Stevens Institute of Technology

Nanotechnology Graduate Program

Controlling light in photonic nanostructures

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We examine the control of photons in engineered photonic crystal nanostructures. First, we describe the strong control of dispersion and localization in photonic crystal structures, leading to the observations of negative refraction, zero-index superlattice band gaps, and ultrahigh-Q subwavelength nanocavities. Coherent interactions lead to our observations of an optical analog to electromagnetically-induced-transparency, and laser cooling in chip-scale cavity optomechanics. Second, we report on studies in nonlinear optics through the tight field confinement and long photon lifetimes in photonic crystal structures. Examples include slow-light enhanced four-wave mixing, soliton dynamics and femtosecond pulse compression (together with Thales), Raman scattering, and optical bistability at the femto-joule level. Third, we describe our efforts on quantum optics in nanostructures. Examples include controlling spontaneous emission through cavity quantum electrodynamics for efficient on-demand single photon sources, single quantum dot exciton-photon coupling, and theoretical proposals to realize scalable quantum phase gates for quantum information sciences.

Professor Chee Wei Wong enjoys examining nonlinear and quantum optics in nanophotonics. He joined the Columbia faculty in 2004, and is a recipient of the DARPA Young Faculty Award in 2007, the NSF CAREER Award in 2008, and the 3M Faculty Award in 2009. He received his Sc.D. at MIT in 2003 and his S.M. at MIT in 2001. From 1999 to 1996 he completed his double degree, B. Sc highest honors and B. A. highest honors, at UC Berkeley. He was a post-doctoral research associate with the MIT Microphotonics Center in 2003. He is a member of APS, ASME, IEEE, OSA and Sigma Xi.

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