Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Enhanced light-matter interactions of a single emitter coupled to a slot waveguide MAIKEN H. MIKKELSEN, NITIPAT PHOLCHAI, PAVEL KOLCHIN, NSF Nanoscale Science and Engineering Center (NSEC), 3112 Etcheverry Hall, University of California, Berkeley, CA 94720, USA, JINYONG OH, M. SAIF ISLAM, Department of Electrical and Computer Engineering, 2064 Kemper Hall, University of California, Davis, CA95616, USA, XIANG ZHANG, NSF Nanoscale Science and Engineering Center (NSEC), 3112 Etcheverry Hall, University of California, Berkeley, CA 94720, USA — Traditionally, enhanced light-matter interactions are achieved using either plasmonic structures or photonic crystals. However, these structures suffer from inherent metal losses or narrow operating bandwidth. Instead, here we use an all-dielectric waveguide structure with ultrasmall mode volume and low-loss and broadband capabilities. A slot-waveguide architecture is used for deep sub-wavelength light confinement in a low-index material surrounded by high-index barriers. Individual colloidal quantum dots are controllably coupled to this waveguide mode. A large Purcell enhancement is observed from lifetime measurements of the spontaneous emission rate of the quantum dot before and after coupling to the waveguide. Second order intensity correlation measurements verify that the observed fluorescence is indeed due to a single quantum dot. The demonstrated system is a promising broadband and low-loss platform for quantum information applications.

Maiken H. Mikkelsen
NSF Nanoscale Science and Engineering Center (NSEC),
3112 Etcheverry Hall, University of California, Berkeley, CA 94720, USA

Date submitted: 28 Nov 2011 Electronic form version 1.4