

Michael R. Falvo

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Research Interests

My research focuses on nanoscale mechanical properties and processes. Using imaging - atomic force, electron, optical, magnetic microscopies - and nanomanipulation techniques, I investigate mechanical deformation, motion, and energy dissipation in nanoscale systems. Current research focuses on single-molecule through single-cell biophysics (Cilia, Fibrin, Cell mechanics). Past research interests include nanometer scale electromechanical systems (NEMS) and nanotribology (friction of nanoscale interfaces)

Education

Ph.D. Physics. University of North Carolina, Chapel Hill, NC. 1997.

M.S. Physics. University of North Carolina, Chapel Hill, NC. 1994.

B.S. Physics. University of Illinois, Urbana-Champaign, IL. 1991.

Appointments

2011- Research Professor, Dept. of Physics and Astronomy UNC-CH

2007-2011. Research Associate Professor, Dept. of Physics and Astronomy UNC-CH

2001-2007. Research Assistant Professor, Curriculum of Appl. and Mat. Science UNC-CH

2000-2001. Research Assistant Professor, Dept. of Physics and Astronomy UNC-CH

1998-2000. Postdoctoral Research Associate, Dept. of Physics and Astronomy UNC-CH

Professional Honors/Activities

Awards/Honors

- 2004 Professor Winner of the UNC Student Undergraduate Teaching Award (SUTASA), presented annually to three UNC professors by the UNC undergraduate student body.
- Member of the UNC Academy of Distinguished Teaching Scholars.

Dept. and University Service:

UNC Dept. Physics & Astronomy

- Grad Admissions Committee (2015-2020)
 - Author of successful nomination letter for Royster Fellowship
- Grad Recruiting Committee (2014)
- K-12 Outreach Committee (2010-2014).

University Wide

- UNC QEP Undergraduate Research Subcommittee (2016-2017). I am co-creator and co-author of the undergraduate research section of the UNC QEP.
- Member of the Search Committee for Associate Director of Program Development and Evaluation for the Office of Undergraduate Education (2017).
- Member of UNC Biophysics Program Training Faculty

External Service / Membership

- Member of the American Physical Society, Biophysical Society, Materials Research Society
- NSF Review Panelist : BioMaterials Program (BMAT), Nanoscience Undergraduate Education Program (NSE-NUE).
- NIH Review Panel: Nanoscience and Nanotechnology in Biology and Medicine.

- Referee: Science, Phys Rev. Lett, J. Vac. Sci. Tech, Trib Lett., Mat. Sci. Res. Thin Solid Films, Appl. Phys. Lett., Nanotechnology, Soft Matter

Selected Publications of > 80, full list below

h-index: 33, citations > 5400, Web of Science 7.9.2020

- Hobson, Chad M., Megan Kern, E. Timothy O'Brien III, Andrew D. Stephens, Michael R. Falvo, Richard Superfine, *Correlating nuclear morphology and external force with combined atomic force microscopy and light sheet imaging separates roles of chromatin and lamin A/C in nuclear mechanics*. Molecular Biology of the Cell, (in press), 2020.
- Beicker K, O'Brien ET 3rd, Falvo MR, Superfine R., Vertical Light Sheet Enhanced Side-View Imaging for AFM Cell Mechanics Studies, Sci Rep. 2018 Jan 24;8(1):1504. doi: 10.1038/s41598-018-19791-3.
- N.E. Hudson., J.R. Houser, O.B.E. T., R.M. Taylor II., R. Superfine, S.T. Lord, and M.R. Falvo, *Stiffening of Individual Fibrin Fibers Equitably Distributes Strain and Strengthens Networks*. Biophysical Journal, 2010 98(8): p. 1632-1640.
- Falvo, M.R., O. Gorkun, and S.T. Lord, *The molecular origins of the mechanical properties of fibrin*. Biophys Chem, 2010 152(1-3): p. 15-20.
- W. Liu, L. M. Jawerth, E. A. Sparks, M. R. Falvo, R. R. Hantgan, R. Superfine, S. T. Lord, M. Guthold, *Fibrin fibers have extraordinary extensibility and elasticity* Science, 313 (5787): 634-634 (2006).
- S. Paulson, A. Helser, M.B. Nardelli, R.M. Taylor, M. Falvo, R. Superfine, and S. Washburn. *Tunable resistance of a carbon nanotube-graphite interface*, Science, 2000. 290(5497): p. 1742-1744.
- M.R. Falvo, R.M. Taylor, A. Helser, V. Chi, F.P. Brooks, S. Washburn, and R. Superfine. *Nanometre-scale rolling and sliding of carbon nanotubes*, Nature, 1999. 397(6716): p. 236-238.
- M.R. Falvo, S. Washburn, R. Superfine, M. Finch, F.P. Brooks, V. Chi, and R.M. Taylor. *Manipulation of individual viruses: Friction and mechanical properties*, Biophysical Journal, 1997. 72(3): p. 1396-1403.
- M.R. Falvo, G.J. Clary, R.M. Taylor, V. Chi, F.P. Brooks, S. Washburn, and R. Superfine. *Bending and buckling of carbon nanotubes under large strain*, Nature, 1997. 389(6651): p. 582-584.

Patents

- R Superfine, BJ Oberhardt, RC Spero, MR Falvo, BL Fiser, RM Taylor II, RM Judith, "Methods, systems, and computer readable media for determining physical properties of a specimen in a portable point of care diagnostic device", US Patent 9,952,149, Issued April 24, 2018.

Selected Current and Former Funding

**Primary Author of Proposal*

- Co-PI***: NSF MBC, "Mechanobiology of Phagocytosis", \$751,993, (6/1/2020-5/31/2023).
- Co-PI***: NSF CBET, "Actuated Surface Attached Post Systems for Microscale Fluid Dynamics", \$270,032, (2014-2017).
- Co-PI**: NSF DMS, "Computational Cell Motility Model Educated from Single-Cell and High-Throughput Phenotype Analysis", \$1,330,035. (2014-2018)
- Co-PI***: NIH-R21 "Microactuated Rheometer for Point of Care Coagulopathy Applications". \$400,000, (2012-2013)
- Co-PI***: North Carolina Biotechnology Center, Institutional Development Grant, "Nanomanipulation System for Biomedical Research and Development", \$165,473. (2012)
- Co-PI***: NSF CMMI. "Ciliary Mechanics", \$400,000. (2011-2014)
- PI**: NSF CMMI. "Tuning Morphology and Mechanics of Fibrin Assemblies", \$383,567. (2010-2013)
- PI** on Subcontract to Durham Public Schools grant: NC Department of Instruction Math Science Partnership: \$700,000 (UNC - \$100,000k) (2011-2014).
- Co-Investigator**. NIH NHLBI "Cellular Determinants of Fibrin Structure and Stability", 1,646,250. (2009-2014).
- Co-PI**: NSF DMR Biomaterials. "*Fibrin fibers: strong, elastic and novel biomaterials*", \$360,000 (2007-2010).
- Co-PI**: NSF ECCS "*Collaborative: Circuit and System Architectures for Self-assembled Nanoscale Computers*". \$ 333,330. 2007-2010.

Co-PI: NSF ECCS “*Collaborative Research: Atomic-scale study of friction for nano-electromechanical structure*”. \$363,965, 2007-2010.

PI: NSF NSE NER. “*NER: Nanophase Calcite*”. \$100,000 (2005-2007).

Co-PI: NSF NSE NIRT “*Bioinspired Actuating Structures*”, \$1,721,234 (2005-2009)

Co-PI: NSF ROLE. “Scale and Scaling Across the Science Domains” \$781,142 (2004-2007). This is an education research project

Co-PI*: NSF ECS. “*The Development of Nanoelectromechanical Structures for GHz Oscillators and Other High Frequency Devices*”. \$270,000 (2001-2005)

PI: NSF NSE-NUE. “*Building Models and Manipulating Molecules-Active Learning for Nanoscience Education*”. \$100,000 (2003-2005)

PI: NSF-ECS SGER. “*Carbon Nanotube Nanoelectromechanical Systems*”. \$59,000 8/31/00 – 9/1/01.

Teaching Experience / Education Activities

Courses:

- **First Year Seminar on Nanoscience and Technology.** Received funding from the NSF (NCER NUE, \$100k) to design and teach this course. (UNC-CH PHYS 053). Taught 10 semesters.
- **Biological Physics.** Junior/Senior Level Biophysics course. (Phys405)
- **Graduate Nanoscience Course.** Designed and taught this introductory nanoscience course for graduate level physicists, chemists, and materials scientists. (UNC-CH PHYS267). Taught 1 semester.
- **Honors Introductory Physics** (UNC-CH, Phys 026A). Taught 3 semesters.
- **Introduction to Materials Science** (UNC-CH, APPL050). Taught 4 semesters.
- **Electricity and Magnetism.** Intermediate Level (UNC-CH, PHYS058) Taught 2 semesters.

Projects/Activities:

- **2020 NCSSM Biophysics Miniterm.** Designed and taught 9-day minicourse on biophysics at North Carolina School of Science and Math, at invitation of Dr. Jonathan Bennett, Chair of NCSSM Physics. 2/20-2/28/2020.
- **MSP-Durham Schools.** PI of the UNC side of a Math Science Partnership Grant from the NC Dept. of Public Instruction. The partner institution was Durham Public Schools. I ran monthly professional development workshops with ~80 DPS k8 teachers to improve their physical science content knowledge (over three years ~ 130 hours of instruction provided). 2011-2013.
- **NSF-NUE.** PI of NSF grant (NSF NSE Nanoscience for Undergraduate Education).
- **NSF-ROLE.** Co-PI on NSF grant (NSF ROLE). Science Education Research.
- **INSPIRE.** Faculty sponsor of student run science outreach project at UNC sending over 40 undergraduate into the local public schools each semester to work with science teachers (2004-2014).
- **NCSTA Meeting.** Presented at the 2003-2011 North Carolina Science Teachers Association Meeting.

Books

Nanoscale Science: Activities for Grades 6-12, M. Gail Jones, M.R. Falvo, Amy R. Taylor, Bethany P. Broadwell, National Science Teacher Association Press, 2007.

Extreme Science: From Nano to Galactic, M. Gail Jones, Amy R. Taylor, M.R. Falvo, National Science Teacher Association Press, 2009.

Students Supervised

Undergrads: Phys 295/395 independent study courses supervised (of > 50) Rohit Prakash (Stanford Bioengineering), Louise Jawerth (Harvard Physics), Michael Adams, Lalkia Skoggins, Roger Holliday, Aarish Patel, Amit Bhagwandass, Deep Mehtaji, Philip Howard, Daniel Millard (GA Tech), Olamide Olusesi (Teach for American), Kyle Pridgen, Igal Bucay (U. Texas Physics Grad School), Patrick Moseby, Zack McCaw, Pranav Haravu, Sarah Boland, Mitch Dudley, Eugene Goh Chen Howe, Autumn Sanson, Keegan Barnes, Autumn Sanson, Loren Fox.

Honors Undergraduate Theses Mentored: Rohit Prakash(2005), Pranav Haravu(2016), Max Hockenberry(2020).

Graduate Students: As Primary Mentor: Kellie Beicker, Nathan Hudson (Asst. Prof., ECU Physics). As Co-Mentor : Megan Kern (current), Chad Hobson (current), Jake Brooks (current), Even Nelsen, Robert Judith, Jerome Carpenter, Briana Fiser (Asst. Prof., High Point University), Adam Shields, Kwan Skinner (Dow Chemical), Onejae Sul, Jing Hao, Dmitry Spivak, Hakan Deniz, Neal Snider, Josh Steele, Scott Paulson (Faculty James Madison Physics), Garrett Mathews (Faculty, Physics U. South Florida), Philip Williams (NASA), Adam Hall (Faculty Physics UNC-Greensboro), Michael Stademann (Staff Scientist, Lawrence Livermore), Chris Dwyer (Faculty Duke Mech Engineering).

Number of Ph.D committees served: 21

Full Publication and Invited Talk Record

(h-index: 33, citations >5400, Web of Science 7.9.2020)

2020

Hobson, Chad M. E. Timothy O'Brien III, Michael R. Falvo, Richard Superfine, *Combined Selective Plane Illumination Microscopy and FRAP maps intranuclear diffusion of NLS-GFP*, Biophys J. (in press), 2020.

E. Nelsen, C.M. Hobson, M.E. Kern, J.P. Hsiao, E.T. O'Brien III, T. Watanabe, B.M. Condon, M. Boyce, S. Grinstein, K.M. Hahn, M.R. Falvo, R. Superfine, *Combined Atomic Force Microscope and Volumetric Light Sheet System for Correlative Force and Fluorescence Mechanobiology Studies*, Sci Rep, **10**(1): p. 8133, 2020.

Hobson, Chad M., Megan Kern, E. Timothy O'Brien III, Andrew D. Stephens, Michael R. Falvo, Richard Superfine, *Correlating nuclear morphology and external force with combined atomic force microscopy and light sheet imaging separates roles of chromatin and lamin A/C in nuclear mechanics*. Molecular Biology of the Cell, p. mbcE20010073, 2020.

2019

Liu B, Hobson CM, Pimenta FM, Nelsen E, Hsiao J, O'Brien T, Falvo MR, Hahn KM, Superfine R., *A Versatile Illumination Engine With a Modular Optical Design for Fluorescence Microscopy*, Optics Express, Opt Express. 2019 Jul 8;27(14):19950-19972.

Sean Hunt, Camden Hunt, Christian Iliadis, Michael Falvo, *Blister resistant targets for nuclear reaction experiments with α -particle beams*, Nuclear Inst. And Methods in Physics Research, A 921, 2019, 1-7.

2018

Yan C, Wang F, Peng Y, Williams CR, Jenkins B, Wildonger J, Kim HJ, Perr JB, Vaughan JC, Kern ME, Falvo MR, O'Brien ET 3rd, Superfine R, Tuthill JC, Xiang Y, Rogers SL, Parrish JZ, *Microtubule Acetylation Is Required for Mechanosensation in Drosophila*, Cell Rep 2018 Oct 23;25(4):1051-1065.e6.

Judith, R.M., B. Lanham, M.R. Falvo, and R. Superfine, *Microfluidic viscometry using magnetically actuated micropost arrays*. PLoS One, 2018. **13**(7): p. e0200345.

Beicker K, O'Brien ET 3rd, Falvo MR, Superfine R., *Vertical Light Sheet Enhanced Side-View Imaging for AFM Cell Mechanics Studies*, Sci Rep. 2018 Jan 24;8(1):1504. doi: 10.1038/s41598-018-19791-3.

2017

Bethany L Walton, Marcus Lehmann, Tyler Skorczewski, Lori A Holle, Joan D Beckman, Jeremy A Cribb, Micah J Mooberry, Adam R Wufsus, Brian C Cooley, Jonathan W Homeister, Rafal Pawlinski, Michael R Falvo, Nigel S Key, Aaron L Fogelson, Keith B Neeves, and Alisa S Wolberg, *Elevated hematocrit enhances platelet accumulation following vascular injury*, Blood, 2017 Mar 1. pii: blood-2016-10-746479. doi: 10.1182/blood-2016-10-746479.

2016

Jeremy A. Cribb, Lukas D. Osborne, Kellie Beicker¹, Matthew Psioda, Jian Chen, E. Timothy O'Brien, Russell M. Taylor III, Leandra Vicci, Joe Ping-Lin Hsiao, Chong Shao, Michael Falvo, Joseph G. Ibrahim, Kris C. Wood,

Gerard C. Blobel & Richard Superfine, *An Automated High-throughput Array Microscope for Cancer Cell Mechanics*, *Sci.Rep.* 6:27371, 2016.

Josh Lawrimore, Joseph Aicher, Patrick Hahn, Alyona Fulp, Ben Kompa, Dr. Leandra Vicci, Michael Falvo, Russell Taylor II, and Kerry Bloom. *ChromoShake: a chromosome dynamics simulator reveals chromatin loops stiffen centromeric chromatin*, *Molecular Biology of the Cell*, 27(1), 153, 2016.

2015

Josh Lawrimore, Paula A. Vasquez, Michael R. Falvo, Russell M. Taylor II, Leandra Vicci, Elaine Yeh, I. M. Gregory Forest, and Kerry Bloom, *DNA loops generate intracentromere tension in mitosis*, *J. Cell Biology*, 210(4), 554, 2015.

Robert M. Judith, Jay K. Fisher, Richard Chasen Spero, Briana L. Fiser, Adam Turner, Bruce Oberhardt, R.M. Taylor, Michael R. Falvo, and Richard Superfine, *Micro-elastometry on whole blood clots using actuated surface-attached posts (ASAPs)*, *Lab on a Chip*, 15(5), 1385-1393, 2015.

Briana Fiser, Adam Shields, Michael Falvo, Richard Superfine; *Highly responsive core-shell microactuator arrays for use in viscous and viscoelastic fluids*, *J. Micromech MicroEng*, 25(2), 025004, 2015.

Igal Bucay, E. T. O'Brien, S.D. Wulfe, R. Superfine, A.S. Wolberg, M.R. Falvo, N.E. Hudson, *Physical Determinants of Fibrinolysis in Single Fibrin Fibers*, *PLOS ONE*, 10(2), e0116350, 2015.

M. Gail Jones, A. Taylor, M.R. Falvo, G. Gardner. *Precollege Nanotechnology Education: A Different Kind of Thinking*, *Nanotechnology Reviews*, 4(1), 33-50, 2015.

2013

Nathan E. Hudson, Feng Ding, Igal Bucay, E. Timothy O'Brien III, Oleg V. Gorkun, Richard Superfine, Susan T. Lord, Nikolay V. Dokholyan, Michael R. Falvo, *Sub-millisecond elastic recoil reveals molecular origins of fibrin fiber mechanics*, *Biophysical Journal*, 104(12), p. 2671-2680, 2013.

Eric Horowitz, K. Rahman, Brian Bower, David Dismuke, Michael Falvo, Jack Griffith, Stephen Harvey, and Aravind Asokan, *Biophysical and ultrastructural characterization of adeno-associated viral capsid uncoating and genome release*, *Journal of Virology*, 87(6), p. 2995-3002, 2013.

A.D. Stephens, R.A. Haggerty, P.A. Vasquez, L. Vicci, C.E. Snider, F. Shih, C. Quammen, C. Mullins, J. Haase, R.M. Taylor II, J. S. Verdaasdonk, M. R. Falvo, Y. Jin, M. G. Forest, K. Bloom. *Loops of Pericentric Chromatin Function as a Non-linear Spring Network to Balance Microtubule-Based Force in Mitosis*. *J. Cell Bio*, 200(6), p. 757-72, 2013.

Tretter, T, M.G. Jones, M.R. Falvo, *Nanoscience for All: Strategies for Teaching Nanoscience to Undergraduate Freshmen Science and Non-Science Majors*, *J. Nano Education*, 5(1), p. 1-9, 2013.

M. Gail Jones, R. Blonder, G. Gardner, V. Albe, M.R. Falvo, J. Chevrier. *Nanotechnology and nanoscale science: Challenges educating the next generation*, *International Journal of Science Education*, 35(9) p. 1490, 2013.

2010

J.R. Houser, N.E. Hudson, L. Ping, E.T. O'Brien III, R. Superfine, S.T. Lord, and M.R. Falvo, *Evidence that alphaC region is origin of low modulus, high extensibility, and strain stiffening in fibrin fibers*. *Biophysical Journal*, 2010 **99**(9): p. 3038-47.

Campbell, R.A., M.M. Aleman, L.D. Gray, M.R. Falvo, and A.S. Wolberg, *Flow Profoundly Influences Fibrin Network Structure: Implications for Fibrin Formation and Clot Stability in Hemostasis*. *Thromb Haemost*, 2010 104(6): .

Falvo, M.R., O. Gorkun, and S.T. Lord, *The molecular origins of the mechanical properties of fibrin*. *Biophys Chem*, 2010 **152**(1-3): p. 15-20.

Hudson, N.E., J.R. Houser, O.B.E. T., R.M. Taylor II., R. Superfine, S.T. Lord, and M.R. Falvo, *Stiffening of Individual Fibrin Fibers Equitably Distributes Strain and Strengthens Networks*. *Biophysical Journal*, 2010 **98**(8): p. 1632-1640.

Shields, A.R., B.L. Fiser, B.A. Evans, M.R. Falvo, S. Washburn, and R. Superfine, *Biomimetic cilia arrays generate simultaneous pumping and mixing regimes*. *Proc Natl Acad Sci U S A*, 2010 **107**(36): p. 15670-5.

Tretter, T.R, M.G. Jones, and M.R. Falvo, *Impact of Introductory Nanoscience Course on College Freshmen's Conceptions of Spatial Scale*, *Journal of Nano Education*, (2010) In Press.

Skinner, K., M.R. Falvo, and S. Washburn, *Designed high tensile strength nanowire interfaces*. Small, 2010 (Under Review)

2009

Grant Gardner, M. Gail Jones, M.R. Falvo, “*New Science*” and *Societal Issues: Considering the ethics of nanosensors*. The Science Teacher, Oct, 2009.

Extreme Science: From Nano to Galactic, M. Gail Jones, Amy R. Taylor, M.R. Falvo, National Science Teacher Association Press, 2009.

2008

A.R. Hall., M.R. Falvo, R. Superfine, and S. Washburn A Self-Sensing Nanomechanical Resonator Built On A Single-Walled Carbon Nanotube, Nano Letters, 2008, 8(11), 3746-3749.

E.T. O’Brien III, M.R. Falvo, D. Millard, B. Eastwood, R. M. Taylor II and R. Superfine, *Self- Assembled Fibrin Sheets: A New Form of Protein Polymer*, Proc. Nat. Accad. Sci, 105(49), 19438-29443, (2008)

M. R. Falvo, D. Millard, E.T. O’Brien III, R. Superfine, and S.T. Lord. *Length of Tandem Repeats in Fibrin’s α C Region Correlates with Fiber Extensibility*. Journal of Thrombosis and Haemostasis, 2008, 6(11), 1991-1993.

2007

M. Guthold, W. Liu, E.A. Sparks, L.M. Jawerth, L. Peng, M. Falvo, R. Superfine, R.R. Hantgan, and S.T. Lord, *A comparison of the mechanical and structural properties of fibrin fibers with other protein fibers*. Cell Biochemistry and Biophysics, 2007. 49(3): p. 165-181.

A.R. Hall., M.R. Falvo, R. Superfine, and S. Washburn, *Electromechanical response of single-walled carbon nanotubes to torsional strain in a self-contained device*. Nature Nanotechnology, 2007. 2(7): p. 413-416.

B.A. Evans, A.R. Shields, R.L. Carroll, S. Washburn, M.R. Falvo, and R. Superfine, *Magnetically actuated nanorod arrays as biomimetic cilia*. Nano Letters, 2007. 7(5): p. 1428-1434..

M. G. Jones, M. R. Falvo, A.R. Taylor, B.P. Broadwell, Nanoscale Science: Activities for Grades 6-12. National Science Teachers Association Press, 2007.

Jones, M. G., Falvo, M., Taylor, A., & Broadwell, B. (2007). Build a virus. The Science Reflector, 36(2), <http://www.ncsta.org/reflector/archives/summer07/activity.html>.

2006

W. Liu, L. M. Jawerth, E. A. Sparks, M. R. Falvo, R. R. Hantgan, R. Superfine, S. T. Lord, M. Guthold, *Fibrin fibers have extraordinary extensibility and elasticity* Science 313 (5787): 634 (2006).

A.R. Hall, L. An, J. Liu, L. Vicci, M.R. Falvo, R. Superfine, S. Washburn, *Experimental Measurement of Singlewall Carbon Nanotube Torsional Properties*, Physical Review Letters, 96 (25): Art. No. 256102 (2006).

M. Gail Jones, M.R. Falvo, , B. Broadwell, S. Dotger. *Self-Assembly – How Nature Builds*, The Science Teacher, Dec, 2006.

R. Prakash, R. Superfine, S. Washburn, and M.R. Falvo, *Functionalization of carbon nanotubes with proteins and quantum dots in aqueous buffer solutions*. Applied Physics Letters, 2006. 88(6): p. 06310

O.J. Sul, M.R. Falvo, R.M. Taylor II, S. Washburn, R. Superfine *Thermally Actuated Untethered Impact-Driven Locomotive Micro-Devices*”, Appl. Phys. Lett, 89 (20): Art. No. 203512.

2005

M. Stadermann, S.J. Papadakis, M.R. Falvo, Q. Fu, J. Liu, Y. Fridman, J.J. Boland, R. Superfine, and S. Washburn, *Exponential decay of local conductance in single-wall carbon nanotubes*. Physical Review B, 2005. 72(24): p. 245406.

M.G. Jones, B. Broadwell, M. Falvo, J. Minogue, and T. Oppewal. *It's a Small World After All: Exploring Nanotechnology in our Clothes.*, Science and Children, 2005

2004

- M. Stadermann, S.J. Papadakis, M.R. Falvo, J. Novak, E. Snow, Q. Fu, J. Liu, Y. Fridman, J.J. Boland, R. Superfine, and S. Washburn. *Nanoscale study of conduction through carbon nanotube networks*, Physical Review B, 2004. 69 (20).
- S.J. Papadakis, A.R. Hall, P.A. Williams, L. Vicci, M.R. Falvo, R. Superfine, and S. Washburn. *Resonant oscillators with carbon-nanotube torsion springs*, Phys. Rev. Lett., 2004. 93(14): p. 146101-1, 146101-4.

2003

- P.A. Williams, S.J. Papadakis, A.M. Patel, M.R. Falvo, S. Washburn, and R. Superfine. *Fabrication of nanometer-scale mechanical devices incorporating individual multiwalled carbon nanotubes as torsional springs*, App. Phys. Lett., 2003. 82(5): p. 805-807.
- M. Stadermann, H. Grube, J.J. Boland, S.J. Papadakis, M.R. Falvo, R. Superfine, and S. Washburn. *Simultaneous atomic force microscopy measurement of topography and contact resistance of metal films and carbon nanotubes*, Review of Scientific Instruments, 2003. 74(8): p. 3653-3655.
- R. Prakash, S. Washburn, R. Superfine, R.E. Cheney, and M.R. Falvo. *Visualization of individual carbon nanotubes with fluorescence microscopy using conventional fluorophores*, App. Phys. Lett., 2003. 83: p. 1219-1221.
- S.J. Papadakis, P.A. Williams, M.R. Falvo, R. Superfine, and S. Washburn. *Mechanics of nanotubes and nanotube-based devices*. in *MOLECULAR NANOSTRUCTURES: XVII International Winterschool Euroconference on Electronic Properties of Novel Materials*. 2003. Kirchberg, Tirol: AIP.
- A. Hall, W.G. Matthews, R. Superfine, M.R. Falvo, and S. Washburn. *Simple and efficient method for carbon nanotube attachment to scanning probes and other substrates*, App. Phys. Lett., 2003. 82(15): p. 2506-2508.

2002

- P.A. Williams, S.J. Papadakis, M.R. Falvo, A.M. Patel, M. Sinclair, A. Seeger, A. Helser, R.M. Taylor, S. Washburn, and R. Superfine. *Controlled placement of an individual carbon nanotube onto a microelectromechanical structure*, App. Phys. Lett., 2002. 80(14): p. 2574-2576.
- P.A. Williams, S.J. Papadakis, A.M. Patel, M.R. Falvo, S. Washburn, and R. Superfine. *Torsional response and stiffening of individual multiwalled carbon nanotubes*, Phys. Rev. Lett., 2002. 89(25): p. art. no.-255502.
- C. Dwyer, M. Guthold, M. Falvo, S. Washburn, R. Superfine, and D. Erie. *DNA-functionalized single-walled carbon nanotubes*, Nanotechnology, 2002. 13(5): p. 601-604.
- R. Superfine, M. Falvo, R. M. Taylor II and S. Washburn. "Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale" In: CRC Handbook of Nanoscience, Engineering, and Technology. Ed. S. Lyshevski, D. Brenner, J. Lafrate and W. Goddard. Boca Raton, CRC Press LLC, (2002).

2001

- A. Seeger, S. Paulson, M.R. Falvo, A. Helser, R.M. Taylor II, R. Superfine, and S. Washburn. *How does it feel to roll a molecule?* in *45th International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication*. 2001.
- A. Seeger, S. Paulson, M. Falvo, A. Helser, R.M. Taylor, R. Superfine, and S. Washburn. *Hands-on tools for nanotechnology*, J. Vac. Sci. Tech. B, 2001. 19(6): p. 2717-2722.

2000

- M.R. Falvo, R. Superfine. "Mechanics and Friction at the Nanometer Scale". J. of Nanoparticle Research. 2, 237-248 (2000) (INVITED REVIEW ARTICLE)
- R. Superfine, M. Falvo, J. Steele, G. Matthews, M. Guthold, D. Erie, A. Helser, M.G. Jones, R.M. Taylor, and S. Washburn. *Touching on the nanometer scale: slip, roll and tear*, Microbeam Analysis 2000, Proceedings, 2000(165): p. 369-370.
- S. Paulson, A. Helser, M.B. Nardelli, R.M. Taylor, M. Falvo, R. Superfine, and S. Washburn. *Tunable resistance of a carbon nanotube-graphite interface*, Science, 2000. 290(5497): p. 1742-1744.
- M. Guthold, M.R. Falvo, W.G. Matthews, S. Paulson, S. Washburn, D.A. Erie, R. Superfine, F.P. Brooks, and R.M. Taylor. *Controlled manipulation of molecular samples with the nanoManipulator*, IEEE-ASME Transactions on Mechatronics, 2000. 5(2): p. 189-198.

M.R. Falvo, J. Steele, S. Paulson, R.M. Taylor II, S. Washburn, and R. Superfine. *Rolling nanotubes: Atomic lattices as gears and contacts*. in *ELECTRONIC PROPERTIES OF NOVEL MATERIALS—MOLECULAR NANOSTRUCTURES: XIV International Winterschool/Euroconference*. 2000. Kirchberg, Tirol Austria: AIP.

M.R. Falvo, J. Steele, R.M. Taylor, and R. Superfine. *Gearlike rolling motion mediated by commensurate contact: Carbon nanotubes on HOPG*, Physical Review B, 2000. 62(16): p. R10665-R10667.

M.R. Falvo, J. Steele, R.M. Taylor, and R. Superfine. *Evidence of commensurate contact and rolling motion: AFM manipulation studies of carbon nanotubes on HOPG*, Tribology Letters, 2000. 9(1-2): p. 73-76.

1999

S. Paulson, M.R. Falvo, N. Snider, A. Helsner, T. Hudson, A. Seeger, R.M. Taylor, R. Superfine, and S. Washburn. *In situ resistance measurements of strained carbon nanotubes*, App. Phys. Lett., 1999. 75(19): p. 2936-2938.

M. Guthold, M. Falvo, W.G. Matthews, S. Paulson, J. Mullin, S. Lord, D. Erie, S. Washburn, R. Superfine, F.P. Brooks, and R.M. Taylor. *Investigation and modification of molecular structures with the nanoManipulator*, Journal of Molecular Graphics & Modelling, 1999. 17(3-4): p. 187-197.

M.R. Falvo, R.M. Taylor, A. Helsner, V. Chi, F.P. Brooks, S. Washburn, and R. Superfine. *Nanometre-scale rolling and sliding of carbon nanotubes*, Nature, 1999. 397(6716): p. 236-238.

1998

R. Taylor, G. Matthews, A. Negishi, M. Guthold, M. Falvo, R. Superfine, S. Washburn, and F. Brooks. *Molecular structure investigation and modification using the nanoManipulator*, Journal of Molecular Graphics & Modelling, 1998. 16(4-6): p. 291-292.

M.R. Falvo, G. Clary, A. Helsner, S. Paulson, R.M. Taylor, V. Chi, F.P. Brooks, S. Washburn, and R. Superfine. *Nanomanipulation experiments exploring frictional and mechanical properties of carbon nanotubes*, Microscopy and Microanalysis, 1998. 4(5): p. 504-512.

1997

R.M. Taylor II, J. Chen, S. Okimoto, N. Llopis-Artime, V.L. Chi, F.P. Brooks Jr., M.R. Falvo, S. Paulson, P. Thiansathaporn, D. Glick, S. Washburn, and R. Superfine. *Pearls Found on the way to the Ideal Interface for Scanned-probe Microscopes*. in *Proceedings of IEEE Visualization '97*. 1997. Phoenix, AZ: IEEE.

R. Superfine, M.R. Falvo, S. Paulson, S. Washburn, R.M. Taylor II, G. Clary, V. Chi, and F.P. Brooks Jr. *Manipulation of Nanometer Objects: Friction, Mechanical Properties and Devices*. in *Proceedings of the International Conference on Novel Materials*. 1997. Puri, India.

M.R. Falvo, S. Washburn, R. Superfine, M. Finch, F.P. Brooks, V. Chi, and R.M. Taylor. *Manipulation of individual viruses: Friction and mechanical properties*, Biophys. J., 1997. 72(3): p. 1396-1403.

M.R. Falvo, G.J. Clary, R.M. Taylor, V. Chi, F.P. Brooks, S. Washburn, and R. Superfine. *Bending and buckling of carbon nanotubes under large strain*, Nature, 1997. 389(6651): p. 582-584.

J. Chen, C. DiMattia, M.R. Falvo, P. Thiansathaporn, R. Superfine, and R.M. Taylor II. *Sticking to the Point: A Friction and Adhesion Model for Simulated Surfaces*. in *Proceedings of the Sixth Annual Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems*. 1997. Dallas, TX.

1996

M.R. Falvo, R. Superfine, S. Washburn, M. Finch, R.M. Taylor II, V. Chi, and F.P. Brooks Jr. *The Nanomanipulator: A Teleoperator for Manipulating Materials at the Nanometer Scale*. in *Proceedings of the International Symposium on the Science and Technology of Atomically Engineered Materials*. 1996. Richmond, VA: World Scientific Publishing.

1995

R.H. Terrill, T.A. Postlethwaite, C.H. Chen, C.D. Poon, A. Terzis, A.D. Chen, J.E. Hutchison, M.R. Clark, G. Wignall, J.D. Londono, R. Superfine, M. Falvo, C.S. Johnson, E.T. Samulski, and R.W. Murray. *Monolayers in three dimensions: NMR, SAXS, thermal, and electron hopping studies of alkanethiol stabilized gold clusters*, JACS, 1995. 117(50): p. 12537-12548.

M. Finch, V. Chi, R.M. Taylor II, M. Falvo, S. Washburn, and R. Superfine. *Surface Modification Tools in a Virtual Environment Interface to a Scanning Probe Microscope*. in *Proceedings of the ACM Symposium on Interactive 3D Graphics*. 1995. Monterey, CA: ACM SIGGRAPH.

Invited Talks Presented

Scholarly

Teaching Nanobiophysics Concepts Using Model Building Activities, Symposium on Horizons in Astronomy and Physics Education, UNC-CH Physics & Astronomy Dept., March, 2017.

Nanobiophysics for First-Year Non-Majors, SESAPS Charlottesville, VA, Nov 2017.

Protein Physics and Cell Mechanics, North Carolina Section of the American Association of Physics Teachers, Spring 2014 Meeting, Boone, NC April 11-12, 2014.

Walking Across Campus: Adventures in Biophysics Research, Science in the Mountains hosted by Appalachian State and the North Carolina Biotechnology Center, Boone, NC, April 12th 2013.

Strain Stiffening of individual fibers strengthens fibrin networks, XXIth International Fibrinogen Workshop. Rotterdam, The Netherland, Aug 2010.

Fabrication and Mechanical Characterization of Carbon Nanotube based NEMS. Invited talk at Hitachi sponsored conference Windows on the Nanoworld: Advanced Analytical and Imaging Techniques. Clemson, NC, Oct 2007.

Nanoscale Mechanical Characterization Using Atomic Force Microscope. Invited talk at Microscopy and Microanalysis, Aug 2007, Ft. Lauderdale, FL

Carbon nanotube based gears, rheostats, and resonators. Duke Dept. of Physics Condensed Matter Colloquium. Feb, 2007.

Fabrication of Carbon Nanotube Based NEMS, PASI conference, Punta Leone, Costa Rica, June 19th-30th, 2006.

CNT NEMS: Lattice Interlocking, Paddle oscillators, and hybrid CNT/MEMS. Annual Meeting of the Society for Experimental Mechanics, Charlotte, NC, June 2003.

Evidence of commensurate contact and rolling motion: AFM manipulation studies of carbon nanotubes on HOPG. Invited talk at the International Conference on Nanotribology: 11h-14th April 2000 Ubud, Bali, Indonesia.

Micro/Nano-Mechatronics for Nanotechnology. Tutorial given at the International Conference on Advanced Intelligent Mechatronics, Georgia Institute of Technology, September 1999.

Controlled Manipulation of Molecular Samples with the nanoManipulator. International Conference on Advanced Intelligent Mechatronics, Georgia Institute of Technology, September 1999.

Nanometer scale tribology of carbon nanotubes. Centennial Meeting of the American Physical Society, Atlanta, GA, March 1999.

Nanometer-Scale Material Properties and Interactions Through Nanomanipulation. M. R. Falvo, R. Superfine. Southeast Regional Meeting of the ACS (SERMACS '98), Research Triangle Park, NC, November 1998.

Studying mechanical and frictional properties through nanomanipulation. Physics Department Colloquium, Southern Illinois University, Sept. 29, 1998.

Handcrafting with AFM: Pushing, Bending, and Building at the Nanometer Scale. Nanotechnology: Materials, Manufacturing and Applications, sponsored by Cambridge Health Institute, San Francisco, CA, June, 1997.

The Nanomanipulator: A Teleoperator for Manipulating Materials at the Nanometer Scale. International Symposium on the Science and Technology of Atomically Engineered Materials, Richmond, VA, October 1995.

Other Outreach / Ed

Presented 1 hour talk on molecules and molecular scale concepts to Wake Elementary School County Teachers. Invited by Cathy Horne, Senior Administrator Wake County Elementary Science. Raleigh, NC, April 30th, 2009

North Carolina Nanotechnology Commercialization Conference, March 25, 2009, Raleigh, NC. Invited to present a primer on nanotechnology to ~200 attendees.

Presented a three hour workshop for elementary, middle and high school science teachers. NanoscIENCE: Instruction for Educators, Institute for Advanced Learning and Research, Danville, VA, Feb 27th, 2009

Sticky, Shaky, Bumpy: Science at the Nanoscale for Elementary Teachers, Featured Speaker, National Science Teachers Association Southeast Regional Meeting, Charlotte, NC, Nov, 2008.

Nanoscale Science: Activities for Grades 6-12. Invited 4 hour Workshop for science teachers. National Science Teachers Association Southeast Regional Meeting, Birmingham, NC, Dec 2007.

Nanoscale Science: Activities for Grades 6-12. Invited web seminars for international audience facilitated by the National Science Teacher Association. Presented on Dec 18th, 2007 and Jan 15th 2008.

Nanoscience. Talk to representatives of member museums in the Nanoscale Informal Science Education (NISE) Network, Museum of Life and Science, Durham NC, Sept, 2007.

Scab Science, Meet a Scientist program, Morehead Planetarium, 2 hr presentation to general public, Sept. 2007.

Nanoscience for Middle and High School Ed, Pfizer sponsored workshop for science teachers, Groton, CN, June 2007

Nanotechnology, Science Café. Presented at Broad Street Coffee. Event organized by the Museum of Life and Science about nanotechnology and its potential impact on society. September 26th, 2006

What is Nanotechnology, Presented a lecture and served on a panel of experts a Forum at the Museum of Life and Science about nanotechnology and its potential impact on society. May 25th, 2006.

What is Nanotechnology. Presentation to ~40 Wayne County science teachers at Wayne County High School, May 3, 2006

Nanoscience Education for Middle and High School. Plenary Talk at the National Educators Workshop, Tempe Arizona, Oct 18th-20th, 2004.