

Curriculum Vita

Prof. James N. Heyman

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I. Education

- 1992-94 Postdoctoral research associate in Physics, Quantum Institute, University of California at Santa Barbara.
- 1986 - 92 University of California, Berkeley CA. Ph.D. in Physics, December 1992.
- 1981 - 85 Williams College, Williamstown MA. B. A. Physics and Philosophy, June 1985

II. Academic Employment

Full-Time Appointments

- 2006- Professor, Department of Physics and Astronomy, Macalester College.
- 2000- Associate Professor, Macalester College.
- 1994 -00 Assistant Professor, Macalester College.

Visiting Appointments

- 2008 Visiting Professor, Institute for Photonics, Technical University of Vienna, Vienna Austria. (Sabbatical Appointment)
- 2001 Visiting Research Professor, Institute for Quantum Engineering Science and Technology, University of California at Santa Barbara. (Sabbatical Appointment)
- 1997 Visiting Research Professor, Institute for Microelectronics, Technical University of Vienna, Vienna Austria. (Sabbatical Appointment)

Highlights

- Publications:** 46 refereed publications, including 30 articles in archival journals
- External Grants:** 9 research grants and 2 instructional grants.
- Service:** Department Chair since Fall, 2005.

III Publications:

III.a Refereed Articles in Archival Journals

30. L. Bell*, J. Rogers*, J. Zimmerman, A.C. Gossard and J. N. Heyman, "THz Emission by Quantum Beating in a Modulation Doped Parabolic Quantum Well", accepted for publication in Applied Physics Letters.
29. J. N. Heyman, D. Bell*, T. Khumalo, " Terahertz Photo-Hall Measurements of Carrier Mobility in GaAs and InP, " Applied Physics Letters **88**, 162104 2006.
28. J. N. Heyman, N. Coates* , A. Reinhardt *, and G. Strasser, "Diffusion and Drift in Terahertz Emission at GaAs Surfaces". Applied Physics Letters **83** (2003): 5476.
27. J. N. Heyman, P. Neocleous*, D. Hebert*, P.A. Crowell, T. Müller, K. Unterrainer, "Terahertz emission from GaAs and InAs in a Magnetic Field" Physical Review **B64**, (2001) 085202.
26. K. Unterrainer, R. Kersting, R. Bratschitsch, T. Muller, G. Strasser, J. N. Heyman, "Few-cycle THz spectroscopy of semiconductor quantum structures". Physica E 9, 1, (Jan. 2001): 76-83.
25. K. Unterrainer, R. Kersting, R. Bratschitsch, T. Muller, G. Strasser, J. N. Heyman, K. D. Maranowski, A.C. Gossard, "Few-cycle THz spectroscopy of nanostructures". Physica E 7, 3-4, (May 2000): 693-7.
24. K. Pozela, S. B. Naran, J.-P. Leburton, J. N. Heyman, "Structure variation of intersubband electron-acoustic phonon scattering rate in coupled quantum wells", Applied Physics Letters, **77**, 2, (July 2000): 265-7.
23. R. Kersting, R. Bratschitsch, G. Strasser, K. Unterrainer, J. N. Heyman, "Sampling a terahertz dipole transition with subcycle time resolution", Optics Lett. **25** (Feb. 2000): 272-274.
22. R. Kersting, J.N. Heyman, G. Strasser and K. Unterrainer. "Coherent Plasmons in n-doped GaAs" Physical Review **B 58** (Aug. 1998): 4553-4559.
21. J. N. Heyman, R. Kersting, K. Unterrainer. "Time-Domain Measurement of Intersubband Oscillations in a Quantum Well" Applied Physics Letters **72** (Feb. 1998): 644-646.
20. J. N. Heyman, J. Barnhorst*, K. Unterrainer, J. Williams, K. Campman, P.F.Hopkins, A.C.Gossard. "Intersubband scattering of cold electrons in a coupled quantum well with subband spacing below $\hbar\omega_{LO}$." Physica E **2** (1998): 195-199.
19. G. Strasser, P. Kruck, M. Helm, J. N. Heyman, L. Hvozdar, and E. Gornik. "Mid-infrared electroluminescence in GaAs/AlGaAs structures." Applied Physics Letters **71** (Nov. 1997): 2892-94

18. K. Unterrainer, J.N. Heyman, K. Craig, B. Galdrikian, M.S. Sherwin, K. Campman, P.F. Hopkins, A.C. Gossard. "Intersubband dynamics of asymmetric quantum wells studied by THz `optical rectification'." *Semiconductor Science and Technology* **11** no.11S (Nov. 1996): 1591-1595.
17. J.N.Heyman, K. Unterrainer, K. Craig, J. Williams, K. Campman, P.F.Hopkins, A.C.Gossard, and M.S.Sherwin, B.N.Murdin & C.J.G.M. Langerak. "Far-Infrared Pump-Probe Measurements of the Intersubband Lifetime in an AlGaAs/GaAs Coupled-Quantum Well" *Applied Physics Letters* **68** (May 1996): 3019-21.
16. K. Craig, B. Galdrikian, J.N.Heyman, A.G.Markelz, J.B.Williams. M.S.Sherwin, K.Campman, P.F.Hopkins, and A.C.Gossard. "Undressing a Collective Intersubband Excitation in a Quantum Well." *Physical Review Letters* **76** (March 1996): 2382-85.
15. J.N.Heyman, K. Unterrainer, K. Craig, B. Galdrikian, K. Campman, P.F.Hopkins, A.C.Gossard & M.S.Sherwin. "Temperature and Intensity Dependence of Intersubband Relaxation Rates from Photovoltage and Absorption." *Physical Review Letters* **74** (April 1995): 2682-85.
14. M.S.Sherwin, K. Craig, B. Galdrikian, J.Heyman, and A.G.Markelz. "Nonlinear Quantum Dynamics in Semiconductor Quantum Wells." *Physica* **D83** no 1-3 (May 1995): 229-42.
13. S.J. Allen, K. Craig, B. Galdrikian, J.N. Heyman, J.P Kaminski, J.S. Scott, M.S. Sherwin, K. Unterrainer, M. Wanke, K. Campman, P.F. Hopkins, A.C. Gossard, D.H. Chow, M. Lui, T.K. Liu. "Materials science in the far-IR with electrostatic based FELs." *Nuclear Instruments & Methods in Physics Research, Section A (Accelerators, Spectrometers, Detectors and Associated Equipment)* **358** no.1-3 (April 1995): 536-9.
12. K. Unterrainer, J.N. Heyman, K. Craig, B. Galdrikian & M.S. Sherwin. "Optical rectification as a probe of quantum dynamics in a heterostructure." *Superlattices and Microstructures* **17** no.2 (1995): 159-62.
11. J. N. Heyman, K. Craig, K. Campman, S. Fafard, B. Galdrikian, A. C. Gossard, P. F. Hopkins, and M. S. Sherwin. "Harmonic Generation and Dynamic Screening in a Double Quantum Well." *Physical Review Letters* **72** (April 1994): 2183-86.
10. J.P.Kaminski, S.J.Allen, M.S.Sherwin, B. Keay, J.S. Scott, K. Craig, J. Heyman, P. Guimaraes, K.L. Campman, P.F. Hopkins, A.C. Gossard, D. Schow, M. Lui, T.Y. Liu. "Probing Terahertz Dynamics in Semiconductor Nanostructures With UC Santa Barbara FELs". *Nuclear Instruments & Methods in Physics Research A* **341** (1994): 169-173.
9. K. Craig, C.L. Felix, J.N. Heyman, A.G. Markelz, M.S. Sherwin, K.L. Campman, P.F. Hopkins, A.C. Gossard. "Far-Infrared Saturation Spectroscopy of a Single Quantum Well." *Semiconductor Science and Technology* **9** no.5 (May 1994): 627-629.
8. S. Metin, J. H. Kaufman, D. D. Saperstein, J. C. Scott, J. N. Heyman, and E. E. Haller. "Amorphous Carbon Antireflective Coatings in the 10 - 50 μm Region of the Far-IR." *Journal of the Materials Research Society* **9** No. 2 (Feb. 1994): 396-400.
7. J. N. Heyman, N. M. Johnson, J. Ager III, J. Walker, and E. E. Haller. "Hydrogen-Induced Platelets in Silicon: Infrared Absorption and Raman Scattering." *Physical Review* **B45** (June 1992): 13363-66.

6. J. N. Heyman, A. Giesekeus, E. E. Haller. "Characterization of the Beryllium Substitutional Pair in Silicon by Infrared Spectroscopy." *Physical Review B* **44** (Dec. 1991): 12769-75.
5. J.A. Wolk, M.B. Kruger, J.N. Heyman, W. Walukiewicz, R. Jeanloz, and E.E. Haller. "Local Vibrational Mode Spectroscopy of DX Centers in Si-Doped GaAs under Hydrostatic Pressure." *Physical Review Letters* **66** (Feb. 1991): 774-77.
4. J.A. Wolk, M.B. Kruger, J.N. Heyman, W. Walukiewicz, R. Jeanloz, and E.E. Haller. "Observation of a Local Vibrational Mode of DX Centers in Si-Doped GaAs." *Semiconductor Science and Technology* **6** (Oct. 1991): B78-B83.
3. E. Merk, J. Heyman and E.E. Haller. "Infrared Spectroscopy of the Neutral Zinc Double - Acceptor in Silicon." *Solid State Communications* **72** no. 9 (1989) :851-854.
2. F. Brown, D. R. Parker, J. Heyman, and N. Newbury. "Avalanche Photomultiplication in the Far Infrared." *Applied Physics Letters* **49** (Dec. 1986): 1548-50.
1. G. N. Gibson, J. Heyman, J. Lugten, W. Fitelson, and C. H. Townes. "Optical Path Length Fluctuations in the Atmosphere." *Applied Optics* **23** (Dec. 1984): 4383-87.

III.b Refereed Conference Proceedings

16. J. N. Heyman, D. Bell*, T. Khumalo*, S. Nabanja* and N. Coetes*, "Sensitive Ultrafast THz Mobility Measurement." Proceedings of the 28th International Conference on the Physics of Semiconductors (ICPS-28), Vienna 2006, ed. by W. Jantsch and F. Schaffler (Springer, Berlin 2006).
15. J. N. Heyman, H. Wrage, C. Lind, D. Hebert, P. Neocleous, P.A. Crowell, T. Müller, K. Unterrainer. "Terahertz Emission From Magneto-plasma Oscillations in Semiconductors", *Ultrafast Phenomena in Semiconductors VI*, Tsen, Song, Jiang, Editors, Proceedings of the SPIE Vol 4163, pp. 12-18, 2002.
14. R. Kersting, R. Bratschitsch, E. Thaller, G. Strasser, K. Unterrainer, J.N. Heyman, "Excitation of intersubband transitions by THz pulses". Technical Digest. (IEEE Cat. No.99CH37013) Conference on Lasers and Electro-Optics, Baltimore, MD, USA, 23-28 May 1999.) Washington, DC, USA: Opt. Soc. America, 1999. p.462-3.
13. R. Kersting, R. Bratschitsch, E. Thaller, G. Strasser, K. Unterrainer, J.N. Heyman, "Excitation of intersubband transitions by THz pulses". Technical Digest. (Cat. No. 99CH37012), Quantum Electronics and Laser Science Conference, Baltimore, MD, USA, 23-28 May 1999.) Wasington, DC, USA: Opt. Soc. America, 1999. p.219-20.
12. J.N. Heyman, R. Kersting, G. Strasser, K. Unterrainer. "THz Time-Domain Spectroscopy of Intersubband Transitions". Proceedings of the 24th International Conference on the Physics of Semiconductors, August 2-7, 1998 Jerusalem, ISRAEL.
11. K. Unterrainer, R. Kersting, G. Strasser, J. N. Heyman, K. Maranoski, and A.C. Gossard. "Few-Cycle THz Spectroscopy of Nanostructures". Proceedings of the 24th International Conference on the Physics of Semiconductors, August 2-7, 1998 Jerusalem, ISRAEL.

10. G. Strasser, S. Gianordoli, L. Hvozdar, H. Bichl, K. Unterrainer, E. Gornik, P. Kruck, M. Helm, J.N. Heyman, "GaAs/AlGaAs intersubband mid-infrared emitter", Proceedings of the Materials Science Society, Fall Meeting, Boston, MA, December 1-5, 1997.
9. J. N. Heyman, R. Kersting, K. Unterrainer, G. Strasser, K. Maranoski, and A.C. Gossard. "THz time-domain spectroscopy of intersubband plasmons". *Intersubband Transitions in Quantum Wells: Physics and Devices*, 173-180, Ed: S. Li & Y.K. Su, Kluwer Academic Publ., Boston, 1998.
8. L. Hvozdar, J.N. Heyman, G. Strasser, K. Unterrainer, P. Kruck, M. Helm, E. Gornik; "Characterization of GaAs/AlGaAs mid-infrared emitters"; Proc. IEEE 24th Int. Symposium on Compound Semiconductors, San Diego (1997), 565-568, Ed.: M. Melloch & M. Reed; IEEE Institute of Physics Publishing, Bristol & Philadelphia 1998.
7. K. Unterrainer, J.N. Heyman, K. Craig, B. Galdrikian, M.S. Sherwin, H. Drexler, K. Campman, P.F. Hopkins, A.C. Gossard. "Nonlinear resonant optical rectification in a coupled quantum well." *Surface Science*, **361-362** (July 1996): 401-405.
6. J.N. Heyman, K. Craig, K. Campman, S. Fafard, A.C. Gossard, P.F. Hopkins, and M.S. Sherwin. "Resonant Harmonic Generation near 100 μ m in an Asymmetric Quantum Well." *Quantum Well Intersubband Transition Physics and Devices*, NATO ASI series E, Vol. 270, pp 467-476. Ed. H.C. Liu, B.F. Levine and J.Y. Anderson (Kluwer Academic Publishers, Dordrecht, the Netherlands) 1994.
5. S.J. Allen, K. Craig, C.L. Felix, P. Guimaraes, and others. "Probing Terahertz Dynamics in Semiconductor Nanostructures With UCSB Free-Electron Lasers." *Journal Of Luminescence*, **60-1** (1994): 250-255.
4. A. G. Markelz, E. G. Gwinn, M. S. Sherwin, J. Heyman, C. Nguyen, and H. Kroemer. "Far-Infrared Harmonic Generation from Semiconductor Heterostructures." *SPIE Proceedings* **1854** (1994): 48.
3. J.N. Heyman, E.E. Haller, and A. Giesekus. "Piezospectroscopy of Two Beryllium Related Double Acceptors in Silicon." *Materials Science Forum* **83-87** (1992): 257-262. Eds. G. Davies, G. DeLeo and M. Stavola (Trans Tech publications, Switzerland).
2. J.A. Wolk, E.E. Haller, M.B. Kruger, R. Jeanloz, J.N. Heyman, and W. Walukiewicz. "Vibrational Mode Fourier Transform Spectroscopy with a Diamond Anvil Cell: Modes of the Si DX center and S-related complexes in GaAs." *Materials Science Forum* **83-87** (1992): 757-762. Eds. G. Davies, G. DeLeo and M. Stavola (Trans Tech publications, Switzerland).
1. E. Merk, J. Heyman, and E.E. Haller. "Infrared Absorption Study of Zinc-Doped Silicon." *Materials Research Society Symposium Proceedings*. **163**, (1990): 815.

IV. Presentations**IV.a Invited Talks / Seminars (2000-08)**

24. "Probing Semiconductors with THz emission", Physics Department, University of Munich, Germany, April 29, 2008
23. "Probing Semiconductors with THz emission", Insitute for Photonics, Vienna University of Technology, Austria, April 17, 2008
22. "Terahertz Emission Probes Semiconductors", Physics Department Colloquium, State University of New York, Buffalo, January 15th, 2008
21. "Terahertz Charge Oscillations in Semiconductors", Department of Physics, Applied Physics and Astronomy Colloquium, Rensselaer Polytechnic Institute, Troy, NY, April 19th, 2004.
20. " Terahertz Charge Oscillations", Physics Department Colloquium, Hamline University, St. Paul, Minnesota, October 22, 2003.
19. "Terahertz Charge Oscillations in Semiconductors", Physics Department Colloquium, University of Missouri, Rolla Missouri, September 19, 2002.
18. "Ultrafast THz emission from Magnetoplasmons in InAs and GaAs", Physics Department Colloquium, University of Iowa, Iowa City, Iowa, March 11, 2002.
17. "Terahertz Emission From Magneto-plasma Oscillations in Semiconductors", International Conference on Optoelectronics, Meeting of the International Society of Optical Engineers (SPIE), San Jose Convention Center, San Jose, California, 19-26 January 2002.
16. "Ultrafast Terahertz Pulses from Semiconductors in Magnetic Fields", Condensed Matter Sack-Lunch Seminar, University of Minnesota, September 25th, 2001.
15. "Ultrafast THz Emission from Magnetoplasma Oscillations", Applied Physics Seminar, University of California, Santa Barbara, California, March 8th, 2001.
14. "Ultrafast Terahertz Pulses from Semiconductors in Magnetic Fields", Condensed Matter Sack-Lunch Seminar, University of Minnesota, November 28th, 2000.
13. "THz emission from GaAs and InAs in a B-Field via Magnetoplasma Oscillations", Institute for Solid State Electronics, Technical University of Vienna, Vienna, Austria September 14th, 2000.
12. "Infrared Spectra in a Trillionth of a Second", Bethel College, Roseville Minnesota, May 1st, 2000.

(11 Invited talks/ Seminars prior to 2000)

V.b Contributed Presentations at National or International Conferences (2000-05)

34. J.N. Heyman, Laura Bell*, Jeff Rogers*, Jeremy Zimmerman and Arthur Gossard, **THz Charge Oscillations in a Modulation Doped Parabolic Quantum Well**, March Meeting of the American Physical Society, New Orleans Louisiana, March 10-15, 2008,
33. James N. Heyman, Alex Reinhardt*, Nelson Coates* and Gottfried Strasser, Ultrafast THz measurements of Hot Carrier Diffusion and Drift in Semiconductors. 27th International Conference on the Physics of Semiconductors, Flagstaff, Arizona, USA July 26-30, 2004.
32. J. N. Heyman, Lance Erickson, Ben Turner and Gottfried Strasser, "Hot Carrier Diffusion vs. Drift in Ultrafast Charge Transport in Semiconductors". March Meeting of the American Physical Society, March 3 - 7, 2003 Austin Texas.
31. J.N. Heyman, P.A. Crowell, D. Hebert, C. Lind, P. Neocleous, H. Wrage¹"Terahertz Emission From Cyclotron-Plasma Oscillations in Semiconductors", 29th International Conference on the Physics of Semiconductors, Edinburgh UK, July 29 - August 2, 2002.
30. J. N. Heyman, P. Neocleous*, D. Hebert*, P.A. Crowell, T. Müller, K. Unterrainer, "Ultrafast Terahertz Emission from Semiconductors in a Magnetic Field", March Meeting of the American Physical Society, March 12-16, 2001, Seattle, Washington.
29. James Heyman, Pelagia Neocleous*, Paul Crowell, "Ultrafast THz Spectroscopy of Spin Dynamics in Narrow Gap Semiconductors", International Terahertz Workshop, 17-19 September, 2000, Sandbjerg, Denmark.
28. James R. Doyle, James Heyman, "Materials Science at a Liberal Arts College", Spring Meeting of the Materials Research Society, April 24-28, 2000, San Francisco, California.
27. James Heyman, Pelagia Neocleous*, Paul Crowell, and Steve Zellinger,. "Ultrafast Terahertz Emission from InAs", March Meeting of the American Physical Society, March 20-25, 2000, Minneapolis Minnesota.

(26 Conference Presentations prior to 2000)

V.c Student Presentations at Undergraduate Workshops (2000-05)

8. Laura Bell, Thanzaw Myint and James Heyman, "Terahertz photo-hall measurements of carrier mobility in a semiconductor". Pew Undergraduate Research Symposium on Physical Science and Mathematics, November 3 – 5 2006, Washington University, St. Louis, MO.
7. Daniel Bell*, Tamsanqa Khumalo* and James Heyman, "Terahertz Emission and Characterization of Organic Semiconductors". Pew Undergraduate Research Symposium on Physical Science and Mathematics, November 4 – 6 2005, University of Chicago, Chicago, IL.

6. Dauda Mawanda* and J. N. Heyman, "Characterization of a Parabolic Quantum Well Sample". Pew Undergraduate Research Symposium on Physical Science and Mathematics, November 5 – 7 2004, Washington University, St. Louis, MO.
5. Sheila Patricia Nabanja, Biniyam Tesfaye Taddese and J. N. Heyman, "Terahertz Cyclotron Oscillations in Semiconductors". Pew Undergraduate Research Symposium on Physical Science and Mathematics, November 5 – 7 2004, Washington University, St. Louis, MO.
4. Nelson Coates* and Alexander Reinhardt*, "Terahertz Emission from Semiconductors". Pew Undergraduate Research Symposium in Mathematics and the Physical Sciences at the University of Chicago, November 14-16, 2003.
3. Evan Acharya*, "Infrared (THz) Spectroscopy with Femtosecond Time Resolution". 17th Winchell Undergraduate Research Symposium, Minnesota Academy of Science, University of Minnesota, April 25-26, 2003.
2. Steve Fisher-Stawinski* and Alex Reinhardt*, "Characterizing the Transient Motion of Charge Carriers in Gallium Arsenide on Ultrafast Time scales". 17th Winchell Undergraduate Research Symposium, Minnesota Academy of Science, University of Minnesota, April 25-26, 2003.
1. Pelagia Neocleous*, Damon Hebert*, James N. Heyman and Paul A. Crowell "Terahertz Emission from InAs and GaAs", Pew Midstates Science & Mathematics Consortium Undergraduate Research Symposium in Mathematics and the Physical Sciences, November 3 - 5, 2000, Washington University, St. Louis, Missouri.

VI. Awards, Recognition and Grants

VI.a Professional Awards/ Recognition

New Directions in Condensed Matter Physics, Mellon Foundation, Spring 2005.

VI.b External Grants

Proposal Title	Source	Dates	Amount
Electronic Properties of Semiconductors from THz Spectroscopy	NSF-RUI	6/06-6/09	\$210,000
NSF Subcontract to UCSB NSF-RUI	NSF KK4104	8/03-7/06	\$ 28,156
Ultrafast Terahertz Spectroscopy of Carrier Dynamics in Semiconductors	NSF-RUI DMR 0317276	7/03-6/06	\$194,998
Acquisition of a Magneto-Optical Cryostat for Terahertz Studies of Semiconductor Heterostructures	NSF-MRI 0215717	9/02-8/04.	\$104,800
Acquisition of a Short-pulse Ti:Sapphire Laser	NSF-MRI 0116323	9/01-8/02	\$133,580

for Terahertz Studies of Semiconductor
Heterostructures

Ultrafast THz Spectroscopy of Spin Dynamics in Semiconductors	NSF-RUI DMR-0074622	6/00-6/03	\$189,239
Ultrafast THz Spectroscopy	UM MRSEC fellowship	6/99-9/99	\$ 16,000
Intersubband Scattering in Quantum Wells	PRF-G	9/97-8/00	\$ 20,000
Microelectronics in the Undergraduate Physics Laboratory (matched at 100%)	NSF-ILI	6/98-5/00	\$ 24,125
Far-infrared laser spectroscopy of semiconductor quantum wells	Research Corp.	1/96-1/98	\$ 54,000
Optical Spectroscopy and Magnetic Resonance in Undergraduate Physics (matched at 100%)	NSF-ILI	6/95-5/97	\$ 18,968