ELECTRON-PHONON INTERACTION IN CARBON-NANOTUBES: A FULL MANY-BODY TREATMENT

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The effect of scattering by phonons in the electronic transport through carbon nanotubes has been a very active area of research during the last years. At high bias (when the electrons gain enough energy to emit either optical or zone boundary phonons) the experimental evidence [1-3] signals e-ph coupling as the source of current saturation. This limits their exceptional properties as ballistic conductors observed at low bias. Therefore, it is of utmost importance to include the e-ph interaction in the modeling and simulation of nanotubes based devices.

While there have been many theoretical studies aimed to tackle this problem [4-10], a clear and complete picture has not yet emerged and many fascinating new directions open up in this rapidly evolving field. The theoretical approaches used to tackle this problem include: the use of the Boltzmann transport equation [6-7], the Fermi Golden Rule [8], a diagonal self-consistent Born approximation [5] and the Kubo method [9-10]. Here, we present a full many-body treatment of electronic transport through carbon nanotubes in the presence of electron-phonon interaction with optical phonons [11]. This allows us to unveil novel quantum effects [11] which are beyond the regime of applicability of the Fermi Golden Rule.

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