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Storing single-photons in microcavities arrays IMRAN M. MIRZA, S.J. VAN ENK, Oregon Center for Optics and Department of Physics, University of Oregon, Eugene, Oregon 97401, USA, H.J. KIMBLE, California Institute of Technology 12-33, Pasadena, California 91125, USA — Coupling light to arrays of microcavities is one of the most promising avenues to store/delay classical light pulses [F. Krauss, Nat. Phot. 2, 448-450 (2008)]. However, from the perspective of benefiting quantum communication protocols, the same ideas in principle can be extended down to the single-photon (quantum) level as well. Particularly, for the purposes of entanglement purification and quantum repeaters a reliable storage of single photons is needed. We consider in our work [I. M. Mirza, S. Van Enk, H. Kimble JOSA B, 30,10 (2013)] cavities that are coupled through an optical fiber which is assumed to be forming a Markovian bath. For this study two powerful open quantum system techniques, Input-Output theory for cascaded quantum systems and the Quantum Trajectory approach are used in combination. For the confirmation of photon delays the Time-Dependent Spectrum of such a single photon is obtained. Interestingly this leads to a hole-burning effect showing that only certain frequency components in the single photon wavepackets are stored inside the cavities and hence are delayed in time. Since on-demand production of single photons is not an easy task we include in our description the actual generation of the single photon by assuming a single emitter in one the resonators.

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