

## Eric J. Gansen

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University of Wisconsin-La Crosse  
Physics Department  
2016 Cowley Hall  
La Crosse, WI 54601

Office Phone: 608-785-8432  
gansen.eric@uwlax.edu

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### CURRENT POSITION:

#### Assistant Professor – University of Wisconsin-La Crosse, La Crosse, WI (2008-present)

Course Instruction: PHY 302 Optics, PHY 332 Electrodynamics, PHY 334 Circuits, PHY 335 Electronics, PHY 432 Advanced Electrodynamics, PHY 476 Advanced Optics.

Research Interests: Semiconductor nanostructures and quantum optics. Current research focused primarily on the study and development of novel semiconductor-quantum-dot-based single-photon detectors and charge storage devices.

### EDUCATION:

#### Ph.D., Electrical and Computer Engineering – University of Iowa, Iowa City, IA (2004)

Dissertation Title: “All-optical polarization switching techniques based on the coherent many-body interactions and the virtual excitation of spin-polarized carriers in semiconductor quantum wells.”

#### M.S., Optical Sciences – University of Rochester, Rochester, NY (1998)

#### B.S., Physics and Mathematics – University of Wisconsin-La Crosse, La Crosse, WI (1997)

### RESEARCH EXPERIENCE:

#### Postdoctoral Researcher – National Institute of Standards and Technology, Boulder, CO (2005-2008)

*Project Leader: Dr. Richard P. Mirin*

Researched novel semiconductor-quantum-dot-based single-photon detectors and charge storage devices. Work funded, in part, by the Disruptive Technologies Office.

- Demonstrated single-shot, single-photon, detection and photon-number-resolving (3-photon dynamic range) capabilities of a quantum dot, optically gated, field-effect transistor (QDOGFET).
- Performed photoluminescence measurements on quantum dot heterostructures to elucidate carrier transport and storage dynamics.
- Performed high-spatial-resolution measurements on superconducting-nanowire single-photon detectors using solid-immersion-lens-integrated confocal microscopy.

#### Graduate Research Assistant – University of Iowa (1999-2004)

*Advisor: Prof. Arthur L. Smirl*

Researched ultrafast nonlinear phenomena in semiconductor materials and heterostructures and their applications to high-speed, all-optical, polarization switching. Work funded, in part, by the Office of Naval Research and the Defense Advanced Research Projects Agency.

- Demonstrated femtosecond polarization switching based on the virtual excitation of spin-polarized carriers and characterized polarization modulation using ellipsometric measurement techniques.
- Investigated many-body contributions to polarization switching and to heavy-hole-light-hole exciton quantum beats.
- Performed time-dependent perturbation calculations of the coherent nonlinear emission from semiconductor quantum wells.

#### Internship – General Electric Lighting Division, Cleveland, OH (May-Aug. 1997)

*Supervisor: Dr. Darryl Michaels*

Researched atomic barium emission from fluorescent lamp cathodes using laser-induced fluorescence and its application to nondestructive methods for predicting lamp-life.

**Undergraduate Research Assistant – Physics Department, University of Wisconsin-La Crosse (1995-1997)***Advisor: Prof. Gubbi Sudhakaran*

Performed high-resolution, far-infrared, laser Stark spectroscopy of PH<sub>3</sub> and <sup>13</sup>CD<sub>3</sub>OD molecules using a custom-built, fourteen-foot, mirror-to-mirror gas discharge laser.

**AWARDS, GRANTS AND SPONSORED RESEARCH:**

University of Wisconsin-La Crosse Faculty Research Grant (2010 and 2008)

UW System & WiSys Technology Foundation Faculty Re-Assignment Grant (2009)

Wisconsin Space Grant Consortium Faculty Infrastructure Program Research Grant (2009)

National Research Council Postdoctoral Associateship (2005-2007)

Univ. of Wisconsin-La Crosse Graduating Senior of the Year in the College of Science and Allied Health (1997)

American Physical Society Industrial Summer Internship (May-Aug. 1997)

American Physical Society Laser Topical Group Summer Research Grant (1996)

Wisconsin Space Grant (1996)

Clark Van Galder Scholarship (1996)

**JOURNAL PUBLICATIONS:**

“*Analysis of photoconductive gain as it applies to single-photon detection,*” M. A. Rowe, G. M. Salley, E. J. Gansen, S. M. Etzel, S. W. Nam, and R. P. Mirin, *Appl. Phys. Lett.* 107, 63110 (2010).

“*Submicrometer photoresponse mapping of nanowire superconducting single-photon detectors,*” R. H. Hadfield, P. A. Dalgarno, J. A. O’Connor, E. Ramsay, R. J. Warburton, E. J. Gansen, B. Baek, M. J. Stevens, R. P. Mirin, and S. W. Nam, *Appl. Phys. Lett.* 91, 241108 (2007).

“*Photon-number-discriminating detection using a quantum dot, optically gated, field-effect transistor,*” E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, R. H. Hadfield, S. W. Nam, and R. P. Mirin, *Nature Photonics* 1, 585-588 (2007).

“*Operational analysis of a quantum dot, optically gated, field-effect transistor as a single-photon detector,*” E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, R. H. Hadfield, S. W. Nam, and R. P. Mirin, *IEEE J. Sel. Topics Quantum Electron.* 13, 967-977 (2007).

“*Single-photon detection using a quantum dot, optically gated, field-effect transistor with high internal quantum efficiency,*” M. A. Rowe, E. J. Gansen, M. Greene, D. Rosenberg, R. H. Hadfield, T. E. Harvey, M. Y. Su, S. W. Nam, and R. P. Mirin, *Appl. Phys. Lett.* 89, 253505 (2006).

“*A near-room-temperature all-optical polarization switch based on the excitation of spin-polarized ‘virtual’ carriers in quantum wells,*” M. Yildirim, J. P. Prineas, E. J. Gansen, and A. L. Smirl, *J. Appl. Phys.* 98, 063506 (2005).

“*Ultrafast polarization modulation induced by the ‘virtual excitation’ of spin-polarized excitons in quantum wells: Application to all-optical switching,*” E. J. Gansen and A. L. Smirl, *J. Appl. Phys.* 95, 3907-3915 (2004).

“ *$\chi^{(3)}$  analysis of all-optical polarization switching in semiconductor quantum wells,*” I. Rumyantsev, N. H. Kwong, R. Binder, E. J. Gansen and A. L. Smirl, *Phys. Rev. B* 69, 235329 (2004).

“*Differential measurements of Raman coherence and two-exciton correlations in quantum wells,*” S. A. Hawkins, E. J. Gansen, M. J. Stevens, A. L. Smirl, I. Rumyantsev, R. Takayama, N. H. Kwong, R. Binder, and D. G. Steel, *Phys. Rev. B* 68, 035313 (2003).

“*Femtosecond all-optical polarization switching based on virtual excitation of spin-polarized excitons in quantum wells,*” E. J. Gansen, K. Jarasiunas, and A. L. Smirl, *Appl. Phys. Lett.* 80, 971-973 (2002).

“*Coherent all-optical polarization switching based on exciton-exciton interactions in quantum wells,*” E. J. Gansen, K. Jarasiunas, S. A. Hawkins, M. J. Stevens, and A. L. Smirl, *J. Appl. Phys.* 90, 1077-1081 (2001).

“*Far-Infrared Laser Stark Spectroscopy of PH<sub>3</sub>*,” M. Jackson, G. R. Sudhakaran, and E. Gansen, *J. of Moll. Spectrosc.* 181, 446-451 (1997).

“*Far-Infrared Laser Stark Spectroscopy of <sup>13</sup>CD<sub>3</sub>OD*,” M. Jackson, G. R. Sudhakaran, and E. Gansen, *J. of Moll. Spectrosc.* 176, 439-441 (1996).

### **PRESENTATIONS AT SCHOLARLY MEETINGS AND CONFERENCES:**

“*Using Semiconductor Quantum Dots to Detect Single Photons of Light*,” E. J. Gansen, 12<sup>th</sup> Annual Wisconsin Space Conference (2010).

“*Detection speeds for single-photon detectors based on Photoconductive Gain*,” M. A. Rowe, M. G. Salley, S. M. Etzel, S. W. Nam, R. P. Mirin, and E. J. Gansen, Conference on Lasers and Electro-Optics (2009).

“*Single-Photon Detection with Quantum Dot, Optically Gated, Field-Effect Transistors*,” M. A. Rowe, M. G. Salley, E. J. Gansen, S. M. Etzel, S. W. Nam, R. P. Mirin, Single-Photon Workshop (2009).

“*Nano-optical studies of superconducting nanowire single-photon detectors*,” (Invited Paper) R. H. Hadfield, P. A. Dalgarno, J. A. O’Connor, E. J. Ramsay, R. J. Warburton, E. J. Gansen, B. Baek, M. J. Stevens, R. P. Mirin, and S. W. Nam, SPIE Photonics West (2009).

“*Investigations of local photon detection efficiency distributions in nanowire superconducting single-photon detectors*,” B. Baek, E. J. Gansen, M. J. Stevens, R. P. Mirin, S. W. Nam, R. H. Hadfield, P. A. Dalgarno, J. A. O’Connor, E. Ramsay, and R. J. Warburton, Conference on Lasers and Electro-Optics (2008).

“*Submicrometer photoresponse mapping of nanowire superconducting single-photon detectors*,” R. H. Hadfield, P. A. Dalgarno, J. A. O’Connor, E. Ramsay, R. J. Warburton, E. J. Gansen, B. Baek, M. J. Stevens, R. P. Mirin, and S. W. Nam, Applied Superconductivity Conference, Chicago, IL (2008).

“*Quantum dot, optically gated, field-effect transistors for single-photonics*,” E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, S. W. Nam, and R. P. Mirin, North American Conference on Molecular Beam Epitaxy (2007).

“*Photon-number discrimination using a semiconductor quantum dot, optically gated, field-effect transistor*,” (Invited Paper) E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, S. W. Nam, and R. P. Mirin, SPIE Optics East (2007).

“*Photon-number-resolving capabilities of a semiconductor quantum dot, optically gated, field-effect transistor*,” E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, R. H. Hadfield, S. W. Nam, and R. P. Mirin, Quantum Electronics and Laser Science Conference (2007).

“*Quantum dot devices for single photon quantum systems*,” (Invited Paper) R. P. Mirin, J. J. Berry, E. J. Gansen, M. Greene, R. H. Hadfield, T. E. Harvey, S. W. Nam, M. A. Rowe, K. L. Silverman, M. J. Stevens, and M. Y. Su, SPIE Photonics West (2007).

“*Single-photon detection using a semiconductor quantum dot, optically gated, field-effect transistor*,” E. J. Gansen, M. A. Rowe, D. Rosenberg, M. Greene, T. E. Harvey, M. Y. Su, R. H. Hadfield, S. W. Nam, and R. P. Mirin, Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference (2006).

“*A room temperature all-optical polarization switch based on the excitation of spin-polarized ‘virtual’ carriers in quantum wells*,” M. Yildirim, J. P. Prineas, E. J. Gansen, and A. L. Smirl, Conference on Lasers and Electro-Optics (2005).

“*Dynamics of virtual spin-polarized carriers in quantum wells*,” E. J. Gansen, I. Rumyantsev, N. H. Kwong, R. Binder and A. L. Smirl, International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (2003).

“*Polarization modulation induced by the ‘virtual excitation’ of spin-polarized carriers in semiconductor quantum wells: applications to all-optical femtosecond polarization switching*,” E. J. Gansen and A. L. Smirl, American Physical Society March Meeting (2003).

- “*Many-particle theory of all-optical polarization switching in semiconductor quantum wells*,” I. Romyantsev, N. H. Kwong, E. J. Gansen, A. L. Smirl, and R. Binder, Quantum Electronics and Laser Science Conference (2003).
- “*Many-particle theory of all-optical polarization switching in semiconductor quantum wells*,” I. Romyantsev, N. H. Kwong, R. Binder, E. J. Gansen, and A. L. Smirl, Frontiers in Optics, the 87<sup>th</sup> Optical Society of America Annual Meeting (2003).
- “*Polarization properties of time-resolved and gated probe quantum beats*,” S. A. Hawkins, M. J. Stevens, E. J. Gansen, A. L. Smirl, I. Romyantsev, R. Takayama, N. H. Kwong, R. Binder, G. Khitrova, and H. M. Gibbs, Seventh International Workshop on Nonlinear Optics and Excitation Kinetics in Semiconductors (2003).
- “*Polarization dynamics induced by the ‘virtual excitation’ of spin-polarized carriers: applications to all-optical polarization switching*,” E. J. Gansen and A. L. Smirl, Conference on Lasers and Electro-Optics (2002).
- “*Polarization dynamics induced by the ‘virtual excitation’ of spin-polarized carriers: applications to all-optical polarization switching*,” E. J. Gansen and A. L. Smirl, 56<sup>th</sup> Scottish Universities Summer School in Physics: Ultrafast Photonics (2002).
- “*Ultrafast polarization dynamics induced by the ‘virtual excitation’ of spin-polarized carriers in semiconductors*,” A. L. Smirl and E. J. Gansen, OSA Ultrafast Phenomena (2002).
- “*All-optical polarization switching based on the excitation of spin-polarized ‘virtual excitons’ in quantum wells*,” E. J. Gansen, K. Jarasiunas, S. A. Hawkins, M. J. Stevens, and A. L. Smirl, Conference on Lasers and Electro-Optics (2001).
- “*Femtosecond all-optical polarization switching based on the virtual excitation of spin-polarized excitons in quantum wells*,” E. J. Gansen, K. Jarasiunas, and A. L. Smirl, International Conference on Novel Aspects of Spin-Polarized Transport and Spin Dynamics (2001).
- “*Coherent all-optical polarization switching in quantum wells*,” E. J. Gansen, K. Jarasiunas, S. A. Hawkins, M. J. Stevens, and A. L. Smirl, OSA Nonlinear Optics: Materials, Fundamentals, and Applications (2000).
- “*Coherent all-optical polarization switching based on exciton-exciton correlations in quantum wells*,” M. J. Stevens, S. A. Hawkins, E. J. Gansen, K. Jarasiunas, and A. L. Smirl, Optical Society of America Annual Meeting (2000).
- “*Far-Infrared Laser Stark Spectroscopy of PH<sub>3</sub>*,” E. Gansen, G. R. Sudhakaran, and M. Jackson, Seventh Annual Symposium for Undergraduates in Science, Engineering and Mathematics at Argonne National Laboratory (1996).
- “*Far-Infrared Laser Stark Spectroscopy of PH<sub>3</sub>*,” M. Jackson, G. R. Sudhakaran, E. Gansen, 51<sup>st</sup> Ohio State University International Symposium on Molecular Spectroscopy (1996).

## CONFERENCE PROCEEDINGS:

- “*Decomposition of noise contributions in QDOGFET Single-Photon Detectors*,” E. J. Gansen, S. D. Harrington, M. A. Rowe, S. M. Etzel, and R. P. Mirin, Proc. Wisconsin Space Conference, (Submitted for Publication).
- “*Nano-optical studies of superconducting nanowire single-photon detectors*,” (Invited Paper) R. H. Hadfield, P. A. Dalgarno, J. A. O’Connor, E. J. Ramsay, R. J. Warburton, E. J. Gansen, B. Baek, M. J. Stevens, R. P. Mirin, and S. W. Nam, Proc. SPIE, (2009).
- “*Designing high electron mobility transistor heterostructures with quantum dots for efficient, number-resolving photon detection*,” M. A. Rowe, E. J. Gansen, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, R. H. Hadfield, S. W. Nam, and R. P. Mirin, J. Vac. Sci. Technol. B 26(3), 1174-1177 (2008).
- “*Photon-number discrimination using a semiconductor quantum dot, optically gated, field-effect transistor*,” (Invited Paper) E. J. Gansen, M. A. Rowe, M. B. Greene, D. Rosenberg, T. E. Harvey, M. Y. Su, S. W. Nam, and R. P. Mirin, Proc. SPIE 6771, 67710Y (2007).

“Polarization state dynamics induced by the virtual excitation of spin-polarized carriers in semiconductor quantum wells,” E. J. Gansen and A. L. Smirl, *Semicond. Sci. Technol.* 19, S372-S374 (2004).

“Polarization dependence of quantum beats in quantum wells: Raman coherence and two-exciton correlations,” S. A. Hawkins, E. J. Gansen, M. J. Stevens, I. Romyantsev, R. Takayama, N. H. Kwong, R. Binder, G. Khitrova, H. M. Gibbs, D. G. Steel, and A. L. Smirl, *Phys. Stat. Sol. (c)* 0, 1453-1458 (2003).

## REFERENCES:

Dr. Arthur L. Smirl  
Professor  
138 Iowa Advanced  
Technology Laboratories  
University of Iowa  
Iowa City, IA 52242  
Phone: (319) 335-3461  
FAX: (319) 335-3462  
art-smirl@uiowa.edu

Dr. Gubbi Sudhakaran  
Professor  
Department of Physics  
Univ. of Wisconsin-La Crosse  
1725 State Street  
La Crosse, WI 54601  
Phone: (608) 785-8431  
sudhakar.gubb@uwlax.edu

Dr. Richard P. Mirin  
Project Leader  
MS 815.04  
National Institute of Standards  
and Technology  
325 Broadway  
Boulder, CO 80305-3337  
Phone: (303) 497-7955  
mirin@boulder.nist.gov