

MICHELLE L. POVINELLI, Ph.D.

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RESEARCH EXPERTISE

Nanophotonics: optical properties of nanostructured materials including photonic crystals and microresonators. Theory and simulation of optical devices, computational electromagnetics. Optical device design, fabrication, and characterization. Opto-nanomechanical devices.

POSITIONS HELD

WiSE Gabilan Assistant Professor, University of Southern California, 2008–
Ming Hsieh Department of Electrical Engineering

Postdoctoral Researcher, Stanford University, 2004–2008
Ginzton Laboratory, with Professor Shanhui Fan

Research Assistant, Massachusetts Institute of Technology, 1998–2004
Physics Department, with Professor John Joannopoulos

EDUCATION

Massachusetts Institute of Technology, 1998–2004, Ph.D. in Physics
Thesis emphasis: computational modeling of photonic crystals with Prof. J. D. Joannopoulos

University of Cambridge, 1997–1998, M.Phil. in Physics, Churchill Scholar
Thesis emphasis: neural networks and Bayesian pattern recognition with Prof. D. J. C. MacKay

University of Chicago, 1993–1997, B.A. in Physics with General Honors and Honors in Physics
Undergraduate research: experimental studies of granular materials and theoretical solid-state physics with Profs. S. R. Nagel, H. Jaeger and S. N. Coppersmith

AWARDS

NSF CAREER Award (2009), ARO Young Investigator Award (2009), USC Powell Faculty Award (2008-2009), WISE Jr. Gabilan Chair, University of Southern California (2008-), L’Oreal For Women in Science Fellowship (2006): \$20,000 research award, NSF Graduate Fellowship (1998), Lucent Technologies GRPW Fellowship (1998–2002), MIT Karl Taylor Compton Scholarship (1998–2001), Sigma Xi (1998), Phi Beta Kappa (1998), Churchill Scholar (1997), Student Marshal, University of Chicago (1997): top 1% of graduating class, Senior Thesis Prize, University of Chicago Physics Department (1997), Goldwater Scholarship (1994–1997), University of Chicago College Honor Scholarship (1993–1997), National Merit Scholarship (1993), Robert Byrd Scholarship (1993–1997), Presidential Scholar (1993)

PATENTS

“Photonic Crystals as Metamaterials,” *US Patent 7,177,513*.

“Polarization-Independent Linear Waveguides in 3D Photonic Crystals,” *US Patent 7,058,242*.

“3D-Periodic Dielectric Layered Structure with Omnidirectional Band Gap,” *US Patent 6,597,851*.

RESEARCH INTERNSHIPS

Bell Laboratories, Lucent Technologies (1999), modeling of optical fiber nonlinearities

Kyushu University, Fukuoka, Japan (1997), summer research exchange student

NASA Lewis (Glenn) Research Center, Cleveland, OH, (1993–5), computational materials modeling

JOURNAL PUBLICATIONS

- C. Lin and **M. L. Povinelli**, “Optical absorption enhancement in silicon nanowire arrays with a large lattice constant for photovoltaic applications”, accepted for publication in *Optics Express*.
- J. Ma and **M. L. Povinelli**, “Large tuning of birefringence in two strip silicon waveguides via optomechanical motion,” *Optics Express* **17**: 17818-17828 (2009).
- S. Sandhu, **M. L. Povinelli**, and S. Fan, “Overcoming gain-bandwidth product constraint in slow light Raman amplification with the use of light-stopping schemes,” *Applied Physics Letters* **95**: 081103 (2009).
- C. R. Otey, **M. L. Povinelli**, and S. Fan, “Capturing light pulses into a pair of coupled photonic crystal cavities,” *Appl. Phys. Lett.*, **94**: 231109 (2009).
- C. R. Otey, **M. L. Povinelli**, and S. Fan, “Completely capturing light pulses in a few dynamically-tuned microcavities,” *J. Lightwave Technology*, **26**: 3784-3893 (2008).
- J. Pan, Y. Huo, K. Yamanaka, S. Sandhu, L. Scaccabarozzi, R. Timp, **M. L. Povinelli**, S. Fan, M. M. Fejer, and J. S. Harris, “Aligning microcavity resonances in silicon photonic-crystal slabs using laser-pumped thermal tuning,” *Appl. Phys. Lett.*, **92**: 103114 (2008).
- S. Sandhu, **M. L. Povinelli**, and S. Fan, “Stopping and time-reversing a light pulse using dynamic loss-tuning of coupled-resonator delay lines,” *Opt. Lett.* **32**: 3333 (2007).
- M. L. Povinelli**, “Microphotronics: Under pressure” (News and Views), *Nature Photonics* **1**:370 (2007).
- S. Fan, M. F. Yanik, **M. L. Povinelli**, and S. Sandhu, “Dynamic photonic crystals,” *Optics and Photonics News* **18**:41 (2007).
- J.-T. Shen, **M. L. Povinelli**, S. Sandhu, and S. Fan, “Stopping single photons in one-dimensional circuit quantum electrodynamics systems,” *Phys. Rev. B* **75**: 035320 (2007).
- S. Fan, M. F. Yanik, Z. Wang, S. Sandhu, and **M. L. Povinelli**, “Advances in theory of photonic crystals,” *J. Lightwave Technology* **24**: 4493-4501 (2006).
- M. L. Povinelli** and S. Fan, “Radiation loss of coupled-resonator waveguides in photonic crystal slabs,” *Appl. Phys. Lett.* **89**: 191114 (2006).
- M. L. Povinelli**, “Slow light: Variable speed limit” (News and Views), *Nature Physics* **2**: 735-736 (2006).
- S. Sandhu, **M. L. Povinelli**, M. F. Yanik, and S. Fan, “Dynamically tuned coupled-resonator delay lines can be nearly dispersion free,” *Optics Letters* **31**: 1985-1987 (2006).
- Q. Xu, S. Sandhu, **M. L. Povinelli**, J. Shakya, S. Fan, and M. Lipson, “Experimental realization of an on-chip all-optical analogue to electromagnetically induced transparency,” *Phys. Rev. Lett.* **96**: 123901 (2006).
- M. L. Povinelli**, M. Loncar, M. Ibanescu, E. J. Smythe, S. G. Johnson, F. Capasso, and J. D. Joannopoulos, “Optical Evanescent-Wave Bonding Between Microphotonic Components,” *Optics Lett.* **30**: 3042-3044 (2005).
- M. L. Povinelli**, S. G. Johnson, M. Loncar, M. Ibanescu, E. J. Smythe, F. Capasso, and J. D. Joannopoulos, “High- Q enhancement of attractive and repulsive optical forces between coupled whispering-gallery-mode resonators,” *Optics Express* **13**: 8286-8295 (2005).
- M. L. Povinelli**, S. G. Johnson, and J. D. Joannopoulos, “Slow-light, band-edge waveguides for tunable time delays,” *Optics Express* **13**: 7145-7159 (2005).
- S. G. Johnson, **M. L. Povinelli**, M. Soljacic, A. Karalis, S. Jacobs, and J. D. Joannopoulos, “Roughness losses and volume-current methods in photonic-crystal waveguides,” *Appl. Phys. B* **81**: 283-293 (2005) (Invited).
- M. L. Povinelli**, M. Ibanescu, S. G. Johnson, and J. D. Joannopoulos, “Slow-light enhancement of radiation pressure using omnidirectional reflectors,” *Appl. Phys. Lett.* **85**: 1466-1468 (2004).

- K. C. Huang, **M. L. Povinelli**, and J. D. Joannopoulos, "Negative effective permeability in polaritonic photonic crystals," *Appl. Phys. Lett.* **85**: 543-545 (2004).
- M. L. Povinelli**, S. G. Johnson, E. Lidorikis, J. D. Joannopoulos, and M. Soljacic, "Effect of a photonic-band gap on scattering from waveguide disorder," *Appl. Phys. Lett.*, **84**: 3639-3641 (2004).
- L.G. L. Wegener, **M. L. Povinelli**, A. G. Green, P. P. Mitra, J. B. Stark, and P. B. Littlewood, "The effect of propagation nonlinearities on the information capacity of WDM optical fiber systems: cross-phase modulation and four-wave mixing," *Physica D* **189**: 81-99 (2004).
- M. L. Povinelli**, R. E. Bryant, S. Assefa, S. G. Johnson, S. Fan, A. A. Erchak, G. S. Petrich, E. Lidorikis, J. D. Joannopoulos, L. A. Kolodziejski, and E. P. Ippen, "Design of a nanoelectromechanical, high-index-contrast, guided-wave optical switch for single-mode operation at 1.55 microns," *IEEE Photonics Technology Lett.* **15**: 1207-1209 (2003).
- E. Lidorikis, **M. L. Povinelli**, S. G. Johnson, and J. D. Joannopoulos, "Polarization-independent linear waveguides in 3D photonic crystals," *Phys. Rev. Lett.* **91**: 023902 (2003).
- M. L. Povinelli**, S. G. Johnson, J. D. Joannopoulos, and J. B. Pendry, "Toward photonic-crystal metamaterials: Creating magnetic emitters in photonic crystals," *Appl. Phys. Lett.* **82**: 1069-1071 (2003).
- M. L. Povinelli**, S. G. Johnson, S. Fan, and J. D. Joannopoulos, "Emulation of two-dimensional photonic crystal defect modes in a photonic crystal with a three-dimensional photonic band gap," *Phys. Rev. B* **64**: 075313 (2001).
- M. L. Povinelli**, S. N. Coppersmith, L. P. Kadanoff, S. R. Nagel, and S. C. Venkataramani, "Noise stabilization of self-organized memories," *Phys. Rev. E* **59**: 4970-4982 (1999).
- T. Taino, K. Ishibashi, K. Maehata, S. Yoshida, **M. L. Povinelli**, H. Nakagawa, H. Akoh, K. Joosse, S. Takada, M. Kishimoto, and M. Katagiri, "Large-area tunnel junction exhibiting two operating modes for X-ray detection," *Jpn. J. Appl. Phys. 1* **37**: 25-30 Suppl. 2 (1998).
- E. R. Nowak, J. B. Knight, **M. L. Povinelli**, H. M. Jaeger, and S. R. Nagel, "Reversibility and irreversibility in the packing of vibrated granular material," *Powder Technology* **94**: 79-83 (1997).
- M. L. Povinelli**, S. A. Korpela, and A. Chait, "Solute boundary-layer on a rotating crystal," *J. Cryst. Growth* **144**: 103-106 (1994).

BOOK CHAPTERS

- W. Zhang and **M. L. Povinelli**, "Photonic Crystals: Physics, Fabrication, and Devices," in *Nanoelectronics and Photonics: From Atoms to Materials, Devices, and Architectures*, A. Korkin and F. Rosei (Eds.), 353-426. Springer: New York, NY (2008).
- S. Fan and **M. L. Povinelli**, "Stopping Light via Dynamic Tuning of Coupled Resonators," in *Slow Light: Science and Applications*, J. B. Khurgin and R. S. Tucker (Eds.), 277-289. CRC Press LLC: Boca Raton, FL (2008).

CONFERENCE PRESENTATIONS

- (Invited) Physics of Quantum Electronics**, Snowbird, UT. "Trapping light in optical microcavities via dynamic tuning," (Jan. 2009).
- (Invited) 4th Charlotte Research Institute Workshop**, University of North Carolina Charlotte, "Optical forces and slow light in microresonators," (June 2007).
- (Invited) PIERS 2007**, Beijing, China. "Optically-induced forces in microphotonic," (March 2007).
- (Invited) SPIE Photonics West**, San Jose, CA. "Dynamically tuned microresonator complexes," (Jan. 2007).
- SPIE Photonics West**, San Jose, CA. "Radiation loss of coupled-resonator waveguides," (Jan. 2007).
- Frontiers in Optics OSA Annual Meeting**, Rochester, NY. "Radiation loss of coupled-resonator waveguides can be much lower than for single resonators," (Oct. 2006).

(Invited) OSA Topical Meeting: Slow and Fast Light, Washington, DC. “Slow light in photonic crystals,” (July 2006).

SPiE Optics & Photonics, San Diego, CA. “Enhancement mechanisms for optical forces in integrated optics,” (Aug. 2006).

Synergy Between Experiment and Computation in Nanoscale Science, Harvard University, Cambridge, MA. “Slowing and stopping light in photonic crystals: theory and experiments,” (May 2006).

(Invited) SPiE Photonics West, San Jose, CA. “Stopping light in photonic crystals: some practical considerations,” (Jan. 2006).

SPiE Photonics West, San Jose, CA. “Tunable time delays in photonic-crystal waveguides,” (Jan. 2006).

Frontiers in Optics OSA Annual Meeting, Tucson, AZ. “Optical forces in microphotonic waveguides,” (Oct. 2005).

SPiE Optics & Photonics, San Diego, CA. “Slow-light, band-edge waveguides for tunable time delays,” (Aug. 2005).

PIERS 2003, Honolulu, HI. “Magnetic behavior from dielectric materials,” (Oct. 2003).

SEMINARS AND TALKS

Pomona College, Physics Colloquium (2009).

Caltech, Applied Physics Seminar (2008).

University of California, Berkeley, Electrical Engineering Plasmonics and Photonics Seminar (2008).

University of Southern California, Ming Hsieh Department of Electrical Engineering Seminar (2007).

Princeton University, Department of Electrical Engineering Seminar (2007).

Cornell University, School of Electrical and Computer Engineering Seminar (2007).

University of Illinois at Urbana-Champaign, Department of Electrical and Computer Engineering Seminar (2007).

University of Wisconsin-Madison, Department of Electrical and Computer Engineering Seminar (2007).

Rice University, Department of Electrical and Computer Engineering Seminar (2007).

University of Michigan, Electrical Engineering and Computer Science Department Seminar (2007).

JILA Seminar (2007).

Argonne National Laboratory, Center for Nanoscale Materials Seminar (2007).

University of Washington, Electrical Engineering Department Seminar (2007).

Carnegie Mellon University, Department of Electrical and Computer Engineering Seminar (2007).

University of Michigan, Physics Department CM/AMO Seminar (2007).

University of California, San Diego, Department of Electrical and Computer Engineering Optics Seminar (2006).

University of Pennsylvania, Department of Electrical and Systems Engineering Seminar (2006).

Columbia University, Optics Seminar (2006).

University at Colorado at Boulder, Electrical and Computer Engineering Department Seminar (2006).

University of California, San Diego, Department of Electrical and Computer Engineering Seminar (2005).

Lucent Technologies, Bell Laboratories, Physical Science Seminar Series (2004).

PROFESSIONAL ACTIVITIES

Committee Member for the QELS 2010 Conference

Associate Editor, *Optics Express*, 2008-

Instructor, Short Course, International Society for Optical Engineering (SPIE) (2005)

Designed and taught 4-hour, paid-tuition, research specialty course to an audience of graduate students and professional engineers at the Photonics North meeting in Toronto, Canada

Reviewer for journals including: *Nature Photonics*, *Nature Physics*, *Optics Letters*, *Optics Express*, *Journal of Lightwave Technology*, *IEEE Sensors*, *Solid State Communications*, *J. Opt. A*, *J. Phys. D: Applied Physics*

PRESS COVERAGE

“Dynamic photonic crystals,” by S. Fan, M. F. Yanik, M. L. Povinelli, and S. Sandhu, *Optics and Photonics News* **18**(3): 41-45 (March 2007).

“Photonics: Transparency on an optical chip,” by R. W. Boyd and D. J. Gauthier, *Nature* (News and Views) **441**: 701 (June 2006).

“Photonic crystals may become magnetic emitters,” *Laser Focus World Newsbreaks* (June 2003).