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Nanotube and Graphene ElectroMechanics

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Carbon nanotubes and graphene have attracted a lot of attentions as high-frequency mechanical resonators. For instance, nanotube resonator devices hold promise for ultralow mass detection or quantum electromechanical experiments. However, the detection of the mechanical vibrations remains very challenging. In this talk, I will present a novel detection method of the vibrations of nanotubes and graphene, which is based on atomic force microscopy. This method enables the detection of the resonances up to 3.1 GHz with subnanometer resolution in vibration amplitude. Importantly, it allows the imaging of the mode-shape for the first eigenmodes. I will also report on a new artificial nanofabricated motor in which one short nanotube moves relative to another coaxial nanotube. The motion is shown to be controlled by how the atoms are arranged within the two nanotubes. The motion is actuated by imposing a thermal gradient along the device, allowing for sub-nanometer displacements. This is, to our knowledge, the first experimental demonstration of displacive actuation at the nanoscale by means of a thermal gradient.