SAPIENZA
UNIVERSITÀ DI ROMA

Distinguished Lecture

Nel quadro delle iniziative scientifiche dell'Italian Chapter dell'IEEE-Photonics Society e nell'ambito del corso di Fotonica della Facoltà di Ingegneria dell'Informazione, il Prof. Sajeev John del Dipartimento di Fisica dell'Università di Toronto terrà una lezione seminario dal titolo:

Photonic Band Gap Materials: Light Trapping Crystals

Il seminario, aperto a studenti e docenti interessati, avrà luogo il giorno 7 Ottobre alle ore 15 nell'auletta affrescata del chiostro della Facoltà di Ingegneria.

ABSTRACT. Photonic Band Gap (PBG) materials are artificial, periodic, dielectrics that enable engineering of the most fundamental properties of electromagnetic waves. These include the laws of refraction, diffraction, and spontaneous emission of light. Unlike traditional semiconductors that rely on the propagation of electrons through an atomic lattice, PBG materials execute their novel functions through selective trapping or "localization of light". This is a fundamentally new and largely unexplored property of Maxwell's equations. This is also of practical importance for alloptical communications, information processing, efficient lighting, and solar energy trapping. Three dimensional (3D) PBG materials offer a unique opportunity to simultaneously (i) synthesize micron-scale 3D circuits of light that do not suffer from diffractive losses and (ii) engineer the electromagnetic vacuum density of states in this 3D optical micro-chip. This combined capability opens a new frontier in integrated optics as well as the basic science of radiation-matter interactions. I review recent approaches to micro-fabrication of photonic crystals with a large 3D PBG centered near 1.5 microns. These include direct laser-writing techniques, holographic lithography, and a newly invented optical phase mask lithography technique. I discuss consequences of PBG materials in classical and quantum electrodynamics.

BIOGRAPHY. Sajeev John 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 introduced 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, where 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 the fall of 1989 he joined the senior physics faculty at the University of Toronto. Professor John is the winner of the 2001 King Faisal International Prize in Science, which he shared with C. N. Yang. He is also the first ever winner of Canada's Platinum Medal for Science and Medicine in 2002. He is the winner of the Institute of Electrical and Electronics Engineers (IEEE) LEOS International Quantum Electronics Award in 2007 for "the invention and development of light-trapping crystals and elucidation of their properties and applications" as well as the winner of the 2008 IEEE Nanotechnology Pioneer Award. He is also the first ever winner of Brockhouse Canada Prize in 2004, which he shared with materials chemist Geoff Ozin for their groundbreaking interdisciplinary work on photonic band gap materials synthesis. He has been awarded the Guggenheim Fellowship (USA) and the Humboldt Senior Scientist Award (Germany). In 2007, Dr. John was awarded the C.V. Raman Chair Professorship of the Indian Academy of Sciences. Prof. John is a Fellow of the American Physical Society, the Optical Society of America, the Royal Society of Canada, and a member of the Max-Planck Society of Germany.

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