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Probing the local density of states in carbon nanotubes with electrostatic forces JINSEONG HEO, MARC BOCKRATH, California Institute of Technology — We discuss a simple yet powerful technique based on electrostatic force microscopy (EFM) that can probe the compressibility of the electron gas in single-walled carbon nanotubes. By varying the tip voltage, we are able to populate additional one-dimensional (1D) subbands. The resulting variation in the compressibility of the electron gas modulates the tip-sample capacitance and enables the van Hove singularities in the density of states to be resolved. This demonstrates the effects of quantum confinement on a nanotube's capacitance, which may have important implications for the high-frequency operation of nanotube devices. We have exploited this capability to measure the local band gap of an intratube quantum-well structure, created by the application of a non-uniform uniaxial strain. From the local band gap versus the local strain, we infer the nanotube chiral angle by comparison to theoretical models. The technique is applicable to other materials and should find wide applicability in investigating the properties of nano-scaled systems.

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