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**Interfacing Superconducting Qubits and Telecom Photons via a Rare-Earth Doped Crystal** NIKOLAI LAUK, CHRISTOPHER O'BRIEN, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany, SUSANNE BLUM, GIOVANNA MORIGI, Department of Physics, University of Saarland, Germany, MICHAEL FLEISCHHAUER, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany — Superconducting qubits (SCQ) are promising candidates for scalable quantum computation. However, they are essentially stationary, which makes them less suitable for quantum information transport. Interfacing short telecom photons with SCQ's would enable the combination of SCQ with low loss optical fiber networks and a fast, reliable quantum network could be realized. To this end, we propose and theoretically analyze a scheme for coupling optical photons to a SCQ, using a rare earth doped crystal (REDC) coupled to the microwave cavity as an interface. The idea is first to store an optical photon by mapping it to a spin excitation in a REDC and then transfer this excitation to a SCQ via a microwave cavity. Due to intrinsic and engineered inhomogeneous broadening of the optical and spin transitions employed in REDC for the storage of short optical photon pulses, we suggest and optimize a special transfer protocol using staggered $\pi$-pulses.

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