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Polarization control of spontaneous emission for rapid quantum state initialization[1] CHITRA RANGAN, CHRISTOPHER DILORETO, University of Windsor — The practical implementation of quantum computers places two specific requirements on the lifetime of a qubit, namely, long relevant decoherence times, and rapid state initialization times. There is a need for protocols wherein the spontaneous emission rate of a quantum system can be selectively increased so that long state lifetimes can be maintained during operation, and upon demand, selectively decreased so that the cooling time can be drastically shortened in duration when qubit purity needs to be restored. We propose an efficient method to selectively enhance the spontaneous emission rate of a quantum system by changing the polarization of an incident control field, and exploiting the polarization dependence of the system's spontaneous emission rate. This differs from the usual Purcell enhancement of spontaneous emission rates as it can be selectively turned on and off. Using a three-level Λ system in a quantum dot placed in between two silver nanoparticles and a linearly-polarized, monochromatic driving field, we present a protocol for rapid quantum state initialization; while maintaining long coherence times for control operations. This process increases the overall amount of time that a quantum system can be effectively utilized for quantum operations.

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