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Coupling cold atoms with mechanical oscillators CRIS MONTOYA, JOSE VALENCIA, ANDREW GERACI, University of Nevada, Reno, MATTHEW EARDLEY, JOHN KITCHING, National Institute of Standard and Technology —
Macroscopic systems, coupled to quantum systems with well understood coherence properties, can enable the study of the boundary between quantum microscopic phenomena and macroscopic systems. Ultra-cold atoms can be probed and manipulated with micro-mechanical resonators that provide single-spin sensitivity and sub-micron spatial resolution, facilitating studies of decoherence and quantum control. In the future, hybrid quantum systems consisting of cold atoms interfaced with mechanical devices may have applications in quantum information science. We describe our experiment to couple laser-cooled Rb atoms to a magnetic cantilever tip. This cantilever is precisely defined on the surface of a chip with lithography and the atoms are trapped at micron-scale distances from this chip. To match cantilever mechanical resonances, atomic magnetic resonances are tuned with a magnetic field.

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