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Magnetic-field-mediated hybridization of ultracold atoms and a nanostring ANDREI TRETIAKOV, ERHAN SAGLAMYUREK, LINDSAY LEBLANC, University of Alberta — Through nanofabrication, mechanical elements can be engineered with vibration frequencies near the hyperfine and Zeeman resonances in an atomic system. By including magnetic elements as part of this mechanical object, we can couple the vibrational modes of the oscillator to the spin states of the atoms. The nanostring design offers new options for creating magnetic fields using dc and ac currents. Here, we consider and compare different ways to provide magnetic coupling between this mechanical motion and the spin states of an ultracold ^{87}Rb gas, and discuss methods of manipulating the quantum state of a mechanical oscillator using cold atoms, such as mechanical cooling. Finally, we discuss our progress towards the experimental realization of this system, including a system for optically transferring at cold ^{87}Rb gas from a remote 3D MOT, and constructing a versatile load-lock type UHV system for rapidly prototyping new devices.

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