Chem. 550
Instructor: Nancy Makri

BASICS PROBLEM 1

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

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

i.e., $C(t)$ is a measure of the overlap of the propagated state with the initial state. 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 $\left|\Phi_0\right\rangle$ of the Hamiltonian, and

b) In a superposition of the ground and first excited eigenstates, i.e., for the initial state

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

Compare your results and comment.

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