Advances in SQUID-detected magnetic resonance force microscopy

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Stellingen

Behorend bij het proefschrift

"ADVANCES IN SQUID-DETECTED MAGNETIC RESONANCE FORCE MICROSCOPY"

I. With the appropriate adjustments and samples, frequency-shift based measurements of the Boltzmann polarization can reach a spatial resolution better than 10 nm.

Chapter IV of this thesis

II. High magnetic-field gradients can be used to enhance the performance of various nano-devices currently limited by interactions with impurity spins.

Chapter V of this thesis

III. The direct flux crosstalk between the readout of the cantilever and the source of the radio-frequency (RF) magnetic field is no longer a limiting factor in SQUID*-detected magnetic resonance force microscopy (MRFM).

Chapter VI of this thesis

IV. Generating RF magnetic fields with sufficiently low dissipation, but strong enough for sophisticated MRFM protocols, is at present the biggest challenge for high-resolution MRFM at milliKelvin temperatures.

Chapter VII of this thesis

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* Superconducting QUantum Interference Device

V. The common approach of optimizing the force sensitivity in MRFM by minimizing the effective mass of the resonator neglects the necessity to make MRFM more widely applicable, which requires the magnet on tip geometry.

S.L. de Bonis et al., Nano Lett. ***18****, 5324-5328 (2018).*

VI. The suggestion by Wagenaar *et al*. to generate the required RF magnetic fields by using higher order vibrational modes of the cantilever, neglects the complications of the use of these modes.

J.J.T. Wagenaar et al., Phys. Rev. Appl. 7, 024019 (2017).

VII. Membrane resonators show great potential as sensors for the mechanical detection of magnetic resonance.

N. Scozzaro et al., J. Magn. Reson. ***271****, 15-20 (2016).*
R.A. Norte et al., Phys. Rev. Lett. ***116****, 147202 (2016).*

VIII. Despite the impressive single-spin sensitivity demonstrated by NV-centers and ESR-STM, both techniques are of limited use for the imaging of biological samples because of their inherent "near-sightedness".

A. Sushkov et al., Phys. Rev. Lett. ***113****, 197601 (2014).*
K. Yang et al., Nat. Nanotechnol. ***13****, 1120-1125 (2018).*

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