Study of non-linear dynamics of a nanomechanical resonator with single-electron tunnelling

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Devices that present non-linear behaviour are of much interest for their broad applications ranging from thermodynamics, chaos to metrology. A promising platform is a suspended Carbon Nanotube (CNT) containing an electrostatically defined quantum dot. The electronic transport couples to the mechanical degrees of freedom of the CNT. When the coupling is in the ultrastrong regime, the CNT experiences a pronounced back-action that leads to non-linear dynamics [1,2]. When the CNT is driven weakly, this nonlinearity is presented as a softening of the resonance frequency of the CNT. However, when the CNT is subjected to a strong driving, intrinsic non-linearities of the mechanics take over. The main feature is the emergence of arch-like resonances in the electronic transport [3].

In this talk, we describe our physical model that captures the combined interplay between the intrinsic non-linearities of the mechanics (modeled as a Duffing oscillator) and the electromechanical coupling under different driving regimes [4]. Finally, we show that our model is in good agreement with our experimental electron transport measurements.

References

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