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Atoms talking to SQUIDs[1] J.E. HOFFMAN, J.A. GROVER, S. RAVETS, K.D. VOIGT, J. LEE, Z. KIM, A.K. WOOD, I. SCHOCH, J.R. ANDERSON, A.J. DRAGT, M. HAFEZI, C.J. LOBB, L.A. OROZCO, S.L. ROLSTON, J.M. TAYLOR, F.C. WELLSTOOD, Joint Quantum Institute, Department of Physics and National Institute of Standards and Technology, University of Maryland, College Park, MD 20742 — We present our advances towards a hybrid quantum system of ^{87}Rb atoms coupled to a superconducting flux qubit through the magnetic dipole transition. We plan to trap atoms in the evanescent field outside a 500 nm nanofiber. This will allow us to bring the atoms less than 5 μm above the surface of the superconductor without producing excessive heating or changing magnetic fields. As an intermediate step, we plan on coupling the atoms to a superconducting LC resonator. Current progress includes production of nanofibers with >98% transmission, and a tunable high-Q superconducting resonator. Additionally, we show how to use our system as a unified interface for microwave and optical photons, in which the atoms act both as a quantum memory and transduce excitations between the two frequency domains. Using coherent control techniques, we examine conversion and storage of quantum information between microwave photons in superconducting resonators, ensembles of ultracold atoms, and optical photons as well as a method for transferring information between two resonators.

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