Abstract: The field of quantum nanophotonics has recently been attracting a great deal of interest. In quantum nanophotonics, fermionic degrees of freedom such as atoms or quantum dots are coupled to traditional nanophotonic systems. As the fermionic components can only absorb a finite number of photons at a time, the interplay between the fermionic and photonic degrees of freedom can fundamentally alter the transport properties of photons and their correlations.

In many conventional photonic systems, however, atom-photon interactions are too weak to realize efficient devices at ultra-low power levels. We show that through proper design, strong atom-photon interaction can be created to produce efficient devices operating down to the single-photon power level. Specific applications include efficient single-photon frequency conversion and long-term photonic storage using quantum interference. Moreover, we design and optimize cavity quantum electrodynamic geometries wherein strong photon-photon interactions can be induced which allow us to produce signals with shot noise below the classical limit, or to achieve fundamentally secret communication over large distances.

DATE: Friday April 25, 2014
TIME: 10:10 a.m.
PLACE: Green Hall, Room 0120