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Real-time Measurement of Mechanical Fluctuations in Carbon Nanotube Resonators IOANNIS TSIOUTSIOS, ALEXANDROS TAVERNARAKIS, JOHANN OSMOND, ICFO, Institut de Cincies Fotniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain, PIERRE VERLOT[1], Universit Claude Bernard Lyon 1, UCBL, Domaine Scientifique de La Doua, 69622 Villeurbanne, France, ADRIAN BACHTOLD, ICFO, Institut de Cincies Fotniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain — Carbon nanotube resonators have been recently shown to hold an exceptional sensing potential, relying on their extremely low mass. As a consequence, they are also expected to transduce the fundamental thermal force into very large motion fluctuations. Recently, an increasing number of theoretical proposals have suggested that this property may strongly affect the vibrational behaviour of carbon nanotube resonators, which has so far remained unobserved. Here we report the first, real-time detection of the thermally-induced vibrations in carbon nanotube resonators with masses in the 10 *ag* range. We show that coupling singly-clamped carbon nanotubes to a focused electron beam enables the full access to their mechanical trajectories. Our detailed analysis demonstrates that our devices behave as linear harmonic oscillators undergoing thermally-driven Brownian motion. Our result establish the viability of carbon nanotube resonator technology at room temperature and paves the way towards the observing novel thermodynamics regimes in nanomechanics.

[1]ICFO, Institut de Cincies Fotniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain

Ioannis Tsioutsios
ICFO, Institut de Cincies Fotniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain

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