Abstract Submitted
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Interfacing rare earth spin ensembles with superconducting circuits S. PROBST, A. TKALCEC, D. RIEGER, H. ROTZINGER, P. JUNG, Physikalisches Institut, KIT, Germany, S. WÜNSCH, M. SIEGEL, Institut für Mikro- und Nanoelektronische Systeme, KIT, Germany, A.V. USTINOV, Physikalisches Institut, KIT, Germany, P. BUSHEV, Institut für Experimentalphysik, Universität des Saarlandes,Germany — Interfacing photonic and solid-state qubits within a hybrid quantum architecture offers a promising route towards large scale distributed quantum computing. Ensembles of optically active rare earth spins embedded in a crystalline matrix are promising candidates for realizing such an interface. Among these, Er ions are distinct from other spin ensembles due to their optical transitions inside the telecom C-band at 1.54 μm [1]. We report on single photon on-chip ESR spectroscopy of Er spin ensembles strongly coupled to superconducting and non superconducting microwave resonators [2]. The maximum coupling strength was measured to be 45 MHz at 200 ppm, and the minimum linewidth was 4 MHz at 50 ppm Er concentration, respectively. The strong anisotropy of Er:YSO prevents us from reaching the strong coupling regime at low field transitions. However, with crystals of higher symmetry such as YAP, strong coupling can be reached at relatively small magnetic fields of 30 mT at 5 GHz. In addition, we measured T_2 of the spins at millikelvins of about 40 μs. The experiments demonstrate the potential of rare earth ion doped crystals for their application in quantum information processing and communication. [1] Phys. Rev. B 84, 06051 (R) (2011) [2] Phys. Rev. Lett. 110, 157001 (2013)

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