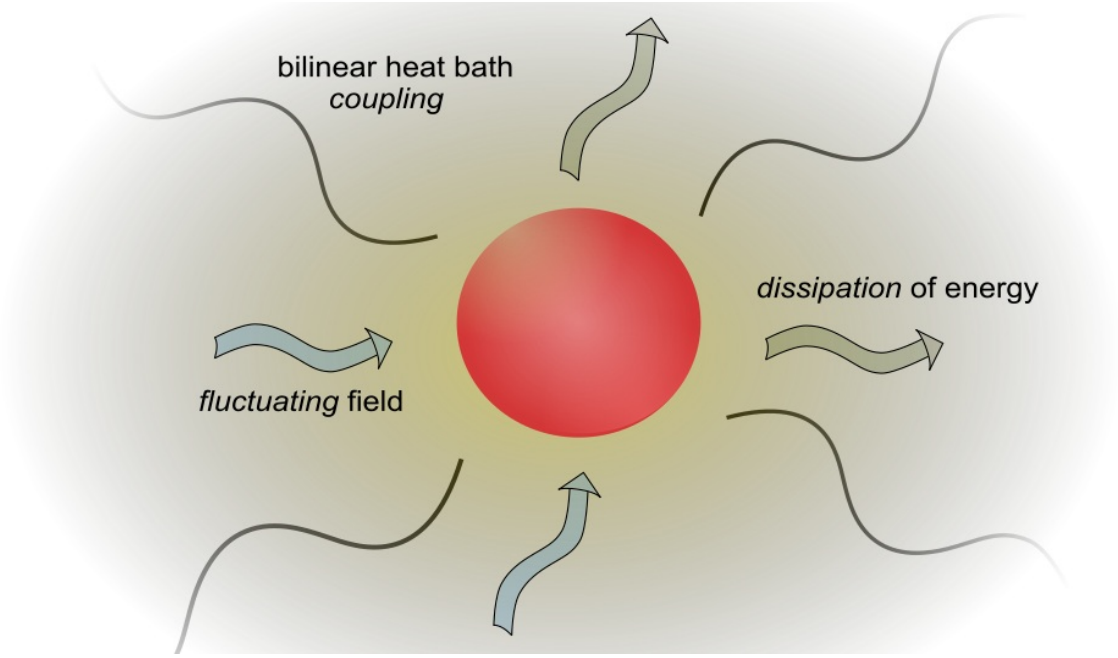
## Dissipative Quantum Dynamics: Mathematical concepts and simulation techniques

*Seminar conducted by J. Stockburger and M. Xu*




Quantum mechanics as taught in the general curriculum is restricted to conservative or classically driven systems. The exchange of energy and information with external degrees of freedom is, however, often a crucial factor if not a game changer.

Dissipative modifications of quantum dynamics can be either subtle or drastic (dissipative phase transitions). They can enhance functional aspects of quantum-related functionality, e.g., in exciton transfer as a step of photosynthesis, or detrimental to function, e.g., as decoherence in quantum computers. Theoretical studies in quantum thermodynamics and transport physics are further applications.

In the case of strong coupling *or* time-varying Hamiltonian, the standard Master equation approach is insufficient. The present seminar provides a comprehensive overview of modern, exact alternatives and their foundational concepts.

**A preliminary selection of presentation topics**

1. Perturbative methods: Master equations
2. Noisy quantum evolution and generating functionals
3. Influence functionals in quantum mechanical path integrals
4. Mapping of a quantum reservoir to a stochastic process
5. Mapping of a quantum reservoir to an harmonic chain
6. Finite representation of infinite reservoirs: Hierarchical equations of motion
7. Applications: Select examples

Topics may be added, split or removed depending on the number of participants.