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 nanoscale plasticity and fracture, the mechanical behavior of sub-micron MEMS, and cell mechanics. (Indefinite career appointment, 2004-now) LLNL LDRD/ER committee member, 2004-2013 (Chair, 2007-2013). **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

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1. R. Freitas, **R. E. Rudd**, M. Asta, and T. Frolov, "Free energy of grain-boundary phases: Atomistic calculations for Σ5(310)[001] grain," Phys. Rev. Mater. **2**, 093603 (2018).
2. N. H. Julian, T. T. Li, **R. E. Rudd**, J. Marian, "MS-STEM-FEM: A Parallelized Multi-slice Fluctuation TEM Simulation Tool," Ultramicroscopy **194**, 117-125 (2018).
3. T. Frolov, Q. Zhu, T.Oppelstrup, J. Marian and **R. E. Rudd**, "Structures and transitions in bcc tungsten grain boundaries and their role in the absorption of point defects," Acta Mater. **159**, 123-134 (2018).
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5. T. Frolov, W. Setyawan, R. J. Kurtz, J. Marian, A. R. Oganov, **R. E. Rudd**, and Q. Zhu, "Grain boundary phases in bcc metals," Nanoscale **10**, 8253-8268 (2018).
6. Q. Zhu, A. Samanta, B. Li, **R. E. Rudd**, T. Frolov, "Predicting Phase Behaivor of Grain Boundaries with Evolutionary Search and Machine Learning," Nature Comm. **9**, 467 (2018).
7. C. E. Wehrenberg, D. McGonegle, C. Bolme, A. Higginbotham, A. Lazicki, H. J. Lee, B. Nagler, H.-S. Park, B. A. Remington, **R. E. Rudd**, M. Sliwa, M. Suggit, D. Swift, F. Tavella, L. Zepeda-Ruiz and J. S. Wark, "In situ X-ray Diffraction Measurement of Shock-Wave-Driven Twinning and Lattice Dynamics," Nature **550**, 496–499 (2017)
8. **R. E. Rudd**, H.-S. Park, R. M. Cavallo, A. Arsenlis, D. A. Orlikowski, S. T. Prisbrey, C. E. Wehrenberg, and B. A. Remington, "Modeling Grain Size Strengthening in Tantalum at High Pressures and Strain Rates," AIP Conf. Proc. **1793**, 110004 (2017).
9. C. M. Huntington, J. L. Belof, K. J. M. Blobaum, R. M. Cavallo, N. B. Kostinski, B. R. Maddox, H. S. Park, C. Plechaty, S. T. Prisbrey, **R. E. Rudd**, D. W. Swift, R. J. Wallace, C. Wehrenberg, M. J. Wilson, and B. A. Remington, "Investigating Iron Material strength Up To 1 Mbar Using Rayleigh-Taylor Growth Measurements," AIP Conf. Proc. **1793**, 110007 (2017).
10. C. J. Ruestes, E. M. Bringa, **R. E. Rudd**, B. A. Remington, T. P. Remington, and M. A. Meyers, "Probing the character of ultra-fast dislocations," Sci. Reports **5**, 16892 (2015).
11. T. Haxhimali, **R. E. Rudd**, W. H. Cabot, and F. R. Graziani, "Shear viscosity for dense plasmas by equilibrium molecular dynamics in asymmetric Yukawa ionic mixtures," Phys. Rev. E **92**, 053110 (2015).
12. C. E. Wehrenberg, A. J. Comley, N. R. Barton, F. Coppari, D. Fratanduono, C. M. Huntington, B. R. Maddox, H.-S. Park, C. Plechaty, S. T. Prisbrey, B. A. Remington, and **R. E. Rudd**, "Lattice-Level Observation of the Elastic-to-Plastic Relaxation Kinetics with Sub-Nanosecond Resolution in Shock Compressed Ta using In Situ Laue Diffraction," Phys. Rev. B **92**, 104305 (2015).
13. B. A. Remington, **R. E. Rudd**, and J. S. Wark, "From Microjoules to Megajoules and Kilobars to Gigabars: Probing Matter at Extreme States of Deformation," Phys. Plasmas **22**, 090501 (2015).
14. J. H. Eggert, R. F. Smith, D. C. Swift, **R. E. Rudd**, D. E. Fratanduono, D. G. Braun, J. A. Hawreliak, J. M. McNaney, and G.W. Collins, "Ramp Compression of Tantalum to 330 GPa," High Pressure Res. **35**, 339-354 (2015).
15. H.-S. Park, **R. E. Rudd**, R. M. Cavallo, N. R. Barton, A. Arsenlis, J. L. Belof, K. J. M. Blobaum, B. S. El-dasher, J. N. Florando, C. M. Huntington, B. R. Maddox, M. J. May, C. Plechaty, S. T. Prisbrey, B. A. Remington, R. J. Wallace, C. E. Wehrenberg, M. J. Wilson,

A. J. Comley, E. Giraldez, A. Nikroo, M. Farrell, G. Randall, and G. T. Gray, III, "Grain-Size-Independent Plastic Flow at Ultrahigh Pressures and Strain Rates," Phys. Rev. Lett. **114**, 065502 (2015).

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19. **R. E. Rudd**, A. Arsenlis, N. R. Barton, R. M. Cavallo, A. J. Comley, B. R. Maddox, J. Marian, H.-S. Park, S. T. Prisbrey, C. E. Wehrenberg, L. Zepeda-Ruiz, and B. A. Remington, "Multiscale strength (MS) models: their foundation, their successes, and their challenges," J. Phys.: Conf. Series **500**, 112055 (2014).
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Material Strength at High Pressure and High Strain Rate," AIP Conf. Proc. **1426**, pp. 1371-1374 (2012).

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36. 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).
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43. **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

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45. **R. E. Rudd** and J. E. Klepeis, "Multiphase Improved Steinberg-Guinan Model for Vanadium," J. Appl. Phys. **104**, 093528 (2008).
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64. 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).
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PATENTS

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COMPUTER SKILLS

C, C++, Fortran, Java, MPI, Unix, Linux, Mathematica, LaTeX, VisIt, etc.

HONORS AND AWARDS

LLNL PLS Publication Award	2018
Department of Energy Defense Programs Award	2015
LLNL Director's Science and Technology Award	2015
LLNL WCI Directorate Award	2015
LLNL DP Division Award	2015
LLNL PLS External Leadership Award	2015
Fellow of the American Physical Society	2014
LLNL Director's Science and Technology Award	2014
LLNL PLS Excellence in Publication Award	2014
LLNL WCI Certificate of Appreciation for NIF Experiments	2011
LLNL Director's Science & Technology Award	2008
Gordon Bell Prize in Supercomputing	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
Molecular Simulation Regional Editor, Editorial Board	2005-
Fellow of the Institute of Physics (FInstP)	2004
Modelling and Simulation in Materials Science and Engineering 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