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Cooling a nanomechanical resonator using spin-dependent transport and noise interference in Andreev reflections PASCAL STADLER, WOLFGANG BELZIG, GIANLUCA RASTELLI, University of Constance — Nanoelectromechanical systems promise to manipulate mechanical motion in the quantum regime using electron transport. For such a goal, a necessary condition is the ability of cooling the resonator into or near to its quantum ground state. A still open challenge in this field is the achievement of active cooling using purely electron transport in, for instance, suspended carbon nanotube quantum dots. We consider the quantum transport in a carbon nanotube quantum dot suspended between two electric nanocontacts. Due to the interaction between electrons and flexural mechanical modes, the electron transport results in inelastic vibration-assisted tunneling processes. These give rise to a mechanical damping and to a steady nonequilibrium phonon occupation of the resonator. We discuss these effects for two different coherent transport regimes: (i) spin-polarized current between two ferromagnets [1,2] and (ii) subgap Andreev current between a superconductor and normal metal [3].
[1] P. Stadler, W. Belzig, and G. Rastelli, Phys. Rev. Lett. 113, 047201 (2014)
[2] P. Stadler, W. Belzig, and G. Rastelli, Phys. Rev. B 91, 085432 (2015)
[3] P. Stadler, W. Belzig, and G. Rastelli, arXiv:1511.04858 (submitted)

Pascal Stadler
University of Constance

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