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Strong Coupling of Two Light Fields mediated by a Single Atom CHRISTOPH HAMSEN, TATJANA WILK, KARL NICOLAS TOLAZZI, GERHARD REMPE, Max Planck Institute of Quantum Optics — Light fields consist of photons that carry neither mass nor charge and therefore do not interact in vacuum. Even in nonlinear optical media, typical interaction strengths are negligible at the level of individual quanta. In novel quantum systems, strong interactions between individual photons of a single light field have been demonstrated based on e.g. photon or Rydberg blockade. This led to the realization of single-photon switches, transistors, and phase shifters. Here, we demonstrate how two optical fields coupled to different longitudinal modes of a cavity can be brought to interaction using a single atom. While each field by itself achieves full transmission, already a single photon in one mode suppresses the transmission of the other mode. In analogy to the cavity quantum electrodynamics situation, we refer to this as strongly-coupled light fields. The novel quantum system exhibits single-photon switching and strong correlations between different light fields.

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