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.