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Quantum transduction with mechanical oscillators[1]

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In modern information technology, micromechanical oscillators are ubiquitous signal processing elements. Because the speed of sound is so slow compared to the speed of light, mechanical structures create superb compact filters and clocks. Moreover they convert force and acceleration signals into more easily processed electrical signals. Although these humble devices appear manifestly classical, they can exhibit quantum behavior when their vibrations are strongly coupled to optical light or to microwave electricity. I will describe our progress in using this recent result to develop quantum information processing elements. First, we are developing a device that uses a mechanical oscillator to transfer information noiselessly between electrical and optical domains. Second, we prepare propagating microwave fields in superpositions of 0 and 1 photon, and use an electromechanical device to store and amplify these fragile quantum bits.

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