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Dynamics of open quantum systems: the resonance theory

We consider the Hamiltonian dynamics of an N level quantum system coupled to a heat bath (thermal quantum field). The effective evolution of the open N level

system is expanded in terms of metastable states and their lifetimes, which emerge as perturbations of stationary states of the uncoupled system. This expansion can be used to construct a completely positive trace preserving (CPT) dynamical semigroup which approximates the true dynamics for all times (up to infinity), and a CPT dynamical semigroup which is exact to all orders in the perturbation for large times. We present an application, deriving the Förster formula of quantum chemistry (and a generalization of it), which describes the excitation transfer, for instance in biological systems (light harvesting complexes).