Title:	Photonic quantum memory using an intra-atomic frequency comb
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Abstract:	Photonic quantum memory, such as an atomic frequency comb (AFC), is essential to make photonic quantum computation and long distance quantum communication scalable and feasible. In standard AFC the frequency of different atoms must be stable relative to each other which presents difficulties in realizing the quantum memory. Here we propose a quantum memory using an intra-atomic frequency comb which does not require frequency stabilization. We show that the transitions between two degenerate energy levels of a single atom can be used to construct the frequency comb. The spacing between the teeth of the comb is controlled by applying an external magnetic field. Since the frequency comb is constructed from individual atoms, these atoms can be used alone or in ensembles to realize the quantum memory. Furthermore, the ensemble based quantum memory with intra-AFC is robust against Doppler broadening which makes it useful for high-temperature quantum memory. As an example, we numerically show the intra-AFC in cesium atoms and demonstrate a photon echo which is essential for quantum memory.
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