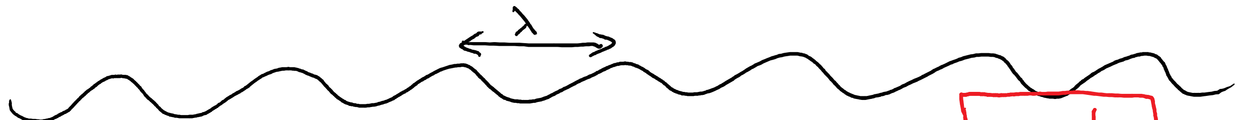
LAST TIME:

fundamental description of a particle:
wavefunction $\psi(x)$.

given $\psi(x)$ at some time, can predict what $\psi(x)$ will be at a later time.

e.g. 

pure sine wave $\Rightarrow$ definite momentum $\boxed{p = \frac{h}{\lambda}}$

$\therefore$ moves at speed $v \sim \frac{1}{\lambda}$

using λ and v, we can work out frequency.

find $f = \frac{v}{\lambda} = \frac{p^2}{2 \cdot m \cdot h} = \frac{E}{h}$ $\therefore \boxed{E = hf}$ same as for photons

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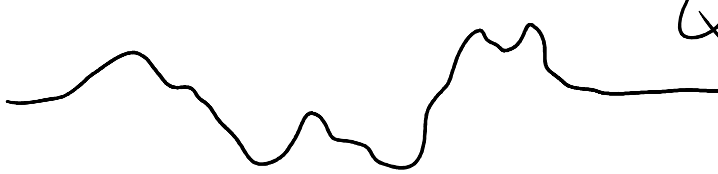
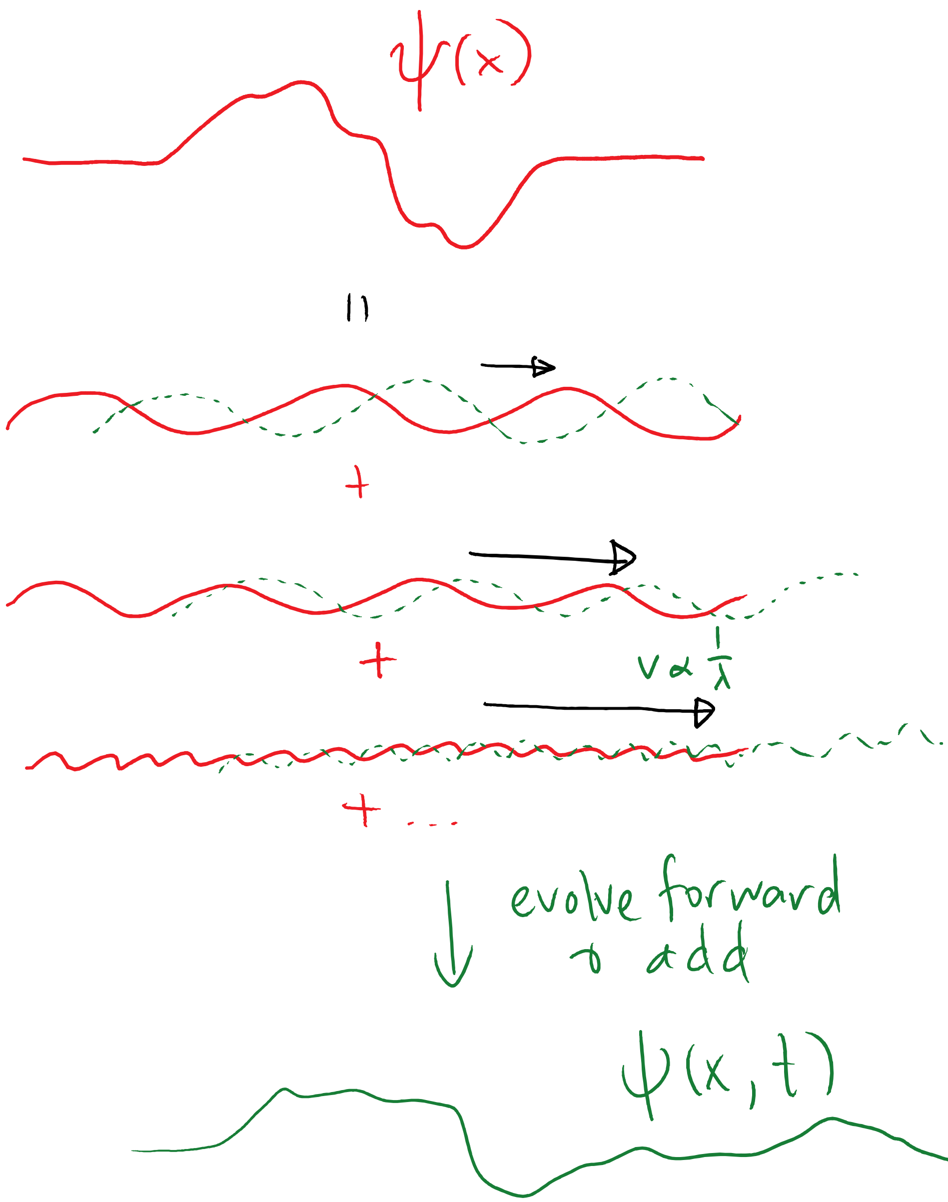


Q: How can we find time dependence of general wavefunction?

A:
1. Write $\psi(x, t=0)$ as a sum of pure waves
2. Evolve pure waves as above to time t
3. Add them up again to get $\psi(x,t)$!



This procedure equivalent to a differential equation

$$\frac{d\psi}{dt} = (\text{number}) \times \frac{1}{m} \cdot \frac{d^2\psi}{dx^2}$$

SCHRÖDINGER'S EQUATION (without forces)

$$\frac{d\psi}{dt} = (\text{number}) \times \frac{1}{m} \cdot \frac{d^2\psi}{dx^2}$$

for sinusoidal waves $\rightsquigarrow$ LS $\propto$ freq.

RS $\propto \frac{1}{m\lambda^2} \propto \frac{p^2}{m} \propto mv^2 \propto$ energy

$\therefore$ says $E = hf$

linear equation $\therefore$ if $\psi_1 + \psi_2$ are solutions, so is $\psi_1 + \psi_2$

$\Rightarrow$ can find how general wavefunctions evolve if we know how pure sinusoidal waves evolve.