Spin detection using a nanotube mechanical resonator

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Micro-scale mechanical resonators are highly sensitive force sensors, enabling the detection of very small ensembles of nuclear spins [1]. Recently, we showed that mechanical resonators made of suspended carbon nanotubes display outstanding properties, such as quality factors up to 5 million, and force noise as low as 10^{-21} N $Hz^{-1/2}$ [2]. We propose to use this excellent sensitivity capability to detect and manipulate the nuclear spins of the ^{13}C atoms naturally present in the carbon nanotube. For this, we use the specific nuclear magnetic resonance protocol developed by Nichol et al. [3] and a metallic nanowire patterned very close to the nanotube to generate both the oscillating magnetic field and the magnetic field gradient, which are needed to manipulate the nuclear spins of the nanotube, and to detect them.

References

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