

# Brian LeRoy

University of Arizona  
Department of Physics  
1118 E. 4<sup>th</sup> St.  
Tucson, AZ 85721

Tel: 520-626-4726  
Fax: 520-621-4721  
E-mail: leroy@physics.arizona.edu

## Research interests

Scanning probe microscopy and electrical transport of nanostructures

## Education

- 2003     **Ph.D.** in Physics, Harvard University, Cambridge, MA, thesis “Imaging coherent electron flow through semiconductor nanostructures”
- 2001     **A.M.** in Physics, Harvard University, Cambridge, MA
- 1998     **B.S.** in Physics and Mathematics, University of Michigan, Ann Arbor, MI

## Research Experience

- 2006-     **University of Arizona**, Tucson, AZ  
Assistant Professor  
Department of Physics
- Scanning tunneling spectroscopy of graphene.
  - Scanning gate microscopy of carbon nanotubes.
  - Wavefunction imaging of semiconductor quantum dots.
- 2003-2006     **Delft University of Technology**, Delft, The Netherlands  
Postdoctoral Researcher in Cees Dekker’s group  
Kavli Institute of Nanoscience
- Acquired atomic resolution images of suspended carbon nanotubes.
  - Observed Coulomb blockade in suspended carbon nanotubes using scanning tunneling spectroscopy.
  - Observed phonon-assisted tunneling in suspended carbon nanotubes due to both emission and absorption of phonons.
  - Integrated gate electrode into nanotube devices for combined transport and spectroscopy measurements.
- 1999-2003     **Harvard University**, Cambridge, MA  
Advisor: Prof. Robert Westervelt  
Department of Physics and Division of Engineering and Applied Sciences
- Imaged wavefunctions from a quantum point contact showing modal pattern and coherent interference fringes spaced by half the Fermi wavelength.
  - Observed branching flow of electrons in a two-dimensional electron gas due to small angle scattering from donors and impurities.
  - Imaged local electron density in a two-dimensional electron gas using a low-temperature scanned probe microscope.
  - Controlled and imaged location and strength of interference fringes in a two-dimensional electron gas using an electron interferometer.

- 1997-1998     **University of Michigan**, Ann Arbor, MI  
Advisor: Prof. Meigan Aronson  
Department of Physics  
• Studied electrical transport and magnetic properties of hexaborides.

### Teaching Experience

- 2006-Present   **University of Arizona**, Tucson, AZ  
**Professor:** Taught graduate level classical mechanics, undergraduate solid state, mathematical methods and wave, optics and thermodynamics courses.
- 2004-2005     **Delft University of Technology**, Delft, The Netherlands  
**Supervisor:** Oversaw and directed research project for master's student.
- 1999           **Harvard University**, Cambridge, MA  
**Teaching Fellow:** Taught section and lab of introductory electricity and magnetism for non-physics concentrators.
- 1998           **Harvard University**, Cambridge, MA  
**Teaching Fellow:** Taught section of course on wave phenomena for physics concentrators.
- 1997           **University of Michigan**, Ann Arbor, MI  
**Tutor:** Assisted students taking a self-paced introductory physics class.

### Awards and Recognition

- My recent work on graphene was highlighted in a Physics article as well as a press release by the American Institute of Physics.
- My work has received considerable attention in the scientific press including cover articles in Physics Today, Nature, Nano Letters and Science News and two articles in Physics World.
- White Prize for outstanding teaching, Harvard University.
- Certificate of Distinction in Teaching (based on student evaluations), Harvard University
- Williams Prize for outstanding Senior Thesis in Physics, University of Michigan (second place).
- Graduated with Highest Honors in Physics, High Honors in Mathematics and Distinction in General scholarship, University of Michigan.
- Class Honors each year at the University of Michigan.
- Member Golden Key National Honor Society, University of Michigan.
- William J. Branstrom Freshman Prize for superior academic achievement (top 5% of class), University of Michigan.

## Invited Talks

### *Local electronic properties of graphene*

- Condensed Matter Seminar, University of Virginia, October 2009.

### *Scanning tunneling spectroscopy of graphene*

- ARL Graphene Workshop, Adelphi MD, August 2009.
- Condensed Matter Seminar, Boston University, February 2009.

### *Local electronic properties of carbon nanostructures*

- Condensed Matter Seminar, University of California, Riverside, November 2008.

### *Scanning probe microscopy of nanostructures*

- Nanoelectronic Devices for Defense & Security Conference, Fort Lauderdale, FL, September 2009.
- Condensed Matter Seminar, Rice University, January 2009.
- Physical Chemistry Seminar, University of Arizona, March 2008.
- Binational Consortium of Optics Winter School, Tucson, AZ, November 2006.
- Low Energy Seminar, University of Arizona, November 2006.

### *Imaging electrons in nanostructures*

- APS Four Corners Section Meeting, Logan, Utah October 2006.

### *Electrical generation and absorption of phonons in carbon nanotubes*

- Nanoscale science seminar, Max Planck Institute for Solid State Research, Stuttgart Germany, May 2006.
- Colloquium, University of Buffalo, February 2006.
- Condensed Matter Seminar, University of California-San Diego, February 2006.
- Colloquium, University of Texas-Austin, February 2006.
- Colloquium, University of Delaware, December 2005.
- Colloquium, Georgia Institute of Technology, December 2005.
- Colloquium, University of Arizona, November 2005.
- International Conference on Low Temperature Physics (LT24), Orlando, August 2005.
- International Conference on the Science and Applications of Nanotubes (NT'05), Göteborg Sweden, July 2005.
- Condensed Matter Seminar, University of California-Berkeley, March 2005.
- EU workshop on carbon based nanoelectromechanical devices, Delft The Netherlands, January 2005.
- Annual Dutch Condensed Matter Physics Conference, December 2004.
- Condensed Matter Seminar, University of Michigan-Ann Arbor, September 2004.

### *Imaging coherent electron flow*

- APS March Meeting, Baltimore, March 2006.
- XXXIV International School on the Physics of Semiconducting Compounds, Jaszowiec Poland, June 2005.
- NIST-Boulder, January 2003.

- Condensed Matter Seminar, Harvard University, October 2002.
- International Conference on the Physics of Semiconductors (ICPS26), Edinburgh Scotland, August 2002.
- Electronic Properties of Two-Dimensional Systems, Prague Czech Republic, July 2001.

## Publications

### *Refereed Journal Articles*

1. “Spatial mapping of the Dirac point in monolayer and bilayer graphene”  
A. Deshpande, W. Bao, Z. Zhao, C.N. Lau, and B.J. LeRoy, *IEEE Transactions on Nanotechnology* submitted, arXiv:0912.0547 (2009).
2. “Mapping the Dirac point in gated bilayer graphene”  
A. Deshpande, W. Bao, Z. Zhao, C.N. Lau, and **B.J. LeRoy**, *Applied Physics Letters*, accepted, arXiv:0910.3720 (2009).
3. “Lithography-free fabrication of high quality substrate-supported and suspended graphene devices”  
W. Bao, G. Liu, Z. Zhao, D. Yan, A. Deshpande, **B.J. LeRoy**, and C.N. Lau, *Nano Research*, accepted (2009).
4. “Spatially resolved spectroscopy of monolayer graphene on SiO<sub>2</sub>”  
A. Deshpande, W. Bao, F. Miao, C.N. Lau, and **B.J. LeRoy**, *Physical Review B* **79**, 205411 (2009). (Featured in May 2009 issue of Physics)
5. “Simultaneous electrical transport and scanning tunneling spectroscopy of carbon nanotubes”  
**B.J. LeRoy**, I. Heller, V.K. Pahilwani, C. Dekker, and S.G. Lemay, *Nano Letters* **7**, 2937 (2007). (cover article)
6. “Three-terminal scanning tunneling spectroscopy of carbon nanotubes”  
**B.J. LeRoy**, J. Kong, V.K. Pahilwani, C. Dekker, and S.G. Lemay, *Physical Review B* **72**, 075413 (2005).
7. “Thermal averages in a quantum point contact with a single coherent wave packet”  
E.J. Heller, K.A. Aidala, **B.J. LeRoy**, A.C. Bleszynski, A. Kalben, R.M. Westervelt, K.D. Maranowski, and A.C. Gossard, *Nano Letters* **5**, 1285 (2005).
8. “Imaging electron interferometer”  
**B.J. LeRoy**, A.C. Bleszynski, K.E. Aidala, R.M. Westervelt, A. Kalben, E.J. Heller, S.E.J. Shaw, K.D. Maranowski, and A.C. Gossard, *Physical Review Letters* **94**, 126801 (2005).
9. “Integration of a gate electrode into carbon nanotube devices for scanning tunneling microscopy”  
J. Kong, **B.J. LeRoy**, S.G. Lemay, and C. Dekker, *Applied Physics Letters* **86**, 112106 (2005).
10. “Electrical generation and absorption of phonons in carbon nanotubes”  
**B.J. LeRoy**, S.G. Lemay, J. Kong, and C. Dekker, *Nature* **432**, 371 (2004).

11. “Scanning tunneling spectroscopy of suspended single-wall carbon nanotubes”  
**B.J. LeRoy**, S.G. Lemay, J. Kong, and C. Dekker, *Applied Physics Letters* **84**, 4280 (2004).
  12. “Imaging coherent electron flow”  
**B.J. LeRoy**, Invited review article for *Journal of Physics: Condensed Matter* **15**, R1835 (2003).
  13. “Imaging electron density in a two-dimensional electron gas”  
**B.J. LeRoy**, M.A. Topinka, R. M. Westervelt, K.D. Maranowski, and A.C. Gossard, *Applied Physics Letters* **80**, 4431 (2002).
  14. “Charge-imaging field-effect transistor”  
L.H. Chen, M.A. Topinka, **B.J. LeRoy**, R.M. Westervelt, K.D. Maranowski, and A.C. Gossard, *Applied Physics Letters* **79**, 1202 (2001).
  15. “Coherent branched flow in a two-dimensional electron gas”  
M.A. Topinka, **B.J. LeRoy**, R. M. Westervelt, S.E.J. Shaw, R. Fleischmann, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Nature* **410**, 183 (2001). (cover article)
  16. “Imaging coherent electron flow from a quantum point contact”  
M.A. Topinka, **B.J. LeRoy**, S.E.J. Shaw, E.J. Heller, R. M. Westervelt, K.D. Maranowski, and A.C. Gossard, *Science* **289**, 2323 (2000).
- Refereed Conference Proceedings*
17. “Imaging electron interferometer”  
A.C. Bleszynski, K.E. Aidala, **B.J. LeRoy**, R.M. Westervelt, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Physics of Semiconductors: 27<sup>th</sup> International Conference on the Physics of Semiconductors (ICPS-27)* AIP Conference Proceedings **772**, 1461-1462 (2005).
  18. “Imaging electron waves”  
R. M. Westervelt, M.A. Topinka, **B.J. LeRoy**, A.C. Bleszynski, K.E. Aidala, S.E.J. Shaw, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Physica E* **24**, 63 (2004).
  19. “Imaging coherent electron flow in a two-dimensional electron gas”  
**B.J. LeRoy**, M.A. Topinka, A.C. Bleszynski, R. M. Westervelt, S.E.J. Shaw, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Applied Surface Science* **210**, 134 (2003).
  20. “Imaging coherent electron flow”  
**B.J. LeRoy**, A.C. Bleszynski, M.A. Topinka, R. M. Westervelt, S.E.J. Shaw, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Physics of Semiconductors 2002: Proceedings of the International Conference on the Physics of Semiconductors (ICPS)*, eds. A.R. Long and J.H. Davies, 169-176 (IOP Publishing, Bristol, UK) (2003) cond-mat/0208194.
  21. “Imaging coherent electron wave flow in a two-dimensional electron gas”  
**B.J. LeRoy**, A.C. Bleszynski, M.A. Topinka, R. M. Westervelt, S.E.J. Shaw, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Physica E* **18**, 163 (2003).

22. "Imaging coherent electron flow"  
R. M. Westervelt, M.A. Topinka, **B.J. LeRoy**, A.C. Bleszynski, S.E.J. Shaw, E.J. Heller, K.D. Maranowski, and A.C. Gossard, *Physica E* **18**, 138 (2003).
23. "Imaging coherent electron wave flow in a two-dimensional electron gas"  
M.A. Topinka, **B.J. LeRoy**, R. M. Westervelt, K.D. Maranowski, and A.C. Gossard, *Physica E* **12**, 678 (2002).