

## Curriculum Vitae

# Jason H. Hafner

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- EDUCATION**
- |      |                 |                                     |
|------|-----------------|-------------------------------------|
| 1998 | Ph.D. (Physics) | Rice University, Houston, TX        |
| 1996 | M.S. (Physics)  | Rice University, Houston, TX        |
| 1993 | B.S. (Physics)  | Trinity University, San Antonio, TX |
- POSITIONS**
- |                |   |
|----------------|---|
| 2017 – present | Magister, Jones College at Rice University.                                     |
| 2016 – present | Assistant Chair for Undergraduate Program, P&A, Rice University.                |
| 2015 – present | Professor, Department of Physics & Astronomy, Rice University.                  |
| 2010 – present | Associate Editor, <i>ACS Nano</i> , ACS Publications.                           |
| 2008 – 2015    | Associate Professor, Department of Physics & Astronomy, Rice University.        |
| 2004 – 2010    | Associate Director, Laboratory for Nanophotonics, Rice University.              |
| 2001 – 2008    | Assistant Professor, Department of Physics & Astronomy, Rice University.        |
| 1998 – 2001    | Postdoctoral Fellow, Dept. of Chemistry & Chemical Biology, Harvard University. |
- HONORS AND AWARDS**
- |      |   |
|------|---|
| 2016 | George R. Brown Award for Superior Teaching, Rice University                            |
| 2013 | Member of Scientia, Rice University   |
| 2012 | Fellow of the Rice Center for Teaching Excellence.                                      |
| 2012 | Inducted into $\Sigma \Pi \Sigma$ by Trinity University.                                |
| 2011 | Norman Hackerman Award in Chemical Research, Welch Foundation.                          |
| 2008 | Hamill Innovation Award, Institute for Biosciences and Bioengineering, Rice University. |
| 2007 | Brown Teaching Grant, Rice University.  |
| 2005 | Smalley-Curl Innovation Award, Rice University.   |
| 2002 | Beckman Young Investigator, Arnold and Mabel Beckman Foundation.                        |
| 1999 | NIH National Research Service Award.  |
| 1998 | H. A. Wilson Award for outstanding Ph.D. thesis.  |
- RESEARCH INTERESTS**
- Interfacial structure and electrostatics of biomembranes.
  - Synthesis and plasmonics of gold nanoparticles with complex shapes.
  - Biological and biomedical applications of plasmon resonant nanoparticles.
- AFFILIATIONS**
- American Chemical Society
  - American Physical Society
  - Rice Quantum Institute, Rice University
  - Laboratory for Nanophotonics, Rice University
  - Institute for Biosciences and Bioengineering, Rice University
- COURSES TAUGHT**
- PHYS 537 Methods of Experimental Physics I Fall 2002 - 2004
  - PHYS 538 Methods of Experimental Physics II, Spring 2003 - 2009
  - PHYS 201 Waves and Optics, Fall 2006 - 2012
  - PHYS 102 Electricity & Magnetism, Spring 2011 - 2017
  - PHYS 101 Mechanics, Fall 2014-2016
  - PHYS 125 General Physics, Fall 2017
  - PHYS 126 General Physics, Spring 2018
  - PHYS 102x Electricity & Magnetism (edX course)
  - PHYS 201x Waves & Optics (edX course)
  - PHYS 101x Mechanics (edX course)

## PROFESSIONAL ACTIVITIES

- Panel member, IEEE MTT-S panel on MOOCs/Flipped Classrooms, Tampa Bay, FL, June 2014.
- Chair, External Advisory Committee, JSU-UCSB PREM (an NSF Center at Jackson State) 2013.
- Member, NIH CSR special emphasis panel, Washington, DC, 2009.
- Member, NSF CHE Panel, Washington, DC, 2010.
- Participant, TAMEST conference, Dallas, TX 2009.
- Panel member, U.S. Measurement System Workshop on Measurement and Standards Needs in NanoBiotechnology”, Houston, TX, 2006.
- Participant, Keck Futures Initiative, National Academy of Sciences, Irvine, CA, 2004.
- Symposium Co-Organizer, Nanostructured Organic Materials, MRS meeting, Boston, MA, 2003.

## UNIVERSITY SERVICE

### *standing committees*

- P&A Graduate Recruiting Committee (2009-2011)
- P&A Graduate Student Activities (2008-2011)
- P&A Colloquium Coordinator (2009-2012)
- P&A Undergraduate Program Committee (2012-2015)
- University Committee on the Library (2005-2012, chair in 2012)
- Curriculum Committee for the Department of Physics and Astronomy (2002 – 2007)
- Graduate student admissions committee for the Appl. Phys. Ph.D. program (2002-4, 2010-2011)

### *ad hoc committees*

- RAAG (2011-2016)
- Rice Quantum Institute Executive Committee (2011-2014)
- P&A Educational Assessment Committee (2007)
- Faculty Childcare Committee (2005 – 2007)
- Faculty Enhancement Committee for the Department of Physics & Astronomy (2005)
- Long Range Planning Committee for the Department of Physics & Astronomy (2007)
- Faculty Search Committees for the Department of Physics and Astronomy (2002, 2004, 2008)
- Faculty Search Committee for the Department of Chemistry (2007)
- Faculty Search Committee for the Dept. of Electrical and Computer Engineering (2007)
- Shared Equipment Authority – member of this committee that manages large shared scientific equipment on campus, and serve as faculty in charge of atomic force microscopes (2001 – 2005).
- Sloan Prof Masters curriculum committee – helped create curriculum for new Professional Master’s in Nanoscale Physics (2001)
- University & Main Committee – served on this faculty committee to advise the Provost on the potential impact of a joint Rice / Texas Medical Center research building (2002).
- Bionanotechnology Session Chair, First Annual Institute for Biosciences and Bioengineering Symposium, Rice University, Houston, TX, July 7, 2005.
- Panel member for ADVANCE Negotiating the Ideal Faculty Position (2007, 2008).
- Panel member, Rice University Symposium on Teaching and Learning, Houston, TX (2014).
- DeLange IX Conference planning committee (2013-2014).

### *guest lecturer*

- ELEC 565 – Topics in Quantum Semiconductor Nanostructures (2001).
- PHYS 534 – Nanostructures and Nanotechnology II (2003, 2004).
- PHYS 539 – Characterization and Fabrication at the Nanoscale (2002, 2003).
- CHEM 533 – Nanostructures and Nanotechnology I (2004, 2005).
- ANTH 235 – Nanotechnology: Content and Context (2009)
- BIOE 403 – Advances in Bionanotechnology (2010)
- ELEC 571 – Imaging at the Nanoscale (2012)
- NSCI 573 – Inquiry Physics for Teachers (2011, 2012)

## STUDENTS SUPERVISED

### Graduate

1. Amber Johnson (Applied Physics), M.S. Fall 2003.
2. Hongwei Liao (Chemistry), M.S. May 2004, Ph.D. December 2006, now Research Scientist at NanoSynthesis Inc.
3. Colleen Nehl (Physics & Astronomy), M.S. July 2004, Ph.D. May 2007, now Lead Technologist at Booz Allen Hamilton.
4. Yi Yang (Physics & Astronomy), M.S. July 2006, Ph.D. May 2009, now Processing Geophysicist at Shell.
5. Nissanka Wickremasinghe (Physics & Astronomy), M.S. September 2005, Ph.D. May 2010.
6. Kathryn Mayer (Physics & Astronomy), M.S. April 2007. Ph.D. May 2010, now Assistant Professor, UT San Antonio.
7. Seung Hyun Lee (Chemistry), M.S. May 2008, Ph.D. August 2011, now Assistant Professor at Suwon University, Korea.
8. Betty Rostro (Applied Physics), Ph.D. February 2011.
9. Lindsey Anderson (Applied Physics), Ph.D. May 2013, now post doc with Jochen Feldmann at LMU Munich.
10. Courtney Payne (Chemistry), Ph.D. August 2014, now a chemist at Schlumberger.
11. James Matthews (Physics & Astronomy), Ph. D. January 2017, now automation engineer at Schlumberger.
12. Steven Demers, (Physics & Astronomy), current grad student.

### Undergraduate

1. Monica Mason (Rice Physics & Astronomy)
2. Kathryn Mayer (Rice Physics & Astronomy), see above.
3. Amneet Gulati (Rice Chemistry), Ph.D. 2013 MIT, now R&D Scientist at Thermo Fisher Scientific.
4. Peter Scully (Rice Physics & Astronomy), now MD/PhD student at Baylor College of Medicine.
5. Amaris Fuentes (Rice Biochemistry & Cell Biology), PharmD 2013 U. Houston, now Clin. Pharm. Spec. at Methodist.
6. Courtney Payne (Rice Physics & Astronomy), see above.
7. Robbie Fraleigh (Rice Physics & Astronomy), current grad student at Penn State Physics.
8. Adrian Delgado (UT Pan Am Physics).
9. Daniel Saenz (Rice Physics & Astronomy), current grad student at Wisconsin Physics.
10. Josue Lopez (Rice Physics & Astronomy), current grad student at MIT ECE.
11. Martin Bell (Rice Physics & Astronomy), current grad student at Rice ECE.
12. Erin Dahlstrom (Rice Physics & Astronomy), current grad student at Harvard Physics.
13. Michael Reynolds (REU), current grad student at Cornell Applied Physics.
14. Cyna Shirazinejad (Rice Physics & Astronomy), current student
15. Grace Isakson (Rice Physics & Astronomy), current student
16. John Luke Garcia (Rice Biosciences), current student
17. Lee Hsieh (Rice Chemical Physics), current student
18. Louis Cole (Rice Physics & Astronomy), current student
19. Takuma Makihara (Rice Physics & Astronomy), current student

## PUBLICATIONS (>16,800 citations, $h = 46$ , ISI)

### Journal Articles

1. Colbert, D. T.; Zhang, J.; McClure, S. M.; Nikolaev, P.; Chen, Z.; Hafner, J. H.; Owens, D. W.; Kotula, P. G.; Carter, C. B.; Weaver, J. H.; Rinzler, A. G.; Smalley, R. E., Growth and Sintering of Fullerene Nanotubes. *Science* **1994**, 266, (5188), 1218-1222.
2. Rinzler, A. G.; Hafner, J. H.; Nikolaev, P.; Lou, L.; Kim, S. G.; Tomanek, D.; Nordlander, P.; Colbert, D. T.; Smalley, R. E., Unraveling Nanotubes - Field-Emission from an Atomic Wire. *Science* **1995**, 269, (5230), 1550-1553.
3. Dai, H. J.; Hafner, J. H.; Rinzler, A. G.; Colbert, D. T.; Smalley, R. E., Nanotubes as nanoprobe in scanning probe microscopy. *Nature* **1996**, 384, (6605), 147-150.
4. Liu, J.; Dai, H. J.; Hafner, J. H.; Colbert, D. T.; Smalley, R. E.; Tans, S. J.; Dekker, C., Fullerene 'crop circles'. *Nature* **1997**, 385, (6619), 780-781.
5. Hafner, J. H.; Bronikowski, M. J.; Azamian, B. R.; Nikolaev, P.; Rinzler, A. G.; Colbert, D. T.; Smith, K. A.; Smalley, R. E., Catalytic growth of single-wall carbon nanotubes from metal particles. *Chemical Physics Letters* **1998**, 296, (1-2), 195-202.
6. Liu, J.; Rinzler, A. G.; Dai, H. J.; Hafner, J. H.; Bradley, R. K.; Boul, P. J.; Lu, A.; Iverson, T.; Shelimov, K.; Huffman, C. B.; Rodriguez-Macias, F.; Shon, Y. S.; Lee, T. R.; Colbert, D. T.; Smalley, R. E., Fullerene pipes. *Science* **1998**, 280, (5367), 1253-1256.
7. Hafner, J. H.; Cheung, C. L.; Lieber, C. M., Direct growth of single-walled carbon nanotube scanning probe microscopy tips. *Journal of the American Chemical Society* **1999**, 121, (41), 9750-9751.
8. Hafner, J. H.; Cheung, C. L.; Lieber, C. M., Growth of nanotubes for probe microscopy tips. *Nature* **1999**, 398, (6730), 761-762.

9. Cheung, C. L.; Hafner, J. H.; Lieber, C. M., Carbon nanotube atomic force microscopy tips: Direct growth by chemical vapor deposition and application to high-resolution imaging. *Proceedings of the National Academy of Sciences of the United States of America* **2000**, *97*, (8), 3809-3813.
10. Cheung, C. L.; Hafner, J. H.; Odom, T. W.; Kim, K.; Lieber, C. M., Growth and fabrication with single-walled carbon nanotube probe microscopy tips. *Applied Physics Letters* **2000**, *76*, (21), 3136-3138.
11. Bockrath, M.; Liang, W. J.; Bozovic, D.; Hafner, J. H.; Lieber, C. M.; Tinkham, M.; Park, H. K., Resonant electron scattering by defects in single-walled carbon nanotubes. *Science* **2001**, *291*, (5502), 283-285.
12. Bozovic, D.; Bockrath, M.; Hafner, J. H.; Lieber, C. M.; Park, H.; Tinkham, M., Electronic properties of mechanically induced kinks in single-walled carbon nanotubes. *Applied Physics Letters* **2001**, *78*, (23), 3693-3695.
13. Hafner, J. H.; Cheung, C. L.; Oosterkamp, T. H.; Lieber, C. M., High-yield assembly of individual single-walled carbon nanotube tips for scanning probe microscopies. *Journal of Physical Chemistry B* **2001**, *105*, (4), 743-746.
14. Jorio, A.; Saito, R.; Hafner, J. H.; Lieber, C. M.; Hunter, M.; McClure, T.; Dresselhaus, G.; Dresselhaus, M. S., Structural (n, m) determination of isolated single-wall carbon nanotubes by resonant Raman scattering. *Physical Review Letters* **2001**, *86*, (6), 1118-1121.
15. Jorio, A.; Souza, A. G.; Dresselhaus, G.; Dresselhaus, M. S.; Saito, R.; Hafner, J. H.; Lieber, C. M.; Matinaga, F. M.; Dantas, M. S. S.; Pimenta, M. A., Joint density of electronic states for one isolated single-wall carbon nanotube studied by resonant Raman scattering. *Physical Review B* **2001**, *6324*, (24), -.
16. Pimenta, M. A.; Jorio, A.; Brown, S. D. M.; Souza, A. G.; Dresselhaus, G.; Hafner, J. H.; Lieber, C. M.; Saito, R.; Dresselhaus, M. S., Diameter dependence of the Raman D-band in isolated single-wall carbon nanotubes. *Physical Review B* **2001**, *6404*, (4), -.
17. Saito, R.; Jorio, A.; Hafner, J. H.; Lieber, C. M.; Hunter, M.; McClure, T.; Dresselhaus, G.; Dresselhaus, M. S., Chirality-dependent G-band Raman intensity of carbon nanotubes. *Physical Review B* **2001**, *6408*, (8), art. no.-085312.
18. Schnitzler, G. R.; Cheung, C. L.; Hafner, J. H.; Saurin, A. J.; Kingston, R. E.; Lieber, C. M., Direct imaging of human SWI/SNF-remodeled mono- and polynucleosomes by atomic force microscopy employing carbon nanotube tips. *Molecular and Cellular Biology* **2001**, *21*, (24), 8504-8511.
19. Souza, A. G.; Jorio, A.; Hafner, J. H.; Lieber, C. M.; Saito, R.; Pimenta, M. A.; Dresselhaus, G.; Dresselhaus, M. S., Electronic transition energy E-ii for an isolated (n,m) single-wall carbon nanotube obtained by anti-Stokes/Stokes resonant Raman intensity ratio. *Physical Review B* **2001**, *6324*, (24), -.
20. Jorio, A.; Matinaga, F. M.; Righi, A.; Dantas, M. S. S.; Pimenta, M. A.; Souza, A. G.; Mendes, J.; Hafner, J. H.; Lieber, C. M.; Saito, R.; Dresselhaus, G.; Dresselhaus, M. S., Resonance Raman scattering: Nondestructive and noninvasive technique for structural and electronic characterization of isolated single-wall carbon nanotubes. *Brazilian Journal of Physics* **2002**, *32*, (4), 921-924.
21. Jorio, A.; Souza, A. G.; Brar, V. W.; Swan, A. K.; Unlu, M. S.; Goldberg, B. B.; Righi, A.; Hafner, J. H.; Lieber, C. M.; Saito, R.; Dresselhaus, G.; Dresselhaus, M. S., Polarized resonant Raman study of isolated single-wall carbon nanotubes: Symmetry selection rules, dipolar and multipolar antenna effects. *Physical Review B* **2002**, *65*, (12), -.
22. Souza, A. G.; Jorio, A.; Dresselhaus, G.; Dresselhaus, M. S.; Saito, R.; Swan, A. K.; Unlu, M. S.; Goldberg, B. B.; Hafner, J. H.; Lieber, C. M.; Pimenta, M. A., Effect of quantized electronic states on the dispersive Raman features in individual single-wall carbon nanotubes. *Physical Review B* **2002**, *65*, (3), -.
23. Souza, A. G.; Jorio, A.; Samsonidze, G. G.; Dresselhaus, G.; Dresselhaus, M. S.; Swan, A. K.; Unlu, M. S.; Goldberg, B. B.; Saito, R.; Hafner, J. H.; Lieber, C. M.; Pimenta, M. A., Probing the electronic trigonal warping effect in individual single-wall carbon nanotubes using phonon spectra. *Chemical Physics Letters* **2002**, *354*, (1-2), 62-68.
24. Souza, A. G.; Jorio, A.; Swan, A. K.; Unlu, M. S.; Goldberg, B. B.; Saito, R.; Hafner, J. H.; Lieber, C. M.; Pimenta, M. A.; Dresselhaus, G.; Dresselhaus, M. S., Anomalous two-peak G'-band Raman effect in one isolated single-wall carbon nanotube. *Physical Review B* **2002**, *65*, (8).
25. Bozovic, D.; Bockrath, M.; Hafner, J. H.; Lieber, C. M.; Park, H.; Tinkham, M., Plastic deformations in mechanically strained single-walled carbon nanotubes. *Physical Review B* **2003**, *67*, (3), -.
26. Johnson, A. S.; Nehl, C. L.; Mason, M. G.; Hafner, J. H., Fluid electric force microscopy for charge density mapping in biological systems. *Langmuir* **2003**, *19*, (24), 10007-10010.
27. Liao, H. W.; Hafner, J. H., Monitoring gold nanorod synthesis on surfaces. *Journal of Physical Chemistry B* **2004**, *108*, (50), 19276-19280.
28. Liao, H. W.; Hafner, J. H., Low-temperature single-wall carbon nanotube synthesis by thermal chemical vapor deposition. *Journal of Physical Chemistry B* **2004**, *108*, (22), 6941-6943.
29. Nehl, C. L.; Grady, N. K.; Goodrich, G. P.; Tam, F.; Halas, N. J.; Hafner, J. H., Scattering spectra of single gold nanoshells. *Nano Letters* **2004**, *4*, (12), 2355-2359.
30. Liao, H. W.; Hafner, J. H., Gold nanorod bioconjugates. *Chemistry of Materials* **2005**, *17*, (18), 4636-4641.
31. Wickremasinghe, N. S.; Hafner, J. H., Protein crystals as scanned probes for recognition atomic force microscopy. *Nano Letters* **2005**, *5*, (12), 2418-2421.
32. Gulati, A.; Liao, H.; Hafner, J. H., Monitoring gold nanorod synthesis by localized surface plasmon resonance. *Journal of Physical Chemistry B* **2006**, *110*, (45), 22323-22327.

33. Nehl, C. L.; Liao, H. W.; Hafner, J. H., Optical properties of star-shaped gold nanoparticles. *Nano Letters* **2006**, 6, (4), 683-688.
34. Wang, H.; Wu, Y. P.; Lassiter, B.; Nehl, C. L.; Hafner, J. H.; Nordlander, P.; Halas, N. J., Symmetry breaking in individual plasmonic nanoparticles. *Proceedings of the National Academy of Sciences of the United States of America* **2006**, 103, (29), 10856-10860.
35. Hao, F.; Nehl, C. L.; Hafner, J. H.; Nordlander, P., Plasmon resonances of a gold nanostar. *Nano Letters* **2007**, 7, (3), 729-732.
36. Yang, Y.; Mayer, K. M.; Hafner, J. H., Quantitative membrane electrostatics with the atomic force microscope. *Biophysical Journal* **2007**, 92, (6), 1966-1974.
37. Hleb, E. Y.; Hafner, J. H.; Myers, J. N.; Hanna, E. Y.; Rostro, B. C.; Zhdanok, S. A.; Lapotko, D. O., LANTCET: elimination of solid tumor cells with photothermal bubbles generated around clusters of gold nanoparticles. *Nanomedicine* **2008**, 3, (5), 647-667.
38. Hleb, E. Y.; Hu, Y.; Drezek, R. A.; Hafner, J. H.; Lapotko, D. O., Photothermal bubbles as optical scattering probes for imaging living cells. *Nanomedicine* **2008**, 3, (6), 797-812.
39. Lassiter, J. B.; Aizpurua, J.; Hernandez, L. I.; Brandl, D. W.; Romero, I.; Lal, S.; Hafner, J. H.; Nordlander, P.; Halas, N. J., Close encounters between two nanoshells. *Nano Letters* **2008**, 8, (4), 1212-1218.
40. Mayer, K. M.; Lee, S.; Liao, H.; Rostro, B. C.; Fuentes, A.; Scully, P. T.; Nehl, C. L.; Hafner, J. H., A label-free immunoassay based upon localized surface plasmon resonance of gold nanorods. *ACS Nano* **2008**, 2, (4), 687-692.
41. Yang, Y.; Mayer, K. M.; Wickremasinghe, N. S.; Hafner, J. H., Probing the Lipid Membrane Dipole Potential by Atomic Force Microscopy. *Biophysical Journal* **2008**, 95, (11), 5193-5199.
42. Lee, S.; Mayer, K. M.; Hafner, J. H. An Improved Localized Surface Plasmon Resonance Immunoassay with Gold Bipyrmaid Substrates. *Analytical Chemistry* **2009**, 81, 4450-4455.
43. Rostro-Kohanloo, B.C.; Bickford, L. R.; Payne, C. M.; Day, E. S.; Anderson, L. J. E.; Zhong, M.; Lee, S.; Mayer, K. M.; Zal, T.; Adam, L.; Dinney, C. P. N.; Drezek, R. A.; West, J. L.; Hafner, J. H. Stabilization and Targeting of Surfactant-Synthesized Gold Nanorods. *Nanotechnology* **2009**, 20, 434005.
44. Lukianova-Hleb, E. Y.; Hanna, E. Y.; Hafner, J. H.; Lapotko, D. O., Tunable plasmonic nanobubbles for cell theranostics. *Nanotechnology* **2010**, 21, 085102.
45. Lukianova-Hleb, E.; Hu, Y.; Latterini, L.; Tarpani, L.; Lee, S.; Drezek, R. A.; Hafner, J. H.; Lapotko, D. O., Plasmonic Nanobubbles as Transient Vapor Nanobubbles Generated around Plasmonic Nanoparticles, *ACS Nano* **2010**, 4, 2109-2123.
46. Lukianova-Hleb, E.; Hafner, J. H.; Lapotko, D. O., Generation and detection of plasmonic nanobubbles in zebrafish, *Nanotechnology* **2010**, 21, 225102.
47. Anderson, L. J. E.; Hansen, E.; Lukianova-Hleb, E.; Hafner, J. H.; Lapotko, D. O.; Optically Guided Controlled Release from Liposomes with Tunable Plasmonic Nanobubbles. *Journal of Controlled Release* **2010**, 144, 151.
48. Anderson, L. J. E.; Mayer, K. M.; Fraleigh, R. D.; Yang, Y.; Lee, S.; Hafner, J. H.; Quantitative measurements of individual gold nanoparticle scattering cross sections, *J. Phys. Chem. C* **2010**, 114, 11127-11132.
49. Mayer, K. M.; Hao, F.; Lee, S.; Nordlander, P.; Hafner, J. H.; A Single Molecule Immunoassay by Localized Surface Plasmon Resonance, *Nanotechnology* **2010**, 21, 255503.
50. Wagner, D. S.; Delk, N. A.; Lukianova-Hleb, E. Y.; Hafner, J. H.; Farach-Carson, M. C.; Lapotko, D. O., The in vivo performance of plasmonic nanobubbles as cell theranostic agents in zebrafish hosting prostate cancer xenografts. *Biomaterials* **2010**, 31, (29), 7567-7574.
51. Lukianova-Hleb, E. Y.; Anderson, L. J. E.; Lee, S.; Hafner, J. H.; Lapotko, D. O.; Hot plasmonic interactions: a new look at the photothermal efficacy of gold nanoparticles. *Phys. Chem. Chem. Phys.* **2010**, 12, (38), 12237-12244.
52. Hu, Y. S.; Jeon, J.; Seok, T. J.; Lee, S.; Hafner, J. H.; Drezek, R. A.; Choo, H., Enhanced Raman Scattering from Nanoparticle-Decorated Nanocone Substrates: A Practical Approach to Harness In-Plane Excitation. *ACS Nano* **2010**, 4, (10), 5721-5730.
53. Lukianova-Hleb, E. Y.; Oginsky, A. O.; Samaniego, A. P.; Shenefelt, D. L.; Wagner, D. S.; Hafner, J. H.; Farach-Carson, M. C.; Lapotko, D. O., Tunable Plasmonic Nanoprobes for Theranostics of Prostate Cancer, *Theranostics* **2011**, 1, (1), 3-17.
54. Lukianova-Hleb, E. Y.; Oginsky, A. O.; Shenefelt, D. L.; Drezek, R. A.; Hafner, J. H.; Farach-Carson, M. C.; Lapotko, D. O.; Rainbow Plasmonic Nanobubbles: Synergistic Activation of Gold Nanoparticle Clusters. *Journal of Nanomedicine and Nanotechnology* **2011**, 2, (1), 1000104.
55. Lee, S.; Anderson, L. J. E.; Payne, C. M.; Hafner, J. H.; A Structural Transition in the Surfactant Layer that Surrounds Gold Nanorods Observed by Analytical Surface Enhanced Raman Spectroscopy. *Langmuir* **2011**, 27, (24), 14748-14756.
56. Anderson, L. J. E.; Payne, C. M.; Zhen, Y.-R.; Nordlander, P. N.; Hafner, J. H.; A Tunable Plasmon Resonance in Gold Nanobelts. *Nano Letters* **2011**, 11 (11), 5034.
57. Wang, C. U.; Arai, Y.; Kim, I.; Jang, W.; Lee, S.; Hafner, J. H.; Jeoung, E.; Jung, D.; Kwon, Y.; Surface-modified Gold Nanorods for Specific Cell Targeting, *Journal of the Korean Physical Society* **2012**, 60 (10), 1700-1707.

58. Lee, S.; Hahm, M. G.; Vajtai, R.; Hashim, D. P.; Thurakitserree, T.; Cipara, A. C.; Ajayan, P. M.; Hafner, J. H.; Utilizing 3D SERS Active Volumes in Aligned Carbon Nanotube Scaffold Substrates, *Advanced Materials* **2012**, 24 (38), 5261-5266.
59. Balamurugan, S.; Mayer, K. M.; Lee, S.; Soper, S. A.; Hafner, J. H.; Spivak, D. A. Nanostructure shape effects on response of plasmonic aptamer sensors, *Journal of Molecular Recognition* **2013**, 26 (9), 402-407
60. Payne, C. M.; Anderson, L. J. E.; Hafner, J. H.; Novel Plasmonic Structures Based on Gold Nanobelts, *Journal of Physical Chemistry C* **2013**, 117 (9), 4734-4739.
61. Anderson, L. J. E.; Zhen, Y.-R.; Payne, C. M.; Nordlander, P.; Hafner, J. H. Gold Nanobelts as High Confinement Plasmonic Waveguides, *Nano Letters* **2013**, 13 (12), 6256-6261.
62. Payne, C. M.; Tsentelovich, D. E.; Benoit, D. N.; Anderson, L. J. E.; Guo, W.; Colvin, V. L.; Pasquali, M.; Hafner, J. H., Synthesis and Crystal Structure of Gold Nanobelts, *Chemistry of Materials* **2014**, 26 (6), 1999-2004.
63. Matthews, J. R.; Payne, C. M.; Hafner, J. H., The Structures and Phases of Supported Lipid Membranes on Gold Nanorods according to Plasmon Resonance Sensing and Surface Enhanced Raman Scattering, *Langmuir* **2015**, 31 (36), 9893-9900.
64. Demers, S. M. E.; Hsieh, L. J. H.; Shirazinejad, C. R.; Garcia, J. L. A.; Matthews, J. R.; Hafner, J. H., Ultraviolet Analysis of Gold Nanorod and Nanosphere Solutions, *J. Phys. Chem. C* **2017**, 121 (9), 5201-5207.
65. Matthews, J. R.; Shirazinejad, C. R.; Isakson, G. A.; Demers, S. M. E.; Hafner, J. H., Structural Analysis by Enhanced Raman Scattering, *Nano Letters* **2017**, 17 (4), 2172-2177.

#### Review Articles

66. Woolley, A. T.; Cheung, C. L.; Hafner, J. H.; Lieber, C. M., Structural biology with carbon nanotube AFM probes. *Chemistry & Biology* **2000**, 7, (11), R193-R204.
67. Hafner, J. H.; Cheung, C. L.; Woolley, A. T.; Lieber, C. M., Structural and functional imaging with carbon nanotube AFM probes. *Progress in Biophysics & Molecular Biology* **2001**, 77, (1), 73-110.
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## EXTERNAL RESEARCH SUPPORT

### *Current*

Title	Dates	Role	Source	Total Amount
18. Membrane Structural Analysis By Enhanced Raman Scattering	07/01/17 - 06/30/20	PI	NSF CHE-	\$ 330,000
17. Surface Enhanced Spectroscopy for Biomembrane Structure	06/01/17 - 05/31/20	PI	Welch Foundation	\$ 240,000

### *Past*

Title	Dates	Role	Source	Total Amount
16. LANCER: Open Architecture Nanosensor	07/01/14 - 05/15/17	PI	Lockheed Martin Corp.	\$ 150,000
15. Rice-HISD Excellence in Secondary Science Teaching Partnership	06/01/12 - 08/31/16	Co-PI	Houston Independent School District	\$ 2,980,000
14. Surface Enhanced Spectroscopy for Membrane Structural Biology	06/01/14 - 05/31/17	PI	Welch Foundation	\$ 180,000
13. MRI: Acquisition of a Time-Resolved Nanophotonic scanning Probe Microscope	08/01/14 - 07/31/17	Co-PI	NSF	\$ 177,003
12. Analytical Surface Enhanced Raman Spectroscopy for Biological Interfaces	06/01/11 - 05/31/14	PI	Welch Foundation	\$ 150,000

<u>Title</u>	<u>Dates</u>	<u>Role</u>	<u>Source</u>	<u>Total Amount</u>
11. EAGER: Validating Atomic Force Measurements of the Lipid Membrane Dipole Moment	07/01/10 - 06/30/13	PI	NSF CHE-1037575	\$ 160,613
10. Photothermal Method for Diagnostics and Selective Thermolysis of Superficial Tumors	04/01/09 - 05/31/11	Co-PI	NIH	\$ 369,050
9. IGERT: Nanophotonics: Fundamentals and Applications in Emerging Technologies	07/01/05 - 06/30/10	Co-PI	NSF DGE-0504425	\$ 3,086,640
8. Gold Nanorods for Targeted Gene Delivery	02/01/07 - 01/31/08	Co-PI	Alliance for Nanohealth (DoD)	
7. Feasibility of selective laser Elimination of leukemia cells targeted with gold and silver nanorods	02/01/07 - 01/31/08	Co-PI	Alliance for Nanohealth (DoD)	
6. A Multimodality Ultramicro-Spectroscopy (MUMS): Imaging with Integrated Spectroscopies for Chemical and Biomolecular Identification	06/01/04 - 05/31/09	Co-PI	DoD W911NF-04-1-0203	
5. Chemical Kinetics of Gold Nanorod Synthesis	06/01/06 - 05/31/09	PI	Welch Foundation	\$ 150,000
4. Probing the Electrostatics of Lipid Bilayer Membranes	07/01/05 - 06/30/08	PI	NSF CHE-0517937	\$ 300,000
3. MRI: Development of Nanoscale Probes for Enhanced Vibrational Spectroscopy	09/01/04 - 08/31/07	Co-PI	NSF ECCS-0421108	\$ 250,000
2. Chemical Kinetics and Selective Synthesis of Carbon Nanotubes	07/01/03 - 06/30/05	PI	Petroleum Research Fund	\$ 50,000
1. Nano-Wells for Biological Atomic Force Microscopy	07/01/02 - 06/30/05	PI	Beckman Foundation	\$ 240,000