

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

Mercredi 29 juin 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Strong coupling of single-electron tunneling to nanomechanical motion

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I will present our results studying a high-quality mechanical resonator made from a suspended carbon nanotube driven into motion by applying a periodic radio frequency potential using a nearby antenna. The suspended nanotube acts as a mechanical beam that vibrates in the range of 300 MHz, and the motion is self-detected by a quantum dot embedded in the suspended segment. A high mechanical quality factor exceeding 10^5 allows the detection of a shift in resonance frequency caused by the addition of a single-electron charge on the nanotube. Single-electron charge fluctuations are found to induce periodic modulations of the mechanical resonance frequency. These single-electron “tuning” oscillations are a mechanical effect that is a direct consequence of single-electron tunneling oscillations. Additional evidence for the strong coupling of mechanical motion and electron tunneling is provided by an energy transfer to the electrons causing mechanical damping, and unusual nonlinear behavior induced by the single electron force. In the absence of external RF driving, we discover that a direct current through the nanotube spontaneously drives the mechanical resonator, exerting a force that is coherent with the high-frequency resonant mechanical motion.

A coffee break will be served at 11h00. The seminar will be given in English.