Freie Universität Berlin

Colloquium
Dahlem Center for Complex Quantum Systems

Carbon nanotube resonators coupled to charge and flux

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Time: Thursday, November 22nd, 2012, 14:00 c.t.

Location: Hörsaal A (1.3.14)

Abstract:

We study the motion of carbon nanotube resonators coupled to single electron charges, and to magnetic flux. Using a single electron transistor embedded in the nanotube to read out the motion of the high quality factor resonator (Q ~ 150,000), we observe the static force exerted on the nanotube by a single electron, and frequency dips from a “single-electron spring”. Using a suspended carbon nanotube SQUID, we couple magnetic flux to the nanotube motion. We find a record-high critical current of 24 nA and supercurrents that persist to magnetic fields greater than 3 T. The magnetic flux in the SQUID is tuned by a DC gate voltage, allowing us to couple to displacements of the nanotube with a strength of 0.4 m\Phi_0/pm. Incorporating these new nanomechanical SQUIDs into superconducting resonator and qubit circuits will enable the readout and control of nanotube mechanical motion a the single phonon level.