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Radio Frequency Scanning Tunneling Microscopy: Instrumentation and Applications UTKU KEMIKTARAK, Dept. of Physics, Boston University, Boston, MA 02215, TCHEFOR NDUKUM, KEITH C. SCHWAB, Dept. of Physics, Cornell University, Ithaca, NY 14853, KAMIL L. EKINCI, Dept. of Aerospace and Mechanical Eng., Boston University, Boston, MA 02215 — A severe limitation of the scanning tunneling microscope (STM) is its low temporal resolution, originating from the diminished high-frequency response of the tunnel current readout circuitry. In order to overcome this limitation, we have built a radio-frequency STM (RF-STM). Using this instrument, we can attain electronic bandwidths as high as 10 MHz by measuring the reflection from or transmission through the tunnel junction, which is embedded in a resonant inductor-capacitor (LC) circuit. This ∼100-fold bandwidth improvement upon the state-of-the-art translates into fast surface topography as well as delicate measurements in mesoscopic electronics and mechanics. Broadband noise measurements across the tunnel junction using this radio-frequency-STM (RF-STM) have allowed us to perform nanoscale thermometry. Furthermore, we have detected high-frequency mechanical motion with a sensitivity approaching 15 fmHz$^{-1/2}$.

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