EQUILIBRIUM PROPERTIES OF QUANTUM DISSIPATIVE SYSTEMS

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In Statistical Mechanics is usually assumed that the physical system is macroscopic, that is, the energy differences between the states (Δ) are smaller than any fluctuation in the system (ξ) [1]. Reducing the number of atoms Δ and ξ can become comparable. Then, the system-bath interaction sets the dynamical and equilibrium properties. In particular, the equilibrium magnitudes do not depend only on the temperature and the system Hamiltonian but also on the specific form of the interaction. Many of these systems (*e.g.* Josephson Junctions, magnetic molecular clusters, ...) can be effectively described by a small number of degrees of freedom (phase accross the junction, net spin, ...) interacting with a large number of harmonic oscillators (bath) [2].
For these systems, and considering the system-bath interaction weak, we present a perturbative scheme that allows to calculate the thermodynamical magnitudes. Besides we recover known results for the exactly solvable models of the damped harmonic oscillator and the two state system [2,3]. Finally we apply our formalism to magnetic systems described by effective spin Hamiltonians.

[1] H.B. Callen, *Thermodynamics and an Introduction to Thermostatistics* (John Wiley & Sons, 1985) .

[2] U. Weiss *Quantum Dissipative Systems* (World Scientific, Singapore, 1993).

[3] P. Hänggi and G-L Ingold `quant-ph/0601056` and references therein.