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Atoms Talking with SQUIDs[1] JEFFREY GROVER, DANIEL HEMMER, JONATHAN HOFFMAN, SAURABH PAUL, ALEX DRAGT, ROBERT ANDERSON, JACOB TAYLOR, CHRIS LOBB, STEVEN ROLSTON, FRED WELLSTOOD, LUIS OROZCO — Recent proposals in quantum computing have centered on the creation of hybrid quantum processors [1]. Here we present a scheme to inductively couple a cloud of ^{87}Rb atoms to a superconducting flux qubit. Conveniently, the flux qubit can be tuned to have the same energy level separation as the 6.8GHz hyperfine splitting in ^{87}Rb. We will trap the atoms around a sub-wavelength optical fiber using a two-color, evanescent wave dipole trap [2]. This will allow us to bring the atoms less than 10μm above the superconductor's surface without producing excessive heating or changing magnetic fields. In addition to interfacing a stable quantum memory (^{87}Rb atoms) with a fast, scalable quantum processor (flux qubit), this setup lends itself to probing sources of decoherence in superconducting qubits.

[1] M. Wallquist *et al.*, Phys. Scr. T137, 014001 (2009).
[2] F. L. Kien *et al.*, Phys. Rev. A 70, 063403 (2004).

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