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Probing the motion of a mechanical resonator via coherent coupling to a single spin qubit[1] SHIMON KOLKOWITZ, QUIRIN UNTERREITHMEIER, Department of Physics, Harvard University, ANIA BLESZYNSKI JAYICH, Department of Physics, UC Santa Barbara, STEVEN BENNETT, Department of Physics, Harvard University, PETER RABL, Austrian Academy of Science, Innsbruck, Austria, J.G.E. HARRIS, Departments of Physics and Applied Physics, Yale University, MIKHAIL LUKIN, Department of Physics, Harvard University — Mechanical systems can be influenced by a wide variety of extremely small forces, ranging from gravitational to optical, electrical, and magnetic. When mechanical resonators are scaled down to nanometer-scale dimensions, these forces can be harnessed to enable coupling to individual quantum systems. In this talk we will present results showing that the coherent evolution of a single electronic spin associated with a Nitrogen Vacancy (NV) center in diamond can be coupled to the motion of a magnetized mechanical resonator. Specifically we use coherent manipulation of the spin to sense the driven and Brownian motion of the resonator under ambient conditions at a picometer length scale. We will discuss potential applications of this technique including the decetion of the zero-point fluctuations of a mechanical resonator, the realization of strong spin-phonon coupling at a single quantum level, and the implementation of quantum spin transducers.

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[X] Prefer Oral Session
[ ] Prefer Poster Session

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