Quantum simulator based on electromechanically coupled carbon nanotube

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Mechanical resonators are systems with high-quality factors and can easily couple to a wide range of forces rendering them excellent candidates for sensing. They are also increasingly promising candidates for quantum information technology. In particular, capacitively coupled, suspended carbon-nanotubes (CNTs) can enable new research-avenue due to their unparalleled electromechanical coupled strength [1] . Quantum dots (QD) have been defined in nanotubes to read out and control the mechanical motion electrically [2]. One of the main difficulties in quantum dots defined in a carbon nanotube is to measure the system's dynamics when the electrons are bounded in the quantum dot, where common techniques based on conductance measurements are not applicable. This state is however interesting for the realization of electro-mechanical qubits , ultraprecise sensors, and quantum simulators [3-4]. The target is to employ CNT-based sensing dots to carry out real-time measurements of a carbon nanotube electromechanical system hosting a double quantum dot at a timescale faster than the mechanical period. This can enable exploration of interesting phenomena, especially in the context of quantum simulator

Figures

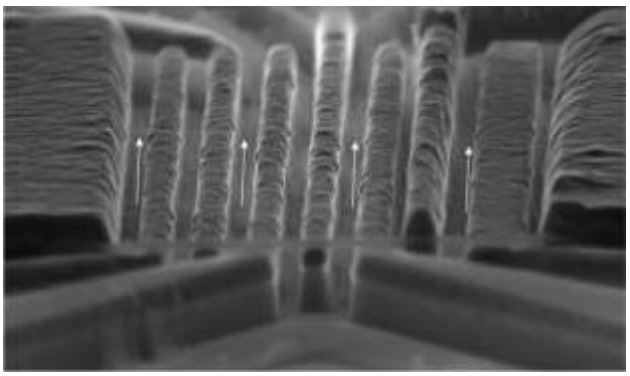

Figure 1: SEM imagine of a suspended CNT(indicated by white arrow). The CNT is suspended over 5 electrodes used to define QD.
An extra electrode has been added to define a 3th QD used as charge sensor

References

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[2] B. Lassagne et al., Science, 5944 (2009) 1170-1110
[3] F.Pistolesi et al., Phys. Rev X, 3 (2021) 031027
[4] U. Bhattacharya et al., Nano Lett. 21 (2021) 9661-9667