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Strain coupling of a mechanical resonator to a single quantum emitter in diamond[1] KENNETH LEE, DONGHUN LEE, PREETI OVARTCHAIYAPONG, ANIA JAYICH, University of California Santa Barbara — Hybrid quantum devices are central to the advancement of several emerging quantum technologies, including quantum information science and quantum-assisted sensing. Here, we present a hybrid quantum device in which strain fields associated with resonant vibrations of a diamond cantilever dynamically modulate the energy and polarization dependence of the optical transitions of a single nitrogen-vacancy defect center in diamond. With mechanical driving, we observe optomechanical couplings exceeding 10 GHz. Through resonant excitation spectroscopy, we quantitatively characterize the intrinsic strain environment of a single defect, and use this optomechanical coupling to tune the zero-phonon line of the defect. Through stroboscopic measurements, we show that we are able to match the frequency and polarization dependence of the optical zero-phonon lines of two separate NV centers. The experiments demonstrated here mark an important step toward realizing a monolithic hybrid quantum device capable of realizing and probing the dynamics of non-classical states of mechanical resonators, spin-systems, and photons.

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