solution

Name:

Quiz 4

A Hamiltonian, H, has energy eigenvectors which satisfy: $H|1\rangle = \hbar\omega|1\rangle$, $H|2\rangle = 0|2\rangle$, and $H|3\rangle = -\hbar\omega|3\rangle$. Another operator, A, has eigevenvectors and eigenvalues of

$$|a_1\rangle = \frac{1}{\sqrt{3}}(|1\rangle - |2\rangle + |3\rangle) \text{ with eigenvalue 1} \quad (1)$$

$$|a_2\rangle = \frac{1}{\sqrt{6}}(2|1\rangle + |2\rangle - |3\rangle) \text{ with eigenvalue 2} \quad (2)$$

$$|a_3\rangle = \frac{1}{\sqrt{2}}(|2\rangle + |3\rangle) \text{ with eigenvalue 3.} \quad (3)$$

1. A measurement of A made at $t = 0$ finds a values of 2. What is the state of the system ~~write~~ after the measurement is made?

right

$$|\psi(0^+)\rangle = \frac{1}{\sqrt{6}}(2|1\rangle + |2\rangle - |3\rangle)$$

2. What is the state of the system a time t after the measurement?

$$|\psi(t)\rangle = \frac{1}{\sqrt{6}}(2e^{-i\omega t}|1\rangle + |2\rangle - e^{+i\omega t}|3\rangle$$

3. At time t another measurement of A is made. What is probability that the outcome is 3? Plot the probability as a function of ωt.

$$|\langle a_3|\psi(t)\rangle|^2 = \left|\frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{6}}(1 - e^{i\omega t})\right|^2$$

$$= \frac{1}{6}\,\frac{1}{2}(2 - \cos(\omega t)) = \frac{1}{6}(1 - \cos(\omega t))$$