Quantum non-demolition detection of photons and demonstration of multi-partite entanglement in solid-state atomic ensembles

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Abstract

Interfacing atomic ensembles with single photons led to many demonstrations of quantum information processing applications. In particular, crystals doped with rare-earth ions are promising physical systems thanks to their long coherence times and the possibility for their integration for more sophisticated quantum information processing architectures. In this talk, I will present our recent theoretical proposals for quantum non-demolition detection of photons and demonstration of multi-partite entanglement in rare-earth ion doped crystals. Both of these theoretical scenarios are accompanied by experimental demonstrations in solid-state atomic ensembles.