

Abstract for an Invited Paper
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Towards single photon nonlinear optics with confined photons and atoms

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We will describe two novel approaches for realization of controlled, deterministic nonlinear optics at a single photon level. These approaches combine the ideas of Electromagnetically Induced Transparency and slow light with tight confinement of photons and atoms. Progress towards realization of these ideas will be discussed. Specifically, we will describe proof-of-principle experimental realization of strong coupling between individual CdSe quantum dots and surface plasmons localized on nano-sized conducting wire. In addition, progress towards realization of novel nonlinear optical medium based on ultra-cold atoms confined in a hollow photonic crystal fiber will be discussed. As an outlook we will discuss novel applications of these ideas. These include switching and transistors operating at a single photon as well as strongly interacting many-body physics with photons.