

PHYS 4073 - Quantum Mechanics- Homework Set 6

Reading Assignment: No additional material.

Due at 5:45pm Monday October 25th in my box or at my office.

Griffiths' Problems

3.4

3.10

3.14

3.27

3.30

Additional Problems

All additional problems use the following two matrices where \hat{H} is the hamiltonian and \hat{A} is a second matrix associated with physical quantity a :

$$\hat{H} = \hbar\omega \begin{pmatrix} 1 & i & 0 \\ -i & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$
$$\hat{A} = \hbar \begin{pmatrix} 1 & 0 & i \\ 0 & 1 & 0 \\ -i & 0 & 1 \end{pmatrix}$$

A1 Are either or both \hat{A} and \hat{H} Hermitian? Why? What does this imply?

A2 Calculate the uncertain relation, $\sigma_E^2 \sigma_a^2 > ?$ for a system in the energy ground state.

A3 A system is prepared in the energy ground state. What values of a could be observed with what probability?

A4 A system is prepared in a linear combination of the energy ground state and the first excited state:

$$|\psi\rangle = \frac{1}{\sqrt{2}}|\phi_0\rangle + \frac{1}{\sqrt{2}}|\phi_1\rangle$$

Calculate the expectation value of a , $\langle a \rangle$, as a function of time directly by calculating $|\psi(t)\rangle$ and then calculating the expectation value.

A5 A measurement is performed that finds the system is in a state with the lowest value of a . Calculate the expectation value of the energy for this state.