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Single photon generation by corporative spontaneous emission of atomic ensembles HODA HOSSEIN-NEJAD, RENE STOCK, DANIEL F.V. JAMES, University of Toronto — The ability to generate single photons on demand is of key importance in a variety of quantum optical applications including quantum key distribution and quantum computation. Recent advances in ion trap technology allow complete control over all degrees of freedom of the trapped ions which in turn permits the creation of large entangled states with long coherence times. In this work, we investigate the feasibility of this technology for deterministic generation of single photons by harnessing the corporative spontaneous emission of the ions. We consider different geometric arrangements of entangled ions and aim to reduce the allowed decay modes into a narrow solid angle such that the emitted photon can be coupled to an optical fiber. For lattice spacings of the order of a wavelength or so, corporative radiative effects must be accounted for. Rather counterintuitively perhaps, superradiance tends to be undesirable since it can drastically alter the lifetime of different decay channels. The ion arrangement must therefore be optimized to ensure not only emission into a narrow solid angle but also that all the decay modes have approximately the same lifetime.

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