

# Abstract

Quantum systems in nature interact with other quantum systems, and these are examples of open quantum systems. In this work, we provide an introduction to the theory of open quantum system with a particular focus on the dynamics of molecular systems embedded in the protein environment, such as those found in photosynthetic antennas. We devote some time to the techniques of constructing equations of motion for the dynamics of a selected quantum system under the interaction with the bath, where we restrict ourselves to a finite number of degrees of freedom. We compare the exact calculation of the whole finite system with the results of approximate equations derived from an ansatz for the time evolution for the degrees of freedom of the bath part. We also reformulate the exact equations into a time non-local master equation using projection operator techniques, and we study the quality of results obtained with the modified quantum master equation. The time evolution of studied systems is also compared to the time evolution obtained by Schrödinger and Liouville-von Neumann equations.