

## Section A. Quantum Mechanics

1. Consider a two-level system with two orthogonal states  $|g\rangle$  and  $|e\rangle$ . It has the time-dependent Hamiltonian:

$$H(t) = \hbar\omega|e\rangle\langle e| + V \cos(\omega t)(|e\rangle\langle g| + |g\rangle\langle e|).$$

Assume that the time-dependent term is small,  $\hbar\omega \gg V > 0$ , so that you may make the corresponding approximation. At time  $t = 0$  the state of the system is specified by the initial complex amplitudes  $c_{g0}$  and  $c_{e0}$ :

$$|\psi(t=0)\rangle = c_{g0}|g\rangle + c_{e0}|e\rangle.$$

What is the state of the system  $|\psi(t)\rangle$  at other times  $t$ ?