

JUDSON D. RYCKMAN

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PERSONAL DATA

Assistant Professor
Holcombe Department of Electrical and Computer Engineering
Clemson University
Clemson, SC 29634
(864) 656-3227

Citizenship: USA

EDUCATION

Ph.D., Vanderbilt University, 2013, Electrical Engineering
B.E., Vanderbilt University, 2008, Electrical Engineering & Physics

PROFESSIONAL EXPERIENCE

Clemson University, 2016-present, Assistant Professor
Intel Corporation, 2013-2016, Research Scientist / Component Design Engineer

CONSULTING EXPERIENCE

Judson D. Ryckman Consulting, LLC, Seneca, SC (2016-present), offering services in the field of silicon photonics and integrated optics

MEMBERSHIPS & AFFILIATIONS

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

PROFESSIONAL ACTIVITIES

IEEE Photonics Conference, Chair, Optical Interconnects (2018, 2019, 2020)
Oak Ridge National Laboratory, Center for Nanophase Materials Science, User Executive Committee, Member-at-large (2018-2019)
IEEE Photonics Conference, Co-Chair, Optical Interconnects (2017)
IEEE Photonics Conference, Committee Member, Optical Interconnects (2016)

PUBLICATIONS

Books 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).

Refereed Journal Publications

17. T. Talukdar, B. McCoy, S. Timmins, T. Khan and **J. D. Ryckman**, "Multi-color laser illumination of structural color devices enables hyperchromatic and perceptually enhanced sensing by the naked eye," *submitted*.
16. N. Sakib and **J. D. Ryckman**, "Theory of extreme optical concentration in all-dielectric waveguides," *submitted (pre-print available, arXiv:1909.12878)*.
15. F. Bin-Tarik, A. Famili, Y. Lao, and **J. D. Ryckman**, "Robust optical physical unclonable function using disordered photonic integrated circuits," *Nanophotonics*, in press.
14. T. H. Talukdar, G. D. Allen, I. Kravchenko, and **J. D. Ryckman**, "Single-mode porous silicon waveguide interferometers with unity confinement factors for ultra-sensitive surface adlayer sensing," *Opt. Express* 27, 22485-22498 (2019).
13. **J. D. Ryckman**, "Random perfect absorption with 2D atomic materials mediated by Anderson localization," *ACS Photonics* 5(2) 574-580 (2018).
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

T. H. Talukdar and **J. D. Ryckman**, "Ultra-Sensitive and High Figure of Merit Interferometric Biosensors Using Dispersion Effects in Porous Waveguides," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper STh1N.4.

F. Bin-Tarik, A. Famili, Y. Lao, and **J. D. Ryckman**, "Realization of robust optical physical unclonable function using a silicon photonic quasicrystal interferometer," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper SF3J.2.

J. C. Perez, T. H. Talukdar, and **J. D. Ryckman**, "Patterning Refractive Index on the Surface of a Chip by Direct Nanoimprinting," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper FTu4Q.5.

F. Bin-Tarik and **J. D. Ryckman**, "Efficient Optical Coupling to Ultra-low Mode Area Silicon V-groove Waveguides," 2019 IEEE Photonics Conference (IPC), San Antonio, TX, 2019, paper WP3.

N. Sakib and **J. D. Ryckman**, "Extreme Sub-wavelength Optical Confinement in Nanostructured All-dielectric Silicon Waveguides," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2019), paper JTh2A.52.

G. D. Allen, W. F. Delaney, and **J. D. Ryckman**, "Porous Silicon Photonics at Unity Confinement Factors for Biosensing Applications," in Conference on Lasers and Electro-Optics, OSA Technical Digest (online) (Optical Society of America, 2018), paper SW3L.4.

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).

PATENTS

Issued: (8)

Y. Chetrit, **J. D. Ryckman**, J. B. Driscoll, H. Frish, L. Liao, "Waveguide transition structure and fabrication method," U.S. Patent 10,054,740 (2018).

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 9,889,504 (2018).

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: (2 published, others confidential/unpublished)

W. Lin, **J. D. Ryckman**, L. Liao, K.C. Magruder, H. Frish, A. Barkai, H.-D. Liu, Y. Kang, "Wavelength Demultiplexer," U.S. Patent Application Serial Number 16 / 236,125 (filed December 2018).

J. D. Ryckman, H. Frish, G. A. Ghiurcan, A. Liu, H. Rong, P. Srinivasan, C. Brandt, I. Hoshino, M. A. Creighton "Single Mode Optical Coupler," U.S. Patent Application Serial Number 15 / 282,728 (filed Sep 2016).

SPONSORED RESEARCH SUPPORT

Total to date: (\$0.9M)

- “Deeply Subwavelength All-Dielectric Nanophotonics in Silicon,” Air Force Office of Scientific Research (AFOSR) Young Investigator Research Program (YIP), Principal Investigator, **\$450,000**, (2019-2021).
- “Fabrication of High Performance Metasurfaces by Nanoimprinting of Refractive Index,” National Science Foundation, CMMI, Award #1825787, Principal Investigator, **\$349,349.00**, (2018-2020).
 - Supplementary award, “INTERN: A graduate internship in the silicon photonics industry,” **\$55,000**, (2019-2020).
- 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**

OTHER SPONSORED ACTIVITY

- Facilities User, “Extreme optical concentration in nanostructured all-silicon waveguides,” Oak Ridge National Laboratory, Center for Nanophase Materials Science, (Cleanroom/Facilities at no cost), (2019-2020).
- Facilities User, “Scalable Metasurfaces by Nanoimprinting of Refractive Index,” Oak Ridge National Laboratory, Center for Nanophase Materials Science, (Cleanroom/Facilities at no cost), (2018-2019).
- Facilities User, “Electrokinetically Enhanced Label-free Nanophotonic Biosensors,” Oak Ridge National Laboratory, Center for Nanophase Materials Science, (Cleanroom/Facilities at no cost), (2017-2018).

TALKS

“Photonics-on-a-chip: Concepts and Applications,” **J. D. Ryckman**, Clemson University SURE Program in Solid-State Devices, Clemson, SC, June 2017/2018/2019.

“Inversely processed mesoporous silicon rib-type waveguides with unity confinement factors for surface adlayer biosensing,” G. D. Allen, W. F. Delaney, **J. D. Ryckman**, Porous Semiconductors – Science and Technology Conference, La Grande Motte, France March 2018.

“Porous Silicon Photonics at Unity Confinement Factors for Biosensing Applications,” G. D. Allen, W. F. Delaney, **J. D. Ryckman**, Conference on Lasers and Electro-Optics (CLEO), San Jose, CA, May 2018.

“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.

TEACHING

October '16 to Present **Clemson University, Holcombe Department of Electrical and Computer Engineering**
Assistant Professor, Clemson, SC
ECE 4040/6040 Semiconductor Devices (Fall '17-'19); ECE 4930/6930 Silicon Photonic Integrated Circuits (Spring '19, '20); ECE4930/6930 Special Topics: Recent Advances in Integrated Photonics (Spring '17, '18); ECE 4920 Special Problems (Spring '17),

PRE-PROFESSIONAL EXPERIENCE

Summers, '09 to '12 **Vanderbilt School of Engineering Pre-College PAVE Program**
Lecturer, Nashville, TN
Lectured a 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
General Physics, Circuits, Audio Engineering, and Microcontrollers.

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.

HONORS & AWARDS

2019	AFOSR Young Investigator Research Program Award
2012	1 st 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

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.), Nicholas Conrad (Summer 2018, ECE), Viviana Arrunategui (Summer 2018, ECE, Brown Univ.), Julius Perez (Summer 2019, ECE, UCSD), Bria McCoy (Summer 2019, ECE).
- **Graduate:** M.S./Ph.D.: Tahmid Talukdar (Clemson Fall 2017-Present, ECE), Nazmus Sakib (Clemson Spring 2018, ECE), Farhan Bin-Tarik (Clemson Summer 2018-Present, ECE; M.S. graduated May 2019); M.S.: Cody Nelson (Clemson Spring 2019-Present, ECE).