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Optimal Control of Storage and Retrieval of Photon States in Atomic Ensembles ALEXEY GORSHKOV, AXEL ANDRE, Physics Department, Harvard University, Cambridge, MA, MICHAEL FLEISCHHAUER, Universitat Kaiserslautern, Kaiserslautern, Germany, ANDERS SORENSEN, Niels Bohr Institute, Copenhagen, Denmark, MIKHAIL LUKIN, Physics Department, Harvard University, Cambridge, MA — We describe an optimal control strategy for storage and retrieval of a photon wavepacket of a given shape in a radiatively broadened Λ-type atomic medium with a given optical depth (OD). The control is provided by an appropriately shaped classical laser field. We present a universal theoretical framework for analyzing various approaches to pulse storage ranging from adiabatic reduction of photon pulse group velocity and pulse propagation control via off-resonant Raman fields to photon-echo based approaches. We show that when properly optimized these three approaches yield identical efficiency. We extend our model to include Doppler broadening and, in particular, show that at high enough OD Doppler broadening is irrelevant.

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