Nonlinear Quantum Relaxation and Generation of Non-classical States in Duffing Oscillators

AURORA VOJE, ALEXANDER CROY, ANDREAS ISACSSON, Chalmers University of Technology — The dissipative quantum dynamics of an anharmonic oscillator is theoretically investigated in the context of carbon-based nano-mechanical systems. In the short-time limit, it is known that macroscopic superposition states appear for such oscillators. Linear and non-linear dissipation leads to decoherence of such non-classical states in the long-time limit. However, as a result of two-vibron losses at zero temperature, the quantum oscillator eventually evolves into a non-classical stationary state — a qubit-like state. The relaxation of the qubit due to thermal excitations and one-vibron losses is numerically and analytically studied. The possibility of verifying the occurrence of the qubit is discussed and signatures of the non-classicality arising in a ring-down setup are presented. Additionally, the generation of entanglement between two coupled oscillators in presence of strong two-vibron losses is discussed.