

NANCY A. BURNHAM

Curriculum Vitae

14 January 2024

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ONE-PAGE BIOGRAPHY



Nancy Burnham graduated from the University of Colorado at Boulder in 1987 with a Ph.D. in Physics. Her dissertation concerned the surface analysis of photovoltaic materials. As a National Research Council Postdoctoral Fellow at the Naval Research Laboratory, she became interested in scanning probe microscopy, in particular its application to detecting material properties at the nanoscale.

After three years as a von Humboldt Fellow in Germany at Forschungszentrum Jülich, she spent another six years in Europe, principally at the École Polytechnique Fédérale de Lausanne in Switzerland, all the while pursuing the mechanical properties of nanostructures and instrumentation for nanomechanics. Her international experience also includes séjours at the University of Bordeaux, Tokyo Institute of Technology, the Royal Institute of Technology in Stockholm, and ETH Zürich. She arrived at WPI in January of 2000 and is now a Full Professor. Furthermore, she became affiliated with the Biomedical Engineering Department in 2012 and started directing WPI's Switzerland Project Center in 2016.

Invited, tutorial, or plenary speaker at over 50 conferences, author or co-author of over 90 publications with over 14,000 citations (h-index 38), she is as well active in professional societies as, e.g., Treasurer of the Nanoscience and Technology Division of the AVS. She was the recipient of the 2001 Nanotechnology Recognition Award from the latter organization, was a 2002 Institute of Physics of Ireland Lecturer, and became a Fellow of the AVS in 2010. Two of her articles were featured among the 25 highlighted publications for the 25th anniversary of the journal Nanotechnology in 2014, out of nearly 12,000 articles. She also enjoys teaching physics and nanoscience, from the introductory up to the graduate level. More research and teaching details are provided on her personal webpage.

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SUMMARY

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EDUCATION:

May 1987: Ph.D., Physics (M.S. December 1985), University of Colorado at Boulder.
May 1980: B.A. Physics, Colgate University, Hamilton NY, USA.

INTERESTS: Nanoscale characterization of nanomaterials and semiconductor devices

ACADEMIC EXPERIENCE:

2000-present: As of 2012: also affiliated with Biomedical Engineering. Associate Professor, then Full Professor of Physics, Worcester Polytechnic Institute, Worcester MA. Adhesion of microsensor surfaces; interpretation of force curves of tissue-growth substrates, living cells, and microbial lipopolysaccharides; precision and accuracy of Atomic-Force Microscopy (AFM) data (*featured in 25 years of research highlights in the journal Nanotechnology*); evolution of microstructures in asphalt binders; adhesion between nanomaterials and calcite surfaces in various fluids; nano-electro-mechanics and stability of perovskite solar cells.

1994-99: Fonctionnaire Scientifique, puis Professeure Invitée, à l'Ecole Polytechnique Fédérale de Lausanne. Friction on 2-D self-organized systems (*Science*), elasticity of carbon nanotubes (*Phys. Rev. Lett.*), rheology of polymer blends. Invented Scanning Local-Acceleration Microscopy as a high-resolution technique to quantitatively measure local materials' properties including nonlinear effects leading to nanoscale chaotic behavior (*Phys. Rev. Lett.*, *a commercially available product*). Simulations of nonlinear dynamic tip-sample interactions.

1991-93: Alexander-von-Humboldt Stipendiatin, Forschungszentrum Jülich GmbH. Discovered patch charges as an origin of surface forces (*Phys. Rev. Lett.*). Built a UHV and ambient AFMs.

1987-91: National Research Council Postdoctoral Fellowship at the Naval Research Laboratory, Washington DC. Measured nanomechanical properties and surface forces of materials (*US patent*). Demonstrated that AFM is sensitive to the chemistry of monolayers (*Phys. Rev. Lett.*). Compared AFM adhesion data of metal surfaces with molecular dynamics simulations (*Science*). Two Chemistry Division Awards for Superior Technical Publication - 1990, 1991.

Graduate work 1980-87: National Renewable Energy Laboratory, Golden CO, and U. Colorado Boulder, USA. Surface analysis, hall measurements, and optical spectroscopy of semiconductors. Dissertation: Determined changes in the core levels and valence band of hydrogenated amorphous silicon as a function of hydrogen concentration using surface analysis techniques.

TEACHING at WPI:

- Introductory (≤ 461 students) and intermediate (~ 40 students) mechanics using cooperative-group problem solving, computer homework, and clicker questions, in addition to traditional physics homework. In 2017 and 2018, conducted pilot courses for Studio Physics, as of Fall 2018 expanded into new active-learning classrooms.
- Developed undergraduate and graduate courses in atomic force microscopy. The corresponding YouTube lectures have acquired over 147,000 hits and 991 subscribers.
- In last two years (Covid!), delivered an average of 677 credit hours/year.

TEACHING at ETH Zürich: Professur für Oberflächentechnik to run a hands-on intensive two-week lab course on AFM, annually in the Materials since 2015 (not 2020 due to Covid-19).

PREVIOUS TEACHING: At Colgate, Physics Department Award for excellence in tutoring undergraduates. At EPFL, English tutor for a mailing list of 700 people and laboratory instructor for up to sixty undergraduates per session (*en français oder auf Deutsch* or in English). At Royal Institute of Technology in Stockholm, a twenty-hour graduate course in Nanomechanics.

RECOGNITION FOR SCHOLARSHIP:

1. National Research Council Postdoc, Naval Research Laboratory, Washington DC, 1987-91.
2. Alexander von-Humboldt Stipendiatin, Forschungszentrum Jülich GmbH, 1991-94.
3. Professeure invitée, Centre de Physique Moléculaire et d'Optique, U. Bordeaux, 1996.
4. Visiting Research Scholar, Tokyo Institute of Technology, July 1999.
5. Visiting Prof., Eng. Materials Physics, Kungliga Tekniska Högskolan Stockholm, fall 1999.
6. Nanotechnology Recognition Award, AVS Nanoscience and Technology Division, 2001.
7. Institute of Physics of Ireland Lecturer, October 2002.
8. AVS Fellow, 2010, "*For technical leadership in areas of nanoscience and nanotechnology, especially for contributions in scanning probe microscopy and nanomechanics.*"
9. 25 papers were featured for the 25th anniversary (2014) of the journal Nanotechnology, including *two* of mine: "How does a tip tap?" (1997) and "Comparison of calibration methods for AFM cantilevers" (2003) out of nearly 12,000 articles.
10. Over 16,000 citations of >100 articles; h-index 40; >50 invited, plenary, tutorial talks.

RECOGNITION FOR TEACHING AND ADVISING:

1. Nominated for Young Faculty Innovation in Undergrad Education, WPI: 2003, '05, '06.
2. Advisor to award-winning senior research projects at WPI: 2003, '06, '07, '09, '12, '17.
3. Advised award-winning undergraduate posters: 2011 (internal), '12 (external), '17 (internal).
4. Advised award-winning graduate posters: 2012, '12 (external), '14, '14 (internal), '17 (internal and external).
5. Outstanding Professor, conferred by WPI's Society of Physics Students, 2015.
6. Designated as "Faculty Champion" by WPI's Student-Athlete Advisory Council, 2020.
7. A D21 Namibian IQP team was a finalist in the President's IQP Awards, 2022.

INVENTIONS:

“**Mechanical and Surface Force Nanoprobe**”, N.A. Burnham and R.J. Colton, US Patent Number 5,193,383, issued March 16, 1993. Licence issued. 64 citations as of January 2018.

“Scanning Local-Acceleration Microscopy”, July 1995, marketed as the Materials Analysis Package from Park Scientific Instruments.

SERVICE:

Professional societies and conference organization, for example: Treasurer, Nanoscale Science and Technology Division of the AVS (NSTD, ~1000 members), since 2002; Program Committee, AVS International Symposia, since 2002; Steering Committee of International Conference on Nanoscience and Technology, since 2006; NanoWorcester Symposia, 2011-17.

As Treasurer of AVS-NSTD, generate funds for **student recognition** through an international graduate-student award competition at the AVS International Symposia, supported annually by industry, since 2009.

Review for NSF, NIH, DOE, National Cancer Institute, funding agencies for Ireland and United Kingdom, and numerous journals, for example: ACS Nano, Nature Nanotechnology, and Small (more are indicated in the table on the next page); editorial board for J. Vac. Sci. Technology. National and international tenure and promotion reviews.

Service to WPI:

- Over the years, served on departmental committees for seminars, undergraduate and graduate studies, and pre-tenure reviews;
- Previously served on WPI’s Educational Development Council, Committee on Academic Policy, Committee on Academic Operations (**Chair**), Committee on Tenure and Academic Freedom (**Chair**), Faculty Appointee to Academic Planning Committee of Board of Trustees, Appointee to Academic Technology Taskforce of Board of Trustees,
- Committee on Financial and Administrative Policy (**Chair** for nine terms), *ex officio* member of Administrative Policy Group, ADVANCE working group on scholarship and service, Search Committee for Aerospace Engineering Department Head, elected member of Committee on Governance.

MEMBERSHIPS:

AVS, American Physical Society, Materials Research Society, Sigma Xi, Sigma Pi Sigma

LANGUAGES:

Native English, good French and German, tourist-level Italian, Swedish, and Dutch.

JOURNAL, BOOK, AND PROCEEDINGS PUBLICATIONS

In this section, I list my work in the scholarship of discovery, integration, and teaching and learning.

My total citations equal 14,294 and my h-index equals 38, as of 14 January 2024. My real-time citation list is at <http://scholar.google.com/citations?user=j3PncjEAAAAJ&hl=en&oi=ao>.

Google Scholar posts patents, book chapters, books, abstracts, and student works, in addition to regular publications; thus the total number of listed works is greater at Google Scholar than what is presented in this section.

This table shows 2022 impact factors (from ISI) of the journals in which I have published and the number of publications. Y or N indicates if I have reviewed for the journal.

Journal	I.F.	#	Journal	I.F.	#
Science, Y	34.66	2	J. Molecular Recognition, N	2.091	1
Advanced Materials, N	18.97	1	J. Microelectromech. Systems, N	1.939	1
J. Cleaner Production, N	11.07	1	Surface Science, Y	1.931	2
Advances Colloid Inter. Sci., N	7.813	1	J. Microbiological Methods, N	1.857	1
Physical Review Letters, Y	7.645	5	Tribology Letters, Y	1.758	1
ACS Appl. Mat. Interfaces, Y	7.145	1	J. Microscopy Microanalysis, N	1.730	1
Analytical Chemistry, N	5.886	1	J. Vacuum Science & Tech. A, Y	1.724	7
Scientific Reports, Y	5.228	1	J. Materials Research, Y	1.579	1
Solar Cells, N	4.732	1	Applied Physics A, N	1.444	1
Langmuir, Y	3.993	1	J. Adhesion, N	1.409	1
J. Colloid Interface Science, N	3.782	1	J. Vacuum Science & Tech. B, Y	1.398	3
Biophysical Journal, Y	3.632	1	J. Petroleum Geology, N	1.341	1
Fuel, N	3.611	1	Review Scientific Instruments, Y	1.336	3
Polymer, N	3.586	1	J. Visualized Experiments, N	1.113	1
Nanotechnology, Y	3.573	4	J. Adhesion Science & Tech., N	0.863	1
Scripta Metallurgica, N	3.305	1	IEICE Transactions, N	0.344	1
J. Bacteriology, N	3.198	1	J. Nano Education, Y	**	1
Applied Physics Letters, Y	3.142	3	J. Bionanoscience, N	**	1
Energy & Fuels, N	2.835	1	IOP Physics Education, N	**	1
J. Applied Physics, Y	2.101	1			

** no information found

PEER-REVIEWED JOURNAL PUBLICATIONS:

The names of 37 publications with 38 or more citations are in **bold**. (The patent with 60 citations is listed on page 3.) The names of publications in journals with impact factors over five are in *italics*. WPI students and postdocs are denoted with an asterisk.

1. “Auger Analysis of Si-H Bonding and Hydrogen Concentration in Hydrogenated Amorphous Silicon,” A.J. Nelson, N.A. Burnham, A.B. Swartzlander, S.E. Asher, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A4**, 1570-73 (1986).
2. “Scanning Auger Microprobe Studies of Ball-Cratered CdS/CuInSe₂ Solar Cells,” L.L. Levenson, N.A. Burnham, R.J. Matson, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A4**, 1680-83 (1986).
3. “*Auger Line-Shape Analysis of Hydrogenated Amorphous Silicon*,” N.A. Burnham, A.J. Nelson, A.B. Swartzlander, and L.L. Kazmerski, *Solar Cells* **21**, 135-40 (1987).
4. “EELS Study of Hydrogenated Amorphous Silicon,” N.A. Burnham, R.F. Fisher, S.E. Asher, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A5**, 2016-18 (1987).
5. “Electron Beam Effects in the Analysis of Compound Semiconductors and Devices,” L.L. Kazmerski, N.A. Burnham, A.B. Swartzlander, A.J. Nelson, and S.E. Asher, *J. Vac. Sci. Technol.* **A5**, 2814-18 (1987).
6. “**Measuring the Nanomechanical Properties and Surface Forces of Materials Using an Atomic Force Microscope**,” N.A. Burnham and R.J. Colton, *J. Vac. Sci. Technol.* **A7**, 2906-13 (1989).
7. **On the Electrochemical Etching of Tips for Scanning Tunneling Microscopy**,” J.P. Ibe, S.L. Brandow, R.A. Brizzolara, N.A. Burnham, D.P. DiLella, K.P. Lee, C.R.K. Marrian, and R.J. Colton, *J. Vac. Sci. Technol.* **A8**, 3570-75 (1990).
8. “*Probing the Surface Forces of Monolayer Films with an Atomic Force Microscope*,” N.A. Burnham, D.D. Dominguez, R.L. Mowery, and R.J. Colton, *Phys. Rev. Lett.* **64**, 1931-34 (1990).
9. “*Atomistic Mechanisms and Dynamics of Adhesion, Nanoindentation and Fracture*,” U. Landman, W.D. Luedtke, N.A. Burnham, and R.J. Colton, *Science* **248**, 454-61 (1990).
10. “**Interpretation Issues in Force Microscopy**,” N.A. Burnham, R.J. Colton and H.M. Pollock, *J. Vac. Sci. Technol.* **A9**, 2548-56 (1991).
11. “*Work Function Anisotropies as an Origin of Long-Range Surface Forces*,” N.A. Burnham, R.J. Colton and H.M. Pollock, *Phys. Rev. Lett.* **69**, 144-47 (1992), and
12. “*Burnham, Colton and Pollock Reply*,” *Phys. Rev. Lett.* **70**, 247 (1993).

13. **“Interpretation of Force Curves in Force Microscopy,”** N.A. Burnham, R.J. Colton and H.M. Pollock, *Nanotechnol.* **4**, 64-80 (1993).
14. **“Apparent and True Feature Heights in Force Microscopy,”** N.A. Burnham, *Appl. Phys. Lett.* **63**, 114-16 (1993).
15. **“Accounting for the Stiffnesses of the Probe and Sample in Scanning Probe Microscopy,”** N.A. Burnham, *J. Vac. Sci. Technol.* **B12**, 2219-21 (1994).
16. **“Attractive Forces Between Micron-Sized Particles: A Patch Charge Model”**, H.M. Pollock, N.A. Burnham and R.J. Colton, *J. Adhesion* **51**, 71-86 (1995).
17. **“Nanosubharmonics: The Dynamics of Small Nonlinear Contacts”**, N.A. Burnham, A.J. Kulik, G. Gremaud and G.A.D. Briggs, *Phys. Rev. Lett.* **74**, 5092-95 (1995).
18. **“Scannning Local-Acceleration Microscopy”**, N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, *J. Vac. Sci. Technol.* **B14**, 794-99 (1996).
19. **“Materials’ Properties Measurements: Choosing the Optimal SPM Configuration”**, N.A. Burnham, G. Gremaud, A.J. Kulik, P.-J. Gallo and F. Oulevey, *J. Vac. Sci. Technol.* **B14**, 1308-12 (1996).
20. **“Electrical-Conductivity SFM Study of an Ultrafiltration Membrane,”** P.-J. Gallo, A.J. Kulik, N.A. Burnham, F. Oulevey and G. Gremaud, *Nanotechnol.* **8**, 10-13 (1997).
21. **“How does a Tip Tap?,”** N.A. Burnham, O.P. Behrend, F. Oulevey, G. Gremaud, P.-J. Gallo, D. Gourdon, E. Dupas, A.J. Kulik, H.M. Pollock and G.A.D. Briggs, *Nanotechnol.* **8**, 67-75 (1997).
22. **“Uniformly Flat Gold Surfaces: Imaging the Domain Structure of Organic Monolayers Using Scanning Force Microscopy,”** D. Stamou, D. Gourdon, M. Liley, N.A. Burnham, A.J. Kulik, H. Vogel, and C. Duschl, *Langmuir* **13**, 2425-28 (1997).
23. **“The Dependence of Friction Anisotropies on the Molecular Organisation of LB films as Observed by AFM,”** D. Gourdon, N.A. Burnham, A.J. Kulik, E. Dupas, F. Oulevey, G. Gremaud, D. Stamou, M. Liley, Z. Dienes, H. Vogel and C. Duschl, *Tribol. Lett.* **3**, 317-24 (1997).
24. **“Local Mechanical Spectroscopy with Nanometer Scale Lateral Resolution,”** F. Oulevey, G. Gremaud, A. Sémoroz, A.J. Kulik, N.A. Burnham, E. Dupas and D. Gourdon, *Rev. Sci. Instruments* **69**, 2085-94 (1998).
25. **“Intermittent Contact: Tapping or Hammering?,”** O.P. Behrend, F. Oulevey, D. Gourdon, E. Dupas, A.J. Kulik, G. Gremaud and N.A. Burnham, *Appl. Phys.* **A66**, S219-21 (1998).

26. ***“Friction Anisotropy and Asymmetry of a Compliant Monolayer Induced by a Small Molecular Tilt”***, M. Liley, D. Gourdon, D. Stamou, U. Meseth, T.M. Fischer, C. Lautz, H. Stahlberg, H. Vogel, N.A. Burnham and C. Duschl, *Science* **280**, 273-75 (1998).
27. ***“Elastic Modulus of Ordered and Disordered Multiwalled Carbon Nanotubes”***, J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.M. Bonard, T. Stöckli, K. Méténier, S. Bonnamy, F. Béguin, N.A. Burnham and L. Forró, *Adv. Mat.* **11**, 161-65 (1999).
28. ***“Elastic and Shear Moduli for Single-Walled Carbon Nanotube Ropes”***, J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.M. Bonard, N.A. Burnham and L. Forró, *Phys. Rev. Lett.* **82**, 944-47 (1999).
29. ***“Phase Imaging: Deep or Superficial?”*** O.P. Behrend, L. Odoni, J.L. Loubet and N.A. Burnham, *Appl. Phys. Lett.* **75**, 25551-53 (1999).
30. ***“Dynamic Mechanical Analysis at the Submicron Scale”***, F. Oulevey, N.A. Burnham, G. Gremaud, A.J. Kulik, H.M. Pollock, A. Hammiche, M. Reading, M. Song and D.J. Hourston, *Polymer* **41**, 3087-92 (2000).
31. ***“Martensitic Transformation of NiTi Studied at the Nanometer Scale by Local Mechanical Spectroscopy”***, F. Oulevey, G. Gremaud, D. Mari, A.J. Kulik, N.A. Burnham and W. Benoit, *Scripta Mat.* **42**, 31-36 (2000).

In the following publications, an asterisk denotes a WPI student or postdoc.

32. ***“A Model for Materials Properties Nanoprobes”***, N.A. Burnham, S.P. Baker and H.M. Pollock, *J. Mat. Research* **15**, 2006-14 (2000).
33. ***“Optimizing Phase Imaging via Dynamic Force Curves”***, X. Chen, M.C. Davies, C.J. Roberts, S.J.B. Tendler, P.W. Williams, and N.A. Burnham, *Surf. Sci.* **460**, 292-300 (2000).
34. ***“Apparatus for Illuminating the Tip-Sample Interface of an AFM”***, E.J. Thoreson* and N.A. Burnham, *Rev. Sci. Instruments* **74**, 94-99 (2003).
35. ***“Comparison of Calibration Methods for Atomic-Force Microscopy Cantilevers”***, N.A. Burnham, X. Chen, C.S. Hodges, G.A. Matei,* E.J. Thoreson,* C.J. Roberts, M.C. Davies, and S.J.B. Tendler, *Nanotechnol.* **14**, 1-6 (2003).
36. ***“Standard-Deviation Minimization for Calibrating the Radii of Spheres Attached to AFM Cantilevers”***, E.J. Thoreson* and N.A. Burnham, *Rev. Sci. Instruments* **75**, 1359-1362 (2004).
37. ***“Precision and accuracy of thermal calibration of atomic force microscopy cantilevers”***, G.A. Matei,* E.J. Thoreson,* J.R. Pratt, D.B. Newell, and N.A. Burnham, *Rev. Sci. Instruments* **77**, 083703 (2006).

38. **“The role of few-asperity contacts in adhesion”**, E. J. Thoreson,* J. Martin, and N. A. Burnham, *J. Colloid Interface Science* **298**, 94-101 (2006).
39. **“Substrate rigidity regulates the formation and maintenance of tissues,”** W.H. Guo, M.T. Frey,* N.A. Burnham, and Y.L. Wang, *Biophys. J.* **90**, 2213-20 (2006).
40. **“Recommendations for the use of an Atomic Force Microscope as an in-fab stiction monitor,”** E. J. Thoreson*, J. Martin, and N. A. Burnham, *J. MEMS* **16**, 694-699 (2007).
41. **“Optimal roughness for minimal adhesion”**, D.-L. Liu,* J. Martin, and N.A. Burnham, *Appl. Phys. Lett.* **91**, 043107 (2007).
42. **“Effect of electrode roughness on the capacitive behavior of self-assembled monolayers”**, E.F. Douglas,* P.F. Driscoll,* D. Liu,* N.A. Burnham, C.R. Lambert, and W.G. McGimpsey, *Anal. Chem.* **80**, 7670-77 (2008).
43. **“Atomic force microscopy study of the role of LPS O-antigen on adhesion of E. coli”**, J. Strauss,* N.A. Burnham, and T.A. Camesano, *J. Mol. Recognit.* **22**, 347-355, (2009) 10.1002/jmr.955.
44. **“Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy”**, J.R. Pratt, G. Shaw, L. Kumanchik, and N.A. Burnham, *J. Applied Phys.* **107**, 044305 (2010).
45. **“Which fractal parameter contributes most to adhesion?”** D.-L. Liu,* J. Martin, and N.A. Burnham, *J. Adhesion Sci. Technol.* **24**, 2383-96 (2010).
46. **“Relating the physical properties of *Pseudomonas aeruginosa* lipopolysaccharides to virulence using atomic force microscopy”**, I.E. Ivanov,* E.N. Kintz, J.B. Goldberg, N.A. Burnham, and T.A. Camesano, *J. Bacteriology* **193**, 1259-66 (2011), doi: 10.1128/JB.0138-10.
47. **“Shape-independent lateral force calibration,”** E.V. Anderson,* S. Chakraborty,* T. Esformes,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, *ACS Appl. Mater. and Interfaces* **3**, 3256-3260 (2011), doi: 10.1021/am200770r.
48. **“Measuring the mechanical properties of living cells using Atomic Force Microscopy,”** G. Thomas,* N.A. Burnham, T. Camesano, Q. Wen, *Journal of Visualized Experiments, J. Vis. Exp.* 76, e50497, doi:10.3791/50497 (2013).
49. **“Outcomes of and materials for two university-level courses on atomic force microscopy,”** N.A. Burnham, *J. Nano Educ.* **5**, 109-114 (2013), doi: 10.1166/jne.2013.1052
50. **“A systematic AFM-based method to measure adhesion differences between micron-sized domains in asphalt binders,”** X. Yu,* N.A. Burnham, R.B. Mallick, M. Tao, *Fuel* **113**, 443-47 (2013), doi: 10.1016/j.fuel.2013.05.042.

51. "Probing large protein adhesion molecules on *Pseudomonas fluorescens* with atomic force microscopy", M. Schwartz,* I.E. Ivanov,* C.D. Boyd,* R.L.Gaddis,* S.A. O'Connor,* N.A. Burnham, G.A. O'Toole and T.A. Camesano, J. Bionanosci. **8**, 455-61 (2014), doi: 10.1166/jbns.2014.1269.
52. "***Surface microstructure of bitumen characterized by atomic force microscopy***" X. Yu,* N.A. Burnham, and M. Tao, Adv. Colloid Interface Sci. **218**, 17-33 (2015).
53. "A high throughput MATLAB program for automated force-curve processing using the AdG polymer model", S.O'Connor,* R. Gaddis,* E. Anderson,* T.A. Camesano, and N.A.Burnham, J. Microbio. Methods 109, 31-38 (2015).
54. "Investigation of the range of validity of the pairwise summation method applied to the calculation of the surface roughness correction to the van der Waals force" A. Gusso and N.A. Burnham, Surf. Sci. **651**, 28-40 (2016).
55. "In-class use of clickers and clicker tests improve learning and enable instant feedback and retests via automated grading." N.A. Burnham, S.V. Kadam, and E. DeSilva. Phys. Educ. **52**, 065018 (2017).
56. "Calcium-Mediated Adhesion of Nanomaterials in Reservoir Fluids." S.L. Eichmann and N.A. Burnham, Scientific Reports **7**, 11613 (2017).
57. "Perspectives on Atomic-Force Microscopy Education." N.A. Burnham, Microscopy and Microanalysis **23.S1**, 2298-2299 (2017).
58. "Time- and composition-dependent evolution of distinctive microstructures in bitumen." X. Yu,* S. Granados-Focil, M. Tao, and N.A. Burnham, Energy Fuels **32**, 67-80 (2018).
59. "Nanoscale hyperspectral characterization of source rock in unconventional reservoirs using Photo-Induced Force Microscopy," S.L. Eichmann, D. Nowak, D. Jacobi, and N.A. Burnham, Microscopy and Microanalysis, **24**(S1), 1040-1041 (2018).
60. "Non-destructive investigation of the thermal maturity and mechanical properties of source rocks," S. L. Eichmann, D. Jacobi, M. H. Haque and N. A. Burnham, J. Petroleum Geology, J. Petroleum Geology, **41**(4), 421-446 (2018).
61. "Microstructural evolution of asphalt binder under combined action of moisture and pressure," M.K. Nivedya,* T.G. Trottier,* X. Yu,* M. Tao. N.A. Burnham, and R.B. Mallick, Journal of Transportation Engineering, Part B: Pavements, **145**(2), 06019001-1 (2019).
62. "Understanding Calcium-Mediated Adhesion of Nanomaterials in Reservoir Fluids by Insights from Molecular Dynamics Simulations," Hsieh Chen, Shannon L. Eichmann, and Nancy A. Burnham, Scientific Reports **9**, 10763 (2019).

63. “*Bitumen’s microstructures are correlated with its bulk thermal and rheological properties*,” X. Yu,* N.A. Burnham, S. Granados-Focil, and M. Tao, *Fuel* **254**, 115509 (2019) March 2019.
64. "Specific ion effects at calcite surface defects impact nanomaterial adhesion." H. Chen, S.L. Eichmann, and N.A. Burnham, *J. Phys. Chem. C* **124**.32 (2020): 17648-17654.
65. “Pressure-Induced Void and Crack Closure Improve the Photoconversion Efficiency and Stability of Perovskite Solar Cells,” D. Oyewole, O.K. Oyewole, B. Agyei-Tuffour, J. Hinostroza-Tamayo, R. Koech, O. Oyelade, S. Adeniji, R. Ichwani, J. Cromwell, R. Ahmed, E.C. Ulloa, L. Titova, N. Burnham, and W. Soboyejo*” submitted to *Advanced Functional Materials*, December 2020.
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SCHOLARSHIP OF APPLICATION AND PRACTICE

Professor Burnham has helped:

- Lawyers understand the physics of their cases,
- Companies determine the surface roughness and topography of their samples,
- Venture capitalists investigate the viability of proposed technology
- Patent litigators as an expert witness, and
- Corporate research laboratories increase their productivity and quality of atomic-force microscopy data, e.g. journal article #40 and proceedings article #12.

Due to non-disclosure agreements, not much detail is provided here.

Inquiries are welcome, particularly if industrial support for a student on a collaborative project could result from an initial consulting agreement.

CONFERENCE, SEMINAR, AND POSTER PRESENTATIONS

In the following, an asterisk denotes a WPI student or postdoc. The presenter is underlined.

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48. “Friction Anisotropies and Highly Ordered Molecules: an AFM Study”, D. Gourdon, M. Liley, N.A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, Swiss Physical Society Meeting, Bern, February 26-27, 1998.
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58. “Intermittent Contact: Tapping or Hammering?” O.P. Behrend, F. Oulevey, D. Gourdon, E. Dupas, A.J. Kulik, G. Gremaud and N.A. Burnham, Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998.
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61. **INVITED:** “Micromechanics and Microtribology of Polymer Films”, F. Oulevey, D. Gourdon, E. Dupas, M. Liley, C. Duschl, A.J. Kulik, G. Gremaud and N. A. Burnham, American Chemical Society Meeting, August 23-27, 1998.
62. “Mixing of Two Acoustic Signals with an AFM”, E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, Park Scientific Instruments Users Meeting, Amsterdam, September 3-4, 1998.
63. “Mixing of Two Acoustic Signals with an AFM”, E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998;
64. “Mixing of Two Acoustic Signals with an AFM”, E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, Ultrasonics International 99, Berlin, March 1999.
65. “Local Mechanical Spectroscopy of Polymers and Polymer Blends”, F. Oulevey, G. Gremaud, N.A. Burnham and A.J. Kulik, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998.
66. “Intermittent Contact: Tapping or Hammering?” O.P. Behrend, E. Dupas, D. Gourdon, F. Oulevey, A.J. Kulik, G. Gremaud and N.A. Burnham, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998.
67. **INVITED:** “Nanoindentation used to Determine the Mechanical Properties of Thin Films or Bulk Materials with High Spatial Resolution”, N.A. Burnham and S.P. Baker, Eröffnungskolloquium des Nanolabs, SURFACE, Hückelhoven, Deutschland, December 9, 1998.
68. **INVITED:** “Acoustical Images at the Nanoscale: Why and How?” A.J. Kulik, E. Dupas, F. Oulevey, D. Gourdon, N. Burnham and G. Gremaud, Ultrasonics International 99, Berlin, March 1999.
69. “Amplitude dependence of down-converted acoustic waves due to a nonlinear force interaction”, E. Dupas, G. Behme, A. Kulik, N. A. Burnham, E. Chilla, and H.-J. Froehlich, 137th Meeting of the Acoustical Society of America, Berlin, March 1999.
70. **INVITED:** i) “Detection of Ultrasound using an Atomic Force Microscope (AFM) - A Step towards Nanometer Resolution, ii) Continuous Wave Ultrasonics - An Old Method with New Applications,” A.J. Kulik, N.A. Burnham, G. Gremaud, 28th Winter School on Molecular & Quantum Acoustics, Ustron, Poland, February 22-27, 1999.

71. **INVITED:** “Friction Anisotropies on Langmuir-Blodgett Films,” D. Gourdon, M. Liley, N. A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, 18th Journée des Matériaux, Lausanne, Switzerland, March 4-5, 1999.
72. “Phase Imaging: Deep or Superficial?” O.P. Behrend, L. Odoni, J.-L. Loubet and N.A. Burnham, STM ‘99, Seoul, July 18-23, 1999.
73. “Friction Anisotropy and Asymmetry of a Compliant Molecule Induced by a Small Molecular Tilt,” D. Gourdon, C. Duschl, M. Liley, A.J. Kulik and N.A. Burnham, STM ‘99, Seoul, Korea, July 18-23, 1999.
74. “Local Mechanical Spectroscopy: A New Technique to Study Inhomogeneous Materials”, F. Oulevey, G. Gremaud, A.J. Kulik and N.A. Burnham, STM ‘99, Seoul, Korea, July 18-23, 1999.
75. “Ultrasonic AFM: Tapping from the Other Side,” A. Kulik, N. Burnham, F. Oulevey, E. Dupas and G. Gremaud, nc-AFM ‘99, Pontresina, Switzerland, 1-4 September, 1999.
76. **INVITED:** “Nanomechanics of Modern Materials via Atomic Force Microscopy”, N.A. Burnham, Brinell Conference 1999, Stockholm.
77. **INVITED:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Nanotribology Workshop – Critical Assessment and Research Needs, NIST Gaithersburg, March 13-15, 2000.
78. **PLENARY:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Micro2000/UKSPM2000, London, April 13, 2000.
79. **INVITED:** “Nanomechanics of Surfaces with the AFM”, N.A. Burnham, Quantitative Surface Analysis 11, Surrey, GB, July 3-7, 2000.
80. “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, American Vacuum Society Fall Meeting, Boston, Oct.2-6, 2000.
81. **TUTORIAL:** “Measuring Mechanical Properties in the Nanometer Regime”, N.A. Burnham and S.P. Baker, Materials Research Society Fall Meeting, Boston, Nov. 27, 2000.
82. **INVITED:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Materials Research Society Fall Meeting, Boston, Nov. 27-31, 2000.

In the following talks, an asterisk denotes a WPI student or postdoc.

83. “The Feasibility of Atomic Force Microscopy as a Cytodetachment Technique to Quantify Osteoblastic Adhesion with Implant Surfaces”, D.J. Gianoli,* S.S. Kohles, N.A. Burnham, M.B. Clark, C.A. Brown, J.N. Kenealy, 27th Annual Northeast Bioengineering Conference, Storrs, CT, March 31-April 1, 2001.

84. **INVITED:** “The Theory of Technique”, N.A. Burnham, Scanning Probe Microscopy of Polymers, Weingarten, Germany, July 21-25, 2001.
85. **PLENARY:** “Nanomechanics of Surfaces with the AFM”, N.A. Burnham, Surface Analysis ‘02, Nashville TN, May 20, 2002.
86. **INVITED:** “Intermittent-Contact Mode Interpretation”, N.A. Burnham, I-PRIME Master Classes, U. Minneapolis, May 30, 2002.
87. **INVITED:** “Dynamic Force Spectroscopy”, N.A. Burnham, Novel Applications of Atomic Force Microscopy, ACS National Meeting, Colloid Division, Boston, August 18-22, 2002.
88. “Thermal Approach to Cantilever Calibration over a 200 kHz Bandwidth”, G.A. Matei,* E.J. Thoreson,* N.A. Burnham, 50th International AVS Symposium, Baltimore MD, 3-7 November 2003.
89. **INVITED:** “Accuracy and Precision in Atomic Force Microscopy”, N.A. Burnham, Nanotechnology Initiative Interagency Grand Challenge Workshop on Instrumentation and Metrology at NIST, Gaithersburg, MD, January 27-29, 2004.
90. **INVITED:** “Atomic Force Microscopy: Applications beyond Conventional EM”, N.A. Burnham, New England Society of Microscopists, Worcester MA, March 8, 2004.
91. “AFM Measurements of Stiction of MEMS Test Structures after Packaging”, E.J. Thoreson,* N.A. Burnham, and J. Martin, International Microelectronics and Packaging Symposium, Boxborough MA, May 6, 2004.
92. **INVITED:** "Intimate inaccurate contact with AFM", N.A. Burnham, Gordon Research Conference on Tribology, Roger Williams University, June 24 - July 2, 2004.
93. **PLENARY:** “Role of Atomic Force Microscopy in Conception, Design, and Characterization of High-Performance and Reliable Nanomaterials”, N.A. Burnham, Workshop on Reliability Issues of Nanomaterials, NIST, Boulder CO, August 18, 2004.
94. “Quantifying the Work of Adhesion between an AFM Cantilever Tip and MEMS Test Structures after Packaging”, E.J. Thoreson,* N.A. Burnham, and J. Martin, ISFTA, Worcester MA, 17 November 2004
95. **PANELIST:** “Measuring Time Dependent Mechanical Properties with Point Probes”, N.A. Burnham, T. Page, G. Pharr, M. Van Landingham, and K. Wahl, MRS Fall Meeting, Boston MA, 30 November 2004.
96. “Work of adhesion between AFM cantilever tips and unpatterned silicon die”, E.J. Thoreson,* J. Martin, and N.A. Burnham, MRS Fall Meeting, Boston MA, 1 December 2004.

97. "Challenges of using the AFM for an in-fab stiction monitor for MEMS devices", E.J. Thoreson,* J. Martin, and N.A. Burnham, International Microelectronics and Packaging Symposium, Boxborough MA, May 17, 2005.
98. "Quantitative work of adhesion values for use as an in-fab monitor of stiction," E.J. Thoreson,* J. Martin, and N.A. Burnham, 52nd International AVS Symposium, Baltimore MD, 31 October 2005.
99. "A few asperities determine the work of adhesion in nanometer contacts," E.J. Thoreson,* J. Martin, and N.A. Burnham, Materials Research Society Fall Meeting, Boston MA, 30 November 2005.
100. **INVITED:** "Nanoscale acoustical imaging – deep or superficial?" A.J. Kulik, G. Gremaud, L. Forro, R. Szoszkiewicz, and N.A. Burnham, 151st Meeting of the Acoustical Society of America, Providence RI, 5-9 June 2006.
101. **DISCUSSION LEADER:** N.A. Burnham, Biotribology Session, Gordon Research Conference on Tribology, Colby College, Waterville ME, 18-23 June 2006.
102. "Substrate Rigidity Regulates the Formation and Maintenance of Tissues", W. Guo, M. Frey,* N. Burnham, Y. Wang, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
103. "A Few Asperities Determine the Work of Adhesion of Nanometer Contacts", E. Thoreson,* J. Martin, N. Burnham, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
104. "Getting to the root of bacterial hair", R. Emerson,* T. Camesano, and N. Burnham, AVS 53rd International Symposium, San Francisco, November 12-17, 2006.
105. "Substrate Rigidity Regulates the Formation and Maintenance of Tissues", W. Guo, M. Frey,* N. Burnham, Y. Wang, AVS 53rd International Symposium, San Francisco, November 12-17, 2006.
106. **INVITED:** "More accurate nanomechanical measurements and modeling of adhesion in MEMS, bacterial exopolymers, and tissue-growth substrates," N.A. Burnham, Surface and Interfacial Nanomechanics at the 2007 Materials Research Society Spring Meeting, San Francisco April 9-13, 2007.
107. **INVITED:** "An Undergraduate Course on Atomic Force Microscopy," N.A. Burnham, 2007 Society for Experimental Mechanics Annual Conference and Exposition, Springfield MA, 3-6 June 2007.
108. "Optimal roughness for minimum adhesion", D. Liu,* J. Martin, and N.A. Burnham, International Conference on Nano Science and Technology – 07, Stockholm, 2-6 July 2007.

109. “Optimal roughness for minimum adhesion”, D. Liu,* J. Martin, and N.A. Burnham, AVS 54th International Symposium, Seattle, 14-19 October 2007.
110. **INVITED:** "Does continuum mechanics break down in interpreting nanoscale adhesion data?" D. Liu,* E.J. Thoreson,* N.A. Burnham, Scanning Probe Microscopy in Modern Nanoscience and Nanotechnology ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
111. “Low-Wear Variable-Slope Method of Lateral Force Calibration”, S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* N. A. Burnham, ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
112. “Low-Wear Variable-Slope Method of Lateral Force Calibration”, S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* N. A. Burnham, 55th International AVS Symposium, Boston MA, 19-24 October 2008.
113. “Influence of the Roughness Exponent on Adhesion”, D. Liu,* J. Martin, N. A. Burnham, ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
114. “Influence of the Roughness Exponent on Adhesion”, D. Liu,* J. Martin, N. A. Burnham International Conference on Nanoscience and Technology, Keystone CO, July 20-25, 2008.
115. **INVITED:** “Perspectives on the last ten years of force measurements – from understanding instrumentation to testing theoretical assumptions” N.A. Burnham, Nanomechanics Symposium 9, Hueckelhoven, Germany, 9-11 September 2008.
116. “Immobilizing Cecropin P1 for detection of pathogenic *E. coli*”, J. Strauss,* C. Mello, N.A. Burnham, and T. Camesano, AFM in Biomedicine, Monterey CA, 15-18 October 2008.
117. “Self-affine fractal analysis of MEMS surfaces for minimizing adhesion”, D.-L. Liu,* J. Martin, N.A. Burnham, 55th International AVS Symposium, Boston MA, 19-24 October 2008.
118. “Optimum roughness for minimum adhesion”, D.-L. Liu,* J. Martin, N.A. Burnham, STLE/ASME International Joint Tribology Conference, Miami, October 20-22, 2008.
119. “Optimal surface parameters for minimal adhesion”, D.-L. Liu,* J. Martin, N.A. Burnham, AVS New England Annual Symposium, Burlington MA, 8 June 2009.
120. **INVITED:** “Role of LPS heterogeneity on adhesion of gram-negative bacteria”, I. Ivanov,* J. Strauss,* C. Cronin, J. Goldberg, E. Kintz, N. Burnham, P. Pinzon-Arango,* E. Anderson,* C. Mello, T. Camesano, American Chemical Society Meeting, Washington DC, 16-20 August, 2009.
121. “Which fractal parameter contributes most to adhesion?” D.-L. Liu,* J. Martin, N.A. Burnham, International Conference on Surface Metrology, Worcester Polytechnic Institute, Worcester MA, 27 October 2009.

122. “Self-affine fractal analysis of MEMS surfaces for minimizing adhesion”, D.-L. Liu,* J. Martin, N.A. Burnham, 56th International AVS Symposium, San Jose CA, 8-14 November 2009.
123. “The effect of friction in cantilever-on-cantilever spring constant calibrations”, G.A. Shaw, J.R. Pratt, L. Kumanchik, N.A. Burnham, SEM Annual Conference, Indianapolis, June 7-9, 2010.
124. “The effects of sample stiffness and sliding friction on force curves in atomic force microscopy,” J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham, Nanobrücken Special Workshop on Nanomechanical Testing, Saarbrücken, February 25-26, 2010.
125. **INVITED:** “Which fractal parameter most determines adhesion?” D.-L. Liu,* J. Martin, N.A. Burnham, ACS North East Regional Meeting, Potsdam NY, June 2-5, 2010.
126. “Sample-Independent Lateral Force Calibration”, E. Anderson,* T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, ACS North East Regional Meeting, Potsdam NY, June 2-5, 2010.
127. “Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy”, J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham, 57th International AVS Symposium, Albuquerque NM, 17-23 October 2010.
128. **INVITED:** “Atomic Force Microscopy, the Eye and Hand of Nanotechnology,” N.A. Burnham, NanoWorcester Symposium, Worcester MA, 12 February 2011.
129. **INVITED:** “Which fractal parameter most determines adhesion?” D.-L. Liu,* J. Martin, N.A. Burnham, AVS New England 41st Annual Symposium, Burlington MA, 6 June 2011.
130. “Shape-Independent Lateral Force Calibration”, E. Anderson,* T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, AVS New England 41st Annual Symposium, Burlington MA, 6 June 2011.
131. “Shape-Independent Lateral Force Calibration”, E. Anderson,* T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, Society for Experimental Mechanics, Mohegan Sun CT, 16 June 2011.
132. “Shape-Independent Lateral Force Calibration”, E. Anderson,* T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, 58th International AVS Symposium, Nashville TN, 30 October – 4 November 2011.
133. “Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy”, J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham, AVS New England Annual Symposium, 11 June 2012, Burlington MA.

134. "Getting to the Root of Bacterial Hairs," R.L. Gaddis,* E.V. Anderson,* and T.A. Camesano, N.A.Burnham, AVS New England Annual Symposium, 11 June 2012, Burlington MA.
135. X. Yu,* B.M. McCarron,* N.A. Burnham, M. Tao, "Microscopic Morphology and Mechanical Properties of Bitumen," AVS New England Annual Symposium, 11 June 2012, Burlington MA.
136. "Correlations between Adhesion and Fractal Parameters of Microsystem Surfaces," D. Liu,* J. Martin, N.A. Burnham, International Conference on Nanoscience and Technology, Paris, France, 23-27 July 2012.
137. "Shape-Independent Lateral Force Calibration," E.V.Anderson* and N.A. Burnham, International Conference on Nanoscience and Technology, Paris, France, 23-27 July 2012.
138. "Analysis of Force Curves of *Pseudomonas aeruginosa* obtained by Atomic Force Microscopy," E.V.Anderson,* R.L. Gaddis,* T.A. Camesano, N.A. Burnham, 59th International AVS Symposium, Tampa FL, 28 October – 2 November 2012.
139. **TUTORIAL:** "Atomic Force Microscopy: The Eye and Hand of Nanotechnology," N.A. Burnham, 2nd Seminar on Surface Metrology for the Americas 2012, Worcester Polytechnic Institute, 15 October 2012.
140. "Micron-sized domains in solution-cast asphalt binders exhibit significantly different mechanical properties," X. Yu,* N.A. Burnham, R.B. Mallick, M. Tao, Petersen Asphalt Research Conference, Laramie WY, 15-17 July 2013.
141. "Adhesion characterization of asphalt binders using atomic force microscopy," X. Yu,* N. Burnham, R. Mallick, and M. Tao, Engineering Mechanics Institute Conference: Mechanics for Sustainable and Resilient Infrastructures (EMI 2013, ASCE), Northwestern University, August 4-7, 2013.
142. "Outcomes of and materials for two university-level courses on atomic force microscopy", N.A. Burnham, 60th AVS International Symposium, Long Beach CA, 25 October – 1 November, 2013.
143. "Microscopic morphology and mechanical properties of asphalt binder characterized by atomic force microscopy", X. Yu,* N.A. Burnham and M. Tao, submitted to the 43rd Annual AVS New England Symposium, Lowell MA, 16 June 2014.
144. "Getting to the root of bacterial hairs: what is "s"?" R.L. Gaddis,* S.A. O'Connor,* E.V. Anderson,* T.A. Camesano, N.A. Burnham, submitted to the 43rd Annual AVS New England Symposium, Lowell MA, 16 June 2014.
145. **FEATURED TALK:** "Outcomes of and materials for two university-level courses on atomic force microscopy", N.A. Burnham, 43rd Annual AVS New England Symposium, Lowell MA, 16 June 2014.

146. "Extension of loss-tangent mode to characterization of materials' stiffness and damping" X. Yu,* M. Tao, and N.A. Burnham, International Conference on Nanoscience and Technology, Vail CO, 21-25 July 2014.
147. "Outcomes of and materials for two university-level courses on atomic force microscopy," N.A. Burnham, International Conference on Nanoscience and Technology, Vail CO, 21-25 July 2014.
148. "Further extension of loss-tangent mode to characterization of materials' stiffness and damping" X. Yu,* M. Tao, and N.A. Burnham, AVS 61st International Symposium, Baltimore MD, 9-14 November 2014.
149. **INVITED WORKSHOPS (7):** "An Introduction to Atomic Force Microscopy" N.A. Burnham, 2015 Conference on Laboratory Instruction Beyond the First Year, 22-24 July 2015, College Park MD. <https://advlabs.aapt.org/items/detail.cfm?ID=14076>
150. **INVITED WORKSHOPS (5):** "An Introduction to Atomic Force Microscopy" N.A. Burnham, AAPT Summer Meeting, 25-29 July 2015, College Park, MD. <https://advlabs.aapt.org/items/detail.cfm?ID=14076>
151. "The negative stiffness and positive damping of air beneath AFM cantilevers", X. Yu,* M. Tao, and N.A. Burnham, AVS 62st International Symposium, San Jose CA, 18-23 October 2015.
152. **INVITED PANELIST:** "How to attract to and teach science? How to consider cognition in the education of engineering sciences?" Tribology: Interactions beyond the surface, Ecole Centrale de Lyon, France, 30-31 March 2016.
153. "Non-destructive investigations of mechanical properties and thermal maturity in source rocks," S.L. Eichmann, D. Jacobi, M. Haque, N.A. Burnham, Geological Society of America, Denver CO, 25-28 September 2016.
154. **INVITED:** "New looks at old materials: Nano-mechanics and nano-chemistry of shale and bitumen." N.A. Burnham, Nanotechnology Materials and Devices Conference (NMDC), IEEE, Toulouse, France, 9-12 October 2016.
155. "Mapping the modulus of organic matter in stiff nano-composites across the thermal maturity scale," N.A. Burnham, S.L. Eichmann, D. Jacobi, M. Haque, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.
156. **INVITED:** "Perspectives on atomic force microscopy education," N.A. Burnham, Microscopy and Microanalysis Meeting, St. Louis MO, 6-10 August 2017.
157. "Nanophysics for improving industrial oil extraction," N.A. Burnham, S.L. Eichmann, Fall 2017 Meeting of the APS New England Section, 20-21 October 2017, Kingston RI.

158. "Calcite mediates adhesion in reservoir fluids," S.L. Eichmann and N.A. Burnham, 64th International AVS Symposium, Tampa FL, 29 October-3 November 2017.
159. **INVITED:** "Oil reservoir properties at the nano-scale: Using AFM in a bulk characterization industry" S.L. Eichmann, D. Jacobi, M.H. Haque, and N.A. Burnham, 2017 Eastern Analytical Symposium & Exposition, Plainsboro NJ, 13-15 November 2017.
160. "In-class use of clickers and clicker tests improve learning and enable instant feedback and retests via automated grading." Burnham, N.A., S.V. Kadam, and E. DeSilva, Spring Meeting of the New England Section of the American Association of Physics Teachers, Nashua NH, 17 March 2018.
161. **INVITED:** "The complex polymers beneath your feet," N.A. Burnham et al., International Conference on Nanoscience and Technology, Brno, Czech Republic, 22-27 July 2018.
162. "Distinctive microstructures in bitumen evolve with time and composition," X. Yu,* S. Granados-Focil, M. Tao, and N.A. Burnham, EVC-15, Geneva, Switzerland, 17-22 June 2018.
163. "Nanoscale hyperspectral characterization of source rock in unconventional reservoirs using photo-induced force microscopy," S.L. Eichmann, D. Nowak, D. Jacobi, and N.A. Burnham, Microscopy and Microanalysis, Baltimore MD, 5-9 August 2018.
164. "Reservoir interactions and chemical heterogeneity at the nanoscale: atomic force microscopy for reservoir applications," S.L. Eichmann, N.A. Burnham, D. Jacobi, D. Nowak, Nanoworld Conference, San Francisco, 23-25 April 2018.
165. "Calcium-mediated adhesion in high salinity reservoir fluids," S.L. Eichmann, H. Chen, and N.A. Burnham, 256th ACS National Meeting, Boston, 19-23 August 2018.
166. **INVITED:** "The complex polymers beneath your feet," N.A. Burnham, X. Yu,* S.L. Eichmann, D. Nowak, M.H. Haque, D. Jacobi, M. Poitzsch, R.B. Mallick, S. Granados-Focil, and M. Tao, 2018 Nanoscientific Symposium, Albany NY, 19 September 2018.
167. "Distinctive Microstructures in a Complex Polymer Evolve with Time and Composition," Xiaokong Yu,* Sergio Granados-Focil, Mingjiang Tao, and Nancy A. Burnham, AVS 65th International Symposium and Exposition, Long Beach CA, 22 October 2018.
168. "The distinctive microstructures in bitumen and their indication of bitumen's phase stability," Xiaokong Yu,* Nancy A. Burnham, Sergio Granados-Focil, and Mingjiang Tao, APS March Meeting, Boston, 4 March 2019.
169. "In-class use of clickers and clicker tests improve learning and enable instant feedback and retests via automated grading," Snehalata Kadam, Nancy A. Burnham, Erin DeSilva, APS March Meeting, Boston, 4 March 2019.

170. "Understanding Calcium-Mediated Adhesion of Nanomaterials in Reservoir Fluids: Insights from Molecular Dynamics Simulations," Hsieh Chen, Shannon L. Eichmann, and Nancy A. Burnham, ACS Colloid & Surface Science Symposium, Atlanta GA, June 16-19, 2019.
171. **INVITED:** "Calcium-Mediated Adhesion in Highly Saline Reservoir Fluids," Shannon L. Eichmann, Hsieh Chen, and Nancy A. Burnham, Special Session 12 on Nanotechnology in Oil and Gas Industry, Diffusion in Solids and Liquids Conference, Athens, Greece, 24-28 June 2019.
172. "Effects of Applied Pressure on Photoconversion Efficiencies of FAI-Based Perovskite Solar Cells," O. K. Oyewole, D. O. Oyewole,* B. Agyie-Tuffour, J. M. Hinostroza Tamayo,* R. K. Koech,* R. Ichwani,* J. Cromwell,* N. A. Burnham, and W. O. Soboyejo, MRS Fall Meeting, Boston MA, November 28-December 4, 2020.
173. "Effects of Annealing Temperature on Interdiffusion of Materials in Layered Perovskite Solar Cells," D. O. Oyewole,* J. M. Hinostroza,* O. K. Oyewole, B. Agyei-Tuffour, R. Koech,* R. Ichwani,* J. Cromwell,* N.A. Burnham, and W. O. Soboyejo, MRS Fall Meeting, Boston MA, November 28-December 4, 2020.
174. "Adhesion and Interfacial Fracture of Perovskite Solar Cells," R. Ichwani,* V. Uzonwanne,* J. M. H. Tamayo,* D. O. Oyewole,* O. K. Oyewole, N. A. Burnham, W. O. Soboyejo, MRS Fall Meeting, Boston MA, November 28-December 4, 2020.
175. **INVITED:** "Nanomaterial Adhesion Depends on Specific-Ion Effects Within Common Reservoir Fluids," Hsieh Chen, Shannon Eichmann, and Nancy Burnham, American Chemical Society Spring Meeting (via Zoom), Industrial and Engineering Chemistry Division, 9 April 2021.
176. "Pressure increases power conversion efficiency and interlayer diffusion in perovskite solar cells," D.O. Oyewole,* J.M. Hinostroza-Tamayo,* Z.M. Mutton,* O.K. Oyewole, W.O. Soboyejo, N.A. Burnham, AVS 67th International Symposium, Charlotte NC, October 24-29, 2021.
177. "Chemical, mechanical, and morphological evolution of nanostructures on the surfaces of asphalt binders," Lei Lyu, Jianzhong Pei, Elham Fini, Lily Poulidakos, and Nancy A Burnham, AVS 69th International Symposium, Portland OR, 5-11 November, 2023.
178. "Nanoscale Evolution of Rubber-Oil Modified Asphalt Binder after Thermal and UV Aging," L. Lyu, J. Pei, N.A. Burnham, E.H. Fini, and L.D. Poulidakos, accepted by Transportation Research Board Annual Meeting, Washington DC, 7-11 January, 2024.

SEMINAR PRESENTATIONS:

1. "Hydrogenated Amorphous Silicon for Beginners," N.A. Burnham,
 a) Condensed Matter Seminar, University of Colorado at Boulder, and
 b) Amorphous Materials Seminar, Colorado School of Mines, February 1987.

2. "Nanostructural Characterization of Hydrogenated Amorphous Silicon by Surface Analysis Techniques," N.A. Burnham, Physics Department, University of Colorado at Boulder, February 1987.
3. "Atomic Force Microscopy," N.A. Burnham, Physics Department, Swarthmore College, Swarthmore PA, November 3, 1988.
4. "Measuring Nanomechanical Properties and Surface Forces of Materials with an Atomic Force Microscope," N.A. Burnham, Chemistry Department, George Washington University, Washington DC, April 7, 1989.
5. "Surface Forces Measured with an Atomic Force Microscope," N.A. Burnham and R.J. Colton, National Institute for Standards and Technology, Gaithersburg MD, May 31, 1989.
6. "Looking at Atoms- the New Scanning Probe Microscopes," N.A. Burnham, Physics Department, Colgate University, Hamilton NY, April 12, 1990.
7. "Looking at Atoms", N.A. Burnham, Rotary Club of Maryland, Silver Spring, MD, September 19, 1990.
8. "Long-Range Forces in Force Microscopy," U. Hartmann and N.A. Burnham, Institute for Thin Film and Ion Technology External Review Board, Jülich, Germany, March 5, 1992.
9. "Two Cantilever-Sample Interactions in Scanning Probe Microscopy," N.A. Burnham, Naval Research Laboratory, Washington DC, December 17, 1992.
10. "Playing with Atoms- the New Scanning Probe Microscopies," N.A. Burnham,
a) School of Physics, Lancaster University, Lancaster UK, April 23, 1993; and
b) Physics Department, Utah State University, Logan UT, May 25, 1993.
11. "Fundamental Mechanisms of Deformation and Adhesion Studied by Force Microscopy", N.A. Burnham, Physics Department, Northeastern University, Boston MA, May 27, 1993.
12. "Interpretation of Force Curves in Force Microscopy", N.A. Burnham, Departement de Physique, Ecole Polytechnique Federale de Lausanne, Switzerland, August 2, 1993.
13. "A Comparison of the Atomic Force Microscope with the Surface Force Apparatus", N.A. Burnham, Laboratoire de Tribologie et Dynamique des Systemes, Ecole Central de Lyon, France, Sept. 17, 1993.
14. "Spektroskopische Möglichkeiten mit den Raster-Sonden-Mikroskopen", N.A. Burnham, Institut für Festkörper Forschung Seminar Reihe, Forschungszentrum Jülich, Deutschland, October 1993.
27. "Analysis of Force Microscopy Data: Adhesion and Local Elastic Properties", N.A. Burnham, Insitute of Physics Seminar, University of Fribourg, Fribourg, Switzerland, November 8, 1993.

28. "Scanning Near-field Acoustic Microscopy", N.A. Burnham, A.J. Kulik, G. Gremaud, C. Wüthrich and G.A.D. Briggs, Chemistry Department, US Naval Academy, Annapolis, MD, April 26, 1994.
29. "Nanomechanics and Local Surface Forces: Understanding AFM Data", N.A. Burnham, Groupe de Physique Appliquée, Université de Genève, July 11, 1994.
30. "Nanoscale Materials Properties Studied Using Scanning Probe Techniques", N.A. Burnham, National Institute of Standards and Technology, Boulder CO, October 21, 1994.
31. "Développements en Microscopies Acoustique et à Force Atomique pour la Caractérisation Mécanique Localisée des Surfaces et Interfaces", N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey and G. Gremaud, U. Fribourg, Switzerland, December 12, 1994.
32. "Nanoscale Materials Properties Studied Using Scanning Probe Techniques", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, Oberflächentechnik, Eidgenössische Technische Hochschule Zürich, February 23, 1995.
33. "Nanoscale Imaging of Materials' Properties", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, National Institute of Standards and Technology, Boulder CO, July 21, 1995.
34. "Nanomechanics: The Physics of Intimate Contact", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, Condensed Matter Seminar, Oxford University, October 26, 1995.
35. "Microscopies à champ proche: choix et applications", P.J. Gallo, N. A. Burnham, A. J. Kulik, F. Oulevey, G. Gremaud, Ecole Supérieure de Chimie Physique Electronique, December 8, 1995.
36. "Scanning Probe Microscopy and Materials Science", N.A. Burnham, Department of Materials, Swiss Federal Institute of Technology, Lausanne, Switzerland, January 30, 1996.
25. "Scanning Probe Microscopy and Nanomechanics: The Physics of Intimate Contact", N.A. Burnham,
 - a) Physics Department, Colorado State University, Ft. Collins CO, March 7, 1996;
 - b) Physics Department, Colorado School of Mines, Golden CO, March 12, 1996;
 - c) Département de Physique, Université de Neuchâtel, Neuchâtel, Suisse, April 10, 1996;
 - d) Istituto di Biofisica, Consiglio Nazionale delle Ricerche, Pisa, Italy, May 28, 1996;
 - e) Department of Physics and Astronomy, Colgate University, Hamilton, NY, 2.18, 1997.
26. "Nanomechanics: Exploiting the Nonlinearity of the Tip-Sample Interaction", N.A. Burnham,
 - a) University of Basel, Basel, Switzerland, July 1, 1996;
 - b) Fraunhofer-Izfp Saarbrücken, Deutschland, July 17, 1996;
 - c) Department of Mechanical Engineering, Stanford University, January 9, 1997;

- d) Department of Physics, U. Massachusetts, Amherst, MA, February 19, 1997;
 - e) The Linear Approximation, Dartmouth College, Hanover, NH, February 20, 1997;
 - f) Beyond Linearity, Dartmouth College, Hanover, NH, Feb. 21, 1997.
27. "Nanomechanics: Extracting Materials Properties from SPM Data," N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, University of Bordeaux, Bordeaux, October 9, 1996.
 28. "SPM Images: Artifact, Topography or Materials Properties?" N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, Max-Planck-Institut für Metallforschung, Stuttgart, November 21, 1996.
 29. "From Oil Tankers to Atoms: Nonlinear Dynamics and Chaos," N.A. Burnham, Department of Mechanical Engineering, Stanford University, January 10, 1997.
 30. "Treffpunkt: The Point of Contact," N.A. Burnham,
 - a) Thayer School of Engineering, Dartmouth College, Hanover, NH, May 9, 1997;
 - b) Physics Department, Western Washington University, Bellingham, 2.10, 1998;
 - c) Physics Department, Northeastern University, Boston, MA, February 12, 1998;
 - d) Physics Department, Simon Fraser University, Burnaby, BC, March 4, 1998;
 - e) Physics Department, University of Oregon, Eugene, OR, March 9 & 10, 1998;
 - f) Department of Applied Physics, Delft University of Technology, March 24, 1998;
 - g) Sandia National Laboratory, Albuquerque, NM, August 17, 1998;
 - h) Lehigh University, Department of Physics, Bethlehem, PA, November 12, 1998;
 - i) McGill University, Department of Physics, Montreal, CA, November 16, 1998;
 - j) Syracuse University, Department of Physics, Syracuse, NY, November 19, 1998;
 - k) University of Wisconsin at Madison, Interdepartmental Colloquium, January 14, 1999;
 - l) University of New Hampshire, Department of Physics, Durham, NH, March 8, 1999;
 - m) Worcester Polytechnic Institute, Dept. of Physics, Worcester, MA, March 9, 1999.
 31. "Mechanical Properties of Materials at the Nanoscale: Phase Transitions in Polymer Blends and Metallic Point Contacts," N.A. Burnham, Rohm and Haas Corporation, Philadelphia, November 13, 1998.
 32. "Probing Mechanical Properties at the Nanoscale: Local Dynamic Mechanical Analysis, Dynamic Force Spectroscopy, and Friction Anisotropy," D. Gourdon, O.P. Behrend, F. Oulevey, E. Dupas, M. Liley, C. Duschl, A.J. Kulik, G. Gremaud, and N.A. Burnham,
 - a) University of Freiburg, Deutschland, Materials Research Center, December 11, 1998;
 - b) University of Münster, Deutschland, Interface Physics Group, February 10, 1999;
 - c) University of Twente, Chemical Technology Institute, February 12, 1999.
 33. "Getting More out of your AFM", N.A. Burnham, Royal Institute of Technology, Stockholm, April 23, 1999.
 34. "Small is Beautiful, Small is Different, Small is Elegant", N.A. Burnham,
 - a) Royal Institute of Technology, Stockholm, Sweden, April 23, 1999;
 - b) Karlstad University, Department of Physics, Karlstad, Sweden, April 26, 1999;

- c) Tokyo Institute of Technology, Tokyo, July 14, 1999;
 - d) Physics Department, Worcester Polytechnic Institute, May 1, 2000;
 - e) Chemistry Department, University of Western Ontario, London ON, May 10, 2000;
 - f) Physics Department, Clark University, Worcester MA, September 14, 2000;
 - g) Physics Department, University of Massachusetts at Lowell, November 8, 2000;
 - h) WPI's International CEO Roundtable on the *Impact of Evolving Technologies on the Future of Business*, Barcelona, April 20, 2001.
 - i) WPI's International CEO Roundtable on the *Impact of Evolving Technologies on the Future of Business*, Worcester, March 18, 2002;
 - j) Hysitron Inc., Minneapolis, May 30, 2002.
 - k) Colgate University, March 29, 2003.
35. "Thermo-mechanical Properties at the Nanoscale: Monolayers, Nanotubes, and Phase Transitions," N.A. Burnham, Tsukuba, Japan, July 12, 1999.
36. "Interpretating Stiffness and Damping Data from Polymer Composites", N.A. Burnham,
- a) Cornell University Department of Materials, Ithaca, NY, February 17, 2000;
 - b) Naval Research Lab Surface Chemistry Branch, Washington DC, March 9, 2000.
37. "How does a Tip Tap?" N.A. Burnham,
- a) MIT Nanomechanics Class, Cambridge MA, April 21, 2000;
 - b) University of Western Ontario SPM Class, London ON, May 8, 2000
-
- In the following talks, an asterisk denotes a WPI student or postdoc.
38. "Mechanical Properties of Carbon Nanotubes", N.P. Thompson* and N.A. Burnham, Project Presentation Day, WPI, April 2002.
39. "Nanomechanics of Modern Materials via Atomic Force Microscopy", N.A. Burnham, Mechanical Engineering Department, WPI, April 26, 2001.
40. "Ties that Bind", WPI's Presidential Roundtable, April 26, 2002.
41. **Inst. of Physics of Ireland Lecturer**, "Pitfalls in the Interpretation of AFM Images", N.A. Burnham
- a) University of Limerick, October 14, 2002;
 - c) University of Ulster Jordanstown, October 16, 2002;
 - d) Trinity College Dublin, October 18, 2002.
42. "The Promise and Peril of Nanotechnology", N.A. Burnham, WPI's NCSSTMST Student Conference, October 24, 2002.
43. "Study of Microsensor Substrates", E. Cagin* and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, February 5, 2003.
44. "Nanotube Tutorial", N.A. Burnham, Second Friday Seminar, WPI, March 14, 2003.

45. "Searching for Molecular Motion", J.N. Waddell*, E.J. Thoreson* and N.A. Burnham, Project Presentation Day, WPI, 15 April 2003.
46. "Adhesion between ADI Test Structures and AFM Tips", E.J. Thoreson* and N.A. Burnham, Analog Devices Inc., Cambridge MA, June 3, 2003.
47. "Measuring the Mechanical Properties of Nanostructures", N.A. Burnham,
 - a) Dept. of Mechanical Engineering, Yale University, April 2, 2003;
 - b) Shipley Corporation, Marlborough MA, August 8, 2003;
 - c) Materials Science Program, U. New Hampshire, Durham NH, October 8, 2003.
48. "Nanotechnology – The Next Small Thing", N.A. Burnham and W.G. McGimpsey, Museum of Science, Boston, 21 January 2003.
49. "Shear Stiffness of Carbon Nanotubes", A. Kaczowka* and N.A. Burnham, Project Presentation Day, WPI, 20 April 2004.
50. "Puzzles of Atomic Contact", N.A. Burnham, Department of Chemical Engineering, Princeton University, 10 May 2004.
51. "AFM Measurements of Stiction on MEMS Test Structures after Packaging", E.J. Thoreson*, N.A. Burnham and J. Martin, Analog Devices Incorporated, Cambridge MA, 2 June 2004.
52. "Carbon Nanotubes as Mechanical Structures and Other Applications of Atomic-Force Microscopy to Materials Science", N.A. Burnham, Materials Science Seminar, WPI, September 30, 2004.
53. "Calibrated AFM measurements to detect changes in die surfaces after packaging", E.J. Thoreson*, J. Martin, N.A. Burnham, Graduate Student Colloquium, WPI, 6 October 2004.
54. "Calibrating an AFM to measure the works of adhesion between an AFM tip and MEMS test structures after packaging," E.J. Thoreson*, J. Martin, and N.A. Burnham, National Institute of Standards and Technology, 3 November 2004.
55. "Puzzles of Atomic Contact", N.A. Burnham,
 - a) Department of Materials Science, University of Connecticut, 2 March 2005;
 - b) Department of Mechanical Engineering, University of Vermont, 27 January 2006;
 - c) Department of Mechanical Engineering, Northeastern University, 24 March 2006.
56. "An Effective Stiffness Approximation for Atomic-Force-Microscope Cantilevers", M. McCowan* and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 19 April 2005.
57. "Characterizing Viscoelastic Properties of Polyacrylamide Gels," Z. Gautreau*, J. Griffin*, T. Peterson*, P. Thongpradit*, N.A. Burnham, and K. Billiar, Project Presentation Day, Physics Department, WPI, 21 April 2006.

58. "Exploring liquid crystal properties with AFM" A. Bothmer^{*}, K. Glynn^{*}, and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 21 April 2006.
59. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 488X, Introduction to Nanomaterials and Nanotechnology, WPI, 26 January 2007.
60. "Optimal roughness for minimum stiction", D. Liu^{*}, J. Martin, and N.A. Burnham, Micromachined Products Division, Analog Device Incorporated, 14 February 2007.
61. "Lateral force calibration for probe microscopy", C. DeGraf^{*}, K. Stevens^{*}, D. Liu,^{*} and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 17 April 2007.
62. "Probing the dynamics of scarpharca dimeric hemoglobin with normal mode analysis", D. Pesce^{*}, J. Sanders^{*}, W. Royer, and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 17 April 2007.
63. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 31 January 2008.
64. "The physics of intimate contact", N.A. Burnham, Worcester State College, 13 February 2008, Sponsored by the American Physical Society Committee on the Status of Women in Physics.
65. "Mean-Value Method of Lateral Force Microscopy," D. Eggiman^{*}, N.A. Burnham, Project Presentation Day, Worcester Polytechnic Institute, 15 April 2008.
66. "Quantum conductance," C. Bruner^{*}, R. Garcia, N.A. Burnham, Project Presentation Day, Worcester Polytechnic Institute, 15 April 2008.
67. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 20 February 2009.
68. "A personal view of rural development in Vietnam and Cambodia", N.A. Burnham and F.L. Hutson, Physics Department Colloquium, 22 April 2009.
69. "Polymer brush force modeling and experiment", E. Anderson^{*}, P. Pinzon^{*}, T. Camesano, and N.A. Burnham, Project Presentation Day, WPI, 23 April 2009.
70. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 5 May 2009.
71. "How does topography influence stiction?" E.J. Thoreson,^{*} D.-L. Liu,^{*} J. Martin, and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.

72. “Which fractal parameter contributes most to adhesion?” D.-L. Liu,* J. Martin, and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.
73. “Kelvin probe force microscopy,” N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.
74. “Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science”, N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 8 February 2010.
75. “Scanning Probe Microscopy and Nanomechanics – the Physics of Intimate Contact,” N.A. Burnham, Colby College Physics Department, Waterville ME, 15 February 2010.
76. “Nanoscience and technology at WPI”, N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 20 April 2010.
77. “Sample independent friction force calibration,” T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, Project Presentation Day, WPI, 22 April 2010.
78. “Atomic Force Microscopy and its application to membrane biophysics,” N.A. Burnham, Experimental Biophysics, WPI, 9 December 2010.
79. “Sample independent lateral force calibration,” E. Anderson,* T. Esformes,* S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, Physics Department Colloquium, WPI, 13 December 2010.
80. “Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science”, N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 27 January 2011.
81. “Organic solar cells like it rough: Enhancing photovoltaic electrodes,” N.T. Nesbitt,* D. Nuzzo-Mueller,* C.R. Lambert, and N.A. Burnham, Project Presentation Day, WPI, 21 April 2011.
82. **PANELIST** in 7 November 2011 Food for Thought Lunch, “Perspectives on the ResponseWare Clickers System”, N.A. Burnham.
83. “Does controlled roughening of a surface increase its capacitance?” G. Thomas,* C.R. Lambert, N.A. Burnham, Project Presentation Day, WPI, 19 April 2012.
84. “Adhesion of silver nanoparticles,” R. Cakounes,* M. Judelson,* R. Roy,* D. Brodeur, J. Liang, N.A. Burnham, Project Presentation Day, WPI, 19 April 2012.
85. “Bacterial Adhesion,” R.L. Gaddis,* E.V. Anderson,* T.A. Camesano, N.A. Burnham, Project Presentation Day, WPI, 19 April 2012.

86. "Investigation of bee structures in asphalt binders," B. McCarron,* X. Yu,* M.J. Tao, N.A. Burnham, Project Presentation Day, WPI, 19 April 2012.
87. "Introduction to Nanoscience and Nanotechnology", N.A. Burnham, to the teachers in our Research Experience for Teacher's program, 3 July 2012, WPI.
88. "Atomic Force Microscopy: The Eye and Hand of Nanotechnology," N.A. Burnham, Polytechnic University of Valencia, Spain, 31 July 2012.
89. "Atomic Force Microscopy as a Tool for Materials Characterization," N.A. Burnham, Cabot Corporation, Billerica MA, 17 August 2012.
90. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 18 September 2012.
91. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 20 November 2012.
92. "Lateral-force calibration and an adhesion standard for atomic force microscopy," N.A. Burnham, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg MD, 30 November 2012.
93. "Atomic Force Microscopy: The Eye and Hand of Nanotechnology," N.A. Burnham, Physics Department, UMass Boston, 5 December 2012.
94. Speaker and **PANELIST** for WPI's STEM Education Center on "Success in first-year physics?" 19 November 2013, WPI, N.A. Burnham.
95. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 18 November 2013.
96. "A high throughput MatLab program for automated force-curve processing using the AdG polymer model," S. O'Connor,* R.L. Gaddis,* E.V. Anderson, T.A. Camesano, and N.A. Burnham, MS thesis defense, Worcester Polytechnic Institute, 13 August 2014.
97. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 24 February 2014.
98. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 20 November 2014.
99. "Surface microstructures and mechanical properties of bitumen characterized by atomic force microscopy," X. Yu,* M. Zaumanis,* R. Mallick, N. A. Burnham, S. dos Santos, L. D. Poulikakos, and M. Tao, Reservoir Engineering Technology, Aramco Research Center, Boston, 13 January 2015.

100. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 26 January 2015.
101. "Clicker tests enable instant feedback for students and no grading for faculty", N.A. Burnham, S.V. Kadam, B.H. Currier, and J.L. Baer, Food For Thought Seminar, Worcester Polytechnic Institute, 9 February 2015.
102. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, College of the Holy Cross, Worcester MA, 25 March 2015.
103. "A systematic method to measure adhesion differences between micron-sized domains in asphalt binders (and other AFM activities at WPI)", X.Yu,* M. Tao, N.A. Burnham, EMPA Dübendorf, Switzerland, 4 June 2015.
104. "The negative stiffness and positive damping of air beneath AFM cantilevers (and other AFM activities at WPI)", X.Yu,* M. Tao, N.A. Burnham, EPF Lausanne, Switzerland, 12 June 2015.
105. "The complex polymers beneath your feet," N.A. Burnham, X. Yu,* S.L. Eichmann, D. Nowak, M.H. Haque, D. Jacobi, M. Poitzsch, R.B. Mallick, S. Granados-Focil, and M. Tao, Mechanical Engineering Department, Tufts University, 18 April 2019.
106. "Summary of previous ADI-WPI work with Jack Martin," N.A. Burnham, MEMS R&D Group, Analog Devices Incorporated, Wilmington MA, 8 May 2019.
107. "Bitumen's microstructures are correlated with its bulk thermal and rheological properties," X. Yu, S. Granados-Focil, M. Tao, N.A. Burnham, Road Engineering Group Meeting, EMPA, Dübendorf, Switzerland, 17 June 2019.
108. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science," N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, January 2016, 2017, 2018, 2019, 2020.
109. "Time- and composition-dependent evolution of distinctive microstructures in bitumen," X. Yu,* S. Granados-Focil, M. Tao, and N.A. Burnham, EMPA Dübendorf, Switzerland, 27 September 2021.
110. "Tracking the domain evolution of asphalt binder modified by crumb rubber and bio-oils during thermal oxidation and ultraviolet exposure," L. Lyu, L. Poulikakos, J. Pei, E. Fini, and N.A. Burnham, EMPA Dübendorf, Switzerland, 16 January 2023.
111. "What's wrong with this picture?" N.A. Burnham, L. Lyu, L. Poulikakos, EMPA Dübendorf, Switzerland, 16 January 2023.

112. "Expanding your research into the nanoscale using Empa's AFM-IR," N.A. Burnham, EMPA Dübendorf, Switzerland, 17 February 2023.
113. "The nanomaterial beneath your feet," N.A. Burnham, Materials Department Colloquium, ETH Zürich, May 3, 2023.

POSTERS:

1. "Cantilever-Sample Contact Area in Force Microscopy," N.A. Burnham, I.L. Singer and R.J. Colton, 35th National American Vacuum Society Symposium, Atlanta, GA, October 3, 1988.
2. "Aspects of Force Microscopy," N.A. Burnham, A. Birkner, C. Heiden, R.J. Colton and H.M. Pollock, NATO Advanced Study Institute on the Fundamentals of Friction, Braunlage/Harz, Germany, July, 1991.
3. "Compact Design of a UHV Force Microscope Using Fiber Optic Detection," N.A. Burnham, A. Birkner and C. Heiden, STM '91, Interlaken, Switzerland, August, 1991.
4. "Interpretation Issues in Materials' Properties Measurements at Ultrasonic Frequencies", A.J. Kulik, N.A. Burnham, G. Gremaud, P.-J. Gallo and F. Oulevey, STM '95, Snowmass CO, July 23-28, 1995.
5. "Study of Mechanical Properties at the Nanoscale Using Scanning Local-Acceleration Microscopy", F. Oulevey, P.J. Gallo, N.A. Burnham, A.J. Kulik and G. Gremaud, European Conference on Applications of Surface and Interface Analysis, October 1995, Montreux, Switzerland.
6. "Mechanical Properties Studied at the Nanoscale Using Scanning Local-Acceleration Microscopy", E. Dupas, F. Oulevey, D. Gourdon, P.-J. Gallo, N.A. Burnham and G. Gremaud,
 - a) Euromat Junior '96, August 26-30, 1996, Lausanne, Switzerland; and
 - b) Nanosciences Workshop, Hasliberg, Switzerland, October 7-11, 1996.
7. "High-Velocity Friction Force Microscopy on Organic Monolayers Patterned Via Self-Organization", D. Gourdon, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H. Vogel, Nanosciences Workshop, Hasliberg, Switzerland, October 7-11, 1996.
8. "Mixing of Ultrasonic Signals with an AFM", E. Dupas, A. Kulik, D. Gourdon, F. Oulevey, N.A. Burnham, G. Gremaud and W. Arnold, STM'97, Hamburg, Deutschland, July 20-25, 1997.
9. "Towards Local Phase-Transition Studies Using Variable Temperature Scanning Local-Acceleration Microscopy," F. Oulevey, A.J. Kulik, N.A. Burnham, E. Dupas, D. Gourdon and G. Gremaud, STM'97, Hamburg, July 20-25, 1997.

10. "How does a Tip Slip? The Relation between Friction and Molecular Tilt in Thiolipid LB Films," D. Gourdon, F. Oulevey, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H. Vogel,
 a) STM'97, Hamburg, Deutschland, July 20-25, 1997;
 b) Imagerie des Polymères, 3-5 février 1998, Nancy, France.
11. "Towards Local Mechanical Spectroscopy: Elasticity and Viscoelasticity of Polymer Blends," F. Oulevey, D. Gourdon, A.J. Kulik, N.A. Burnham, E. Dupas and G. Gremaud,
 a) 14th Meeting, Swiss Society for Optics and Microscopy, Fribourg, January 22, 1998;
 b) Imagerie des Polymères, Nancy, France, 3-5 février 1998;
 c) Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998.
12. "Amplitude Dependence of Down-Converted Acoustic Waves due to a Nonlinear Force Interaction," E. Dupas, G. Behme, A. Kulik, N. Burnham, E. Chilla and H.-J. Fröhlich, STM '99, Seoul, Korea, July 18-23, 1999.

In the following posters, an asterisk denotes a WPI student or postdoc.

13. "Calibration Method for Atomic-Force Microscopy Cantilevers," G.A. Matei,* E.J. Thoreson,* N.A. Burnham, X. Chen, C.S. Hodges, AVS 49th International Symposium, Denver CO, 4-8 November 2002.
14. "Stiction Measurements Made with an Atomic Force Microscope on Test Structures with Various Die-Attach Materials", E.J. Thoreson,* J. Martin, N.A. Burnham
 a) 50th AVS International Symposium, Baltimore MD, 3-7 November 2003;
 b) MRS Fall Meeting, Boston MA, 1-5 December 2003.
15. "Quantifying the Work of Adhesion between an AFM Cantilever Tip and MEMS Test Structures after Packaging", E.J. Thoreson,* N.A. Burnham, and J. Martin, ISFTA, Worcester MA, 17 November 2004.
16. "SI-traceable verification of a thermal cantilever calibration method for AFMs", G.A. Matei,* E.J. Thoreson,* J.R. Pratt, D.B. Newell, and N.A. Burnham, NIST internal review, 23 November 2004.
17. "Metrology for AFM stiction measurements", C.A. Rehm,* E.J. Thoreson,* and N.A. Burnham, International Microelectronics and Packaging Symposium, Boxborough MA, May 17, 2005.
18. "An undergraduate course on Atomic Force Microscopy," N.A. Burnham, Materials Research Society Fall Meeting, 29 November 2005.
19. "What's a few small bumps between friends?" E.J. Thoreson,* J. Martin, and N.A. Burnham, Gordon Research Conference on Tribology, Colby College, Waterville ME, July 18-23, 2006.

20. "Getting to the root of bacterial hair", R. Emerson,* T. Camesano, and N. Burnham, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
21. "UV-cleavable polyacrylamide substrates for spatio-temporal mechanotransduction studies," M.T. Frey,* N.A. Burnham, Y. Wang, Biomedical Engineering Society Meeting, Chicago, October 11-14, 2006.
22. "Optimal roughness for minimum stiction", D. Liu,* J. Martin, and N.A. Burnham, Graduate Research Achievement Day, Worcester Polytechnic Institute, 28 March 2007.
23. "Probing the dynamics of scarpharca dimeric hemoglobin with normal mode analysis", D. Pesce,* J. Sanders,* W. Royer, and N.A. Burnham, Project Presentation Day, Department of Biology and Biotechnology, WPI, 17 April 2007.
24. "Optimal roughness for minimum stiction", D. Liu,* J. Martin, and N.A. Burnham, Seeing at the Nanoscale V, Santa Barbara CA, 24-27 June 2007.
25. "Magnetite synthesis on micro-composites made of bentonite and xanthan", D.D. Bilanovic, T.J. Kroeger, and N.A. Burnham, MC8: Advancing Materials by Chemical Design, London, 2-7 July, 2007.
26. "Optimal roughness for minimal adhesion", D. Liu,* J. Martin, and N.A. Burnham,
a) MRS Fall Meeting, Boston, 26-30 November 2007.
b) 2008 NSTI Nanotechnology Conference and Trade Show, June 1-5, 2008, Boston
27. "Effect of the roughness exponent on adhesion", D. Liu,* J. Martin, and N.A. Burnham, Graduate Research Achievement Day, Worcester Polytechnic Institute, 19 March 2008.
28. "Low-wear variable-slope method of lateral force calibration," S. Chakraborty,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham,
a) International Conference on Nanoscience and Technology, Keystone CO, 20-25 July 2008;
b) National Nano-Engineering Conference, Boston MA, 12 November 2008.
29. "Magnetite Coating of Colloidal Clay-Xanthan Aggregates," D.D. Bilanovic, T.J. Kroeger, R. Armon, C.A. Rehm* and N.A. Burnham, Gordon Research Conference - Green Chemistry 2008, August 3-8, 2008, Bates College, Lewiston, ME.
30. "Getting to the root of bacterial hairs," E. Anderson,* P. Pinzon-Arango,* I. Ivanov,* T.A. Camesano, and N.A. Burnham,
a) Graduate Research Appreciation Day, WPI, Worcester MA, 31 March 2010;
b) Sigma Xi Northeast Regional Conference, Quinnipiac University, New Haven, 17 April 2010.
31. "Surface-independent friction force calibration," T. Esformes* and N.A. Burnham, Sigma Xi Northeast Regional Conference, Quinnipiac University, New Haven CT, 17 April 2010.

32. "Environmental guidelines for nanotechnology," Z. Chen,* A. Lamb,* C. Liu,* L. Luo,* N.A. Burnham, J. Shatkin, Sustainability Poster Competition, Worcester Polytechnic Institute, 21 April, 2010.
33. "Optimization of organic solar cells via nanotechnology," N. Nesbitt,* D. Nuzzo-Mueller,* C. Lambert, N. Burnham, NanoWorcester Symposium, Worcester MA, 12 February 2011.
34. "Shape-independent lateral force calibration," E.V. Anderson,* S. Chakraborty,* T. Esformes,* D. Eggiman,* C. DeGraf, K. Stevens,* D. Liu,* and N.A. Burnham,
 a) NanoWorcester Symposium, Worcester MA, 12 February 2011;
 b) Graduate Research Appreciation Day, WPI, Worcester MA, 30 March 2011.
35. "Silver-carbon nanotube composite fabrication", R.M. Roy,* X. Geng,* N.A. Burnham, J. Liang, Graduate Research Appreciation Day, WPI, Worcester MA, 30 March 2011.
36. "Organic Solar Cells Like it Rough: Enhancing Photovoltaic Electrodes," N. Nesbitt,* D. Nuzzo-Mueller,* C. Lambert, N. Burnham, WPI's Sustainability Poster Competition, Worcester MA, 6 April 2011.
37. "Silver (Ag) – Carbon Nano Tube (CNT) Composite for Wastewater Treatment", R. Roy,* N. Burnham, and J. Liang, 3rd International Conference from Nanoparticles and Nanomaterials to Nanodevices and Nanosystems, Crete, Greece, 26-29 June 2011.
38. "Adhesion strength of silver nanoparticles", R. Cakounes,* M. Judelson,* R.Roy,* D. Brodeur, N.A. Burnham, and J. Liang,
 a) NanoWorcester Symposium, WPI, 17 March 2012;
 b) Project Presentation Day, Chemistry Department, WPI, 19 April 2012;
 c) Project Presentation Day, Mechanical Engineering Department, WPI, 19 April 2012;
 d) IMAPS Symposium, Boxborough MA, 8 May 2012.
39. "Microscopic morphology and mechanical properties of bitumen," X. Yu,* N.A. Burnham, M.J. Tao,
 a) NanoWorcester Symposium, WPI, 17 March 2012;
 b) Graduate Research Appreciation Day, WPI, 28 March 2012.
40. "Getting to the root of bacterial hairs," R.L. Gaddis,* E.V. Anderson,* T.A. Camesano, N.A. Burnham,
 a) NanoWorcester Symposium, WPI, 17 March 2012;
 b) Graduate Research Appreciation Day, WPI, 28 March 2012.
41. "Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy," J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham,
 a) NanoWorcester Symposium, WPI, 17 March 2012;
 b) International Conference on Nanoscience and Technology, Paris, France, 23-27 July 2012.

42. "Nanoparticle-roughened photoelectrodes for efficient dye-sensitized photovoltaic systems," Z. Wang,* C.R. Lambert, and N.A. Burnham, NanoWorcester Symposium, WPI, 17 March 2012.
43. "Does controlled roughening of a surface increase its capacitance?" G.M. Thomas,* C.R. Lambert, N.A. Burnham, NanoWorcester Symposium, WPI, 17 March 2012.
44. "Investigating 'bee structures' in asphalt binders," B. McCarron,* X. Yu,* M.J. Tao, N.A. Burnham,
 a) NanoWorcester Symposium, WPI, 17 March 2012:
 b) Project Presentation Day, Civil and Environmental Engineering, WPI, 19 April 2012.
45. "Shape-independent lateral force calibration," E.V. Anderson,* S. Chakraborty,* T. Esformes,* D. Eggiman,* C. DeGraf,* K. Stevens,* D. Liu,* and N.A. Burnham, NanoWorcester Symposium, WPI, Worcester MA, 12 February 2011.
46. "Silver (Ag) – Carbon Nano Tube (CNT) Composite For Wastewater Treatment," R. Roy,* N.A. Burnham, and J. Liang,
 a) NanoWorcester Symposium, WPI, 17 March 2012:
 b) Graduate Research Appreciation Day, WPI, 28 March 2012.
47. "Relating the Physical Properties of *Pseudomonas aeruginosa* Lipopolysaccharides to Virulence using Atomic Force Microscopy," I.E. Ivanov,* E.N. Kintz, L.A. Porter, J.B. Goldberg, F.L. Hutson, N.A. Burnham, and T.A. Camesano, International Conference on Nanoscience and Technology, Paris, France, 23-27 July 2012.
48. "Microscopic morphology of bitumen," X. Yu,* B. McCarron,* N.A. Burnham, M. Tao, and R. Mallick, NSF CMMI Engineering Research and Innovation Conference, Boston , 9-12 July 2012.
49. "How sticky is an asphalt binder?" X. Yu,* M. Tao, N.A. Burnham, and R. Mallick, NSF CMMI Engineering Research and Innovation Conference, Boston , 9-12 July 2012.
50. "Micron-sized domains in solution-cast asphalt binders exhibit significantly different mechanical properties," X. Yu,* N.A. Burnham, R.B. Mallick, and M. Tao, Graduate Research Appreciation Day, WPI, Worcester MA, 13 March 2013.
51. "High throughput method for analyzing force curves," S. O'Connor,* R. Gaddis,* T.A. Camesano, and N.A. Burnham, Graduate Research Appreciation Day, Worcester Polytechnic Institute, Worcester MA, 13 March 2013.
52. "Measuring the mechanical properties of living cells using atomic force microscopy," G.M. Thomas,* N.A. Burnham, T.A. Camesano, Q. Wen, Graduate Research Appreciation Day, Worcester Polytechnic Institute, Worcester MA, 13 March 2013.
53. "Multi-wavelength characterization of CdTe solar cell: Development of Q-EBIC and NSOM measurement techniques," A.G. Gianfrancesco,* H.P. Yoon, M.S. Leite, N.B. Zhitinev, and

- N.A. Burnham, Graduate Research Appreciation Day, Worcester Polytechnic Institute, Worcester MA, 13 March 2013.
54. “Getting to the root of bacterial hairs,” R.L. Gaddis,* S. O’Connor,* T.A. Camesano, N.A. Burnham, Graduate Research Appreciation Day, WPI, Worcester MA, 13 March 2013.
 55. “PH 2510, Atomic Force Microscopy, A Writing-Intensive Course,” N.A. Burnham, Showcase of Writing-Intensive Courses, Worcester Polytechnic Institute, 2 May 2013.
 56. “Getting to the root of bacterial hairs,” R.L. Gaddis,* S. O’Connor,* T.A. Camesano, N.A. Burnham, 2013 NanoWorcester Symposium, Clark U., Worcester MA, 28 September 2013.
 57. “Micron-sized domains in thin-film asphalt binders exhibit different mechanical properties,” X. Yu,* N.A. Burnham, R.B. Mallick, and M. Tao, 2013 NanoWorcester Symposium, Clark University, Worcester MA, 28 September 2013.
 58. “Outcomes of and materials for two university-level courses on atomic force microscopy,” N.A. Burnham, 2013 NanoWorcester Symposium, Clark University, Worcester MA, 28 September 2013.
 59. “High-throughput MatLab program for automated force curve processing using the AdG polymer model,” S.A. O’Connor,* R.L. Gaddis,* E.V. Anderson,* T.A. Camesano, N.A. Burnham, Graduate Research Appreciation Day, Worcester Polytechnic Institute, 26 March 2014; **2nd PLACE WINNER** for master’s competition in science, 14 April 2014.
 60. “Getting to the Root of Bacterial Hairs: What is ‘s’?” R.L. Gaddis,* S.A. O’Connor,* E.V. Anderson,* T.A. Camesano, N.A. Burnham, Graduate Research Appreciation Day, WPI, 26 March 2014; **FINALIST** for competition, 14 April 2014.
 61. “Getting to the Root of Bacterial Hairs: What is ‘s’?” R.L. Gaddis,* S.A. O’Connor,* E.V. Anderson, T.A. Camesano, N.A. Burnham, University of Massachusetts Center for Clinical and Translational Science, 5th Annual Research Retreat, UMass Medical School, Worcester MA, 20 May 2014.
 62. “High throughput method for analyzing bacterial force curves”, S.A. O’Connor,* R.L. Gaddis,* E.V. Anderson, T.A. Camesano, and N.A. Burnham, International Conference on Nanoscience and Technology, Vail CO, 21-25 July 2014.
 63. “The negative stiffness and positive damping of a thin air film”, X. Yu,* M. Tao, and N.A. Burnham, Graduate Research Innovation Exchange, Worcester Polytechnic Institute, 10 December 2014.
 64. “The negative stiffness and positive damping of a thin air film”, X. Yu,* M. Tao, and N.A. Burnham, NanoWorcester, 29 April 2015, Worcester Polytechnic Institute

65. "Getting to the Root of Bacterial Hairs," Rebecca Gaddis,* Samantha O'Connor,* Evan Anderson,* Terri A. Camesano and Nancy A. Burnham, NanoWorcester, 29 April 2015, Worcester Polytechnic Institute.
66. "An intensive short course on atomic force microscopy," N.A. Burnham, N.D. Spencer, Swiss Nano Convention, 27-28 May 2015, Neuchâtel Switzerland.
67. "The negative stiffness and positive damping of a thin air film", X. Yu,* M. Tao, and N.A. Burnham, Swiss Nano Convention, 27-28 May 2015, Neuchâtel Switzerland.
68. "High Throughput Method for Analyzing Force Curves," S.O'Connor*, R. Gaddis,* E. Anderson,* T.A. Camesano, and N.A.Burnham, Swiss Nano Convention, 27-28 May 2015, Neuchâtel Switzerland.
69. "Studio Physics in a Seven-Week Term," Sophia Leitzman,* Joseph DePaolo-Boisvert,* Jeanne Hubelbank, Nancy Burnham, American Association of Physics Teachers Spring Meeting, Worcester MA, 17-18 March, 2017.
70. "Atomic Force Microscopy Education," Nancy Burnham, Andrew Pic,* Valerie Moore,* Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.
71. "In-class use of clickers and clicker tests improve learning and enable instant feedback and retests via automated grading" Snehalata Kadam, Nancy Burnham, Erin DeSilva, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.
72. "Investigation of the range of validity of the pairwise summation method applied to the calculation of the surface roughness correction to the van der Waals force," Nancy Burnham, Andre Gusso, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.
73. "Innovating Nanoparticle Safety: Storage, Handling, and Disposal Processes," Finn O'Brien,* Katherine Moore,* Ivanna Stuart,* Andrew Lewis,* Nancy Burnham, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.
74. "The chemo-microstructure-mechanical relationships for bitumen," Xiaokong Yu,* Nancy Burnham, Sergio Granados-Focil, Mingjiang Tao, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute. **2nd PLACE WINNER**, PhD Level, Student Competition.
75. "Studio Physics in a Seven-Week Term with Transportable Labs in a Shared Space," Sophia Leitzman,* Joseph DePaolo-Boisvert,* Jeanne Hubelbank, Nancy Burnham, Spring 2017 Meeting of the APS New England Section, held jointly with NanoWorcester, 14-15 April 2017, Worcester Polytechnic Institute.

76. "The chemo-microstructure-mechanical relationships for bitumen," Xiaokong Yu,* Nancy Burnham, Sergio Granados-Focil, Mingjiang Tao, Graduate Research Innovation Exchange, Worcester Polytechnic Institute. 24 April 2017, **1st PLACE WINNER**, PhD level, Engineering.
77. "Investigation of the range of validity of the pairwise summation method applied to the calculation of the surface roughness correction to the van der Waals force," Nancy Burnham, Andre Gusso, Swiss Nano Convention, Fribourg, Switzerland, 1-2 June 2017.
78. "The chemo-microstructure-mechanical relationships for bitumen," Xiaokong Yu,* Nancy Burnham, Sergio Granados-Focil, Mingjiang Tao, Swiss Nano Convention, Fribourg, Switzerland, 1-2 June 2017.
79. "Resolving the nanoscale chemical composition of source rock using hyperspectral photo-induced force microscopy," D. Nowak, K. Park, D. Jacobi, S.L. Eichmann, N.A. Burnham, TechConnect World Innovation Conference, Anaheim, 13-16 May 2018.
80. "Calcium mitigates adhesion in highly saline reservoir fluids," Shannon L. Eichmann and Nancy A. Burnham, Swiss Nano Convention 2018, ETH Zurich, 6-7 June 2018.
81. "Physics education research on inexpensive active-learning lab modules," Zoe Mutton,* Corinne Rywalt,* Megan Varney,* Nancy Burnham, APS March Meeting, Boston, 5 March 2019.
82. "Understanding Calcium-Mediated Adhesion of Nanomaterials in Reservoir Fluids: Insights from Molecular Dynamics Simulations," Hsieh Chen, Shannon L. Eichmann, and Nancy A. Burnham, 13th International Symposium on Electrokinetics, Cambridge MA, 12-14 June 2019.
83. "Bitumen's microstructures are correlated with its bulk thermal and rheological properties," Xiaokong Yu, Mingjiang Tao, Sergio Granados-Focil, and Nancy A Burnham, Swiss Nano Convention, Lausanne, Switzerland, 6-7 June 2019.
84. "Characterization of asphaltene deposits & solid bitumen by ToF-SIMS," T. Terlier, S. Enayat, Z. Zhang, X. Yu, M. Tao, N.A. Burnham, F. Vargas, S. Biswal, and R. Verduzco, SIMS XXII, The 22nd International Conference on Secondary Ion Mass Spectrometry, Kyoto, October 2019.
85. "Atomistic Molecular Dynamics Simulations of Nanomaterial Adhesion on Calcite Surface Defects in Deionized Water and Reservoir Fluids," Materials Research Society, H. Chen, S.L. Eichmann, and N.A. Burnham, MRS Fall Meeting, Boston, 3 December 2019.
86. "Combining Atomic Force Microscopy and Molecular Dynamics Simulations to Study the Adhesion of Nanomaterials in Reservoir Fluids," Hsieh Chen, Shannon L. Eichmann, Nancy A. Burnham, Middle East Oil & Gas Show and Conference, Bahrain, 24-27 May 2021.

87. "Nanomaterial adhesion depends on specific-ion effects within common reservoir fluids," Hsieh Chen, Shannon L. Eichmann, and Nancy A. Burnham, AVS 67th International Symposium, Charlotte NC, October 24-29, 2021.
88. "Towards artifact-free AFM image interpretation," N.A. Burnham, L. Lyu, L. Poulikakos, Swiss Nano Convention, Neuchâtel, Switzerland, 15-16 June 2023.
89. "Domain evolution in the nanomaterial beneath your feet," L. Lyu, N.A. Burnham, J. Pei, E. Fini, and L. Poulikakos, Swiss Nano Convention, Neuchâtel, Switzerland, 15-16 June 2023.
90. "Towards artifact-free AFM image interpretation," N.A. Burnham, L. Lyu, L. Poulikakos, AVS International Symposium, Portland OR, 6 November, 2023.
91. "The role of charge transport in strain development and degradation of perovskite solar cells," Nikoloz Gegechkori, Winston O. Soboyejo, John Adjah, Husna Amini, Kateryna Kushnir, Lyubov V. Titova, and Nancy A. Burnham, accepted to MRS Fall Meeting 2023.

SPONSORED RESEARCH ACTIVITY SINCE 2000

My income for scholarship totals \$674,105, more than four times my start-up package of \$150,000. The numbers and types of awards are seen in this table. The details are listed below, where the amounts of the awards are shown in **bold**.

Type	Student grants	Teaching grants	Corporate grants	Federal grants	Other
Number of awards	14	4	5	2	3
Amount	\$12,397	\$15,112	\$362,800	\$264,290	\$19,506

STUDENT SUPPORT:

1. Sigma Xi Grants-in-Aid of Research, by Jack Waddell, MQP student, 9 January 2003, "Mechanical Photoresponse of Wild-Type Bacteriorhodopsin", **\$814 awarded**. (Advisor)
2. Sigma Xi Grants-in-Aid of Research, by Aaron Kaczowka, MQP student, December 2003, "Shear Stiffness of Carbon Nanotubes", **\$966 awarded**. (Advisor)
3. AVS Undergraduate Student Award, by Aaron Kaczowka, MQP student, January 2004, "Shear Stiffness of Carbon Nanotubes", **\$1000 awarded**. (Advisor)
4. Applied for WPI 2005 Summer Undergraduate Research Fellowships for three undergraduates, \$9,000. (PI)
5. Sigma Xi Grants-in-Aid of Research, by Anne Bothmer and Kevin Glynn, MQP students, Fall 2005, "Photo-Induced Nanophase Segregation in Dye-Doped Liquid Crystals", \$986 requested, **\$700 awarded**. (Advisor)
6. Sigma Xi Grants-in-Aid of Research, by David Pesce and Jeffrey Sanders, MQP students, Fall 2006, "In-vitro mechanical interaction of cytoplasmic dynein with microtubules", submitted 15 October 2006, \$802 requested. (Advisor)
7. Sigma Xi Grants-in-Aid of Research, by Colin DeGraf and Keeley Stevens, MQP students, Fall 2006, "Improved Direct Force Balance Method for Lateral Force Calibration", submitted 15 October 2006, \$690 requested, **\$690 awarded**. (Advisor)
8. Sigma Xi Grants-in-Aid of Research, by Derek Eggiman, MQP student, Fall 2007, "Mean Value Method for Lateral Force Calibration", submitted 15 October 2007, \$482 requested, **\$482 awarded**. (Advisor)
9. Sigma Xi Grants-in-Aid of Research, by Evan Anderson, MQP student, "Is it the root or mesh spacing that determines the interaction force between an AFM tip and a polymer brush?" submitted 15 October 2008, \$820 requested. (Advisor)

10. Sigma Xi Grants-in-Aid of Research, by Taylor Esformes, MQP student, "Sample-Independent Friction Force Calibration," submitted October 2009, **\$395 requested and awarded.** (Advisor)
11. Sigma Xi Grants-in-Aid of Research, by Daniel Nuzzo-Mueller and Nathan Nesbitt, MQP students, "Optimization of substrate surface topography for organic thin-film solar cells," submitted 15 October 2010, \$865 requested, **\$700 awarded.** (Advisor)
12. NSF Graduate Student Poster Contest Award, "Silver (Ag) – Carbon Nano Tube (CNT) Composite for Wastewater Treatment", R. Roy, N. Burnham, and J. Liang, **conference registration, \$800 towards travel, and free housing** at the 3rd International Conference from Nanoparticles and Nanomaterials to Nanodevices and Nanosystems, Crete, Greece, 26-29 June 2011
13. NSF Graduate Student Poster Contest Award, "Silver (Ag) – Carbon Nano Tube (CNT) Composite for Wastewater Treatment", R. Roy, N. Burnham, and J. Liang, **\$1500** more graciously provided by WPI's Office of Graduate Admissions for student travel.
14. "Optimization of Organic Solar Cells via Surface Roughening with Gold Nanoparticles," Summer Undergraduate Research Fellowship, Worcester Polytechnic Institute, for Zhixin Wang, co-advisor Prof. C.R. Lambert, **\$3000 awarded** for summer 2011. (PI)
15. Sigma Xi Grants-in-Aid of Research, by Benjamin McCarron, MQP student, "The evolution and dissolution of 'bee' structures in asphalt binders," submitted 15 October 2011, \$778 requested. (Advisor)
16. Sigma Xi Grants-in-Aid of Research, by Robert Cakounes and Michael Judelson, MQP students, "Quantitative analysis of the adhesion strength of silver nanoparticles to substrates," submitted 15 October 2011, \$865 requested, **\$400 awarded.** (Advisor)
17. Sigma Xi Grants-in-Aid of Research, by Rebecca Gaddis, MQP student, "Determining the parameters of force curves on pseudomonas aeruginosa: Is "s" the root spacing or the mesh spacing?" submitted 15 October 2011, \$589 requested, **\$550 awarded.** (Advisor)
18. Sigma Xi Grants-in-Aid of Research, by Gawain Thomas, MQP student, "Does controlled roughening of a surface increase its capacitance?" submitted 15 October 2011, \$724 requested, **\$400 awarded.** (Advisor)

TEACHING GRANTS:

1. WPI Teaching Technology Fellowship Grant, “Does Computerized Physics Homework Help or Hinder Student Learning?” **\$1000** for external evaluation, 2005. (PI)
2. Travel grant to the Teaching Professors Conference, Cambridge, MA, May 21-23, 2010, **\$1133 requested and awarded**, from WPI’s Class of ’57 Excellence in Teaching Fund. (PI)
3. WPI’s Course Design Technology Grants, “Clicker Questions for Preparation for Introductory Mechanics Laboratories,” submitted 22 January 2013, **\$3479 requested and awarded**. (PI)
4. WPI’s Course Design Technology Grants, “A step toward hands-on competency-based education for introductory physics,” submitted 12 January 2016, **\$9500 requested and awarded**. (PI)

CORPORATE SUPPORT:

1. Analog Devices Corporate Fellowship in the durability of microsensor surfaces, **\$150,000 requested and awarded** for support of a graduate student for three years starting May 1, 2003. (PI)
2. Analog Devices Corporate Fellowship in the properties of microsensor surfaces, **\$150,000 requested and awarded** for support of a graduate student for three years starting May 15, 2006. (PI)
3. “Microsensor surfaces under extremes of humidity”, to Analog Devices, September 2009, \$225,000 requested. (PI)
4. “Kelvin Probe Force Microscopy of ADI Devices”, to Analog Devices, September 2010, \$225,000 requested. (PI)
5. Donation of two marble balance tables to Physics Department from Nanosurf Instruments, value **\$2,800.00**, 2015. (PI)
6. Academic-year half-time sabbatical from Aramco Research Center – Boston, **\$54,900**. (PI)
7. Occasional contract work to supplement my repair fund, **\$5100** in income since 2008. (PI)
8. Laboratory services agreement under discussion with a major life-sciences corporation in Massachusetts, 2018. (PI)

FEDERAL GRANTS:

1. Preapplication to DOE, Nanoscale Science, Engineering, and Technology, “Molecular Photomechanics”, with W.G. McGimpsey, submitted 12 January 2001. (co-PI)
2. NSF Instrumentation for Materials Research, “Development of Instrumentation for Measuring and Controlling Molecular Forces Generated by Photoexcitation and for Education”, with W.G. McGimpsey, submitted 25 January 2001. (PI)
3. A Phase I Inquiry to the WM Keck Foundation to establish the Nanomechanics Laboratory at WPI, with W.G. McGimpsey, submitted 7 May 2001. (co-PI)
4. Preapplication to DOE, Nanoscale Science, Engineering, and Technology, “Instrumentation for Studying the Molecular Transduction of Light to Motion”, with W.G. McGimpsey, submitted 2 November 2001. (co-PI)
5. NSF Major Research Instrumentation, “Development of Instrumentation for Measuring and Controlling Molecular Forces Generated by Photoexcitation and for Education”, with W.G. McGimpsey, submitted January 24, 2002. (PI)
6. NSF Nanotechnology Undergraduate Education Program, “NUE: Further Development of a Course on Atomic Force Microscopy for Undergraduates”, submitted September 2002. (PI)
7. NSF Nanotechnology Undergraduate Education Program, “NUE: Development of a Set of Instructional Materials for a Course on Atomic Force Microscopy for Undergraduates”, **\$66,290 awarded.** Award # 0406687. August 2004 (PI)
8. NSF Nanoscale Interdisciplinary Research Teams, “NIRT: Active Nanoscale Fluidic Devices with Nanopatterned Surfaces of Optically-Switched Wettability”, with N. Gatsonis, W.G. McGimpsey, V. Thalladi (all WPI), and D. Hitt (UVM), submitted November 29, 2005, \$1,590,848 requested. (co-PI)
9. NSF Nanoscale Interdisciplinary Research Teams, “NIRT: Active Nanoscale Fluidic Devices with Nanopatterned Surfaces of Optically-Controlled Wettability”, with N. Gatsonis, W.G. McGimpsey, V. Thalladi (all WPI), and D. Hitt (UVM), submitted November 29, 2006, \$1,397,892 requested. (co-PI)
10. NSF Program on Bio- and Nano-Mechanics, “Self-affine fractal analysis of Lotus-Effect surfaces to determine the role of nanoscale roughness in the adhesion and wetting of micro- and nano-devices”, N.A. Burnham, PI, submitted 21 February 2008, \$358,720 requested. (PI)
11. NSF Program on Bio- and Nano-Mechanics, “Self-affine fractal analysis of Lotus-Effect surfaces to determine the role of nanoscale roughness in the adhesion and wetting of micro- and nano-devices”, N.A. Burnham, PI, submitted 16 September 2008, \$299,950 requested. (PI)

12. “MRI: Acquisition of an Atomic Force Microscope for Bioengineering and Life Science Research Across Multiple Scales: Molecules, Polymers, Microbes, and Cells”, (Camesano-PI, with co-PIs Garcia, Burnham, Billiar, and McGimpsey), NSF 0922901, January 2009, **\$198,000 requested and awarded.** (co-PI)
13. NSF Nanotechnology Undergraduate Education #1138233, “NUE: A First-year Course on Nanotechnology and the Search for Sustainability”, with J. Liang (PI-ME), S. Jiusto (IGSD), D. Golding (IGSD), submitted 19 April 2011, \$199,794 requested. (co-PI)
14. National Science Foundation, “MRI: Acquisition of a combined atomic force microscope and infrared spectrometer (AFM-IR) for life science and materials research and education,” N.A. Burnham, T.A. Camesano, A. Gericke, C.R. Lambert, M. Tao, submitted 26 January 2014, \$407,278 requested. (PI)
15. National Science Foundation, “NUE: Integrating atomic force microscopy into undergraduate curriculum and research at Worcester Polytechnic Institute,” N.A. Burnham, submitted 27 May 2014, \$199,808 requested. (PI)
16. National Science Foundation, “MRI: Acquisition of an atomic force microscope for nanoscale vibrational spectroscopic imaging,” N.A. Burnham, A. Gericke, W.O. Soboyejo, M. Tao, M.T. Timko, submitted 11 January 2017, \$347,365 requested. (PI)
17. National Science Foundation, “MRI: Acquisition of an atomic force microscope for the study of nanoscale light-matter interactions for health, energy, and the environment,” N.A. Burnham, A. Gericke, W.O. Soboyejo, M. Tao, M.T. Timko, submitted 22 January 2019, \$568,890 requested. (PI)
18. National Science Foundation, “Engineering Efficient and Stable Perovskite and Perovskite/Silicon Solar Cells, W.O. Soboyejo, N.A. Burnham, R.L. Grimm, O.K. Oyewole, P.M. Rao, submitted 15 September 2020, \$1,999,300 requested. (co-PI)
19. National Science Foundation, “Integrating Experimental and Machine Learning for Accelerated Climate Change Mitigation,” W.O. Soboyejo, N.A. Burnham, R. Neamtu, O.K. Oyewole, submitted 24 May 2022, \$1,499,996 requested. (co-PI)
20. Expression of Interest letter to NSF-Swiss Lead Agency Opportunity, “The effect of stress on the formation of nanoscale iron oxides,” PI Burnham, Co-PI Crockett (Empa), \$580,000 requested from NSF, 446,000 CHF requested from SNSF, submitted 26 July 2023. **Accepted** on 31 August 2023.
21. Swiss NSF-NSF Lead Agency Opportunity, “The effect of stress on the formation of nanoscale iron oxides,” PI Crockett (Empa), Co-PI Burnham, \$593,349 requested from NSF, 449,466 CHF requested from Swiss NSF, submitted 29 September 2023.

OTHER:

1. Research Advancement Proposal “Atomic Force Microscopy and Nanomechanics at WPI”, to WPI’s Research Development Council, spring 2000. (PI)
2. Research Advancement Proposal to the RDC at WPI, “Molecular Photomechanics of Bacteriorhodopsin”, submitted 9 May 2001. **\$14,006 awarded.** (PI)
3. Cottrell Scholar Award (Research Corporation), “Molecular Photomechanics”, submitted August 31, 2002. (PI)
4. A set of parents were especially appreciative of my mentoring their child during his senior research project. They donated **\$500** to my laboratory, 2007.
5. Raised **\$5,000** in support of the Switzerland Project Center from a private donor, 2017.
6. WPI Dean of Engineering Seed Grants, “A User-Friendly Materials Characterization Laboratory,” M. Tao, R. Mallick, N.A. Burnham, submitted 28 November 2017, \$29,900 requested (co-PI).
7. WPI Women’s Impact Network Advancement Mini-Grant proposal, N.A. Burnham, submitted 5 January 2018, \$2000 requested for travel support to a conference in the Czech Republic to which I am an invited speaker. (PI)
8. WPI Women’s Impact Network, WIN Impact Grant proposal, “Engaging undergraduate women in leadership and skills in nanoscience,” N.A. Burnham, \$33,120 requested, submitted 21 February 2018. (PI)
9. WPI Women’s Impact Network Advancement Mini-Grant proposal, N.A. Burnham (PI), submitted 4 February 2019, \$1990 requested for generation of “Preliminary data to attract an industrial collaboration in resource recovery.”

TEACHING

2000 {390.0 credit hours}

- C00 PH 1110, Conference Instructor, Introductory Mechanics, two conferences
- D00 PH 1120, Conference Instructor, Introductory Electricity and Magnetism, two conferences
- A00 Physics Lab Coordinator for PH 1110, 1111, and 1130 (507 students)
- B00 PH 1120, Conference Instructor, Introductory Electricity and Magnetism, two conferences

2001 {269.5 credit hours}

- C01 PH 1111, Principles of Physics – Mechanics (taught using cooperative groups)
- D01 PH 3117, Atomic Force Microscopy (new course)
- A01 PH 2201, Intermediate Mechanics I (taught using cooperative groups)
- B01 PH 1120, Introductory E&M Conference Instructor, one section (taught using cooperative groups)

2002 {336.5 credit hours}

- C02 PH 1111, Principles of Physics – Mechanics (taught using cooperative groups)
- D02 PH 3117, Atomic Force Microscopy (improvements to labs since the previous year)
- A02 PH 2201, Intermediate Mechanics I (cooperative groups, computer homework)
- B02 PH 1120, Conference Instructor, two sections (taught using cooperative groups)

2003 {342.5 credit hours}

- C03 PH 1110, Conference Instructor, two sections (cooperative groups, computer homework)
- D03 PH 1120, Conference Instructor, two sections (taught using cooperative groups)
- D03 GN 3515, Technical Topics in German (team-taught with Dollenmayer et al.)
- A03 PH 2201, Intermediate Mechanics I (taught using cooperative groups)
- B03 PH 1120, Conference Instructor, two sections (taught using cooperative groups)

2004 {450.0 credit hours}

- C04 PH 1110, Conference Instructor, two sections (taught using cooperative groups)
- D04 PH 3117, Atomic Force Microscopy (improvements to readings since the previous offering)
- A04 PH 2201, Intermediate Mechanics I (computer homework)
- B04 PH 2202, Intermediate Mechanics II, (taught using cooperative groups)

2005 {352.0 credit hours}

- D05 GN 3515, Technical Topics in German (team-taught with Dollenmayer et al.)
 - D05 PH 2510, Atomic Force Microscopy (improvements to labs since the previous offering)
 - A05 PH 1111, Principles of Physics – Mechanics (computer homework, 82 students) 4.16/5.00
- Two course releases associated with NUE grant

First six years averaged 357 credit hours per year. Next 9.5 years (until sabbatical) averaged 509 credit hrs/yr.

Reported course evaluation numbers begin with the use of WPI's own forms in AY 2005-06. I list the averaged responses to "My overall rating of the instructor's teaching is..." Full scale is 5.00.

2006 {484.0 credit hours}

- D06 PH 2510, Atomic Force Microscopy (improvements to labs since the previous offering) 4.46
- A06 PH 1111, Principles of Physics – Mechanics, lecture and one conference, 3.61, 4.36
- B06 PH 2202, Intermediate Mechanics II, 4.56
- F06 PH 597C, Careers in Physics (no evaluation available)

2007 {503.5 credit hours}

- C07 PH 3501, Relativity, 4.50
- D07 GN 3515, Technical Topics in German (team-taught with Brisson et al., evaluation not available)
- A07 PH 1110, Intro Mechanics with TH Keil (372 students) first rendition: revised labs, initiated summary homework, 3.44 for lecture, 3.84 for my conference
- B07 PH 2202, Intermediate Mechanics II, 4.67

2008 {547.3 credit hours}

- C08 PH 1111, Principles of Physics – Mechanics (cooperative groups) new labs, **5.00**
- D08 PH 2510, Atomic Force Microscopy, 4.71
- S08 PH 597A, Atomic Force Microscopy, first rendition at graduate level, 4.33
- A08 PH 1110, Introductory Mechanics with TH Keil (376 students), 4.13 lecture, 4.55 conference
- B08 PH 2202, Intermediate Mechanics II, 4.87

2009 {484.0 credit hours}

- C09 PH 1110, Introductory Mechanics, Conference Instructor, two sects, 4.45, 4.50
- D09 PH 1120, Introductory Electricity and Magnetism, Conference Instructor, one conf + lab, 4.65
- S09 PH 597A, Atomic Force Microscopy, 4.67
- A09 PH 1110, Introductory Mechanics w/ TH Keil (368 students), 3.84 lecture, no conference (released for being Chair of CTAF). First use of lecture capture with both white board and Symposium.
- B09 PH 2202, Intermediate Mechanics II, **5.00**

2010 {587.0 credit hours}

- C10 PH 1130, Introduction to 20th Century Physics, Conference Instructor, two conferences, 4.62, 4.63
- D10 PH 2510, Atomic Force Microscopy, 4.86
- A10 PH 1110, Introductory Mechanics w/ TH Keil (379 students), first use of Notebook software, 3.75 lecture, 4.08 conference
- B10 PH 1121, Principles of Physics, Electricity and Magnetism, two conferences, 4.33, 4.57

2011 {549.5 credit hours}

- C11 Worcester Community Project Center, sixteen students, four IQP teams, 4.56
- D11 PH 2510, Atomic Force Microscopy (undergraduate version), 4.90
- S11 PH 597A, Atomic Force Microscopy (graduate version), 4.89
- A11 PH 1110, Introductory Mechanics w/ H Kashuri (346 students), first use of clickers, 3.76 lecture, 4.16 conference

2012 {440.3 credit hours}

- C12 PH 2201, Intermediate Mechanics I, new book, first use of clickers, first time since 2004, 4.35
- D12 PH 1140, Oscillations and Waves, Conference Instructor, first time, 4.77
- A12 PH 1110, Introductory Mechanics w/ H Kashuri (217 students), second use of clickers, lectures, 4.04, 4.17
- B12 PH 1121, Principles of Physics, Electricity and Magnetism, two conferences, 4.93, 4.60
- F12 PH 597N, Nanoscience Journal Club, first time, 12 students, 4.67

2013 {482.0 credit hours}

- C13 PH 2201, Intermediate Mechanics I, different book, 4.76
- D13 PH 2510, Atomic Force Microscopy, 4.63
- A13 PH 1110, Introductory Mechanics w/ H Kashuri (261 students), third use of clickers, first use of clicker lab-prep questions and online reading questions, lectures, 4.23, 4.31
- B13 PH 1121, Principles of Physics, Electricity and Magnetism, two conferences, 4.69, 4.79
- S13 PH 597N, Nanoscience Journal Club, second time, 12 students, 4.92
- F13 PH 597N, Nanoscience Journal Club, third time, 6 students, **5.00**

2014 {572.0 credit hours}

- C14 PH 1110, Introductory Mechanics, two sections, clickers for multiple-choice exams, 4.18
- C14 PH 2201, Intermediate Mechanics I, different book, clickers for one exam, 4.35
I taught two undergraduate courses simultaneously in C14. It was challenging, and I wasn't able to give as much individual attention as usual.
- A14 PH 1110, Introductory Mechanics, six sections in lecture plus one conference, first use of clickers for tests and integrated into conferences. **4.51** lecture (N = 129), 4.47 conference
- B14 PH 1121, Principles of Physics, Electricity and Magnetism, two conferences, 4.63, 4.43
- F14 PH 597N, Nanoscience Journal Club, fourth time, 12 students, 4.50

2015 {185.0 credit hours for Spring, on sabbatical in the Fall}

- C15 PH 2201, Intermediate Mechanics I, clickers, return to familiar book, 4.65
- D15 PH 2510, Atomic Force Microscopy, 4.80
- S15 PH 561, Atomic Force Microscopy, had to write new lab instructions on the fly, 4.33
- E15 IQP on AFM education, **5.00** on advisor effectiveness
- E15 AFM course given in short-course format at ETH Zürich

2016 {On sabbatical in the Spring, 159 credit hours for Fall}

- S16 AFM course given in short-course format at ETH Zürich
- A16 PH 1111, Principles of Physics, Mechanics, two conferences, 4.40, 4.50
- B16 PH 1121, Principles of Physics, Electricity and Magnetism, two conferences, 4.88, 4.82

2017 {190.5 credit hours for $\frac{3}{4}$ FTE}

- C17 PH 111X, Studio Physics – Mechanics, small pilot studio course made up on the fly, 3.85
- D17 PH 2510, Atomic Force Microscopy, 4.33
- A17 Released for being Director of Switzerland Project Center, 2016
- B17 PH 1120, General Physics – Electricity and Magnetism, two conferences, 4.67, 4.50
- E17 AFM course given in short-course format at ETH Zürich

2018 {565.0 credit hours for $\frac{3}{4}$ FTE}

- C18 PH 111X, Studio Physics – Mechanics, second small rendition of pilot studio course, 4.30
- D18 PH 2510, Atomic Force Microscopy, 4.77
- S18 PH 561, Atomic Force Microscopy, 4.77
- E18 AFM course given in short-course format at ETH Zürich
- A18 PH 1110S, studio version of General Physics – Mechanics in new active-learning classroom, 3.7
- B18 Released for being Director of Switzerland Project Center, 2017

2019 {285.5 credit hours for $\frac{3}{4}$ FTE}

- C19 PH 1130, conference instructor, two sections, 4.6
- D19 Released for doubling up in A Term with 139 students in two large sections of PH 1110S
- E18 AFM course given in short-course format at ETH Zürich
- A19 PH 1110S, studio version of General Physics – Mechanics in new active-learning classroom, 3.7
- B19 Released for being Director of Switzerland Project Center, 2018

2020 {724.0 credit hours for $\frac{3}{4}$ FTE}

- C20 PH 2510, Atomic Force Microscopy, 4.4
- D20 Released for being Director of Switzerland Project Center, 2019
- E20 No AFM course in Switzerland due to Covid-19 restrictions
- A20 PH 1110, lead instructor for 20-section remote course with **461** students, 3.3
- B20 Released for being Director of Switzerland Project Center, 2020

2021 {629.0 credit hours for $\frac{3}{4}$ FTE}

C21 PH 1110, lead instructor for 8-section remote course with 214 students, 3.6

D21 Namibia Project Center, advisor to six IQPs, 24 students (all remote due to Covid), 4.6

E21 No AFM course in Switzerland due to Covid-19 restrictions

A21 Switzerland Project Center, advisor to six IQPs, 24 students (partially remote due to Covid), 4.6

B21 Released for being Director of Switzerland Project Center, 2021

2022 {501.0 credit hours for spring semester}

C22 PH 2510, Atomic Force Microscopy, 5.0

D22 PH 2550, Atmospheric and Space Envrnmnts, 161 students, 3.4 (first rendition, mixed-level class)

E22 AFM course given in short-course format at ETH Zürich, 4.5

A22 Sabbatical at EMPA Dübendorf, Switzerland

B22 Sabbatical at EMPA Dübendorf, Switzerland

2023

C23 Sabbatical at EMPA Dübendorf, Switzerland

D23 Sabbatical at EMPA Dübendorf, Switzerland

E23 AFM course given in short-course format at ETH Zürich, **4.9**

A23 Released for work for Zurich Project Center

B23 Released for work for Lausanne Project Center

2024

C24 PH 2510, Atomic Force Microscopy

C24 PH 1120S, General Physics – Mechanics in studio format

E24 AFM course given in short-course format at ETH Zürich

STUDENT PROJECTS ADVISED AND THESES REFERREED

STUDENT PROJECTS:

Graduate and postgraduate projects are in **bold**.

1. M. Lennartz, “Optischer und mechanischer Aufbau eines Rasterkraftmikroskops” Diplomarbeit, Fachhochschule Aachen, Abteilung Jülich, 1992-93.
2. F. Oulevey, “Détermination des propriétés mécaniques de surface des matériaux à l’échelle microscopique grâce à la propagation d’ondes ultrasonores pendant une mesure AFM,” diplôme, EPFL, 1994-95.
3. **F. Oulevey, “Cartographie et spectrométrie des propriétés mécanique a l’échelle nanometrique par microscopie en champ proche,” thèse, EPFL, 1995-99.**
4. **D. Gourdon, “Molecular Tribology of Highly Ordered Monolayers,” PhD thesis, EPFL, 1996-99.**
5. **E.J. Thoreson, “Apparatus to deliver light to the tip-sample interface of an atomic force microscope”, M.S. Physics, WPI, August 2002.**
6. N.P. Thompson, “Mechanical Properties of Carbon Nanotubes”, WPI senior research project, 2001-02.
7. E. Cagin, “Durability of Microsensor Surfaces”, WPI independent study project, 2002-03.
8. J.N. Waddell, “Molecular Photomechanics”, WPI senior research project, 2002-03.
9. A.B. Kaczowka, “Shear Stiffness of Carbon Nanotubes”, WPI senior research project, 2003-04.
10. M.S. McCowan, “An Effective Stiffness Approximation for AFM Cantilevers”, WPI senior research project, 2004-05.
11. T. Allwood, K. Psiakis, T. Regan, “Will ‘Prey’ Consume Nanotechnology?” WPI junior research project, 2004-05, Co-advisor I. Bar-On.
12. **E.J. Thoreson, “From the nanoscale to the macroscale, using the atomic force microscope to quantify the role of few-asperity contacts in adhesion,” Ph.D. in Physics, Fall 2005.**
13. A.V. Sklyar, J.W. Smith, C.C. Stedman II, “Social Acceptance of Technologies” WPI junior research project, 2005-06, Co-advisor J. Liang.

14. Z. Gautreau, J. Griffin, T. Peterson, P. Thongpradit, "Characterizing Viscoelastic Properties of Polyacrylamide Gels," WPI senior research project, 2005-06. Co-advisor to K. Billiar.
15. A. Bothmer, K. Glynn, "Exploring liquid crystal properties with AFM", WPI senior research project 2005-06. Co-advisor G. Iannacchione.
16. **D. Liu, "Properties of microsensor surfaces", postdoctoral research, 2006-09.**
17. David Pesce, PH '07, Jeffrey Sanders, PH '07, "Physics of molecular motors," WPI senior research project, 2006-07.
18. Colin DeGraf, PH '07, Keeley Stevens, PH '07, "Lateral force calibration," WPI senior research project, 2006-07.
19. Nathalia Arenas, CBC '08, Katelyn Ryan, BBT '08, Ergys Subashi, PH '08, "Social acceptance of nanomedicine," WPI junior research project 2006-07.
20. Christopher Bruner, PH '08, "Quantum Conductance," WPI senior research project, 2007-08.
21. Derek Eggiman, PH '08, "Improved lateral force calibration," WPI senior research project, 2007-08.
22. David Beavers AE '09, Calvin Goodrich ECE '09, Brad Kaufman BCB '09, "Nanoscience and society," WPI junior research project, 2007-08.
23. David Aaron Costello, Yuval Harel, Justin LeBeau, Robert Warren, "Nanoscience and society", 2007-08
24. E.V. Anderson PH '09, "Polymer Brush Force Modeling and Experimentation", WPI senior research project, 2008-09, Co-advisor T.A. Camesano (CHE).
25. **E.V. Anderson, "Atomic Force Microscopy: Lateral-Force Calibration and Force-Curve Analysis," M.S. in Nanophysics, 2009-12. Co-advisor T.A. Camesano (CHE).**
26. Zhen Chen, Alexander Lamb, Chang Liu, Lan Luo, "Environmental guidelines for nanotechnology", 2009-10.
27. Taylor Esformes, "Lateral force calibration on arbitrary surfaces", 2009-10.
28. Nathan T Nesbitt, PH '11, Daniel Nuzzo-Mueller, PH '11, "Charge separation in thin films", 2010-11, Co-advisor C.R. Lambert (BEI).
29. Gregory D Anderson, CM '12, Michael A Jenkins, ME '12, Casey J Rivera, CM '12, Yow-Chyuan Yeh, BE '12, "EcoTarium Energy Project", B10-C11.

30. Mariela L Castillo, ME '12, Tanawit Permsuk, CE '12, Eduardo LE Pizzini, ECE '12, Daniel B Thomas, ECE '12, Daniel C Valerio, BIO '12, "Green Renovations for the Worcester Youth Center", B10-C11.
31. John P Flynn, CE '12, John K Pearsall, RBE '12, Michael A Pettiglio, BIO '12, Yiming Wu, ECE '11, "Worcester Public Library Programming", B10-C11.
32. Zhichao Liao, CE '12, Eric D Petrin, MA '12, James M Post, MIS '12, "Determining the Economic Value of Trees", B10-C11.
33. Rebecca L Gaddis, PH '12, "Determining the Parameters of Force Curves on *P. aeruginosa*," 2011-12 (MQP NAB MP13), Co-advisor T. Camesano (CHE).
34. Benjamin McCarron, PH'12, "Investigation of 'Bee-Structures' in Asphalt Binders," 2011-12 (MQP NAB MP14), Co-advisor M. Tao (CEE).
35. Gawain Thomas, PH'12, "Capacitance of Rough Surfaces," 2011-12 (MQP NAB MP15), Co-advisor C. Lambert (BEI).
36. Robert Cakounes, CH '12, Michael Judelson, CH'12, "Adhesion of Silver Nanoparticles to Graphite Substrates," 2011-12 (MQP NAB MP16), Co-advisor J. Liang (ME), D. Brodeur (CH).
37. **Anthony Gianfrancesco, MS in Physics '13, "Multi-wavelength characterization of cadmium telluride solar cell: Development of Q-EBIC and NSOM measurement techniques", work conducted at NIST.**
38. **Samantha O'Connor, MS in Physics '14, "A high throughput MATLAB program for automated force curve processing using the AdG polymer model," Co-advisor T.A. Camesano (CHE).**
39. **Rebecca L. Gaddis, MS in Physics '15, "Determining the parameters of force curves on Pseudomonas aeruginosa: Is "s" the root spacing or the mesh spacing?" Co-advisor T.A. Camesano (CHE).**
40. Katherine Longhurst, capstone project for a Minor in Physics, "The Magnificent Motion Book" C Term 2015.
41. Andrew C. Pic, BME '17, Valerie A. Moore, ECE '18, "Atomic Force Microscopy Education, Summer-A Term 2015 (IQP NAB NS07). Resulted in published book chapter.
42. Andrew L Lewis, RBE '18; Katherine A Moore, IE '18; Finn E O'Brien, AE, PH '18; Ivanna M Stuart, ME '18; Nanoparticle safety (IQP NAB NS08), A Term 2016 in Buchs, Switzerland.
43. Joseph Anthony DePaolo-Boisvert, PH; Sophia M Leitzman, APH; "Implementation and Evaluation of a Seven-Week Pilot Studio Mechanics Course," (IQP NAB PE1) B16-D17.

44. Peter D Melander, PH and AE '17. Underwater Kite Power (MQP DJO 1701) Co-advisor D. Olinger. Provost's MQP Honorable Mention in both PH and AE, Salisbury Prize.
45. **Xiakong Yu, PhD in Civil Engineering, 2017, "Understanding on relationships among chemical, microstructure, and mechanical properties of asphalt binders," March 2018. Co-advisor M. Tao.**
46. Zoe Marie Josephine Mutton PH '21, Corinne Elizabeth Rywalt PH '21, Megan Elise Varney PH '21, "Physics Education Research on Inexpensive Active-Learning Lab Modules," (IQP NAB PE2) A18-C19.
47. Taylor G Trottier, PH '19, "Analysis of Adhesion between Silica Nanoparticles and Thin Calcite Layers" (MQP NAB MP17) A18-D19 (Physics Department Award Winner)
48. J.Martin Hinostroza Tamayo, PH '20, "Pressurizing Solar Cells," (MQP NAB MP18), co-advised with W. Soboyejo and O.K. Oyewole (double major, ME&PH).
49. Nicole T. Burns, PH '20, "Simple Rheometer," (MQP NAB MP19), co-advised with W. Soboyejo and J.D. Obayemi.
50. Zoe M. Mutton, PH '21, "Perovskite Solar Cells," (MQP NAB MP20), co-advised with W. Soboyejo and O.K. Oyewole (Physics Department Award Winner)
51. Jennifer Brownell, Kaustubh Pandit, Meagan Smith, Nicholas Weiland, "Combating Unemployment in Namibia by Expanding Donor Support for MSR," Windhoek IQP Project Center D21, co-advised with ADK Smith.
52. Kevin Dang, Kimberly Hazeltine, Katherine O'Leary, Kaitlyn Pothier, "Improved Online Presence of MSR," Windhoek IQP Project Center D21, co-advised with ADK Smith.
53. Augustine Asumadu, Devan Blechinger-Slocum, Maggie Gunville, Sarah MacDonald, "PAY it Forward: Competitive Robotics Team for Youth in Katutura, Namibia in Partnership with Physically Active Youth," Windhoek IQP Project Center D21, co-advised with ADK Smith.
54. Jacqueline Aaron, Anna Catlett, Matthew Maloney, Joshua Thomas, Renovating an Educational Robotics Curriculum for Physically Active Youth (P.A.Y.)," Windhoek IQP Project Center D21, co-advised with ADK Smith. Finalist in President's IQP Award Competition, 28 January 2022.
55. John Benoit, Elizabeth DiRuzza, Andrew Fisher, and Daniel Marsh, "Training the Trainers: Developing Robotics Faculty across Africa," Windhoek IQP Project Center D21, co-advised with ADK Smith.

56. Leila Card, Michelle Frasc, Ethan Schock, Meghan Slaney, “Refining the Online Institute to Create Stronger Partnerships and Enhance the Scale of Impact,” Windhoek IQP Project Center D21, co-advised with ADK Smith.
57. Drew Sullivan, Eduardo Morel, Erica Bonelli, Kaylie Lunderville, “Developing a Virtual Showcase for the Cibachrome Association,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
58. Daniel Ali Tribaldos, Robert Chiocchio, Grace Holden, Bao Huynh, “Scaling Capacity Zurich: Fostering Refugee and Migrant Talent through Entrepreneurship,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
59. Marino Bertone, Jack Cirolì, Thanh Trac, Jason White, “Assessing Potential Applications of the Internet of Things in Hearing Research and Clinical Otology,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
60. Brandon Simpson, Evan MacGregor, Joelynn Petrie, Chelsea Chang “Microtechnology: The Project-based Approach,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
61. Ben Martin, Kurtis Kiai, Kayla Lepping, Eric Johnson, “Creating a Multimedia Narrative to Raise Awareness for Emerging Technologies,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
62. Toni Vigliotti, Jacob Mitchell, David Acuna, Ha Nguyen, “A Road to Zero Emissions in Long Range Freight Transport,” Zürich IQP Project Center A21, co-advised with Francesca Bernardi.
63. Olivia Chiasson (AE ‘22), Adrienne Curtis (AE ‘22), Zachary Sotland (AE ‘22), Andrew Ventrua Molina (AE ‘22), Thomas Rau (AE/PH ‘22), “Redesign and Testing of a Surface UnderSea Kite Model,” Major Qualifying Project co-advised with David Olinger.
64. Brigitte Lefebvre (PH ‘22), Samuel Skinner (AppPH ‘22), “Investigating the Mechanical and Opto-Electrical Properties of PEO-Doped Flexible Perovskite Solar Cells,” Major Qualifying Project co-advised with Winston Soboyejo and Kehinde Oyewole.
65. Nikolas Gegechkori (PH'23), "Strain in perovskite solar cells," Major Qualifying Project co-advised with Winston Soboyejo.
66. **Lei Lyu, PhD student at Empa, successfully defended dissertation at Chang'an University, China, 12 June 2023 (two collaborative publications).**
67. Michelle C Sangillo (PH'24), Investigating drivers of wave growth in the coastal Alaskan Artic, Major Qualifying Project co-advised with Dr Madison M Smith, Woods Hole Oceanographic Institute.

COMMITTEE MEMBER FOR THESES, DISSERTATIONS, AND HABILATIONS:

1. A.Menck, “Defects and growth processes at ionic and oxide crystal surfaces studied by atomic force microscopy,” external PhD thesis committee member, EPFL, October 1998.
2. H. Kim, “Magneto-optic properties of Ce-substituted yttrium iron garnet films by pulsed laser deposition”, licentiate exam committee member, KTH Stockholm, 9 November 1999.
3. I.M. Krausz, “Synthesis of Nanostructured Inorganic Materials for Enhanced Heterogeneous Catalysis”, PhD proposal committee member, WPI, 25 August 2000.
4. I.M. Krausz, “Synthesis of Nanostructured Inorganic Materials for Enhanced Heterogeneous Catalysis”, PhD defense committee member, WPI, 21 March 2002.
5. L. Romana, Université des Antilles et de la Guyane, habilitation committee member, 27 September 2002.
6. S. Cuenot, "Reduced-Size Effect on the Elastic Modulus of Nanomaterials: Measurement with AFM-based methods", Université catholique de Louvain, PhD thesis committee member, 25 June 2003.
7. R.J. Emerson, “A Nanoscale Investigation of Pathogenic Microbial Adhesion in Biomaterial Systems”, PhD Proposal committee member, Chemical Engineering Department, WPI, 16 December 2003.
8. D. Bennett, “Neuronal Magnetism Detection by Magnetic Resonance Imaging as an Indicator of Motor Recovery after Stroke in Adults”, Biomedical Engineering Department, WPI, Ph.D. Qualifying Examinations, 30 July 2004 and 31 August 2004.
9. M. Reinstädler, “Elastische und tribologische Oberflächencharakterisierung auf der Nanoskala mittels Torsions- und Lateralmoden von Sensorbalken der Rasterkraftmikroskopie”, Universität des Saarlandes, Ph.D. thesis reviewer, January 2005.
10. J. Balestrini, “Pulmonary myofibroblast activation: possible interaction between cyclic stretch, TGF- β , and EN-1”, Biomedical Engineering Department, WPI, Ph.D. Qualifying Examination, 25 October and 9 December 2005.
11. P. Bilas, “Approache quantitative des phénomènes de frottement à l’échelle atomique et méso échelle par microscopie à force de frottement,” Université des Antilles et de la Guyane, PhD thesis committee member, 23 November 2005.
12. R.J. Emerson, “A Nanoscale Investigation of Pathogenic Microbial Adhesion in Biomaterial Systems”, PhD defense committee member, 5 April 2006.
13. A.R. Klempner, “Development of a modular interferometric microscopy system for characterization of MEMS”, Mechanical Engineering Department, WPI, M.S. thesis defense, 19 December 2006.

14. P.A. Pinzon-Arango, "Impact of sporulation environment on the germination, virulence, and killing of *Bacillus anthracis* spores," PhD Qualifying Examination committee member, 29 November 2010.
15. P.A. Pinzon-Arango, "Investigation of the biological and physicochemical properties of *Bacillus anthracis* spores during germination, virulence, and killing," dissertation committee member, PhD in Biomolecular Engineering, WPI, 5 January 2012.
16. Heather Cirka, Biomedical Engineering Student, Specific Aims Meeting and Qualifying Exam, WPI, July-August 2012.
17. X. Yu, "Microscopic morphology, mechanical properties characterization and chemical analysis of asphalt binder", Comprehensive Exam, Civil and Environmental Engineering Department, WPI, 23 April 2014.
18. Georges Minatchy, l'Université des Antilles et de la Guyane, Contribution à l'étude des propriétés mécaniques à l'échelle nanométrique de films réducteurs de frottement et de l'usure, Pointe-à-Pitre, Guadeloupe, 28 April 2014.
19. Gawain Thomas, MS in PH, 14 December 2016, "The Role of Integrins in Cellular Response to Mechanical Stimuli".
20. Xiaokong Yu, WPI Civil and Environmental Engineering Department Ph.D. defense, "Understanding on relationships among chemical, microstructure, and mechanical properties of asphalt binders," March 2018.
21. William H Linthicum, WPI Biomedical Engineering Department Ph.D. defense, 13 June 2019
22. Vanessa Obiageli Uzonwanne, MTE PhD Qualifying Oral Exam, "An investigation of the viscoelastic properties and actin cytoskeletal structure of triple negative breast cancer cells," 5 August 2019.
23. Arvand Navabi, ME PhD Qualifying Oral Exam, 31 October 2019.
24. Deborah Olubunmi Oyewole, MSE PhD Dissertation Defense, "A Study of the Effects of Thermal Annealing/Pressure and Stretching on Performance of Organic & Hybrid Perovskite Solar Cells," 3 May 2021.
25. Melissa Wojnowski, BME Specific Aims and Qualifying Exams, May and June, 2021.
26. Vahid Khosravi, "Enhancement of Oil Recovery from Sandstone Reservoirs using Smart Water," PhD Dissertation Defense, Petroleum Engineering, Universiti Teknologi Petronas, Perak, Malaysia, 5 January 2022.

27. Yinduo Chen, “Identifying and Characterization of Nanoparticles in Community Wastewater,” PhD Comprehensive Exam, WPI’s Civil, Environmental, and Architectural Engineering Department, 23 February 2022.
28. Yinduo Chen, “Identifying and Characterization of Nanoparticles in Community Wastewater,” PhD Dissertation Defense, WPI’s Civil, Environmental, and Architectural Engineering Department, 21 and 26 April 2022.
29. Vanessa Uzonwanne, “New Frontiers for Triple Negative Breast Cancer Detection and Treatment: From Mechanical Biomarkers to Specific Nanoparticle Entry for Robotically Controlled Laser-Induced Hyperthermia,” PhD Dissertation Defense, WPI’s Materials Science and Engineering Department, 29 April 2022.
30. Arvand Navabi, “Interfacial Adhesion and Deformation Mechanisms in Hard and Soft Materials using Molecular Dynamics,” PhD Dissertation Defense, WPI’s Materials Science and Engineering Department, 29 April 2022

EXTERNAL AND INTERNAL SERVICE

SERVICE TO THE PROFESSION:

1. Reviewer for internal and external tenure and promotion cases, national and international funding agencies, and journals with impact factors of up to 31. (See p. 3-4 for more details.)
2. Member of Sigma Xi, Materials Research Society, Sigma Pi Sigma, AVS, and APS.
3. Editorial Board, Journal of Vacuum Science and Technology 2007-16.
4. Treasurer of the Nanoscale Science and Technology Division of the AVS since 2002.
5. Organizer, European project meeting on AFM and Micro-acoustics, April 1995.
6. Local Arrangements Committee for STM'95, 585 participants.
7. Co-organizer, Fundamentals of Nanoindentation and Nanotribology, MRS, Spring 1998.
8. NSTD representative to IUVSTA, the International Union for Vacuum Science, Technology, and Applications, 2004-21 (15,000 members). Secretary of Divisional (executive) Committee, 2004-10.
9. Program Committee for AVS International Symposia, 2002-present. Abstract selection meetings in Chicago, 2003, 2007.
10. NSTD and SPM Focus Committees for the 59th AVS International Symposium, 2011-12.
11. Founding member of NanoWorcester. Organized 2012, 2015, 2017 NanoWorcester Symposia at Worcester Polytechnic Institute.
12. Program Committee, International Conf. Nanoscience and Technology, Stockholm 2007. Steering Committee, Nano9, Stockholm 2007.
13. Reverse-site panel reviewer for NSF's National Nanotechnology Coordinated Infrastructure, Alexandria VA, 28-31 May 2019, 3-7 May 2020.
14. Steering Committee, International Conf. Nanoscience and Technology,
 - a) Basel, 2006;
 - b) Keystone CO, 2008;
 - c) Beijing, 2010;
 - d) Paris, 2012;
 - e) Paris, 2013;
 - f) Vail CO, 2014;
 - g) Busan, South Korea 2016;
 - h) Brno, Czech Republic 2018;

SERVICE TO WPI:

1. Organizer of WPI's Nanoscience and Technology Interest Group, 2003-present
2. Speaker, WPI's International CEO Roundtable on the *Impact of Evolving Technologies on the Future of Business*, Barcelona, April 20, 2001.
3. Speaker, WPI's International CEO Roundtable on *Molecular Engineering*, Worcester, March 19, 2002.
4. Speaker, WPI's *Presidential Roundtable*, April 26, 2002 on the "Ties that Bind."
5. Speaker, WPI's *NCSSSTMST Student Conference*, October 24, 2002, on "The Promise and Peril of Nanotechnology."
6. "Probing the mechanical properties of carbon nanotubes," for *Research at Worcester Polytechnic Institute*, 2003.
7. Speaker at the Museum of Science, Boston, 21 January 2004, on "Nanotechnology – the Next Small Thing."
8. Speaker, Convocation at WPI, April 20, 2004.
9. Advisory Board for the Development of a new Recreational Center, 2004-05.
10. Advisory Board for WPI Technology Confidence Index, 2004-05.
11. WPI's Email Advisory Committee, 2006.
12. WPI's Educational Development Council, Provost's Appointee, 2006-09.
13. Advisor to Department of Physical Education, Recreation, and Athletics, 2006-present.
14. Wrote "Touching the Unseeable" for *Research at Worcester Polytechnic Institute*, 2007.
15. WPI's Committee on Tenure and Academic Freedom, 2007-10. **Chair**, 2009-10.
16. Selection Committee, Architects for WPI's new Recreation Center, 2008.
17. Planning Committee, WPI's new Recreation Center, 2008-09.
18. New Faculty Orientation Panelist on "Teaching, Scholarship, Service (and Life!): Advice from Colleagues", 20 August 2010.
19. Recalled to Committee on Tenure and Academic Freedom for an additional case where two serving members of CTAF were recused, Fall 2010.

20. Committee on Academic Operations, 2010-13, Secretary 2011-12, **Chair** Fall 2012.
21. Committee on Governance, ad-hoc subcommittee on the effects of the rapid increase in undergraduate enrollment, Fall 2010- Fall 2011.
22. New Faculty Orientation Panelist on “Teaching, Scholarship, Service (and Life!): Advice from Colleagues”, 19 August 2011.
23. Recalled to Committee on Tenure and Academic Freedom for an additional case where two serving members of CTAF were recused as was the immediate former Chair, Fall 2011.
24. Gave feedback on Rec Center Policies and Procedures Manual, Fall 2011.
25. Lead organizer for 2012 NanoWorcester Symposium at WPI, 17 March 2012.
26. Trained all TAs in department, not just my course, in mechanics labs; 2011-14
27. Rec Center Advisory Committee 2012-
28. CAO’s ad-hoc committee on improvements to WPI’s academic calendars, 2013-16
29. Committee on Academic Policy, 2013-16.
30. Advisory Committee to 2013 NanoWorcester Symposium, Clark University, 28 September 2013
31. Assist with annual course scheduling for physics department, 2006-18.
32. Helped shape plans for Alumni Gym, 2013.
33. Teaching mentor for a new faculty member in Biomedical Engineering, 2013-14, in Chemistry 2015-16, in Mechanical Engineering 2018-19.
34. Strategic Pillar II, Elevating Distinctive Undergraduate Programs, 2014-15.
35. Appointed to Academic Planning Committee of WPI’s Board of Trustees, 2014-16.
36. Appointed to Academic Technology Task Force of WPI’s Board of Trustees, 2016-19.
37. Elected to the Committee on Financial and Administrative Policy, 2017-20. Secretary 2018-19, Chair 2018-19, Chair 2019-20 through A20. As Chair of FAP, served as *ex officio* member of the new Administrative Policy Group, D20.
38. Changes to WPI's academic calendars were finally implemented in AY2017-18, after my starting the initiative while I was on the Committee on Academic Operations in 2010!

39. Appointed to the leadership team for WPI's interdisciplinary group of Materials and Advanced Manufacturing. Lead person for Nanomaterials subgroup. Spring 2019 – present.
40. Appointed as a reviewer of the Materials and Manufacturing Seed Grants of 2018.
41. Appointed to Implementation Lead for Interdisciplinary Research and Education for WPI's next strategic plan, Spring 2020; after Covid delay, then additionally the Projects Team in Fall 2020, both continuing into 2021.
42. Member, Aerospace Engineering Department Head Search Committee, summer 2020.
43. Member, ADVANCE working group on multiple forms of scholarship and service, summer 2020.
44. Co-organizer, Global School Europe Event, 21 April 2021. Coordinated promotion video for WPI's European Project Centers.
45. Elected to Committee on Governance as replacement member, C21-Summer 2022.
46. Co-organizer, Global School Europe Event, 14 April 2022.

SERVICE TO WPI'S PHYSICS DEPARTMENT:

1. Search committees:
 - a) to replace machinist, 2000-01;
 - b) to replace faculty, 2000-01, 2001-02, 2002-03;
 - c) to replace Athletic Director, 2002;
 - d) to replace Physics Department Head, 2003-04;
 - e) to replace faculty, 2005-06 and 2006-07;
 - f) to replace Department Head, 2007-08;
 - g) Search Chair, Full Professor of Quantum Science, Spring 2022.
2. Physics/Nano Colloquium Organizer 2000-02.
3. Physics Department Undergraduate Curriculum Committee, 2002-05.
4. Physics Department Graduate Committee 2000-02, 2005-09. Elected Chair Spring 2006.
5. Physics Department Tenure Committee, 2010-11, 2012-14, 2016-18, 2019-20.

SERVICE TO AND RECOGNITION OF STUDENTS:

1. Organized a tour of Intel's Fab 17 (Pentium IV) for physics grad students, 17 July 2003.
2. Organized a tour of Analog Devices Wilmington plant (IC fabrication) for physics and ECE grad students, 19 July 2007.
3. As Treasurer of AVS-NSTD, generate funds for student recognition through an international graduate-student award competition at the AVS International Symposia, supported annually by industry, since 2009.
4. Took two students to and judged a poster competition at the Sigma Xi Northeast Regional Student Conference, New Haven, CT, 17 April 2010.
5. Helped a student team prepare an executive summary to submit to the President's IQP Competition, September 2010. (Environmental Guidelines for Nanotechnology)
6. Judge for Great Problems Seminars' Poster Competition, WPI, 12 December 2011.
7. Judge for Sustainability Poster Competition, WPI, 16 April 2014.
8. Panelist for Graduate Student Government Roundtable, WPI, 24 April 2014.
9. Judge for Graduate Research Innovation Exchange, WPI, 2014, 2015, 2018, 2019, 2022
10. Write approximately 20 recommendation letters each year.
11. Designated as "Faculty Champion" by WPI's Student-Athlete Advisory Council, 2020.
12. The User-Friendly Characterization Lab, directed towards undergraduate research. Now comprises an optical microscope, a scanning electron microscope, an atomic-force microscope, an x-ray fluorescence spectrometer, and a fourier-transform infrared spectrometer. A reservation system has been researched and created, a Canvas site organized into which users can self-enroll, and training materials and qualification quizzes were completed in 2022. The bottleneck in usage is the limited number of faculty and staff trainers.
13. A 2019 Switzerland IQP Team had their work published as part of an invited review in the well-respected journal *Small*. Bas, A.,* Burns, N.,* Gulotta, A.,* Junker, J.,* Drasler, B., Lehner, R., ... & Rothen-Rutishauser, B. (2021). Understanding the Development, Standardization, and Validation Process of Alternative In Vitro Test Methods for Regulatory Approval from a Researcher Perspective. *Small*, 17(15),
14. A 2020 Switzerland IQP Team had their work published in the peer-reviewed journal *Toxicological and Environmental Chemistry*. Rothen-Rutishauser, B., Bogdanovich, M.,* Harter, R.,* Milosevic, A., & Petri-Fink, A. (2021). Use of Nanoparticles in Food Industry: Current Legislation, Health Risk Discussions and Public Perception with a focus on Switzerland. *Toxicological & Environmental Chemistry*, (just-accepted), 1-17.

68. The work in “Creating a Multimedia Narrative to Raise Awareness for Emerging Technologies,” Zürich IQP Project Center A21, was featured on the Swiss Academy of Engineering Sciences blog, December 2021, <https://www.satw.ch/de/blog/wie-erkläre-ich-meinem-grosspapi-was-blockchain-ist>
69. A 2021 Namibia project team made it to the finals of the President’s IQP Competition, 28 January 2022.

OTHER ACTIVITIES

1. Attended Gordon Research Conference on the Chemistry and Physics of Nanostructure Fabrication, Tilton NH, July 23-28, 2000.
2. Attended New Faculty Workshop, American Association of Physics Teachers, College Park MD, November 9-12, 2000.
3. Attended 9th Conference on Molecular Nanotechnology, Santa Clara CA, November 9-11, 2001.
4. Attended National Nanotechnology Workshop on Instrumentation and Metrology for Nanotechnology, January 27-29, 2004, at NIST Gaithersburg. Participated in Nanomechanics breakout session.
5. Attended Innovation in the Physics Classroom – Increasing Motivation and Mastery, a workshop at Rensselaer Polytechnic Institute, November 4, 2006.
6. Lecturer, Lehigh Microscopy School, June 14-17, 2010.
7. Attended Spring Institute on Teaching with Writing, WPI, 4-8 June 2012.
8. Alexander von Humboldt host of Dr Frank Wittbracht, Feodor Lynen Scholar, in Professor Whitesides' laboratory in the Chemistry Department at Harvard University, 2013.
9. Attended Izon Research Symposium, Boston MA, 21 October 2013.
10. Attended New England Faculty Development Council's meeting at Holy Cross, 15 November 2013.
11. Edited internal news article, <https://www.wpi.edu/news/nburnham>, 2014.
12. Participated in WPI's Spring Faculty Institute for Online Training and completed the assignments, May-December 2017.
13. Edited internal news article, <https://www.wpi.edu/news/switzerland-project-center-have-29-students-iqps-mqps>, 2017
14. Attended Park Systems opening ceremonies in Albany NY, November 2017.
15. Participated in WPI's Value Creation Workshop, 9 January 2018.