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Optomechanical accelerometers and gravity gradiometers

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Compact optical cavities can be combined with highly stable mechanical oscillators to yield accelerometers and gravity gradiometers of exquisite sensitivity, which are also traceable to the SI.

We have incorporated Fabry-Pérot fiber-optic micro-cavities onto low-loss monolithic fused-silica mechanical oscillators for gradiometry, acceleration, and force sensing. These devices consist solely of a glass oscillator and fiber optics to inject and read out the coherent optical signal, making them very simple and compatible with space applications.

We have demonstrated displacement sensitivities better than 200 am/$\sqrt{}$Hz with these fiber-optic micro-sensors. This translates into broadband acceleration noise floors below 100 nano-g/$\sqrt{}$Hz over a 10kHz, when combined with compact high frequency mechanical oscillators. Similarly, we have developed monolithic oscillators with resonance frequencies near and below 10 Hz, yielding measurement sensitivities better than 10^{-9} m/s^2.

We will introduce our sensor concepts and present results on our fiber-optic displacement sensors and novel optomechanical devices.