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Single-photon nonlinearity[1]

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Optical nonlinearity at the level of single photons will enable a variety of novel effects and applications, including the possibility of quantum gates between individual photons. We generate such a nonlinearity in an atomic ensemble by replacing the strong (classical) coupling field of electromagnetically induced transparency by the mode of an optical resonator. Then the resonant transmission of light through the atomic ensemble can be substantially altered even by the cavity vacuum. The vacuum induces a group delay of the optical pulse that corresponds to a group velocity of 1600 m/s. We also discuss possibilities for implementing a single-photon switch.

[1]DARPA, NSF