

Chapter 5

Conclusion

In this thesis, we formulated a new relaxation theory for strongly coupled quantum dissipative systems. By the TCL formalism, we derived the master equation which determines time evolution of the quantum dissipative systems toward the correct equilibrium state. Then we expanded the master equation in terms of the eigenstates of the coupled system. Thus we obtained a solvable equation of motion for the elements of the reduced density matrix. In addition to the usual bilinear coupling between the coupled quantum system and the reservoir, higher order dissipative mechanisms are included in our formulation.

Applying the above mentioned relaxation theory to the two systems, the Jaynes-Cummings model and the strongly coupled spin $\frac{1}{2}$ system, we investigated how the quantum mechanical coherent motion is destroyed by the dissipation effects (phase relaxation) and how the system relaxes to form the canonical distribution at thermal equilibrium (energy relaxation).

The relaxation theory which we have developed in this thesis is not restricted to the fundamental problems of quantum statistical mechanics, but can contribute also to clarify quantum-relaxation features of various real physical systems of quantum optics and other fields of science.

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