Quantum Mechanics of Open Systems: A Statistical Quasi-Particle Approach

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Abstract:
In this talk, I will present the dissipaton-equation-of-motion (DEOM) [1], a fundamental and statistical quasiparticle theory in quantum mechanics (including quantum thermodynamics) of open systems. Not only it recovers the hierarchical equations of motion formation [2,3], the new theory also identifies the auxiliary density operators to the quasi-particles dynamics of hybridizing bath [1]. The DEOM theory unifies the treatments on three distinct classes of environments, electron bath, phonon bath, and exciton (two-level spin) bath. It provides an accurate and versatile means in characterizing strongly correlated system and hybridization bath dynamics. Induced bath dynamics could be reflected directly in experimentally measurable quantities, such as Fano resonances and quantum transport current noise spectrum. Some benchmark evaluations on strongly correlated systems will be presented [4-6]. Recent advancements include further a comprehensive theory of quantum dissipation in a class of non-Gaussian coupling environment [7] and also thermodynamics of open quantum systems.

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