

Cavity enhanced rephased spontaneous emission

Matthew Sellars

Australian National University

One of the key components required for optical quantum computation and communication technologies is a high efficiency, triggerable single photon source. We are developing such a source based on the rephasing of the spontaneous emission from an ensemble of rare-earth ions in a crystal.

The protocol uses a photon echo technique to rephase the coherence generated in an ensemble of ions during a spontaneous emission event, causing the ensemble to emit a second photon identical to the initial spontaneously emitted photon. The release time of the second photon is controlled by choosing when the coherence is rephased. Critical to achieving a high fidelity source is the use of an optical cavity, impedance matched to the ensembles coherent emission.

Recent results will be presented demonstrating that the spontaneously emitted emission is entangled with the rephased emission and that this entangled quantum state can be stored on the nuclear spin states of the ions.