiscale Modeling of the Strength and Failure of Transition Metals," SimBioMa Conference, Konstanz, Germany, April 2, 2008.
10. "Modeling of Equilibrium Distributions and the Nanostructure Diagram for Epitaxial Quantum Dots," MRS Spring Meeting, San Francisco, CA, March 27, 2008.
11. "Void Growth and Ductile Fracture from the Atomistic Level," OX莫斯 Workshop, Oxford UK, March 10, 2008.
12. "Nanomechanical Theory: From atoms to NEMS," 2 lectures, NEMSSS Summer School, Caltech, Pasadena, CA, July 11, 2007.
13. "Atomistic Modeling of Material Strength," Los Alamos, NM, June 2007.
14. "Dislocation Processes Associated with High Rate Plastic Deformation," Plasticity'07, Girdwood, AK, June 5, 2007.
15. "Outlook for the Multiscale Simulation of the Mechanics of Solids," NCSU/ARO Workshop on Multiscale Modeling, Research Triangle, NC, June 15, 2006.
16. "Nanomechanics: Concurrent multiscale modeling of mechanical components of NEMS," Workshop on Computational Techniques for Nanoscale Physics, GE Global Research, Jan 18, 2006.
17. "Connecting Atomistic and Continuum Level Modeling of Void Coalescence in Ductile Metals," Workshop on Multiscale Modeling of Condensed Matter, UCLA, Oct 20, 2005.
18. "Lanczos and Recursion Techniques for Multiscale Modeling of Mechanical Materials Behavior," DGP60 Multiscale Modeling Workshop, Oxford, UK, July 9, 2005.
19. "The Biomechanics of Protein-Ligand Binding: Force Spectroscopy and Computer Modeling," Caltech, June 1, 2005.
20. "Connecting Atomistic and Continuum Level Modeling of Void Coalescence in Ductile Metals," Multiscale Modeling in Solids Workshop, Montreal Canada, Apr 29, 2005.
21. "The Biomechanics of Protein-Ligand Binding: Force Spectroscopy and Computer Modeling," Univ. Pennsylvania, Jan 20, 2005.
22. "Multiscale Simulation of Void Growth in Dynamic Fracture of Ductile Metals," ASME Conference, Anaheim, CA, Nov 18, 2004.
23. "Multiscale modeling of elasticity and dissipation in NEMS resonators," 2<sup>nd</sup> Intl. Conf.

- Multiscale Materials Modeling, Los Angeles, Oct 14, 2004.
- 24. "Coarse-Grained Molecular Dynamics: Statistical Mechanics of the Transition from the Atomic Level to the Continuum Level," Dartmouth, Oct 4, 2004.
  - 25. "The Nanostructure Diagram and Computational Modeling of Self-Assembled Epitaxial Island Size Distributions," NASA/SRC workshop, Mountain View, CA, July 8, 2004.
  - 26. "Concurrent Multiscale Modeling of Void Growth," SIAM Conference, Los Angeles, CA, May 25, 2004.
  - 27. "Multiscale Simulation of Dynamic Fracture of Ductile Metals," Stanford Univ., Palo Alto, CA, February 4, 2004.
  - 28. "Concurrent Multiscale Modeling of Solids: CLS and CGMD methodologies," Multi-algorithm Methods for Multiscale Simulations Workshop, Livermore, CA, January 15, 2004.
  - 29. "Atomistic and Multiscale Modeling of Void Growth in Ductile Metals," 2<sup>nd</sup> Intl. Workshop on Strength and Fracture, Berkeley, CA, January 7, 2004.
  - 30. "Coarse-Grained Molecular Dynamics and Nanomechanical Resonators," Univ. of California, Berkeley, Dept. of Mechanical Engineering, December 5, 2003.
  - 31. "Relevant Variables and Nanoscale Effective Models of Ductile Fracture," European Solid Mechanics Conference, Thessaloniki, Greece, August 19, 2003.
  - 32. "Multiscale Modeling of Transition Metal Plasticity and Living Cell Mechanics," Biocomplexity V Conference, Notre Dame, IN, August 15, 2003.
  - 33. "Plastic Deformation associated with Void Growth: Multiscale modeling," US National Congress on Computational Mechanics, Albuquerque, NM, July 29, 2003.
  - 34. "Concurrent Multiscale Modeling," 2 Lectures at MRI Summer Institute, Livermore, CA, July, 2003.
  - 35. "Nanomechanics through Concurrent Multiscale Simulation," American Chemical Society Meeting, New Orleans, LA, March 23, 2003.
  - 36. "Atomistic Simulation of Void Growth Associated with Fracture at High Strain Rates," Materials Science Seminar, Univ. of Pennsylvania, March 20, 2003.
  - 37. "Coarse-Grained Molecular Dynamics for Nano-Design," Keynote talk: Nanotech2003, San Francisco, CA, February 27, 2003.
  - 38. "Modeling of the Mechanical Deformation of Living Cells in AFM," Chemical Engineering Seminar, UC-Davis, Davis, CA, November 4, 2002.
  - 39. "Multiscale Modeling of Plasticity in Dynamic Fracture of Ductile Metals," Society of Engineering Science Conf., State College, PA, October 15, 2002.
  - 40. "Multiscale Modeling of Plastic Deformation in Void Growth and Fracture," US National Congress on Theoretical and Applied Mechanics, Blacksburg, VA, June 27, 2002.
  - 41. "Multiscale Modelling of Plasticity Associated with Void Growth in Dynamic Fracture," Intl. Conf. on Multiscale Materials Modelling, London UK, June 19, 2002.
  - 42. "Modeling of the Deformation of Living Cells Induced during Indentation by an Atomic Force Microscope," Materials Seminar, Oxford University, June 11, 2002.
  - 43. "Atomistic Simulation of Copper Fracture at High Strain Rates," Geophysical Laboratory Seminar, Carnegie Institution, Washington, DC, June 4, 2002.
  - 44. "Coarse-Grained Molecular Dynamics and Multiscale Modeling of NEMS Resonators," Intl. Conf. on Computational Nanoscience (ICCN'02), San Juan, Puerto Rico, April 23, 2002.
  - 45. "Multiple Time and Length Scale Techniques," Discussion Session co-leader, Intl. Conf. on Computational Nanoscience (ICCN'02), San Juan, Puerto Rico, April 23, 2002.
  - 46. "Multiscale Modeling of Void Growth and Plasticity in Dynamic Fracture," Workshop on Multiscale Modeling, Bodega Bay, CA, October 7-10, 2001 (UCRL-PRES-145596).
  - 47. "Multiscale Modelling of Void Formation in Dynamic Fracture," Materials Seminar, Oxford University, September 25, 2001.

48. "Multiscale Modelling of Dynamic Material Failure," CECAM Workshop: Modelling materials: from atoms to microstructures, Lyon France, September 19, 2001.
49. "Hybrid Atomistic and Continuum Modeling for Solids," 4 Lectures at MRI Summer Institute, Livermore, CA, July 24-27, 2001.
50. "Signatures of atomistic physics in sub-micron MEMS resonators," ACSIN'01, Lake Tahoe, CA, July 11, 2001.
51. "Plasticity Associated With Dynamic Fracture: Atomistic and multiscale simulations," European Materials Research Society Meeting, Strasbourg, France, June 7, 2001.
52. "MEMS Modeling: Pushing the Limits of Miniaturization," Conference on High-Speed Computing, Salishan, OR, April 26, 2001.
53. "Bridging over Multiple Length and Time Scales," Round-Table Discussion, Materials Research Society Meeting, San Francisco, CA, April 20, 2001.
54. "Multiscale Modeling of Plasticity in Dynamic Fracture," Materials Research Society Meeting, San Francisco, CA, April 18, 2001.
55. "Concurrent Multiscale Modeling of Silicon Microsystems and Dynamic Fracture," Caltech, Pasadena, CA, April 5, 2001.
56. "Concurrent Multiscale Simulation and Coarse-Grained Molecular Dynamics," American Chemical Society Meeting, San Diego, CA, April 4, 2001.
57. "Design and Simulation of MEMS," (Invited tutorial) American Physical Society March Meeting, Seattle, WA, March 11, 2001.
58. "Grand Unification of Materials Models: Concurrent Multiscale Modeling," Materials Research Institute, Livermore, CA, Nov 1, 2000.
59. "Unified Atomistic and Finite Element Modeling of Silicon Microsystems and Dynamic Fracture," Computation and Mechanics Dept., Stanford University, Oct 26, 2000.
60. "Multiscale Modelling of Ge/Si Quantum Dot Growth and Ductile Fracture at Grain Boundaries," Intl. Workshop on Materials Modelling (MML2000), Oxford, UK, Sept 19, 2000.
61. "A Unified Atomistic and Finite Element Model of the Dynamics and Thermodynamics of Silicon Microsystems," Intl. Conf. on Computl. Eng. & Sci., Los Angeles, CA, Aug 23, 2000.
62. "Concurrent Multiscale Simulation: the link between dynamic atoms and continuum models," MML Seminar, Univ. of Oxford, May 12, 2000.
63. "Coupling of Length Scales in MEMS Modeling: the atomic limit of finite elements," keynote talk at the Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS (DTIP2000), Paris France, May 11, 2000.
64. "Coarse-Grained Molecular Dynamics: Coupling length scales from the atomistic to the continuum," Applied Analysis Seminar, Maths Institute, Oxford, Jan 31, 2000.
65. "Concurrent Multiscale Simulation of Silicon Microsystems," LLNL, Nov 1, 1999.
66. "Coupling of Length Scales: Removing Atomic Degrees of Freedom via Finite Elements at the Periphery," Materials Modelling Workshop, MML'99, Oxford, Sept 4, 1999.
67. "Molecular Dynamics: Simulation of Sub-micron Systems at Finite Temperature," Materials Modelling Workshop, Materials Modelling Workshop, MML'99, Oxford, Sept 2, 1999.
68. "Multiscale Simulation of Dynamical Processes in Silicon Microsystems," 5<sup>th</sup> US National Conference on Computational Mechanics, USNCCM'99, Boulder CO, Aug 5, 1999.
69. "Multiscale Simulation of Sub-micron Structures on Semiconductor Surfaces," Naval Research Laboratory, July 13, 1999.
70. "Multiscale Simulation of Silicon Micro-structures," NIST Workshop on Multiscale Modeling, NIST, Gaithersburg MD, May 13, 1999.
71. "Coupling of Length Scales in the Physics of Microsystems," Imperial College London, UK,

- May 5, 1999.
- 72. "Micromachines," Linacre College, UK, March 2, 1999.
  - 73. "Multiscale Phenomena in Silicon Microsystems," MML Seminar, Oxford, Feb 19, 1999.
  - 74. "Multiscale Simulation of Dynamical Processes in Silicon," Maui International Meeting on High-Temperature Materials, Maui HI, Jan 4, 1999.
  - 75. "Multiscale Simulation and High Performance Computing," Louisiana State, Nov 2, 1998.
  - 76. "Coupling of Length Scales in Semiconductors," Brown University, Sept 16, 1998.
  - 77. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Los Alamos National Laboratory, June 25, 1998.
  - 78. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," DOD High Performance Computing Users Group Conf., Houston, Texas, June 3, 1998.
  - 79. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Technical University of Denmark, May 26, 1998.
  - 80. "Coupling of Length Scales and Atomistic Simulation of MEMS Devices," Oxford, May 22, 1998.
  - 81. "Coupling of Length Scales and Atomistic Simulation of MEMS," MIT, May 12, 1998.
  - 82. "Coupling of Length Scales and Atomistic Simulation of MEMS," UC-Davis, April 9, 1998.
  - 83. "Superstring Theory," Georgetown University, October 30, 1997.
  - 84. "Superstring Theory," Naval Research Laboratory, January 1997.
  - 85. "Two Dimensional QCD on the Torus," Rockefeller University, May 1993.
  - 86. "Compactification Propagation and Light-Cone String Theory," Rockefeller Univ, Dec 1991.