

Physics 4410
Quantum Mechanics 2

Lecture 1

Review: Finite-dimensional systems

August 24, 2020

1. Describe the difference between classical and quantum n state systems.

2. Physical observables are Hermitian operators.

3. Describe what happens when a quantum system is measured.

4. The Schrödinger equation governs time evolution of quantum states.

5. The time-independent Schrödinger equation admits a simple formal solution.

Activity: Quantum Zeno effect.

Consider a two state system with Hamiltonian

$$H = \gamma (|1\rangle\langle 2| + |2\rangle\langle 1|).$$

(a) What are the eigenstates and eigenvalues of H ? Assume $\gamma > 0$.

(b) Suppose the initial wave function is $|\psi(0)\rangle = |1\rangle$. We evolve for time τ , and then measure the operator

$$P = |1\rangle\langle 1| - |2\rangle\langle 2|.$$

What is the probability we measure +1 (i.e. find state $|1\rangle$)?

(c) Suppose we measure P n times, at $t = \tau/n, 2\tau/n, \dots, \tau$. What is the probability that every measurement returns $|1\rangle$? What happens as $n \rightarrow \infty$?