

Professor Steven G. Johnson

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Education and Awards

Massachusetts Institute of Technology (MIT), 1995–2001:

- **Ph.D. Physics:** “Photonic Crystals: From Theory to Practice.” 5.0/5.0 GPA.
- National Defense Science and Engineering Graduate (NDSEG) Fellowship
- MIT Karl Taylor Compton Fellowship
- National Science Foundation (NSF) Fellowship (declined)
- Hertz Foundation Fellowship (declined)
- 1999 J. H. Wilkinson Prize for Numerical Software (see FFTW, below)
- 1999 Laurels Award in Electronics from Aviation Week & Space Technology

MIT, 1991–1995:

- B.S. Mathematics, 5.0/5.0 GPA.
- B.S. Electrical Engineering and Computer Science, 5.0/5.0 GPA.
- B.S. Physics, 5.0/5.0 GPA.
- MIT Orloff Award for scholarship in physics.

Thesis on semi-classical analyses of quantum chaos. Honor societies: Phi Beta Kappa (liberal arts), Sigma Pi Sigma (physics), Tau Beta Pi (engineering), and Eta Kappa Nu (electrical engineering).

Illinois Mathematics and Science Academy, 1988–1991:

Eagle Scout, National Merit Scholarship.

Employment and Research

Assistant Professor of Applied Mathematics, MIT Math Dept., July 2004–present:

“Nanostructures and Computation” research group. Also affiliated with the MIT Research Laboratory of Electronics (RLE), the MIT Center for Materials Science and Engineering (CMSE), and the MIT Institute for Soldier Nanotechnology (ISN).

Postdoctoral research associate, Harvard Appl. Phys. Dept., Jan.–Aug. 2004:

Collaborating with Prof. Capasso in the theory and experiment of structured optical media, such as modeling their thermal and quantum-optical properties.

Postdoctoral research associate, MIT Dept. Physics, May 2001–Dec. 2003:

Continued work in the group of Prof. J. D. Joannopoulos.

Graduate research assistant, MIT Dept. Physics, 1996–2001:

In the group of Prof. J. D. Joannopoulos, collaborating with both theoretical and experimental colleagues to advance the science of photonic crystals and structured optical media.

Tohoku University (Sendai, Japan), Dec. 2002:

Collaborated with Kawakami group in theoretical analysis of autocloned photonic-crystal heterostructure waveguides, exploring the limits of envelope/effective-index approximations as well as studying losses via group theory and other principles.

OmniGuide Communications (Cambridge, MA), Sep. 2000–Jan. 2001–present:

Led theory and simulation group in investigation and theoretical characterization of a new class of hollow optical fibers. I continue there as a consultant to the present day.

Femtosecond Technology Research Association (Tsukuba, Japan), July 2000:

Introduced researchers at FESTA to the theoretical study of photonic crystals, and computationally characterized the structures fabricated at their laboratory.

MIT Laboratory for Computer Science, 1997–present:

Co-developed the FFTW fast-Fourier-transform library (www.fftw.org). 1999 J. H. Wilkinson Prize for Numerical Software, awarded every four years by Argonne Natl. Lab., the National Physical Lab. (UK), and the Numerical Algorithms Group (NAG) to the software that “best addresses all phases of the preparation of high-quality numerical software.” 1999 Laurels Award in “Electronics” from Aviation Week & Space Technology for “significant contributions to the global field of aerospace in 1999.”

AT&T Bell Labs, summer 1993–1994 (MIT VI-A internship program):

Developed real-time visualization software for high-speed optics, built laser-alignment system for free-space optics, and wrote a program for 3d capacitance extraction.

MIT Mathematics Dept. and School of Mgmt., spring 1993 (MIT UROP program):

Numerical studies of options contracts and the Black-Scholes equations.

Fermi Natl. Accelerator Laboratory, summers/winters 1989–1991, 1995:

Developed simulation software for liquid-Helium cryogenics systems.

Teaching

MIT Department of Mathematics, Fall 2004–present.

MIT MRS Chapter, IAP Tutorial Series, 2003:

Taught intensive one-week seminar on photonic crystals to ~100 graduate students, advanced undergraduates, faculty, and MIT affiliates (ab-initio.mit.edu/photons/tutorial).

MIT Experimental Study Group, 1994–2000:

Exclusive instructor of freshman physics courses to small groups of 1–3 students, for 7 semesters, in this optional alternative program for MIT freshmen.

Invited Talks

- “Photonic Crystals and Their Applications,” Advanced Photon Source Colloquium, Argonne National Laboratories (July 2007).
- “Robust Design of Slow-Light Tapers in Periodic Waveguides,” presented by Almir Mutapcic, SIAM Conference on Control and Its Applications, San Francisco (June 2007).
- “Computation and Design of Photonic Crystals,” Chinese Academy of Sciences Engineering Colloquium, Beijing (June 2007).
- “The Magic of Periodicity in Electromagnetism: Photonic Crystals, Defects, and Quasicrystals,” Workshop on Symbolic Dynamics and Engineering Applications, Boston University (June 2007).
- “Photonic crystals: From waves to photons,” University of Toronto Cross-border Workshop on Laser Science, Toronto (May 2007).
- “Quantum effects in photonics: Single-photon switches and Casimir forces,” Cornell Photonics Seminar series, Cornell (October 2006).
- “Computational Photonics: Frequency and Time-domain Methods,” Cornell Nanoscale Facility Fall Workshop, Cornell (October 2006).
- “Photonic Crystals: From Order to Disorder,” Europhysical Conference on Defects in Insulating Materials, Milan, Italy (July 2006).
- “From Pixels to Photons: Large Effects from Small Perturbations in Nanophotonics,” Asia-Pacific Conference on Transducers and Micro-Nano Technology, Singapore (June 2006).
- “Virtual photons in imaginary time: Computing Casimir forces,” Conf. on Synergy between Experiment and Computation in Nanoscale Science, Harvard (June 2006).
- “Perturbative Methods in Nanophotonics,” Advanced Computational Electromagnetics Workshop, Boston Univ. (May 2006).
- “Effects of bandgaps on roughness losses: correcting the volume-current method,” Intl. Conf. on Mat. for Adv. Tech., Singapore (July 2005).
- “Photonic crystals: From order to disorder,” Intl. Symp. on Photonic and Electromag. Crystal Structures VI, Crete (June 2005).
- “Design and Disorder in Photonic Crystals,” MIT Center for Integrated Photonics Systems annual meeting, (May 2005).
- “FFTW: The Fastest Fourier Transform in the West,” Computational Research in Boston, Cambridge, MA (April 2005).
- “Surface roughness in photonic crystals,” Nanophotonics for Information Syst. Topical Meeting, San Diego, CA (April 2005).
- “Photonic crystals: A crash course in designer electromagnetism,” IEEE Lasers and Electro-optics Soc. workshop on photonic crystals, MIT Lincoln Labs (Mar. 2005).
- “Deviations from periodicity in photonic crystals,” Science Colloquium series, IBM Almaden Research, San Jose, CA (February 2005).
- “FFTW: Toward a minimal compositional framework for high-performance FFTs,” Conf. on Scalable Approaches to High Performance and High Productivity Computing, Bertinoro, Italy (Sep. 2004).
- “When photonic-crystal waveguides go bad,” Intl. Symp. on Photonic and Electromag. Crystal Structures V, Kyoto, Japan (March 2004).

- “The design and modeling of microstructured optical fiber,” Opt. Fiber Commun. Conf. and Expo., Los Angeles (Feb. 2004).
- “Understanding Broken Symmetry in Photonic Crystals: Semi-analytical approaches to disorder and slow tapers,” Nat. Taiwan Normal University, Taiwan (Oct. 2003).
- “Photonic crystals: Perfect except for the imperfections,” Stanford Photonics Symposium, Stanford (September 2003).
- “Imperfect photonic-crystal waveguides,” Intl. Symp. on Mod. Opt. and Appl., Bandung, Indonesia (August 2003).
- “Coupling, Scattering, and Perturbation Theory: Semi-analytical Analyses of Photonic-Crystal Waveguides,” Europ. Symp. on Photonic Crystals, Warsaw (June 2003).
- “Photonic crystals: Periodic surprises in electromagnetism,” Columbia University, New York (April 2003).
- “Photonic crystals: New opportunities for controlling the flow of light,” DARPA/MTO PBG Topical Meeting, San Diego (January 2003).
- “Coupling to photonic-crystal waveguides with adiabatic tapers,” MRS Fall Meeting, Boston (December 2002).
- “High-Q cavities without a complete photonic band gap,” ETOPIIM: Electrical Transport and Optical Properties of Inhomogeneous Media, Salt Lake City (July 2002).
- “Iterative eigensolver techniques and Maxwell’s equations in periodic systems,” PIERS: Progress In Electromagnetics Research Symposium, Cambridge MA (July 2002).
- “Breaking the glass ceiling: Hollow OmniGuide fibers,” ESPC: European Symposium on Photonic Crystals, Warsaw (April 2002).
- “Minimizing scattering losses in photonic-crystal slabs,” Materials Research Society (MRS) meeting, San Francisco, CA (April 2002).
- “Breaking the Glass Ceiling: Hollow OmniGuide Fibers,” SPIE Optoelectronics 2002, San Jose, CA (January 2002).
- “A Novel Photonic-Crystal System for Integrated Optics,” ITCOM 2001, Denver, Colorado (August 2001).
- “Modeling Linear Waveguides in Photonic Crystals,” 9th Intl. Workshop on Optical Waveguide Theory and Numerical Modeling, Paderborn, Germany (April 2001).
- “FFTW, FFTs, Portability, and Performance,” Conference for Computational Physics, Australia (December 2000).
- “FFTW: An Adaptive Software Architecture for the FFT,” Cornell University, Ithaca NY (February 2000).
- “Photonic Crystal Slabs: Hybrid Structures for Integrated Optics,” Corning Research, Corning NY (February 2000).
- “Designing a Photonic Crystal Slab,” Sandia Natl. Laboratory, Albuquerque NM (August 1999).
- “The Fastest Fourier Transform in the West,” ICIAM ‘99 (Wilkinson Prize Symposium), Edinburgh, Scotland (July 1999).
- “Photonic Crystals: Theory and Applications,” Northeastern University, Boston MA (May 1999).

Publications

- J. D. Joannopoulos, S. G. Johnson, J. N. Winn, and R. D. Meade, *Photonic Crystals: Molding the Flow of Light*, 2nd edition (Princeton Univ. Press, spring 2008).
- S. G. Johnson and J. D. Joannopoulos, *Photonic Crystals: The Road from Theory to Practice* (Kluwer, Boston, 2002).
- J. Bravo-Abad, S. Fan, S. G. Johnson, J. D. Joannopoulos, and M. Soljagic, “Modeling nonlinear optical phenomena in nanophotonics,” *J. Lightwave Tech.* **25**, 2539–2546 (2007).
- A. Rodriguez, M. Ibanescu, D. Iannuzzi, J. D. Joannopoulos, and S. G. Johnson, “Virtual photons in imaginary time: Computing exact Casimir forces via standard numerical-electromagnetism techniques,” *Phys. Rev. A*, 032106 (2007).
- A. Rodriguez, M. Ibanescu, D. Iannuzzi, F. Capasso, J. D. Joannopoulos, and S. G. Johnson, “Computation and visualization of Casimir forces in arbitrary geometries: Nonmonotonic lateral-wall forces and the failure of proximity-force approximations,” *Phys. Rev. Lett.* **99**, 080401 (2007).
- A. Rodriguez, M. Soljagic, J. D. Joannopoulos, and S. G. Johnson, “ $\chi^{(2)}$ and $\chi^{(3)}$ harmonic generation at a critical power in inhomogeneous doubly resonant cavities,” *Opt. Express* **15**, 7303–7318 (2007).
- S. G. Johnson and M. Frigo, “A modified split-radix FFT with fewer arithmetic operations,” *IEEE Trans. Signal Processing* **55**, 111–119 (2007).
- A. Farjadpour, D. Roundy, A. Rodriguez, M. Ibanescu, P. Bermel, J. D. Joannopoulos, S. G. Johnson, and G. Burr, “Improving accuracy by subpixel smoothing in FDTD,” *Optics Lett.* **31**, 2972–2974 (2006).
- P. Bermel, A. Rodriguez, S. G. Johnson, J. D. Joannopoulos, and M. Soljagic, “Single-photon all-optical switching using waveguide-cavity quantum electrodynamics,” *Phys. Rev. A* **74**, 043818 (2006).
- C. Luo, M. Ibanescu, E. J. Reed, S. G. Johnson, and J. D. Joannopoulos, “Doppler radiation emitted by an oscillating dipole moving inside a photonic band-gap crystal,” *Phys. Rev. Lett.* **96**, 043903 (2006).
- M. Ibanescu, M. Soljagic, S. G. Johnson, and J. D. Joannopoulos, “Ultra-flat bands in two-dimensional photonic crystals,” *Proc. SPIE* **6128**, 612808 (2006).
- A. Rodriguez, M. Ibanescu, J. D. Joannopoulos, and S. G. Johnson, “Disorder-immune confinement of light in photonic-crystal cavities,” *Optics Lett.* **30**, 3192–3194 (2005).
- M. L. Povinelli, M. Loncar, M. Ibanescu, E. J. Smythe, S. G. Johnson, F. Capasso, and J. D. Joannopoulos, “Evanescent-wave bonding between optical waveguides,” *Optics Lett.* **30**, 3042–3044 (2005).
- M. Skorobogatiy, S. A. Jacobs, S. G. Johnson, C. Anastassiou, and B. Temelkuran, “Heating of hollow photonic Bragg fibers from field propagation, coupling, and bending,” *J. Lightwave Tech.* **23**, 3517–3525 (2005).
- M. Povinelli, S. Johnson, M. Loncar, M. Ibanescu, E. Smythe, F. Capasso, and J. 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," *Opt. Express* **13** (18), 7145–7159 (2005).
- S. G. Johnson, M. L. Povinelli, M. Soljagic, 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, special issue.)
- M. Ibanescu, S. G. Johnson, D. Roundy, Y. Fink, and J. D. Joannopoulos, "Microcavity confinement based on an anomalous zero group-velocity waveguide mode," *Opt. Lett.* **30** (5), 552–554 (2005).
- M. Frigo and S. G. Johnson, "The design and implementation of FFTW3," *Proc. IEEE* **93** (2), 216–231 (2005). Invited paper, special issue on program generation, optimization, and platform adaptation.
- P. Rakich, H. Sotobayashi, J. Gopinath, S. G. Johnson, J. W. Sickler, C.-W. Wong, J. D. Joannopoulos, and E. P. Ippen, "Nano-scale photonic crystal microcavity characterization with an all-fiber based 1.2–2.0 μm supercontinuum," *Opt. Express* **13** (3), 821–825 (2005).
- S. Assefa, P. Rakich, P. Bienstman, S. G. Johnson, G. S. Petrich, J. D. Joannopoulos, L. A. Kolodziejcki, E. P. Ippen, and H. I. Smith, "Guiding 1.5 μm light in photonic crystals based on dielectric rods," *Appl. Phys. Lett.* **85** (25), 6110–6112 (2004).
- A. Karalis, S. G. Johnson, and J. D. Joannopoulos, "Discrete-mode cancellation mechanism for high-Q integrated optical cavities with small modal volume," *Opt. Lett.* **29** (19), 2309–2311 (2004).
- Y. Tanaka, Y. Sugimoto, N. Ikeda, H. Nakamura, K. Asakawa, K. Inoue, S. G. Johnson, "Group velocity dependence of propagation losses in single-line-defect photonic crystal waveguides on GaAs membranes," *Elec. Lett.* **40** (3), 174–176 (2004).
- M. L. Povinelli, M. Ibanescu, S. G. Johnson, and J. D. Joannopoulos, "Slow-light enhancement of radiation pressure in an omnidirectional reflector waveguide," *Appl. Phys. Lett.* **85** (9), 1466 (2004).
- M. Qi, E. Lidorikis, P. T. Rakich, S. G. Johnson, J. D. Joannopoulos, E. P. Ippen, and H. I. Smith, "A three-dimensional optical photonic crystal with designed point defects," *Nature* **429**, 538–542 (2004).
- M. L. Povinelli, S. G. Johnson, E. Lidorikis, J. D. Joannopoulos, and M. Soljagic, "Effect of a photonic band gap on scattering from waveguide disorder," *Appl. Phys. Lett.* **84** (18), 3639–3641 (2004).
- C.-W. Wong, P. Rakich, S. G. Johnson, M. Qi, H. I. Smith, Y. Jeon, G. Barbastathis, S.-G. Kim, E. P. Ippen, and L. C. Kimerling, "Strain-tunable Silicon photonic band gap microcavities in optical waveguides," *Appl. Phys. Lett.* **84** (8), 1242–1244 (2004).
- M. Soljagic, E. Lidorikis, M. Ibanescu, S. G. Johnson, J. D. Joannopoulos, and Y. Fink, "Optical bistability and cutoff solitons in photonic bandgap fibers," *Opt. Express* **12** (8), 1518–1527 (2004).
- M. Ibanescu, S. G. Johnson, D. Roundy, C. Luo, Y. Fink, and J. D. Joannopoulos, "Anomalous dispersion relations by symmetry breaking in axially uniform waveguides," *Phys. Rev. Lett.* **92** (6), 063903 (2004).

- Y. Sasaki, Y. Ohtera, S. G. Johnson, and S. Kawakami, "A reference analytical model of three-dimensional photonic crystal waveguides and their mode spectrum," *Trans. Inst. Elect. Info. Comm. Eng. C* **J87-C** (3), 328–334 (2004).
- S. G. Johnson and J. D. Joannopoulos, "Designing synthetic optical media: photonic crystals," *Acta Materialia* **51** (19), 5823–5835 (2003).
- M. Skorobogatiy, Steven G. Johnson, O. Weisberg, Torkel D. Engeness, Steven A. Jacobs, Rokan U. Ahmad, and Yoel Fink, "Quantitative characterization of higher-order mode converters in weakly multimoded fibers," *Opt. Express* **11** (22), 2838–2847 (2003).
- 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 Phot. Tech. Lett.* **15**, 1207–1209 (2003).
- C. Luo, S. G. Johnson, and J. D. Joannopoulos, "Subwavelength imaging in photonic crystals," *Phys. Rev. B* **68**, 045115 (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. Soljacic, M. Ibanescu, S. G. Johnson, J. D. Joannopoulos, and Yoel Fink, "Optical Bistability in Axially Modulated OmniGuide Fibers," *Opt. Lett.* **28**, 516–518 (2003).
- T. D. Engeness, M. Ibanescu, S. G. Johnson, O. Weisberg, M. Skorobogatiy, S. Jacobs, and Y. Fink, "Dispersion tailoring and compensation by modal interactions in OmniGuide fibers," *Opt. Express* **11**, 1175–1198 (2003).
- M. Ibanescu, S. G. Johnson, M. Soljacic, J. D. Joannopoulos, Y. Fink, O. Weisberg, T. D. Engeness, S. A. Jacobs, and M. Skorobogatiy, "Analysis of mode structure in hollow dielectric waveguide fibers," *Phys. Rev. E* **67**, 046608 (2003).
- C. Luo, S. G. Johnson, J. D. Joannopoulos, and J. B. Pendry, "Negative refraction without negative index in metallic photonic crystals," *Opt. Express* **11**, 746–754 (2003).
- P. Beinstman, S. Assefa, S. G. Johnson, J. D. Joannopoulos, G. S. Petrich, and L. A. Kolodziejski, "Taper structures for coupling into photonic crystal slab waveguides," *J. Opt. Soc. Am. B* **20** (9), 1817–1821 (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** (7), 1069–1071 (2003).
- C. Luo, M. Ibanescu, S. G. Johnson, and J. D. Joannopoulos, "Cerenkov radiation in photonic crystals," *Science* **299**, 368–371 (2003).
- E. Chow, J. Bur, S. G. Johnson, and J. D. Joannopoulos, "Low-loss, wide-angle Y splitter at $\sim 1.6\mu\text{m}$ wavelengths built with a two-dimensional photonic crystal," *Opt. Lett.* **27** (16), 1400–1402 (2002).
- S. G. Johnson, Peter Beinstman, M. A. Skorobogatiy, Mihai Ibanescu, Elefterios Lidorikis, and J. D. Joannopoulos, "Adiabatic theorem and continuous coupled-mode theory for efficient taper transitions in photonic crystals," *Phys. Rev. E* **66**, 066608 (2002).

- M. Soljacic, M. Ibanescu, S. G. Johnson, Y. Fink, and J. D. Joannopoulos, "Optimal bistable switching in nonlinear photonic crystals," *Phys. Rev. E Rapid Comm.* **66**, 055601(R) (2002).
- M. Skorobogatiy, S. A. Jacobs, S. G. Johnson, and Y. Fink, "Geometric variations in high index-contrast waveguides, coupled mode theory in curvilinear coordinates," *Opt. Express* **10**, 1227–1243 (2002).
- M. Skorobogatiy, M. Ibanescu, S. G. Johnson, O. Weisberg, T. D. Engeness, M. Soljacic, S. A. Jacobs, and Y. Fink, "Analysis of general geometric scaling perturbations in a transmitting waveguide. The fundamental connection between polarization mode dispersion and group-velocity dispersion," *J. Opt. Soc. Am B* **19**, 2867–2875 (2002).
- M. R. Watts, S. G. Johnson, H. A. Haus, and J. D. Joannopoulos, "Electromagnetic cavity with arbitrary Q and small modal volume without a complete photonic bandgap," *Opt. Lett.* **27**, 1785–1787 (2002).
- M. Soljacic, S. G. Johnson, S. Fan, M. Ibanescu, E. Ippen, and J. D. Joannopoulos, "Photonic-crystal slow-light enhancement of nonlinear phase sensitivity," *J. Opt. Soc. Am. B* **19**, 2052–2059 (2002).
- C. Luo, S. G. Johnson, and J. D. Joannopoulos, "All-angle negative refraction in a three-dimensionally periodic photonic crystal," *Appl. Phys. Lett.* **81**, 2352 (2002).
- S. G. Johnson, M. Ibanescu, M. Skorobogatiy, O. Weisberg, J. D. Joannopoulos, and Y. Fink, "Perturbation theory for Maxwell's equations with shifting material boundaries," *Phys. Rev. E* **65**, 066611 (2002).
- C. Luo, S. G. Johnson, J. D. Joannopoulos, and J. B. Pendry, "All-angle negative refraction without negative effective index," *Phys. Rev. B.* **65**, 201104(R) (2002).
- S. G. Johnson, M. Ibanescu, M. A. Skorobogatiy, O. Weisberg, T. Engeness, M. Soljacic, S. A. Jacobs, J. D. Joannopoulos and Y. Fink, "Low-loss asymptotically single-mode propagation in large-core OmniGuide fibers," *Opt. Express* **9** (13), 748–779 (2001).
- S. Y. Lin, E. Chow, S. G. Johnson, and J. D. Joannopoulos, "Direct measurement of the quality factor in a two-dimensional photonic-crystal microcavity," *Opt. Lett.* **26** (23), 1903–1905 (2001).
- S. G. Johnson, A. Mekis, S. Fan, and J. D. Joannopoulos, "Molding the flow of light," *Computing in Science and Engineering* **3** (6), 38–47 (2001).
- 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).
- S. G. Johnson, S. Fan, A. Mekis, and J. D. Joannopoulos, "Multipole-cancellation mechanism for high-Q cavities in the absence of a complete photonic band gap," *Appl. Phys. Lett.* **78** (22), 3388–3390 (2001).
- S. Fan, S. G. Johnson, J. D. Joannopoulos, C. Manolatou, and H. A. Haus, "Waveguide branches in photonic crystals," *J. Opt. Soc. Am. B* **18** (2), 162–165 (2001).
- S. G. Johnson and J. D. Joannopoulos, "Block-iterative frequency-domain methods for Maxwell's equations in a planewave basis," *Opt. Express* **8** (3), 173–190 (Focus Issue on Photonic Bandgap Calculations) (2001).

- E. Chow, S. Y. Lin, J. R. Wendt, S. G. Johnson, and J. D. Joannopoulos, "Quantitative analysis of bending efficiency in photonic-crystal waveguide bends at $1.55\mu\text{m}$ wavelengths," *Opt. Lett.* **26**, 286–288 (2001).
- S. Fan, S. G. Johnson, J. D. Joannopoulos, C. Manolatou, and H. A. Haus, "Waveguide branches in photonic crystals," *J. Opt. Soc. Am. B* **18** (2), 162–165 (2001).
- S. G. Johnson and J. D. Joannopoulos, "Three-dimensionally periodic dielectric layered structure with omnidirectional photonic band gap," *Appl. Phys. Lett.* **77**, 3490–3492 (2000).
- E. Chow, S. Y. Lin, S. G. Johnson, P. B. Villeneuve, J. D. Joannopoulos, J. R. Wendt, G. A. Vawter, W. Zubrzycki, H. Hou, and A. Alleman, "Three-dimensional control of light in a two-dimensional photonic crystal slab," *Nature* **407**, 983–986 (2000).
- S. G. Johnson, P. R. Villeneuve, S. Fan, and J. D. Joannopoulos, "Linear waveguides in photonic-crystal slabs," *Phys. Rev. B* **62**, 8212–8222 (2000).
- S. Y. Lin, E. Chow, S. G. Johnson, and J. D. Joannopoulos, "Demonstration of highly efficient waveguiding in a photonic crystal slab at the $1.5\text{-}\mu\text{m}$ wavelength," *Opt. Lett.* **25**, 1297–1299 (2000).
- S. G. Johnson, S. Fan, P. R. Villeneuve, J. D. Joannopoulos, and L. A. Kolodziejski, "Guided modes in photonic crystal slabs," *Phys. Rev. B* **60**, 5751–5758 (1999).
- C. Manolatou, S. G. Johnson, S. Fan, P. R. Villeneuve, H. A. Haus, and J. D. Joannopoulos, "High-Density integrated optics," *J. Lightwave Tech.* **17** (9) (1999).
- S. G. Johnson, C. Manolatou, S. Fan, P. R. Villeneuve, J. D. Joannopoulos, and H. A. Haus, "Elimination of cross talk in waveguide intersections," *Optics Letters* **23**, 1855–1857 (1998).
- P. R. Villeneuve, S. Fan, S. G. Johnson, and J. D. Joannopoulos, "Three-dimensional photon confinement in photonic crystals of low-dimensional periodicity," *IEE Proc. Optoelec.* **145**, 384 (1998).
- M. Frigo and S. G. Johnson, "FFTW: An adaptive software architecture for the FFT," *Proc. ICASSP 1998* **3**, 1381 (1998).
- W. M. Soyars and S. G. Johnson, "Simulating the Tevatron liquid Helium satellite refrigerators," *Advances in Cryogenic Engineering* **39**, 1231–1235 (1994).

Patents

- “Composite photonic crystals,” U.S. Patent #6134043.
- “Optical waveguide crossings,” U.S. Patent #6198860.
- “Electromagnetic mode conversion in photonic crystal multimode waveguides,” U.S. Patent #6563981.
- “Electromagnetic mode conversion in photonic crystal multimode waveguides,” U.S. Patent #6728439.
- “Periodic dielectric structure having a complete three-dimensional photonic band gap,” U.S. Patent #6597851.
- “Low-loss photonic crystal waveguide having large core radius,” U.S. Patent #6625364.
- “Low-loss photonic crystal waveguide having large core radius,” U.S. Patent #7072553.
- “High index-contrast fiber waveguides and applications,” U.S. Patent #6801698.
- “High index-contrast fiber waveguides and applications,” U.S. Patent #6788864.
- “High index-contrast fiber waveguides and applications,” U.S. Patent #6898359.
- “Photonic crystals: a medium exhibiting anomalous Cerenkov radiation,” U.S. Patent #6828575.
- “Shock-wave modulation and control of electromagnetic radiation,” U.S. Patent #6809856.
- “Shock-wave modulation and control of electromagnetic radiation,” U.S. Patent #7079308.
- “Mach-Zehnder interferometer using photonic band gap crystals,” U.S. Patent #6917431.
- “Polarization-independent optical networks in 3D photonic crystals,” U.S. Patent #7058242.
- “Waveguide coupling into photonic crystal waveguides,” U.S. Patent #7072547.
- “Metamaterials employing photonic crystal,” U.S. Patent #7177513.
- “Radiation-free optical cavity,” U.S. Patent #7224868.
- “Nano-electromechanical high-index contrast,” U.S. Patent #7260287.
- “Vertically and laterally confined 3D optical coupler,” U.S. Patent #7120335.
- “Dynamically tunable photonic bandgap microcavity waveguides via mechanical lattice control,” U.S. Patent #7092606.
- “A photonic crystal negative refraction medium employing a positive effective index,” pending.
- “Electromagnetic cavity with arbitrary lifetime and finite modal volume,” pending.
- “Optimal bistable switching in nonlinear photonic crystals,” pending.
- “Optical waveguide side-monitoring of photonic-crystal fibers,” pending.
- “Photonic crystal high index contrast fiber waveguides and devices based on axial modulation,” pending.
- “Photonic crystal waveguides having tailored dispersion profiles,” pending.
- “Dielectric waveguide with transverse index variation that supports a zero-group velocity mode at a non-zero longitudinal wavevector,” pending.
- “High-index contrast fiber waveguides,” pending.
- “OTDR-style monitoring of photonic crystal fibers,” pending.