Quantum Effects in a Vibrating RF-SQUID

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The quest for quantum effects in nanomechanical devices has motivated an intense research effort in recent years. Experimental demonstration of such effects may provide an important insight into the problem of quantum to classical transition [1]. We study experimentally a novel configuration, in which a nanomechanical beam is integrated into the loop of a radio frequency superconducting interference device (RF-SQUID) [2]. Coupling such a device with an electromagnetic (EM) resonator and employing the technique of sideband cooling allow reducing the effective temperature of mechanical vibrations well below the equilibrium value [3]. The strong nonlinear coupling between the vibrating beam and the EM resonator can be exploited for performing a quantum nondemolition measurement of discrete Fock states of the nanomechanical resonator [4]. Moreover, we discuss the prospects of experimental observation of quantum superposition states of the nanomechanical beam in such a configuration [5].

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