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Quantum Dephasing and Decoherence in Carbon Nanotubes : Role of Electron-Phonon coupling

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In this talk, the role of electron-phonon coupling on quantum transport is addressed in clean and disordered carbon nanotubes. Defects and impurities are modelled by static disorder, whereas dynamic disorder is driven by the time-dependent vibrations of carbon atoms, that impact on the electronic overlap matrix coupling. On the basis of the Kubo framework in the coherent regime, the conductance scaling properties in the weak localization regime are explored, and from the incorporation of the superimposed effect of acoustic phonon modes phonon, the energy-dependent coherence length and coherence times will be derived, following a phenomenological perspective. Additionally, the strong disturbance of the electronic structure due to optic modes is analyzed, and shown to strongly alter the conductance scaling behaviour of both metallic and semiconducting otherwise clean nanotubes. Consequences for the high-bias regime of nanotubes-based field effect transistors and limitations of semi-classical focus will be discussed.