

The Movies

$$i(x \cdot P - Ht)/\hbar$$

We recall $\langle \vec{x}, t | = \langle \vec{0}, 0 | e$

or
$$|\vec{x}, t\rangle = e^{-i(x \cdot P - Ht)/\hbar} |\vec{0}, 0\rangle.$$

The Schrödinger-picture state is

$$|\psi, t\rangle = e^{-iHt/\hbar} |\psi\rangle.$$

Its inner product with $\langle \vec{x} |$ gives the wave-function at \vec{x}, t

$$\begin{aligned} \psi(\vec{x}, t) &= \langle \vec{x}, t | \psi \rangle = \langle \vec{x} | e^{-iHt/\hbar} | \psi \rangle \\ &= \langle \vec{x} | \psi, t \rangle. \end{aligned}$$

Actually, this S-state $|\psi, t\rangle$ is $|\psi\rangle$ moved to $-t$. In the S-picture, the mean value of an operator A is

$$\langle \psi, t | A | \psi, t \rangle = \langle \psi | e^{iHt/\hbar} A e^{-iHt/\hbar} | \psi \rangle.$$

In the Heisenberg picture, the operator A has the time dependence

$$A(t) = e^{iHt/\hbar} A e^{-iHt/\hbar} \quad \text{and}$$

$$\langle \psi, t | A | \psi, t \rangle = \langle \psi | A(t) | \psi \rangle.$$