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**Coupling phonons and spins in diamond** STEVEN BENNETT, SHIMON KOLKOWITZ, QUIRIN UNTERREITHMEIER, Harvard University, PETER RABL, IQOQI-University of Innsbruck, ANIA BLESZYNSKI-JAYICH, University of California, Santa Barbara, JACK HARRIS, Yale University, MIKHAIL LUKIN, Harvard University — We present theoretical considerations for coupling quantized mechanical motion to the electronic spin of a nitrogen-vacancy (NV) defect center in diamond. In a recent experiment, a single NV spin was used to detect both driven and thermal motion of a magnetic force microscope cantilever at room temperature, reading out the spin state optically. This demonstration raises interesting theoretical questions, such as the feasibility of reaching the strong coupling regime and of measuring the quantum zero-point motion of the cantilever using the NV spin as a detector. We discuss these possibilities for the magnetically coupled system, as well as alternative spin-phonon coupling mechanisms in diamond with prospects for improved magnetometry and mechanical cavity QED.

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