

## **IEEE Distinguished Lecture**

**Title:** Photonic Band Gap Materials: Light Trapping Crystals

**Speaker:**

Professor Sajeed John  
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**Date:** Tuesday, 8 February 2011

**Time:** 10:30 am

**Venue:** Room 603, Chow Yei Ching Building

**Abstract:**

Photonic band gap (PBG) materials [1,2] are artificial periodic dielectric microstructures capable of trapping light in three-dimensions [3] on sub-wavelength scales without absorption loss. This offers new opportunities for efficient solar energy trapping and harvesting in suitably microstructured thin films [4]. It also enables virtually complete control of the flow of light on microscopic scales in a 3D optical chip [5-7] as well as very strong coupling of light to matter where desired. By further engineering the electromagnetic density of states [8-10] within the chip it is possible to realize unprecedented coherent optical control of the quantum state of resonant atoms or quantum dots [11, 12]. This defines a fundamentally new strong-coupling regime for quantum optics. It enables multiple-wavelength channel optical logic to be performed on a chip on picosecond time scales at microwatt power levels.

I discuss further consequences of light trapping in classical and quantum electrodynamics. I also discuss the challenges and requirements for materials fabrication to realize these remarkable effects.

**Biography of the speaker:**

Sajeed John is a "University Professor" at the University of Toronto and Government of Canada Research Chair. He received his Bachelors degree in physics in 1979 from

the Massachusetts Institute of Technology and his Ph.D. in physics at Harvard University in 1984. His Ph.D. work at Harvard originated the theory of classical wave localization and in particular the localization of light in three-dimensional strongly scattering dielectrics. From 1986-1989 he was an assistant professor of physics at Princeton University. While at Princeton, he co-invented (1987) the concept of photonic band gap materials, providing a systematic route to his original conception (1984) of the localization of light. In 1989 he joined the senior faculty at the University of Toronto.

Professor John is the winner of the 2001 King Faisal International Prize in Science, together with C. N. Yang. He is the first ever winner of Canada's Platinum Medal for Science and Medicine in 2002 and the Brockhouse Canada Prize for Interdisciplinary Research in 2004. He has also received the Guggenheim Fellowship (USA) and the Humboldt Senior Scientist Award of Germany. Dr. John received the IEEE Quantum Electronics Award in 2007 for "the invention and development of light-trapping crystals and elucidation of their properties and applications" and the 2008 IEEE Nanotechnology Pioneer Award. He was also awarded the C.V. Raman Chair Professorship of the Indian Academy of Sciences. He is a Fellow of the American Physical Society, the Royal Society of Canada, and the Optical Society of America.

**Organizer:** Dr. K.K.Y. Wong