

Cale M. Gentry

School Address

Department of Electrical, Computer, and Energy Engineering
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EDUCATION

<i>Ph.D.</i> , Electrical Engineering University of Colorado Boulder, Boulder, CO		<i>in progress</i>
<i>Master of Science</i> , Electrical Engineering University of Colorado Boulder, Boulder, CO	GPA 3.77	May 2013
<i>Bachelor of Science</i> , Engineering Physics Minor in Mathematics University of Oklahoma, Norman, OK	GPA 3.92	May 2011

PROFESSIONAL EXPERIENCE

University of Colorado Boulder August 2011 - Present
Graduate Research Assistant
Nanophotonic Systems Laboratory, PI: Miloš A. Popović

- Developed a two-dimensional Eigen-Mode Expansion (EME) Method-based numerical simulation tool in MATLAB. This included a slab waveguide eigensolver (finding a complete set of discrete modes) and a scattering matrix-based mode matching technique to model the optical properties of nanophotonic devices, with emphasis on fiber-to-chip grating couplers. The tool incorporates perfectly matched layer (PML) boundary conditions and supports complex indices of refraction.
- Introduced a novel concept for single-mode selection and ultrabroad tuning in microphotonic lasers utilizing "imaginary-frequency splitting" due to far field interference and a Vernier-like tuning mechanism in a 'Dark State Laser' resonant geometry
- Designed integrated nanophotonic devices with primary emphasis in nonlinear optical phenomena such as Four-wave mixing in microcavities.
- Performed thorough testing of both active and passive nanophotonic devices.
- Experience designing and testing photonic devices integrated in Silicon- and SiN-based platforms at wavelengths ranging from 400 nm to 1640 nm.
- Collaborate with researchers at NIST in implementing photon number resolving transition edge sensors (TES) and superconducting single photon detectors coupled evanescently via waveguides.
- Developed a numerical simulation tool to design optimally dispersion-less azimuthally symmetric microcavities for Four-wave mixing applications.
- Demonstrated the first example of wavelength conversion in an unmodified CMOS electronics platform.
- Demonstrated the first generation of quantum-correlated photons directly from a commercial CMOS microelectronics microchip.

National Institute of Standards and Technology (NIST) Boulder
Summer Undergraduate Research Fellowship (SURF) Program
Quantum Electrical Metrology Division (817), Boulder, CO

June - August 2010

- Collaborated in the development of a reference system for the characterization and calibration of passive 350 GHz imaging systems. The reference system utilized an array of superconducting transition edge sensors operating at cryogenic temperatures.
- Collaborated in the assembly and calibration of the THz system
- Numerically modeled optical transmission properties of system.
- Worked with cryogenic electronics and ultra high vacuum.

University of Oklahoma
Senior Capstone Project
Department of Physics, PI: J. Shaffer

August 2010 - May 2011

- Designed and fabricated microchips for trapping ultracold atoms.
- Photolithography, metal evaporation and gold electroplating to fabricate wires on AlN substrates.

Montana State University, Bozeman, MT

June - August 2009

National Science Foundation (NSF) Research Experience for Undergraduates (REU)
Condensed Matter/Laser Physics

- Fabricated and characterized a tunable external cavity diode laser.
- Performed optical experiments in the laboratory concerning confocal Fabry-Perot interferometers for use in LIDAR receivers.

Baker Hughes Inc.

June - August 2008

Hughes Christensen Co., The Woodlands, TX
Manufacturing Department Engineering Intern

- Researched the profiles of wear flats on diamond cutters taken from drill bits from the field.
- Developed standard operating procedures for manufacturing equipment.

JOURNAL PUBLICATIONS

In Preparation

- **C. M. Gentry**, J. M. Shainline, M. W. Wade, M. J. Stevens, S. D. Dyer, X. Zeng, F. Pavanello, T. Gerrits, S. W. Nam, R. P. Mirin, and M. A. Popović, “Quantum-correlated photon pairs generated in commercial 45 nm complementary metal-oxide semiconductor microelectronics,” available on arXiv: 1507.01121 (2015).

Published

- X. Zeng, **C. M. Gentry**, and M. A. Popović, “Four-wave mixing in silicon coupled-cavity resonators with port-selective, orthogonal supermode excitation,” *Optics Letters* **40**, 2120 (2015).
- **C. M. Gentry**, Xiaoge Zeng, and M. A. Popović, “Tunable coupled-mode dispersion compensation and its application to on-chip resonant four-wave mixing,” *Optics Letters* **39**, 5689 (2014). available on arXiv: 1406.2750 (2014).
- **C. M. Gentry**, and M. A. Popović, “Dark State Lasers,” *Optics Letters* **39**, 4136 (2014). available on arXiv: 1402.4767 (2014).

CONFERENCE PRESENTATIONS

Submitted

- N/A

Published in Conference Proceedings

- **C. M. Gentry**, M. T. Wade, J. M. Shainline, X. Zeng, M. J. Stevens, S. D. Dyer, F. Pavanello, S. W. Nam, R. P. Mirin, and M. A. Popović, “Microresonator Source of Photon Pairs Integrated in 45 nm CMOS,” at *Single Photon Workshop 2015* (Geneva, Switzerland 2015).
- M. T. Wade, F. Pavanello, R. Kumar, **C. M. Gentry**, A. Atabaki, R. Ram, V. Stojanović, and M. A. Popović, “75% Efficient Wide Bandwidth Grating Couplers in 45 nm Microelectronics CMOS Process,” at *Optical Interconnects: 2015*, presentation TuB4.
- **C. M. Gentry**, M. T. Wade, X. Zeng, F. Pavanello, and M. A. Popović, “Low-Power Parametric Wavelength Conversion in 45 nm Microelectronics CMOS Silicon-On-Insulator Technology,” in *CLEO: 2015*, OSA Technical Digest (Optical Society of America, 2015), paper STu2I.7.
- **C. M. Gentry**, X. Zeng, and M. A. Popović, “A discrete resonance, all-order dispersion engineering method for microcavity design for four-wave mixing,” in *Frontiers in Optics 2014*, OSA Technical Digest (Optical Society of America, 2014), paper FTu5D.3.
- **C. M. Gentry**, X. Zeng, and M. A. Popović, “Wide-band on-chip four-wave mixing via coupled cavity dispersion compensation,” in *CLEO: 2014*, OSA Technical Digest (Optical Society of America, 2014), paper SW3M.2.
- X. Zeng, **C. M. Gentry**, and M. A. Popović, “Four-wave mixing in silicon “photonic molecule” resonators with port-selective, orthogonal supermode excitation,” in *CLEO: 2014*, OSA Technical Digest (Optical Society of America, 2014), paper SW3M.3.
- M. T. Wade, R. Kumar, K. Nammari, **C. M. Gentry**, J. Shainline, J. S. Orcutt, A. Tamma, R. Ram, V. Stojanovic, and M. A. Popović, “Unidirectional chip-to-fiber grating couplers in unmodified 45nm CMOS Technology,” in *CLEO: 2014*, OSA Technical Digest (Optical Society of America, 2014), paper STh3M.5.
- D. Becker, **C. M. Gentry**, I. Smirnov, P. Ade, J. Beall, H. -M. Cho, S. Dicker, W. Duncan, M. Halpern, G. Hilton, K. Irwin, D. Li, N. Paulter, C. Reintsema, R. Schwall, C. Tucker, “Standoff passive video imaging at 350 GHz with 251 transition edge sensor bolometers,” *Proc. SPIE* 9078, Passive and Active Millimeter-Wave Imaging XVII, 907804 (June 9, 2014).
- **C. M. Gentry** and M. A. Popović, “Dark State Lasers,” in *CLEO: 2013*, OSA Technical Digest (Optical Society of America, 2013), paper CM3F.1.
- D. Becker, **C. M. Gentry**, P. Ade, J. Beall, H. Cho, S. Dicker, W. Duncan, M. Halpern, G. Hilton, K. Irwin, P. Lowell, M. Niemack, N. Paulter, C. Reintsema, F. Schima, R. Schwall and C. Tucker, “High-resolution passive video-rate imaging at 350 GHz,” *Proc. SPIE* 8022, Passive Millimeter-Wave Imaging Technology XIV, 802206 (May 25, 2011).

Conferences without Published Proceedings

- **C. M. Gentry**, M. T. Wade, J. M. Shainline, X. Zeng, M. J. Stevens, S. D. Dyer, F. Pavanello, S. W. Nam, R. P. Mirin, and M. A. Popović, “Photon Pair Source Integrated in a Commercial 45 nm CMOS Microelectronics Platform,” presented at *PICQUE Scientific School in integrated quantum photonics applications: from simulation to sensing* (Rome, Italy 2015).
- D. Becker, **C. M. Gentry**, J. Beall, H. Cho, W. Duncan, D. Li, G. Hilton, K. Irwin, N. Paulter, C. Reintsema, R. Schwall, P. Ade, C. Tucker, S. Dicker, and M. Halpern, “Passive video imaging at 350 GHz with 251 transition edge sensor bolometers,” *Proc. SPIE* 8900, Millimetre Wave and Terahertz Sensors and Technology VI, 890031 (Sept 24, 2013).

- K. Nammari, **C. M. Gentry**, M. A. Popović, “Efficient, fiber-to-chip coupling and optical through-silicon vias for monolithically integrated electronic-photonics circuits,” USNC-URSI National Radio Science Meeting (2013)
- A. Schwettmann, J. Sedlacek, **C. M. Gentry**, J. Shaffer, “Probing RF electric fields with Rydberg atoms,” APS Division of Atomic, Molecular and Optical Physics, Vol. **56**, Num. 5 (2011)

COMPUTING SKILLS

- Proficient in MATLAB, Mathematica, LaTeX, Microsoft Office
- Proficient writing and running optical simulation codes such as eigenmode solvers, Finite Difference Time Domain (FDTD), beam propagation etc...
- Experience in COMSOL, Sentaurus-Synopsys, AutoCAD, SolidWorks, LabView, L-Edit
- Experience programming in MATLAB, Python, C++, IDL, and Java
- Experience with UNIX

MEMBERSHIPS

Optical Society of America, Student Member
Society of Physics Students at University of Oklahoma

Honors/Awards

- 2011 University of Colorado and NIST Measurement Science and Engineering Fellowship
- 2011 Dept. of Electrical, Comp., & Energy Engineering Dean’s Graduate Assistantship and Fellowship
- 2011 University of Oklahoma College of Engineering Distinguished Scholar
- 2011 University of Oklahoma Department of Physics and Astronomy Outstanding Senior Award
- 2007-2011 Award of Excellence Scholarship from the University of Oklahoma Scholars Program
- 2007-2011 Karcher Scholarships from the University of Oklahoma Department of Physics and Astronomy
- 2008-2009 William Schriever Award for Outstanding Scholarship in Engineering Physics
- 2008-2011 University of Oklahoma President’s List
- 2008-2011 College of Engineering Dean’s List

Teaching/Outreach

- 2013 NanoDays volunteer demonstrating shape-memory alloys to 3rd and 4th grade students
- Mentored undergraduate researchers in lab
- 2007-2010 Tutored Calculus I-III, Physics I and II, Digital Design, and Statics
- 2010 Presented physics demonstrations to high school students visiting the University of Oklahoma