Interfacing Superconducting Qubits and Telecom Photons via a Rare-Earth Doped Crystal

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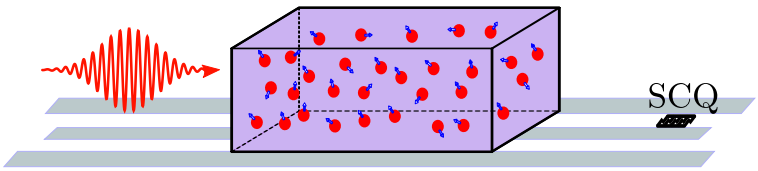

Superconducting qubits (SCQ's) are one of the most promising candidates for scalable quantum computing. However, there is one major limitation: they are essentially stationary, which makes transfer of quantum information between different nodes difficult. To resolve this problem and to enable realization of reliable quantum networks an interface between SCQ's and photons is needed. Photons are so far the only flying qubits and hence best suited for quantum information transport.
In this talk I will present a proposal for coupling optical photons to a SCQ, via a rare earth doped crystal (REDC) coupled to a microwave cavity. After a short introduction to gradient echo based quantum memories I will show how one can store single photons as a collective excitation in REDC. This excitation in turn can be mapped to a SCQ excitation via a stripline cavity. I will discuss the overall transfer efficiency and limiting factors and suggest a special protocol that optimizes the transfer.