



# Jan Petykiewicz

Hardware Engineer

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## Research

<b>Google</b>	2018 - current
Hardware Engineer Platforms Optics Group [Hong Liu, Ryohei Urata]	
<b>Globalfoundries</b>	2016 - 2018
Sr. Engineer, TD Research	
Differentiating Technologies Research Group [Ajey Jacob]	
Lithography, Modeling, and Architecture Group [Jongwook Kye]	
<ul style="list-style-type: none"> <li>▪ Team lead for enabling freeform design and lithography-aware verification for SiPh</li> <li>▪ Design and technical guidance of photonic devices for future photonics nodes</li> <li>▪ OPC and lithography modeling for SiPh designs, focused on internal and customer designs</li> <li>▪ Pathfinding for inverse-designed photonics</li> <li>▪ EDA flow development for future electronic and photonic nodes (Cadence/Mentor)</li> <li>▪ Competitive analysis for future process nodes</li> </ul>	
<b>Stanford University</b>	2010 - 2016
PhD Student, Electrical Engineering	
Nanoscale and Quantum Photonics Group [Jelena Vuckovic]	
<ul style="list-style-type: none"> <li>▪ Strained Germanium laser</li> <li>▪ Nanophotonic inverse design</li> <li>▪ Electrically injected III-V lasers and modulators</li> </ul>	
<b>California Institute of Technology</b>	2008 - 2010
Undergraduate Researcher	
Atwater Research Group [Harry Atwater]	
Senior Thesis	
Summer Undergraduate Research Fellowship, sponsored by The Aerospace Corporation.	
<ul style="list-style-type: none"> <li>▪ Silicon nanowire solar cells</li> </ul>	
<b>California Institute of Technology</b>	2007 - 2007
Undergraduate Researcher	
Caltech Nanofabrication Group [Axel Scherer]	
Summer Undergraduate Research Fellowship, sponsored by The Aerospace Corporation.	
<ul style="list-style-type: none"> <li>▪ Ultra-low-voltage electro-optic modulator</li> </ul>	

## Education

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<b>Stanford University</b>	2010 - 2016
Nanoscale and Quantum Photonics Group [Jelena Vuckovic]	
PhD, <i>Electrical Engineering</i>	2016
MS, <i>Electrical Engineering</i>	2013
<b>California Institute of Technology</b>	2006 - 2010
BS with honors, <i>Electrical Engineering</i>	2010
<i>Lloyd House</i>	

## Skills

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### Optics:

- Design and fabrication of nanoscale lasers, LEDs, modulators and optical cavities
- Micro-photoluminescence, electroluminescence, and reflectivity measurements
- Low-power, high-speed photoluminescence measurements
- Microscope design and construction
- Test setup design, construction, and automation
- Device physics modeling (FDTD, FDFD, FEM)

### Programming:

- *Python*: Layout automation and optical simulation with numpy, scipy, ctypes
- *Matlab*: FDTD, data analysis, physics optimization
- *GPU acceleration* of physics simulation with *CUDA* and *OpenCL*
- *TCL, bash*: EDA scripting and automation
- *C, C++, Rust*: Minor projects and device drivers
- Hobby experience in software disassembly
- Open-source physics code available at <https://mpxd.net/code>

### EDA and simulation tools:

- *Python*: Layout, shape manipulation, and simulation
- *Mentor Calibre (SVRF/TVRF)*: DRC and automated layout manipulation
- *Cadence Innovus* for electronics place and route. Also *Virtuoso, Voltus*, and related.
- *Lumerical*: Optical simulation; particularly EME and FDTD.

### Nanofabrication:

- Electron-beam lithography, SEM imaging
- Plasma etching: Ge, InP, dielectrics
- Process development
- Strain engineering

## Awards

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National Physical Science Consortium Fellowship	2010-2016
Gerald L. Pearson Memorial Fellowship (Stanford)	2010
NSF Graduate Research Fellowship Program Honorable Mention	2010
Kanel Foundation Scholar (Caltech)	2008
San Pietro Scholarship (Caltech)	2006-2010
Walmart Scholarship	2006
National Merit Scholarship	2006

## Patents

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**Crossed Nanobeam Structure for a Low-Threshold Germanium Laser**, D. Nam, J. A. Petykiewicz, D. S. Sukhdeo, S. Gupta, J. Vuckovic, K. C. Saraswat, US 9,595,812, 2017.

**Semiconductor Wire Array Structures, and Solar Cells and Photodetectors Based on Such Structures**, M. D. Kelzenberg, H. A. Atwater, R. M. Briggs, S. W. Boettcher, N. S. Lewis, J. A. Petykiewicz, US 8,808,933; WO/2011/066570A3; EP2507843A2, 2014.

## Publications

&gt;2800 citations

h-index 15

[\[google scholar page\]](#)

- Nanophotonic inverse design with SPINS: Software architecture and practical considerations**, L. Su, D. Vercruyssen, J. Skarda, N. V. Sapra, J. A. Petykiewicz, J. Vuckovic, *Applied Physics Reviews*, 2020. [pdf] [doi]
- On the fundamental limitations of imaging with evanescent waves**, A. Y. Piggott, L. Su, J. Petykiewicz, J. Vuckovic, (*preprint*), 2020. [pdf]
- Improving Performance, Power, and Area by Optimizing Gear Ratio of Gate-Metal Pitches in Sub-10nm Node CMOS Designs**, Y. Ban, X. Zhu, J. Petykiewicz, J. Zeng, *IEEE Symposium on VLSI Technology*, 2018. [pdf] [doi]
- Inverse design and demonstration of a compact on-chip narrowband three-channel wavelength demultiplexer**, L. Su, A. Y. Piggott, N.V. Sapra, J. Petykiewicz, J. Vuckovic, *ACS Photonics*, 2018. [pdf] [doi]
- Fabrication-constrained nanophotonic inverse design**, A. Y. Piggott, J. Petykiewicz, L. Su, J. Vuckovic, *Scientific Reports*, 2017. [pdf] [doi]
- Direct bandgap light emission from strained Ge nanowires coupled with high-Q optical cavities**, J. Petykiewicz, D. Nam, D. S. Sukhdeo, S. Gupta, S. Buckley, A. Y. Piggott, J. Vuckovic, K. C. Saraswat, *Nano Letters*, 2016. [pdf] [doi]
- Strained Ge light emitter with Ge on dual insulators for improved thermal conduction and optical insulation**, Y. Kim, J. Petykiewicz, S. Gupta, J. Vuckovic, K. C. Saraswat, D. Nam, *IEIE Transactions on Smart Processing & Computing*, 2015. [pdf] [doi]
- Inverse design and demonstration of a compact and broadband on-chip wavelength demultiplexer**, A. Y. Piggott, J. Lu, K. G. Lagoudakis, J. Petykiewicz, T. M. Babinec, J. Vuckovic, *Nature Photonics*, 2015. [pdf] [doi]
- Ge microdisk with lithographically-tunable strain using CMOS-compatible process**, D. S. Sukhdeo, J. Petykiewicz, S. Gupta, D. Kim, and S. Woo, Y. Kim, J. Vuckovic, K. C. Saraswat, D. Nam, *Optics Express*, 2015. [pdf] [doi]
- Second-harmonic generation in GaAs photonic crystal cavities in (111)B and (001) crystal orientations**, S. Buckley, M. Radulaski, J. Petykiewicz, K. G. Lagoudakis, J. H. Kang, M. Brongersma, K. Biermann, J. Vuckovic, *ACS Photonics*, 2014. [pdf] [doi]
- Nonlinear frequency conversion using high-quality modes in GaAs nanobeam cavities**, S. Buckley, M. Radulaski, J. L. Zhang, J. Petykiewicz, K. Biermann, J. Vuckovic, *Optics Letters*, 2014. [pdf] [doi]
- Multimode nanobeam cavities for nonlinear optics: high quality resonances separated by an octave**, S. Buckley, M. Radulaski, J. L. Zhang, J. Petykiewicz, K. Biermann, J. Vuckovic, *Optics Express*, 2014. [pdf] [doi]
- Inverse design and implementation of a wavelength demultiplexing grating coupler**, A. Y. Piggott, J. Lu, T. M. Babinec, K. G. Lagoudakis, J. Petykiewicz, J. Vuckovic, *Scientific Reports*, 2014. [pdf] [doi]
- Strain-induced pseudoheterostructure nanowires confining carriers at room temperature with nanoscale-tunable band profiles**, D. Nam, D. S. Sukhdeo, J.-H. Kang, J. Petykiewicz, J. H. Lee, W. S. Jung, J. Vuckovic, M. L. Brongersma, K. C. Saraswat, *Nano Letters*, 2013. [pdf] [doi]
- Electrical properties of GaAs photonic crystal cavity lateral p-i-n diodes**, J. Petykiewicz, G. Shambat, B. Ellis, J. Vuckovic, *Applied Physics Letters*, 2012. [pdf] [doi]
- Electrically driven photonic crystal nanocavity devices**, G. Shambat, B. Ellis, J. Petykiewicz, M.A. Mayer, A. Majumdar, T. Sarmiento, J. Harris, E.E. Haller, J. Vuckovic, *Selected Topics in Quantum Electronics, IEEE Journal of*, 2012. [pdf] [doi]
- Ultrafast direct modulation of a single-mode photonic crystal nanocavity light-emitting diode**, G. Shambat, B. Ellis, A. Majumdar, J. Petykiewicz, M. A. Mayer, T. Sarmiento, J. Harris, E. E. Haller, J. Vuckovic, *Nature Communications*, 2011. [pdf] [doi]
- Nanobeam photonic crystal cavity light-emitting diodes**, G. Shambat, B. Ellis, J. Petykiewicz, M. A. Mayer, T. Sarmiento, J. Harris, E. E. Haller, J. Vuckovic, *Applied Physics Letters*, 2011. [pdf] [doi]
- Enhanced absorption and carrier collection in Si wire arrays for photovoltaic applications**, M. D. Kelzenberg, S. W. Boettcher, J. A. Petykiewicz, D. B. Turner-Evans, M. C. Putnam, E. L. Warren, J. M. Spurgeon, R. M. Briggs, Nathan S. Lewis, H. A. Atwater, *Nature Materials*, 2010. [pdf] [doi]

## Invited conference talks

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**Electrically Controlled Photonic Crystal Nanocavity Sources and Modulators**, J. Petykiewicz, G. Shambat, B. Ellis, T. Sarmiento, A. Piggott, J. Vuckovic, *IEEE Photonics Society Summer Topicals, Waikoloa, HI*, 2013.

**Optical nanocavities: From light sources to single cell probes**, J. Petykiewicz, G. Shambat, B. Ellis, T. Sarmiento, A. Piggott, J. Vuckovic, *IEEE Photonics Conference, Bellevue, WA*, 2013.

**Electrical design for lateral junction photonic crystal lasers and LEDs**, J. Petykiewicz, G. Shambat, B. Ellis, J. Vuckovic, *Photonics West, San Francisco, CA*, 2013.

**Photonic Crystal Nanocavity Lasers and Modulators**, J. Vuckovic, B. Ellis, G. Shambat, J. Petykiewicz, A. Majumdar, T. Sarmiento, M. Mayer, Harris J. S., E. Haller, *IEEE Photonics Conference, Burlingame, CA*, 2012.