How to read a physics book

1. Do so, preferably before class
   - much of what's in the book won't be covered in lecture
   - doing the reading first allows you to get more out of lecture

2. Follow the math. (Have paper & pencil handy.)

3. If you don't know what a symbol means, stop & figure it out.

4. Monitor your own understanding ("meta-cognition")

5. E-mail me questions (or ask in office hours)

Plausibility argument for Schrödinger's eqn (ctd.)

1. Interference like x-rays
   - linear DEQ.

2. \( p = \hbar k \), \( E = \hbar \omega = \hbar k \)

3. non-relativistic \( \Rightarrow E = \frac{p^2}{2m} + V \)

4. Free electron has well-defined \( p \)

\[ \Psi_{\text{free}} = \frac{1}{\sqrt{2 \pi}} e^{i(kx - \omega t)} \]

i.e. the wave function is inherently complex !!!!!!!

\[ \hat{P}_x = \frac{\hbar}{i} \frac{\partial}{\partial x} \]

\[ \frac{\hbar^2}{2m} \Psi + V \Psi = i\hbar \frac{\partial}{\partial t} \Psi \]

Time-dependent Schrödinger eqn

Note: for a particle w/ well-defined \( p \) (i.e. a free particle),

\[ \hat{P}_x \Psi_{\text{free}} = \hat{P}_x \Psi_{\text{free}}, \text{an eigenvalue eqn} \]

\[ \text{eigenvalue} \]

\[ \text{eigenfunction (just like an eigenvector\text--with an \( \infty \) \# of rows)\text{\textendnote{The number of solutions is countably infinite.}}} \]
Physical meaning of \( \Psi \)

\[ |\Psi(x,t)|^2 \, dx = \text{the probability of finding the particle between } x \text{ and } x + dx \text{ at } t \]

\( \Rightarrow \) The scaling of \( \Psi \) is determined by

\[ \int_{-\infty}^{\infty} |\Psi|^2 \, dx = 1 \]

\text{Normalization}

\( \Psi \):

1) Whatever is waving, that we add together to get interference.

2) Contains all possible info about the particle.

For any physical observable (momentum, energy, angular momentum, etc), there is an operator which, acting on \( \Psi \), pulls out the value of the observable if \( \Psi \) is a state with a well-defined value of the observable, e.g.

\[ \hat{P} \Psi_{\text{free}} = P \Psi_{\text{free}} \]