Single Photon Generation and Cross-Phase-Modulation with Electromagnetically Induced Transparency

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In this talk I will introduce the mechanism of single photon generation via collective spin excitations of atomic ensembles. In addition, a four-level N-type cross-phase-modulation (XPM) with electromagnetically induced transparency can reach an observable phase shift at single photon level will be discussed. XPM refers to the phase of a photon pulse (probe pulse) modulated by another pulse (signal pulse). If the phase shifts of the order of π with single-photon pulses can be achieved in the EIT-based XPM scheme. One can utilize the signal and probe pulses as the control and target qubits to realize the controlled phase gate which is the basic and essential element in the quantum computation.