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A Tunable Carbon Nanotube Oscillator

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Nanoelectromechanical systems (NEMS) hold promise for a number of scientific and technological applications. Carbon nanotubes (NT) are perhaps the ultimate material for realizing a NEMS device as they are the stiffest material known, have low density, ultrasmall cross sections and can be defect-free. Equally important, a nanotube can act as a transistor and thus is able to sense its own motion. Here, we report the electrical actuation and detection of the guitar-string oscillation modes of doubly-clamped NT oscillators. We observed resonance frequencies in the 5MHz to 150MHz range with quality factors in the 50 to 100 range. We showed that the resonance frequencies can be widely tuned by a gate voltage. We also report on the temperature dependence of the quality factor and present a discussion of possible loss mechanisms.

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