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Optically-Defined Micromechanical Sensors

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In the field of optomechanics we have learned to use the forces exerted by laser light to gain a new level of control over a wide variety of mechanical systems, from kilogram-scale mirrors in gravitational wave detectors to nanomechanical elements in cryogenic environments. In this talk I will discuss how a very modest source of laser light (i.e. a few milliwatts) in an optical resonator can completely redefine the properties of an embedded micromechanical sensor. Since the behavior of photons in a cavity is fundamentally different from that of atoms in a flexible material, such systems should circumvent the limitations of the best existing materials and achieve an unprecedented level of force sensitivity. In the ultimate limit, we hope to essentially create ultrasensitive "microphones" capable of detecting (among other things) the quantum "hiss" of radiation pressure or the delicate superposition forces from a variety of qubits.

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