

observable is any particle property that can be measured.

Q.M. every observable \longrightarrow operator

$$\frac{d}{dx} f(x) \quad : \text{take derivative}$$

↑
operator

↑
operand.

$$\langle Q \rangle = \int_{-\infty}^{+\infty} \psi^* [Q] \psi dx$$

↑
observable

↑
operator

Examples:

Momentum $[p] = -i\hbar \frac{\partial}{\partial x}$

$$[x^2] = x^2$$

Kinetic energy $[K] = \frac{[p]^2}{2m} = -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2}$

Hamiltonian $[H] = -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + U(x)$

Energy $[E] = i\hbar \frac{\partial}{\partial t}$