Abstract Submitted
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Detection of cantilever thermal motion and feedback cooling using a quantum point contact MICHELE MONTINARO, University of Basel, Switzerland, SARAH HELLMÜLLER, KLAUS ENSSLIN, ETH Zuerich, Switzerland, MARTINO POGGIO, University of Basel, Switzerland — Nanomechanical oscillators enable ultrasensitive detection of force, mass and displacement. In particular, recent measurements of oscillator displacement have achieved an imprecision below that at the standard quantum limit (SQL), using optical [1] or microwave techniques [2]. A quantum point contact (QPC) has been employed as a transducer of nanomechanical motion, thanks to the sensitive dependence of its conductance on electrostatic fields. Such an approach has been demonstrated in combination with an off-board micromechanical cantilever in a versatile design compatible with nanoscale oscillators and, in principle, with a variety of force-sensing applications, including magnetic resonance force microscopy [3]. The aim of the research we present here is to improve this technique and to approach the SQL by accessing a regime in which, due to the one-dimensional electron transport, quantum mechanical back-action effects emerge on the mechanical resonator. We demonstrate the use of different types of QPCs as sensitive detectors of the low-temperature thermal motion of an off-board cantilever and their ability to cool the cantilever oscillation mode through feedback.

[1] Phys. Rev. A 82, 061804 (2010)
[2] Nat. Nano. 4, 820 (2009)
[3] Nat. Phys. 4, 635 (2008)

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