5.61 Lecture #3S: Postulates

Postulate 1

The state of a quantum–mechanical system is completely specified by a function $\Psi(r, t)$ that depends on the coordinates of the particle and on time. This function, called the wave function or state function, has the important property that $\Psi^*(r, t)\Psi(r, t)dx dy dz$ is the probability that the particle lies in the volume element $dx dy dz$ located at $r$ at time $t$.

Postulate 2

To every observable in classical mechanics there corresponds a linear, Hermitian operator in quantum mechanics.

Postulate 3

In any measurement of the observable associated with the operator $\hat{A}$, the only values that will ever be observed are the eigenvalues $a_n$, which satisfy the eigenvalue equation

$$\hat{A}\Psi_a = a\Psi_a$$

Postulate 4

If a system is in a state described by a normalized wave function $\Psi$, then the average value of the observable corresponding to $\hat{A}$ is given by

$$\langle a \rangle = \int_{-\infty}^{\infty} \Psi^* \hat{A}\Psi d\tau$$

Postulate 5

The wave function or state function of a system evolves in time according to the time-dependent Schrödinger equation

$$\hat{H}\Psi(x, t) = i\hbar\frac{\partial\Psi}{\partial t}$$