Many-Body Systems out of Equilibrium

Module „Quantum Many-Body Physics", also for **PhD Students**
Prof. E: Arrigoni
Introductory lecture Tue. Mar 4.th 2025 at 14:00
(Schedule can be changed upon request by the participants)
Prerequisite: Advanced quantum mechanics (at least attendance)

This lecture deals with modern approaches based on Feynman diagrams and Green's functions to deal with quantum many-body systems out of equilibrium. Central part of the course will be the theory of nonequilibrium Green's functions by Kadanoff, Baym, and Keldysh. I will start with a short review on equilibrium Green's functions, before going over to the Keldysh formalism. Applications to nonlinear transport in mesoscopic semiconductor structures, as well as to relaxation in ultracold quantum gases will be discussed.

There is a strong link with topical research aspects carried out at the Institute of Theoretical and Computational Physics. Therefore, the course provides essential material useful for a Master or PhD thesis at the Institute. The course consists of a highly interactive class lecture whereby the presentation is alternated by exercises and tasks carried out by the participants in order to achieve an optimal comprehension of the subject.

Content:

- Brief review on equilibrium Green's functions
- Nonequilibrium Green's functions
- Derivation of quantum kinetic and Boltzmann transport equations
- Applications to modern correlated systems
- Nonequilibrium Superconductors
- (possibly) Connection with Open Quantum Systems