

## Brian J. Keay

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### Education History:

University of California, Santa Barbara  
Ph. D.: Physics, March 1996

University of California, Berkeley  
B.A.: Physics — *Graduated with Honors*, May 1987

### Work Experience:

#### Manufacturing Test Engineer

PerkinElmer Optoelectronics, Santa Clara, CA (05/2005 – 01/2009)

- Responsible for implementing performance and quality testing of flat panel digital x-ray detectors at several different stages of production.
- Responsible for providing the interpretation of test results and statistical data analysis support to process integration engineers and yield improvement teams.
- Received several performance based awards, including the *Employee of the Month*, *Above and Beyond Award*, and the *Business Impact Award*.

#### Senior Scientist and Program Leader

Bookham Technology Ltd., Oxfordshire, United Kingdom (03/2001 – 10/2002)

- Responsible for the design, testing, and modeling of laser devices for optoelectronic communication systems.
- Participated in studies on the effect that impurities and defect states have on the performance of silicon traveling-wave photodetectors, and presented research reports to senior management.

#### Research Associate

Dept. of Physics, Vanderbilt University, Nashville, TN (04/1996 – 04/2000)

Conducted experiments involving the laser spectroscopy of materials and developed theoretical models of the results.

- Discovered a new method of studying the dynamics and optical properties of molten semiconductors.
- Presented the first experimental evidence that molten GaAs behaves as a metal on thermal timescales.

#### Research/Teaching Assistant

University of California, Santa Barbara (09/1987- 04/1996)

- Ph.D. Dissertation: *Superlattice Transport in Terahertz Electric Fields*.
- Conducted a series of groundbreaking experiments involving semiconductor nanostructures under the influence of terahertz radiation from a free-electron laser. These experiments resulted in the first observation of:
  - Photon-assisted tunneling in semiconductors.
  - Multiphoton-assisted tunneling in semiconductors.
  - Dynamic localization in superlattices.
  - Absolute Negative Conductance in semiconductor superlattices.
- Performed theoretical studies of electron transport in solids using renormalization group theory techniques.
- Conducted independent research in theoretical particle physics and quantum gravity and published the results.

- Collaborated with the NA31 group at the Centre Européen pour la Recherche Nucleaire (CERN), Geneva, Switzerland, studying CP violation in K-meson decays.
- Led discussion sections for graduate and undergraduate courses.

### **Research Assistant**

Lawrence Berkeley Laboratory, Berkeley, CA (1985 – 1986)

Participated in intermediate energy heavy ion physics experiments using the Bevalac heavy ion accelerator.

### **Computer Skills:**

Operating Systems: Linux/Unix, Windows, MacOS and VAX/VMS.

Programming Languages: C/C++, Visual C++, Python, Perl, FORTRAN, HTML, MathML, and experience with shell programming, OpenGL, and Java.

Numerical libraries: Numerical Recipes, IMSL, LAPACK, BLAS, GNU Scientific Library, and NURBS libraries, etc.

Other: National Instruments Labview certified, MiniTab, Mathematica, Matlab, Mathcad, Tex, Igor, Sigma Plot, Crosslight laser design software, Kaleidagraph, Excel, the GIMP, CorelDraw, Procmail, Samba, Sendmail, and PowerPoint. Experience writing documents using the DocBook document type definition (DTD), and processing them using Extensible Stylesheet Language Transformation (XSLT) engines.

**Languages:** Italian

### **Publications and Invited Speaking Engagements:**

For a complete list, please see <http://www.scifree.org/cv.html>

### **Laboratory Skills:**

Measurement equipment: Electrical spectrum analyzers, monochrometers, spectrometers, OSAs, holographic filters, voltage and current sources, integrating spheres, oscilloscopes, goniometric radiometers, photodetector arrays, bolometers, phototubes, pyroelectric detectors, PEM detectors, scanning electron microscopes, optical fiber equipment, pulse generators, lock-in amplifiers, geometrical optics equipment and lenses. Laser diode drivers, temperature control equipment: including thermocouples, temperature transducers, TEC controllers, and other cryogenic equipment. Various electronic and manual micropositioning equipment, and piezoelectric detectors. Superconducting magnets for high magnetic field characterization experiments.

Lasers: Semiconductor lasers, free-electron lasers, CO<sub>2</sub>, TEA, YAG, Argon, HeNe, and Ti:Sapphire lasers, using pulse durations ranging from picosecond, nanosecond, and microsecond to CW. Wavelengths ranging from millimeter to UV.

Experimental optics methods and techniques: Sum-frequency generation, harmonic generation, Raman spectroscopy, laser pump-probe, optical tomography, fluorescence spectroscopy, FTIR spectroscopy, and relative intensity noise measurements.

Electronic/magnetic characterization methods: Van der Pauw methods and quantum transport measurements: including quantum Hall and Shubnikov-de Haas magnetoresistance measurements, capacitance-voltage measurements, and considerable experience doing current-voltage and photocurrent measurements on a broad range of semiconductor devices.

Cleanroom/processing equipment: Reactive ion etcher, e-beam evaporator, thermal evaporator, oxygen plasma etchers, photolithographic aligners, wire bonders, solder bonders, SiO<sub>2</sub> deposition equipment, rapid thermal annealer, scanning tunneling microscope, and wet chemical etching equipment.

## Publications:

1. *Time-resolved infrared transmittance and reflectance of a propagating melt in GaAs*, B. J. Keay, M. Mendenhall, and G.S. Edwards, Phys. Rev. B **60**, 10898 (1999).
2. *THz response of GaAs/AlGaAs superlattices: from classical to quantum dynamics*, S. Zeuner, B. J. Keay et al., Superlattices and Microstructures **22**, 149 (1997).
3. *Virtual states and photon-assisted tunneling*, B. J. Keay, C. Aversa, Phys. Rev. B **54**, R2284 (1996).
4. *Virtual states, dynamic localization, absolute negative conductance and stimulated multiphoton emission in semiconductor superlattices*, B. J. Keay et al., Semicond. Sci. Techn. **11**, 1596 (1996).
5. *Inverse Bloch-oscillator: strong terahertz-photocurrent resonance at the Bloch frequency*, K. Unterrainer, B. J. Keay et al., Phys. Rev. Lett. **76**, 2973 (1996).
6. *Transition from classical to quantum response in semiconductor superlattices at THz frequencies*, S. Zeuner, B. J. Keay et al., Phys. Rev. B **53**, R1717 (1996).
7. *Photon-assisted transport through semiconductor quantum structures in intense terahertz electric fields*, S. J. Allen et al., Physica B **227**, 367 (1996).
8. *Dynamic localization, absolute negative conductance and stimulated, multiphoton-emission in sequential resonant tunneling semiconductor superlattices*, B. J. Keay et al., Phys. Rev. Lett. **75**, 4102 (1995).
9. *Photon-assisted electric field domains and multiphoton-assisted tunneling in semiconductor superlattices*, B. J. Keay et al., Phys. Rev. Lett. **75**, 4098 (1995).
10. *Photon-assisted electric field domains and multiphoton-assisted tunneling in antenna coupled semiconductor superlattices*, B.J. Keay et al., in *Hot Carriers in Semiconductors: Proceedings of the Ninth International Conference*, K. Hess, J-P. Leburton, U. Ravaioli eds., Chicago, Illinois (Plenum, New York, 1996).
11. *Strong terahertz-photocurrent resonances in miniband superlattices at the Bloch frequency*, K. Unterrainer, B.J. Keay et al., in *Hot Carriers in Semiconductors: Proceedings of the Ninth International Conference*, K. Hess, J-P. Leburton, U. Ravaioli eds., Chicago, Illinois (Plenum, New York, 1996).
12. *Multiphoton-assisted tunneling, dynamic localization and absolute negative conductance*, B. J. Keay et al., Surface Science **362**, 176 (1996).
13. *Sequential resonant tunneling via photon virtual states in semiconductor superlattices*, B. J. Keay et al., *The Physics of Semiconductors: Proceedings of the 22nd International Conference*, Vancouver, **2**, 1055, D.J. Lockwood ed., Canada (World Scientific, 1995).
14. *Terahertz, photon-assisted tunneling in semiconductor nanostructures*, S.J. Allen, B.J. Keay et al., *Nanostructures and Quantum Effects*, ed. by H. Sakaki and H. Noge, (Springer Verlag, Heidelberg, Germany 1994).
15. *Probing terahertz dynamics in semiconductor nanostructures with the UCSB free-electron lasers*, with S.J. Allen et al., J. of Luminescence **60 - 61**, 250 (1994).
16. *Superlattice transport in intense terahertz electric fields*, B. J. Keay et al., Surface Science **305**, 385 (1994).

17. *Probing terahertz electron dynamics in semiconductor nanostructures with the UC Santa Barbara FELs*, with J.P. Kaminski *et al.*, Nuclear Instruments and Methods in Physics Research, **A341**, 169 (1994).
18. *Electrical transport properties of superlattices under intense terahertz electric fields*, P.S.S. Guimaraes, B. J. Keay *et al.*, Brazilian J. Phys. **24**, 163 (1994).
19. *Photon-mediated sequential resonant tunneling in intense terahertz electric fields*, P.S.S. Guimaraes, B. J. Keay *et al.*, Phys. Rev. Lett. **70**, 3792 (1993).
20. *S1XS2 wormholes*, B. J. Keay and R. Laflamme, Phys. Rev. D **40**, 2118 (1989).
21. *Subthreshold production of strange hadrons in relativistic heavy ion collisions*, with S. Trentalange *et al.*, *Intersections Between Particle and Nuclear Physics: AIP Conference Proceedings 150*, editor D.F. Geesaman (AIP, NY 1986), pp 814 - 820.

#### **Invited Talks:**

*Multiphoton-assisted tunneling, dynamic localization and absolute negative conductance in THz driven superlattices*, Workshop on Millimeter Wave Spectroscopy of Solids, Los Angeles, CA, March 25 - 27, 1996.

*Superlattice transport in terahertz electric fields*, 9th International Winterschool on New Developments in Solid State Physics, Nanostructure Physics and Technology, Mauterndorf, Province of Salzburg, Austria, February 19 -23, 1996.

*Multiphoton-assisted tunneling, dynamic localization and absolute negative conductance in THz driven superlattices*, Phasdom-95, Annual Meeting of the European Community on the Physics and Technology of Mesoscopic Structures, Cambridge, England, October 1-5, 1995.

*Dynamic localization and negative absolute conductance in terahertz driven semiconductor superlattices*, FEL'95, 2nd Annual FEL User Workshop, New York, New York, August 21-25, 1995.

*Multiphoton-assisted tunneling, dynamic localization and absolute negative conductance*, EP2DS-11, 11th International Conference on the Electronic Properties of Two-Dimensional Systems, Nottingham, England, August 7-11 1995.

#### **Contributed Talks:**

*Time-resolved infrared transmittance and reflectance of a propagating melt in GaAs*, March Meeting of the American Physical Society, Atlanta, Georgia, March 20-25, 1999.

*Time-resolved infrared transmittance and reflectance spectroscopy of optical-pulse-induced phase transitions in GaAs*, FEL'98, Williamsburg, Virginia, August 1998.

*Time-resolved infrared transmittance and reflectance spectroscopy of optical-pulse induced phase transitions in GaAs*, SESAPS, Nashville, Tennessee, November 1997.

*Dynamic localization, absolute negative conductivity and stimulated, multiphoton-emission in sequential resonant tunneling semiconductor superlattices*, The International Conference on Intersubband Transitions in Quantum Wells: Physics and Applications, ITQW'95, Israel, October 23-26, 1995.

*Dynamic localization and absolute negative resistance in terahertz driven semiconductor superlattices*, The Ninth International Conference on Hot Carriers in Semiconductors, HCIS-9, Chicago, July 31-August 4, 1995.

*Photon-assisted tunneling in semiconductor superlattices antenna coupled to intense terahertz electric fields*, March APS Meeting, San Jose, CA, 20-25 March 1995.

*Superlattice transport in intense terahertz electric fields*, EP2DS-10, 10th International Conference on the Electronic Properties of Two-Dimensional Systems, Newport, RI, USA, 31 May - 4 June 1993.

*Superlattice transport in intense terahertz electric fields*, March APS Meeting, Seattle, WA, 22-26 March 1993.

**References available on request**