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Renormalization of the dephasing by zero point fluctuations

SWARNALI BANDOPADHYAY, Physics Department, Norwegian University of Science and Technology, NO-7491, Trondheim, Norway, DORON COHEN, Department of Physics, Ben-Gurion University, Beer-Sheva 84105, Israel — One of the most fundamental properties of an quantum particle is to maintain its phase-coherence. When an quantum particle is coupled to a fluctuating environment its wave-function gets phase-randomised. During the last decade a controversy has emerged in the mesoscopic literature regarding the role of zero-point-fuctuations (ZPF) in low temperature dephasing. We propose an exactly solvable model for dephasing due to short range scattering with environmental modes in dephasing at low temperature. Unlike the Caldeira-Leggett model where the interaction is with an homogeneous fluctuating field of force, here we consider the environment consisting of infinitely many localized fluctuating modes with (say) Ohmic spectral function and the interaction is local as in “s-scattering”. We find that in low temperature ZPF can enhance the inelastic cross-section. Our study shows [Phys. Rev. B **77**, 155438 (2008)] we need finite temperature to see the effect. Thus indirectly ZPF might contribute to the dephasing at low temperature.

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