Coherence and incoherence in open quantum systems

To understand the coherence properties of small quantum systems coupled to reservoirs is one of the 'classic' challenges of many-body physics. We revisit this problem focussing on the problem of a single spin coupled to a bosonic reservoir. We show that this seemingly simple model, which is heavily used in distinct fields such as condensed matter physics, quantum optics, physical chemistry, and quantum information science, shows a surprisingly rich variety of different dynamical regimes and a rich structure of corresponding transitions. We e.g. identify a parameter regime in which raising temperature leads to 'more coherent' behavior and show that non-Markovian memory effects can play a prominent role.