Towards Coupling Neutral Atoms to a Superconducting Resonator at 20 mK$^1$ J.A. GROVER, J.E. HOFFMAN, Z. KIM, K.D. VOIGT, A.K. WOOD, J.R. ANDERSON, A.J. DRAGT, M. HAFEZI, C.J. LOBB, L.A. OROZCO, S.L. ROLSTON, J.M. TAYLOR, C.P. VLAHACOS, F.C. WELLSTOOD, Joint Quantum Institute, Dept. of Physics, UMD and NIST, College Park, MD 20742, USA, P. SOLANO, Center for Optics and Photonics, Universidad de Concepción, Casilla 160-C, Concepción, Chile — Recent proposals in quantum computing center on the creation of hybrid quantum processors. Here we report progress on an experiment to couple an ensemble of $^{87}$Rb atoms to a superconducting, thin-film LC resonator at 20 mK through a magnetic dipole transition. We have demonstrated tuning of the LC resonator to within 2 kHz of the 6.8GHz hyperfine splitting of $^{87}$Rb. The next step is to trap the atoms around a sub-wavelength optical fiber using a two-color, evanescent wave dipole trap. This will allow us to bring the atoms less than 10 $\mu$m above the surface of the superconductor without producing excessive heating. We seek to provide proof of principle for interfacing a stable quantum memory, the $^{87}$Rb atoms, to superconducting qubits.

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