Abstract Submitted
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Scanning optical homodyne detection of high-frequency picoscale resonances in cantilever and tuning fork sensors[1] J. C. RANDEL, G. ZELTZER, Stanford University, A. K. GUPTA, R. BASHIR, Purdue University, S.-H. SONG, H. C. MANOHARAN, Stanford University — Hybrid high-frequency sensors represent the next generation of scanned probe technology. In this work, higher harmonic modes in nanoscale silicon cantilevers and microscale quartz tuning forks are detected and characterized using a custom scanning optical homodyne interferometer. Capable of both mass and force sensing, these resonators exhibit high-frequency harmonic motion content with picometer-scale amplitudes detected in a 2.5 MHz bandwidth, driven by ambient thermal radiation. Quartz tuning forks additionally display both in-plane and out-of-plane harmonics. The first six electronically detected resonances are matched to optically detected and mapped fork eigenmodes. Mass sensing experiments utilizing higher tuning fork modes indicate greater than six times sensitivity enhancement over fundamental mode operation. (This work supported by NSF and ONR).

[1]G. Zeltzer et. al., *Appl. Phys. Lett.* **91**, 173124 (2007).

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