Jan Petykiewicz

Hardware Engineer

Google

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Research

Google 2018 - current

Hardware Engineer

Platforms Optics Group [Hong Liu, Ryohei Urata]

Globalfoundries 2016 - 2018

Sr. Engineer, TD Research

Differentiating Technologies Research Group [Ajey Jacob] 2017 - 2018

Lithography, Modeling, and Architecture Group [Jongwook Kye] 2016 - 2017

- Team lead for enabling freeform design and lithography-aware verification for SiPh
- Design and technical guidance of photonic devices for future photonics nodes
- OPC and lithography modeling for SiPh designs, focused on internal and customer designs
- Pathfinding for inverse-designed photonics
- EDA flow development for future electronic and photonic nodes (Cadence/Mentor)
- Competitive analysis for future process nodes

Stanford University 2010 - 2016

PhD Student, Electrical Engineering

Nanoscale and Quantum Photonics Group [Jelena Vuckovic]

- Strained Germanium laser
- Nanophotonic inverse design
- Electrically injected III-V lasers and modulators

California Institute of Technology 2008 - 2010

Undergraduate Researcher

Atwater Research Group [Harry Atwater]

Senior Thesis 2010

Summer Undergraduate Research Fellowship, sponsored by The Aerospace Corporation. 2008

- Silicon nanowire solar cells

California Institute of Technology 2007 - 2007

Undergraduate Researcher

Caltech Nanofabrication Group [Axel Scherer]

Summer Undergraduate Research Fellowship, sponsored by The Aerospace Corporation. 2007

- Ultra-low-voltage electro-optic modulator

Education

Stanford University 2010 - 2016

Nanoscale and Quantum Photonics Group [Jelena Vuckovic]

PhD, *Electrical Engineering* 2016
MS, *Electrical Engineering* 2013

California Institute of Technology 2006 - 2010

BS with honors, *Electrical Engineering* 2010
Lloyd House

Skills

Optics:

- Design and fabrication of nanoscale lasers, LEDs, modulators and optical cavities
- Micro-photoluminesecence, 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

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

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

>2800 citations h-index 15 [google scholar page]

Nanophotonic inverse design with SPINS: Software architecture and practical considerations, L. Su, D. Vercruysse, 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

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.