

JUDSON D. RYCKMAN

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EDUCATION

Vanderbilt University, Nashville, TN

Ph.D. in Electrical Engineering, May 2013

Thesis: "Porous and phase change nanomaterials for photonic applications"

Advisor: Prof. Sharon M. Weiss

Vanderbilt University, Nashville, TN

B.E. in Electrical Engineering (Physics double major), May 2008

Magna Cum Laude, Honors in Electrical Engineering

PROFESSIONAL EXPERIENCE

October '16 to Present **Clemson University, Holcombe Department of Electrical and Computer Engineering**

Assistant Professor, Clemson, SC

Established the *Nanophotonics Laboratory* focusing on the study and application of photonic platforms to solve problems in areas of sensing, biomedicine, food-safety, and computing/communications. Specific topics of study include: integrated optoelectronic devices and passives, visible/IR wavelength integrated optics and sensors, photonic nanocavities, novel nano-fabrication techniques, spatial-mode and diffraction phenomena, ultra-high surface area nano-materials, and opto-electronic devices for trace-level biosensing.

July '13 to September '16 **Intel Corporation - Silicon Photonics Group**

Research Scientist, Santa Clara, CA

Responsible for the design, development, and integration of next-generation silicon based optical components for high-speed communications and interconnects.

June '08 to May '13 **Vanderbilt University EECS Department**

Graduate Research, Nashville, TN

Performed research related to nanophotonics and its relevance to a diversity of areas/applications including chemical and biological sensing and optical communications. Gained research expertise and proficiency in the theory, fabrication, and characterization of nanostructured optical devices.

Summer '07 **Vanderbilt School of Engineering Summer Research Program**

Researcher, Nashville, TN

Performed undergraduate research in the photonic crystals lab of the department of electrical engineering. Investigated methods to achieve enhanced quantum dot emission in a silicon compatible platform.

Summer '06 **Air Force Institute of Technology, WPAFB**

Engineering Technician, Dayton, OH

Worked in the VLSI lab of the electrical engineering department. Modeled computer and processing solutions down to the transistor level. Learned to use Linux, VHDL, and various Mentor Graphics simulation products.

TEACHING

October '16 to Present **Clemson University, Holcombe Department of Electrical and Computer Engineering**

Assistant Professor, Clemson, SC

ECE4930/6930 Special Topics: Recent Advances in Integrated Photonics (Spring '17), ECE 4920 Special Problems (Spring '17), ECE 4040/6040 Semiconductor Devices (Fall '17)

Summers, '09 to '12 **Vanderbilt School of Engineering Pre-College PAVE Program**
Lecturer, Nashville, TN

Lectured a weeklong digital logic course to approx. 70 pre-college youths interested in the field of electrical engineering. Organized and instructed laboratory projects. Graded and provided students feedback in individual meetings.

School years '08-'09 and '06-'07 **Vanderbilt University Physics & EECS Departments**
Graduate Teaching Assistant, EECS
Undergraduate Teaching Assistant, Physics

Actively assisted students with homework assignments, exam preparation, and labs in courses including General Physics, Circuits, Audio Engineering, and Microcontrollers.

HONORS & AWARDS

2012 1st Place for Best Student Paper, Group IV Photonics
2012 Vanderbilt Graduate School – Dissertation Enhancement Grant
2012 Porous Semiconductors – Science and Technology Conference, Talk of the Day Award
2011 Best Research Paper, Vanderbilt School of Engineering [**]
2011 MRS Spring Meeting 2011 Graduate Student Presentation Award (Symposium T)
2010-2013 NSF Graduate Research Fellowship
2010 Semitool Inc. student grant award, Porous Semiconductors – Science and Technology Conference, Valencia, Spain
2008-2012 IBM Topping-Up Award
2007 Inducted into Sigma Pi Sigma – Physics Honor Society
2007 Society of American Military Engineer's General Barnes Scholarship
2004 Eagle Scout – Boy Scouts of America

SPONSORED RESEARCH SUPPORT

- Southeastern Center for Electrical Engineering (SCEEE) Research Initiation Grant, SCEEE-17-02, "Porous Nanomaterials for Next Generation Optical Biosensors," PI: Judson D. Ryckman, Amount: \$23,624.82. Institution Cost Matching Amount: \$23,624.82. Total Award: **\$47,249.64**

STUDENTS ADVISED

- **Undergraduate:** Mark Anayee (Clemson Spring 2017, MSE Major), Marachella Mariano (Clemson Summer 2017, CHME), Grayson Glanton (Summer 2017, ECE/Physics), Ethan Kirkland (Summer 2017, MSE), Gabriel Allen (Summer 2017, ECE, W. Mich. Univ.), Aliya Langley (Summer 2017, BME/PreMed, Oakwood Univ.)
- **Graduate:** Tahmid Talukdar (Clemson Fall 2017-Present, ECE), Nazmus Sakib (Clemson Spring 2018, ECE)

MEMBERSHIPS & AFFILIATIONS

Institute of Electrical and Electronics Engineers Student Member (IEEE)
American Association for the Advancement of Science (AAAS)
The International Society for Optical Engineering (SPIE)
Optical Society of America (OSA)
Materials Research Society (MRS)
Society of American Military Engineers (SAME)

PUBLICATIONS

Refereed Journal Articles (13 total / 2 cover articles):

13. **J. D. Ryckman**, "Random coherent perfect absorption with 2D atomic materials mediated by Anderson localization," *ACS Photonics*, in press (2017).
12. G. A. Rodriguez†, **J. D. Ryckman**†, Y. Jiao, S. M. Weiss, "A size selective porous silicon grating-coupled Bloch surface and sub-surface wave biosensor," *Biosens Bioelectron* 53, 486 (2014).

11. **J. D. Ryckman**, K. A. Hallman, R. E. Marvel, R. F. Haglund, and S. M. Weiss, "Ultra-compact silicon photonic devices reconfigured by an optically induced semiconductor-to-metal transition," *Opt. Express* 21, 10753 (2013).
10. **J. D. Ryckman**, Y. Jiao, and S. M. Weiss, "Three dimensional patterning and morphological control over porous nanomaterials by gray-scale direct imprinting," *Sci. Rep.* 3, 1502 (2013).
9. Y. Jiao, **J. D. Ryckman**, D. S. Koktysh, and S. M. Weiss, "Controlling surface enhanced Raman scattering using grating-type patterned nanoporous gold substrates," *Opt. Mat. Express* 3, 1137-1148 (2013).
8. **J. D. Ryckman** and S. M. Weiss, "Low mode volume slotted photonic crystal single nanobeam cavity," *Appl. Phys. Lett.* 101, 071104 (2012). [APL cover article, August 13th 2012 issue; featured in *Optics & Photonics News* December 2013 special issue]
7. **J. D. Ryckman**, V. Diez-Blanco, J. Nag, R. E. Marvel, B. K. Choi, R. F. Haglund, and S. M. Weiss, "Photothermal optical modulation of ultra-compact hybrid Si-VO₂ ring resonators," *Opt. Express* 20, 13215-13225 (2012).
6. **J. D. Ryckman** and S. M. Weiss, "Localized field enhancements in guided and defect modes of a periodic slot waveguide," *IEEE Photon. J.* 3, 06986 (2011).
5. Y. Jiao, **J. D. Ryckman**, P. N. Ciesielski, C. A. Escobar, G. K. Jennings, and S. M. Weiss, "Patterned nanoporous gold as an effective SERS template," *Nanotechnol.* 22, 295302 (2011).
4. **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Direct imprinting of porous substrates: A rapid and low-cost approach for patterning porous materials," *Nano Lett.* 11, 051857 (2011). [featured on cover, May 2011 issue; **]
3. **J. D. Ryckman**, R. A. Reed, R. A. Weller, D. M. Fleetwood, and S. M. Weiss, "Enhanced room temperature oxidation in silicon and porous silicon under 10keV x-ray irradiation," *J. Appl. Phys.* 108, 113528 (2010).
2. **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Porous silicon structures for low-cost diffraction-based biosensing," *Appl. Phys. Lett.* 96, 171103 (2010). [Selected to appear in *Virtual Journal of Biological Physics Research* vol. 19, issue 9 (2010)]
1. G. Rong, **J. D. Ryckman**, R. Mernaugh, and S. M. Weiss, "Label-free porous silicon membrane waveguide for DNA sensing," *Appl. Phys. Lett.* 93, 161109 (2008). [Also appears in *Virtual Journal of Biological Physics Research* vol. 16, issue 9 (2008) and *Virtual Journal of Nanoscale Science & Technology* vol. 18, issue 18 (2008)]

Conference Proceedings:

J. D. Ryckman, "Random Perfect Absorption in 2D Atomic Layers on All-Dielectric Substrates Mediated by Anderson Localization," in *CLEO: QELS Fundamental Science*, OSA Technical Digest (Optical Society of America, 2017), paper FTu4H.4.

P. Markov, **J. D. Ryckman**, R. E. Marvel, K. A. Hallman, R. F. Haglund, and S. M. Weiss, "Silicon-VO₂ hybrid electro-optic modulator," in *CLEO: Science and Innovations*, OSA Technical Digest (Optical Society of America, 2013), paper CTu2F.7.

G. A. Rodriguez, **J. D. Ryckman**, Y. Jiao, R. L. Fuller, and S. M. Weiss, "Real-time detection of small and large molecules using a porous silicon grating-coupled Bloch surface wave label-free biosensor," *Proc. SPIE* 8570, 857004 (2013).

J. D. Ryckman, V. Diez-Blanco, J. Nag, R. E. Marvel, B. K. Choi, R. F. Haglund, and S. M. Weiss, "Photothermal optical modulation of ultra-compact hybrid Si-VO₂ ring resonators," in *Group IV Photonics (GFP)*, 9th IEEE International Conference on, pp.69-71, 29-31 Aug. (2012). [*1st Place for Best Student Paper*]

J. D. Ryckman and S. M. Weiss, "Low mode volume slotted photonic crystal single nanobeam cavity in silicon," in Group IV Photonics (GFP), 9th IEEE International Conference on, pp.24-26, 29-31 Aug. (2012).

J. D. Ryckman, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Low-cost Micro- and Nano-structures in Porous Nanomaterials Realized by Direct Imprinting of Porous Substrates," *Mater. Res. Soc. Symp. Proc.* 1340, t01-08 (2011).

J. D. Ryckman, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Direct imprinting of porous substrates," in Conference on Lasers and Electro-Optics/International Quantum Electronics Conference, OSA Technical Digest (Optical Society of America, 2011), paper CMEE3.

Y. Jiao, **J. D. Ryckman**, M. Liscidini, J. E. Sipe, P. N. Ciesielski, C. A. Escobar, G. Jennings, and S. M. Weiss, "Direct Imprinted Gratings on Nanoporous Gold as Effective SERS Substrates," in Conference on Lasers and Electro-Optics/International Quantum Electronics Conference, OSA Technical Digest (Optical Society of America, 2011), paper CFN3.

J. D. Ryckman, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Diffraction based biosensing with porous silicon," in Conference on Lasers and Electro-Optics/International Quantum Electronics Conference, OSA Technical Digest (Optical Society of America, 2010), paper CTuB4.

J. Nag, **J. D. Ryckman**, M. T. Hertkorn, B. K. Choi, R. F. Haglund, Jr., and S. M. Weiss, "Ultrafast compact silicon-based ring resonator modulators using metal-insulator switching of vanadium dioxide," *Proc. of SPIE* 7597, 759710 (2010).

J. D. Ryckman, M. Liscidini, J. E. Sipe, and S. M. Weiss, "Low-cost optical microstructures fabricated by imprinting porous silicon," *Proc. of SPIE* 7591, 759108 (2010).

J. E. Sipe, **J. D. Ryckman**, S.M. Weiss, and M. Liscidini, "Enhancement of diffraction-based biosensing using porous structures and electromagnetic surface states," *Proc. of SPIE* 7553, 75530M (2010).

Book Chapters:

J. D. Ryckman and S. M. Weiss, "Imprinting Porous Silicon," in *Handbook of Porous Silicon*. Edited by: L. Canham (Springer International Publishing), Book Chapter (2014).

PATENTS

Issued: (6)

M. Krishnamurthi, **J. D. Ryckman**, H. Rong, L. Liao, H. Frish, O. Harel, A. Barkai, Y.-C. Na, H.-D. Liu, "Optical Coupler," U.S. Patent 9,709,734 (2017).

J. D. Ryckman, "Double-sided orthogonal grating optical coupler," U.S. Patent 9,715,066 (2017).

S. M. Weiss, Y. Jiao, **J. D. Ryckman**, P. N. Ciesielski, G. K. Jennings, "Nanoscale porous gold film SERS template," U.S. Patent 9,593,981 (2017).

S. M. Weiss, **J. D. Ryckman**, M. Liscidini, and J. E. Sipe, "Direct imprinting of porous substrates," U.S. Patent 9,352,543 (2016).

M. Krishnamurthi, **J. D. Ryckman**, H. Rong, L. Liao, H. Frish, O. Harel, A. Barkai, Y.-C. Na, H.-D. Liu, "Optical Coupler," U.S. Patent 9,348,099 (2016).

S. M. Weiss, **J. D. Ryckman**, C. Kang, M. Liscidini, and J. E. Sipe, "Optical sensor comprising diffraction gratings with functionalized pores and method of detecting analytes using the sensor," U.S. Patent 8,349,617 (2013).

Applications: (1 published, others confidential/unpublished)

S. M. Weiss, **J. D. Ryckman**, Y. Jiao, “Porous nanomaterials having three-dimensional patterning and methods of making and using the same,” *U.S. Patent Application Serial Number 8,349,617* (filed January 2013).

TALKS

“Photonics-on-a-chip: Concepts and Applications,” **J. D. Ryckman**, Clemson University SURE Program in Solid-State Devices, Clemson, SC, June 2017.

“Random Perfect Absorption in 2D Atomic Layers on All-Dielectric Substrates Mediated by Anderson Localization,” **J. D. Ryckman**, Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2017.

“Porous and Phase Change Materials for Photonic Applications,” **J. D. Ryckman**; Intel Labs, Tech Talk, Santa Clara, CA, April 2013.

“Photothermal optical modulation of ultra-compact hybrid Si-VO₂ ring resonators,” **J. D. Ryckman**, V. Diez-Blanco, J. Nag, R. E. Marvel, B. K. Choi, R. F. Haglund, and S. M. Weiss, 9th IEEE International Conference on Group IV Photonics (GFP), San Diego, CA, August 2012 [*1st Place for Best Student Paper*].

“Low mode volume slotted photonic crystal single nanobeam cavity in silicon,” **J. D. Ryckman** and S. M. Weiss, 9th IEEE International Conference on Group IV Photonics (GFP), San Diego, CA, August 2012.

“Engineering light in low mode volume optical cavities,” **J. D. Ryckman**; Vanderbilt Institute of Nanoscale Science and Engineering, Summer Nanoseminar, June 2012.

“Gray-scale direct imprinting of porous substrates,” **J. D. Ryckman** and S. M. Weiss; Porous Semiconductors – Science and Technology Conference, Malaga, Spain, March 2012. [*Talk of the Day Award*]

“Direct imprinting of porous substrates,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; Conference on Lasers and Electro-Optics, Baltimore, MD, May 2011.

“Low-cost Micro- and Nano-structures in Porous Nanomaterials Realized by Direct Imprinting of Porous Substrates,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; Materials Research Society Spring Meeting & Exhibit, San Francisco, CA, April 2011. [MRS Spring Meeting 2011 Graduate Student Presentation Award (Symposium T)]

“Si-VO₂ Hybrid Structures for Optical Modulation and Reconfigurable Photonic Networks,” **J. D. Ryckman**, J. Nag, C. Kang, T. E. Whittle, P. Markov, Bo K. Choi, R. F. Haglund, and, S. M. Weiss; Materials Research Society Spring Meeting & Exhibit, San Francisco, CA, April 2011.

“Direct imprinting of porous substrates: A rapid and low-cost approach for patterning porous materials,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; Vanderbilt Institute of Nanoscale Science and Engineering – NanoDay Invited Student Talk, Oct. 2010.

“Diffraction based biosensing with porous silicon,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; Conference on Lasers and Electro-Optics, San Francisco, CA, May 2010.

“Micron and submicron sized optical structures fabricated by imprinting porous silicon,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; Porous Semiconductors – Science and Technology Conference, Valencia, Spain, Mar. 2010.

“Low-cost optical microstructures fabricated by imprinting porous silicon,” **J. D. Ryckman**, M. Liscidini, J. E. Sipe, and S. M. Weiss; SPIE Photonics West, San Francisco, CA, Jan. 2010.

“Ultrafast compact silicon-based ring resonator modulators using metal-insulator switching of vanadium dioxide,” **J. Nag**, **J. D. Ryckman**, R. F. Haglund, Jr., and S. M. Weiss; SPIE Photonics West, San Francisco, CA, Jan. 2010.