CHAPTER OVERVIEW

4: Irreversible Relaxation

At a fundamental level, the basic laws governing the time evolution of isolated quantum mechanical systems are invariant under time reversal. That is, there is no preferred direction to the arrow of time. The Time Dependent Schrödinger Equation is reversible, meaning that one can find solutions for propagating either forward or backward in time. If one reverses the sign of time and thereby momenta of objects, we should be able to go back where the system was at an earlier time. We can see this in the exact solution to the two-level problem, where amplitude oscillates between the two states with a frequency that depends on the coupling. If we reverse the sign of the time, the motion is reversed. In contrast, when a quantum system is in contact with another system having many degrees of freedom, a definite direction emerges to the arrow of time, and the system's dynamics is no longer reversible. Such irreversible systems are *dissipative*, meaning they decay in time from a prepared state to a state where phase relationships between the basis states are lost.