JEFFREY GUEST

Scientist, Experimental Physicist

Quantum and Energy Materials Group

Center for Nanoscale Materials
Building 440, Room A237
Phone: 630-252-7073
Fax: 630-252-4646
E-mail: jrguest@anl.gov

Argonne National Laboratory
9700 S Cass Ave., Argonne, IL 60439

Education

Ph.D. Applied Physics, University of Michigan
M.S. Applied Physics, University of Michigan
B.S.E. Mechanical Engineering / Engineering Physics, Princeton University

Research interests

- Development of low temperature ultrahigh vacuum (UHV) scanning tunneling microscopes (STMs) combined with single 'particle' laser spectroscopy to correlate optical properties and photophysical processes with atomic scale structure
- Optical, photophysical, and quantum coherence properties of nanoscale structures, molecular self-assemblies, 2D materials and semiconductor defects (in addition to structural, electronic, and magnetic properties)
- Nanomechanical dynamics of self-assembled structures, nanofabricated systems, and individual nanoparticles; development of experimental techniques to measure and control nanomechanical motion

Professional Experience

Argonne National Laboratory - Center for Nanoscale Materials (CNM)
Scientist *2013-present*
Assistant Scientist *2007-2013*

Argonne National Laboratory – Physics Division *2004-2007*
Arthur Holly Compton Fellow

- Developed and demonstrated the first laser-cooling and laser-trap of radium (radium-225 and 226)
- Measured transition energies, lifetimes, hyperfine splittings, and isotope shifts in the radium atom
- Developed a next generation test for time-reversal asymmetry (or electric dipole moment (EDM) search) around laser-trapped radium-225 atoms

University of Michigan, Physics Department, Ann Arbor, MI *2000-2004*
Postdoctoral Researcher

- Developed a superconducting atom and plasma laser trap for cold Rydberg atom gas and plasma studies at high magnetic fields (3-6 Tesla)
- Observed quantum chaos in laser-cooled strongly-magnetized Rydberg atoms; magnetically trapped Rydberg atoms; measured tunneling resonances and coherences in optical lattices
- Demonstrated coherent optical excitation of Rydberg states for quantum information processing

University of Michigan, Physics Department, Ann Arbor, MI *1994-2000*
Research Assistant

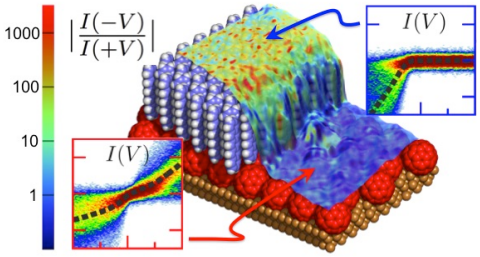
- Designed, built and demonstrated a scanning probe near-field optical microscope for linear and nonlinear optical spectroscopy of single quantum dots at low temperature (4K)
- Mapped local optical density of states of single quantum dots and the spatial wavefunction of a single quantum dot exciton
- Measured absorption and studied decoherence of excitons confined by a single quantum dot

JEFFREY GUEST

Selected Publications

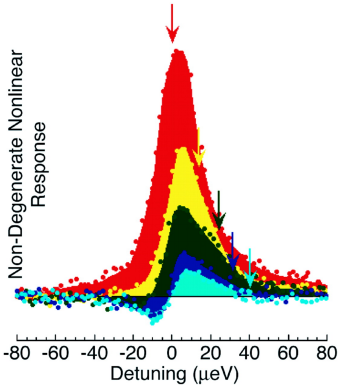
Selected from 50+ publications:

Ultrahigh vacuum scanning tunneling microscopy/spectroscopy of 2D materials, molecular heterojunctions



1. J. A. Smerdon, N. C. Giebink, N. P Guisinger, P. Darancet, **J. R. Guest,** "Large spatially-resolved rectification in a donor-acceptor molecular heterojunction," ***Nano Letters*** 16, 2603 (2016).
2. L. Gao, P. P. Pal, T. Seideman, N. P. Guisinger, **J. R. Guest,** "Current-driven hydrogen desorption from graphene: experiment and theory," ***J. Phys. Chem. Lett.*** 7, 486 (2016).
3. A. J. Mannix, X.-F. Zhou, B. Kiraly, J. D. Wood, D. Alducin, B. Myers, X. Liu, B. L. Fisher, **J. R. Guest**, M. J. Yacaman, A. Ponce-Pedraza, A. R. Oganov, M. C. Hersam, N. P. Guisinger, "Synthesis of Borophene: An Anisotropic, Two-Dimensional Boron Allotrope," ***Science*** 350, 1513 (2015).
4. J. A. Smerdon, R. B. Rankin, J. P. Greeley, N. P Guisinger, **J. R. Guest**, "Chiral 'pinwheel' heterojunctions self-assembled from C60 and pentacene," ***ACS Nano*** 7, 3086 (2013).
5. J.-W. Cho, L. Gao, Ö. Süzer, **J. R. Guest**, and N. P. Guisinger, "Structural and Electronic Decoupling of C_{60} from Epitaxial Graphene on SiC," ***Nano Letters*** 12, 3018 (2012).
6. A. E. DePrince III, M. Pelton, **J. R. Guest,** S. K. Gray, "Emergence of excited-state plasmon modes in linear hydrogen chains from time-dependent quantum mechanical methods," ***Phys. Rev. Lett.*** 107, 196806 (2011).
7. J. A. Smerdon, M. Bode, N. P Guisinger, **J. R. Guest**, "Monolayer and bilayer pentacene on Cu(111)," ***Phys. Rev. B*** 84, 165436 (2011).
8. J.-W. Cho, L. Gao, J. Tian, H. Cao, Q. Yu, E. Yitamben, B. Fisher, **J. R. Guest**, Y. P. Chen, N. P. Guisinger, "Atomic-scale investigation of graphene grown on Cu foil and the effects of thermal annealing," ***ACS Nano*** 5, 3607 (2011).
9. L. Gao, **J. R. Guest**, N. P. Guisinger, "Graphene on Cu(111)," ***Nano Letters*** 10, 3512 (2010).
10. P. Sessi, **J. R. Guest**, M. Bode, N. P. Guisinger, "Patterning graphene at the nanometer scale via hydrogen desorption," ***Nano Letters*** 9, 4343 (2009).
11. P. Sessi, N. P. Guisinger, **J. R. Guest,** M. Bode, "Temperature and size dependence of anti-ferromagnetism in Mn nanostructures," ***Phys. Rev. Lett***. 103, 167201 (2009).
12. N. P. Guisinger, T. S. Santos, **J. R. Guest**, A. Bhattacharya, J. W. Freeland, M. Bode, "Nanometer-scale striped surface terminations on fractured $SrTiO_3$ surfaces," ***ACS Nano*** 3, 4132 (2009).

Low temperature near-field scanning optical microscopy and spectroscopy of single quantum dots



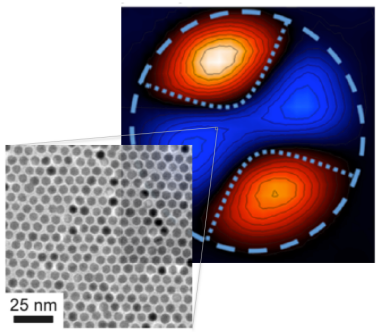
13. **J. R. Guest**, T. H. Stievater, G. Chen, E. A. Tabak, B. G. Orr, D. G. Steel, D. Gammon, D. S. Katzer, "Near-field coherent spectroscopy and microscopy of a quantum dot system," ***Science*** 293, 2224 (2001).
14. **J. R. Guest**, T. H. Stievater, X. Li, J. Cheng, D. G. Steel, D. Gammon, D. S. Katzer, D. Park, C. Ell, A. Thranhardt, G. Khitrova, H. M. Gibbs, "Measurement of optical absorption by a single quantum dot exciton," ***Phys. Rev. B*** 65, 241310R (2002).
15. T. H. Stievater, X. Li, **J. R Guest**, D. G. Steel, D. Gammon, D. S. Katzer, D. Park, "Wavelength modulation spectroscopy of single quantum dots," ***Appl. Phys. Lett***. 80, 1876 (2002).

Ultrahigh vacuum atomic force microscopy

16. A. S. Tayi, A. K. Shveyd, C.-H. Sue, J. M. Szarko, B. Rolczynski, J. A. Kennedy, A. A. Sarjeant, C. L. Stern, D. Cao, W. F. Paxton, W. Wu, S. K. Dey, A. C. Fahrenbach, **J. R. Guest**, H. Mohseni, L. X. Chen, K. L. Wang, J. F. Stoddart, S. I. Stupp, "Room Temperature Ferroelectricity in Supramolecular Networks of Charge-Transfer Complexes," ***Nature*** 488, 485 (2012).

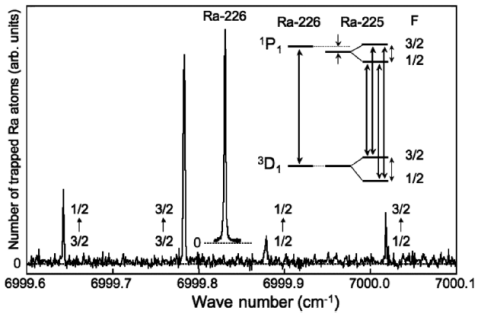
17. W. Wu, Y. Horibe, N. Lee, S.-W. Cheong, **J. R. Guest**, "Conduction of topologically-protected charged ferroelectric domain walls," ***Phys. Rev. Lett.*** 108, 077203 (2012).
18. W. Wu, **J. R. Guest**, Y. Horibe, S. Park, T. Choi, S. B. Kim, S.-W. Cheong, M. Bode, "Polarization-modulated rectification at ferroelectric surfaces," ***Phys. Rev. Lett.*** 104, 217601 (2010).

Nanomechanics

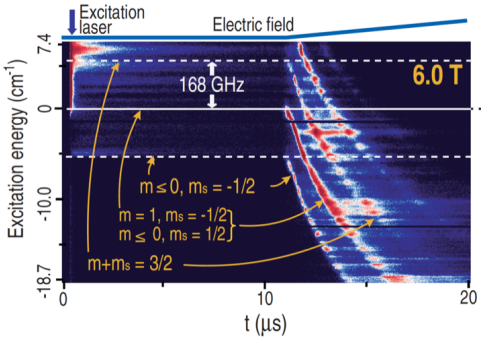


19. C. Chen, D. H. Zanette, **J. R. Guest**, D. A. Czaplewski, D. Lopez, "Self-sustained micromechanical oscillator with linear feedback," ***Phys. Rev. Lett.***, *in press.*
20. D. Antonio, D. A. Czaplewski, **J. R. Guest**, D. Lopez, S. I. Arroyo, D. H. Zanette, "Nonlinearity-induced synchronization enhancement in micromechanical oscillators," ***Phys. Rev. Lett***. 114, 034103 (2015).
21. P. Kanjanaboos, X.-M. Lin, J. E. Sader, S. M. Rupich, H. M. Jaeger, **J. R. Guest**, "Self-assembled nanoparticle drumhead resonators," ***Nano Letters*** 13, 2158 (2013).

Atomic physics: laser-cooling radioactive isotopes, precision measurement, Rydberg atom spectroscopy



22. **J. R. Guest**, N. D. Scielzo, I. Ahmad, K. Bailey, J. P. Greene, R. J. Holt, Z.-T. Lu, T. P. O'Connor, D. H. Potterveld, "Laser trapping of ^{225}Ra and ^{226}Ra with repumping by room-temperature blackbody radiation," ***Phys. Rev. Lett***. 98, 093001 (2007).
23. N. D. Scielzo, **J. R. Guest**, E. C. Schulte, I. Ahmad, K. Bailey, D. L. Bowers, R. J. Holt, Z.-T. Lu, T. P. O'Connor, D. H. Potterveld, "Measurements of the lifetime of the lowest $^3P_1$ state in neutral Ba and Ra," ***Phys. Rev. A*** 73, 010501(R) (2006).
24. J.-H Choi, **J. R. Guest**, E. Hansis, A. P. Povilus, G. Raithel, "Landau quantization in the ionization of cold, magnetized Rydberg atoms" ***Phys. Rev. Lett.*** 95, 253005 (2005).
25. J.-H Choi, **J. R. Guest**, E. Hansis, A. P. Povilus, G. Raithel, "Magnetic trapping of long-lived Rydberg atoms," ***Phys. Rev. Lett.*** 95, 243001 (2005).
26. T. Cubel, B. K. Teo, V. Malinovsky, **J. R. Guest**, A. W. Reinhard, B. Knuffman, P. R. Berman, G. Raithel, "Coherent population transfer of ground state atoms into Rydberg states," ***Phys. Rev. A*** 72, 023405 (2005).
27. **J. R. Guest**, J.-H Choi, E. Hansis, A. P. Povilus, G. Raithel, "Laser cooling and magnetic trapping at several Tesla," ***Phys. Rev. Lett.*** 94, 073003 (2005).
28. A. Walz-Flannigan, **J. R. Guest**, J.-H Choi, G. Raithel, "Cold Rydberg gas dynamics," ***Phys. Rev. A*** 69, 063405 (2004).
29. B. K. Teo, D. Feldbaum, T. Cubel, **J. R. Guest**, P. R. Berman, G. Raithel, "Autler-Townes spectroscopy of the $5S_{1/2} - 5P_{3/2} - 44D$ cascade of cold ^{85}Rb atoms," ***Phys. Rev. A*** 68, 053407 (2003).
30. **J. R. Guest**, G. Raithel, "High-|m| Rydberg states in strong magnetic fields," ***Phys. Rev. A*** 68, 052502 (2003).
31. **J. R. Guest**, J.-H. Choi, G. Raithel, "Decay rates of high-|*m*| Rydberg states in strong magnetic fields," ***Phys. Rev. A*** 68, 022509 (2003).



32. **J. R. Guest**, B. K. Teo, N. V. Morrow, G. Raithel, "Magnetic behavior of atoms in gray optical lattices," ***J. Opt. Soc. Am. B*** 20, 942 (2003).
33. B. K. Teo, **J. R. Guest**, G. Raithel, "Tunneling resonances and coherence in an optical lattice," ***Phys. Rev. Lett.*** 88, 173001 (2002).
34. S. K. Dutta, **J. R. Guest**, D. Feldbaum, A. Walz-Flannigan, G. Raithel, "Ponderomotive optical lattice for Rydberg atoms," ***Phys. Rev. Lett***. 85, 5551 (2000).