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Interacting Rydberg polaritons as a single photon source.

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Long-range Rydberg interactions in combination with electromagnetically induced transparency(EIT) in cold atom ensembles provide a platform to study quantum optics and few-body physics of interacting photons, where the strength, sign, and shape of the interactions are widely controllable. Such control can be applied to both coherent and dissipative interactions, which provides the potential to generate novel few-photon states. We study experimental control of few body interactions in Rydberg interacting ensembles, demonstrate an efficient, pure and indistinguishable single-photon source, and use that source to observe two-photon quantum interference between photons generated from the atomic ensemble and a single atomic ion, located in different buildings and linked via optical fiber.