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Novel systems for single-photon generation using quantum memory PHILIP WALTHER, ALEX NEMIROSKI, Harvard University, MASON KLEIN, Harvard-Smithsonian Center for Astrophysics, DAVID PATTERSON, ALEXEY GORSHKOV, SAHAND HORMOZ, ALEXANDER ZIBROV, Harvard University, RONALD WALSWORTH, Harvard-Smithsonian Center for Astrophysics, JOHN DOYLE, Harvard-MIT Center for Ultracold Atoms, MIKHAIL LUKIN, Harvard University — The effective generation of single photons on demand is one of the most important prerequisites for scalable quantum computation and quantum communication using linear optics and measurement-induced nonlinearities. Using atomic memories and the controlled interaction of photons and atoms could allow for the realization of such single-photon sources. One promising approach is based on writing and reading single excitations in atomic ensembles using Raman processes and electromagnetically induced transparency. We report on the development of two novel experimental systems for the realization of such single-photon sources, each combining long coherence times with high efficiencies and purity. The first approach makes use of 1mm-wide paraffin-coated Rubidium cells at room temperature whose volumes are in the order of the interaction region. The second approach makes use of buffer gas cooling to create an appropriate dense medium with excellent coherence properties. Experimental realization and comparison of these two approaches will be presented.

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