

Chem. 542
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Time Evolution Basics – Problem 2

The survival amplitude for a system initially described by the state $|\Psi(0)\rangle$ is defined as

$$C(t) = \langle \Psi(0) | \Psi(t) \rangle$$

i.e., $C(t)$ is a measure of the overlap of the propagated state with the initial one. The survival probability $P(t)$ is defined as the absolute square of the survival amplitude. Calculate the survival probability for a harmonic oscillator which at $t = 0$ is prepared

- a) in the ground eigenstate $|\Phi_0\rangle$ of the Hamiltonian, and
- b) in a superposition of the ground and first excited eigenstates, i.e., for the initial state

$$|\Psi(0)\rangle = 2^{-\frac{1}{2}} (|\Phi_0\rangle + |\Phi_1\rangle).$$

Compare your results and comment.