

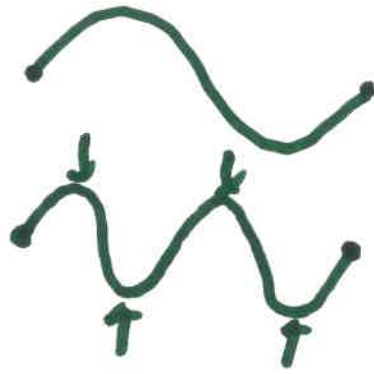
① Quantum Theory

1. Waves

- Sound/Music

↓ Notes

Harmonics



Whole number of troughs

2. Particles/Objects

- Collisions



Conserve

Momentum

Billiard Balls

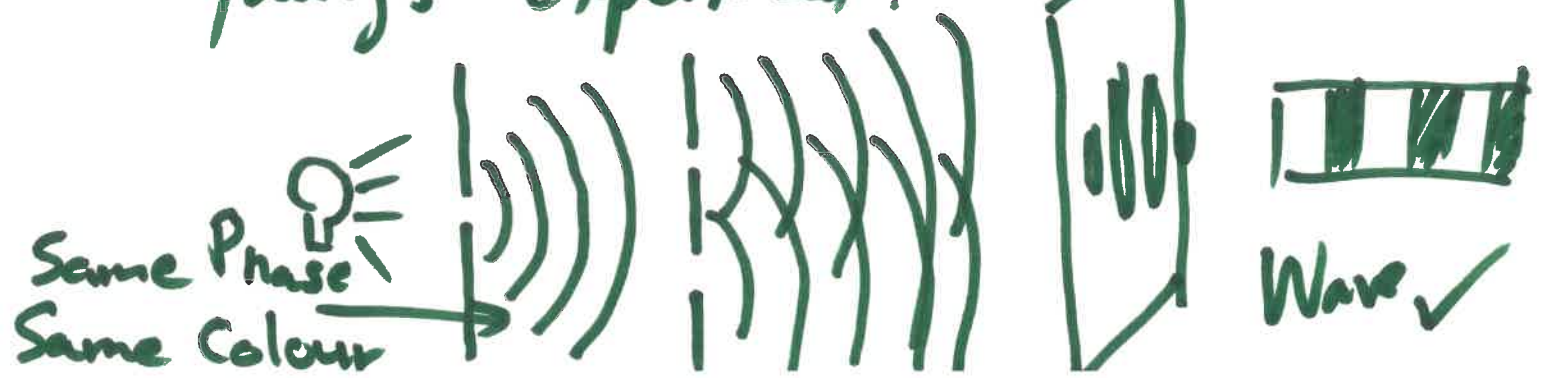
Football balls

$$p = mv$$

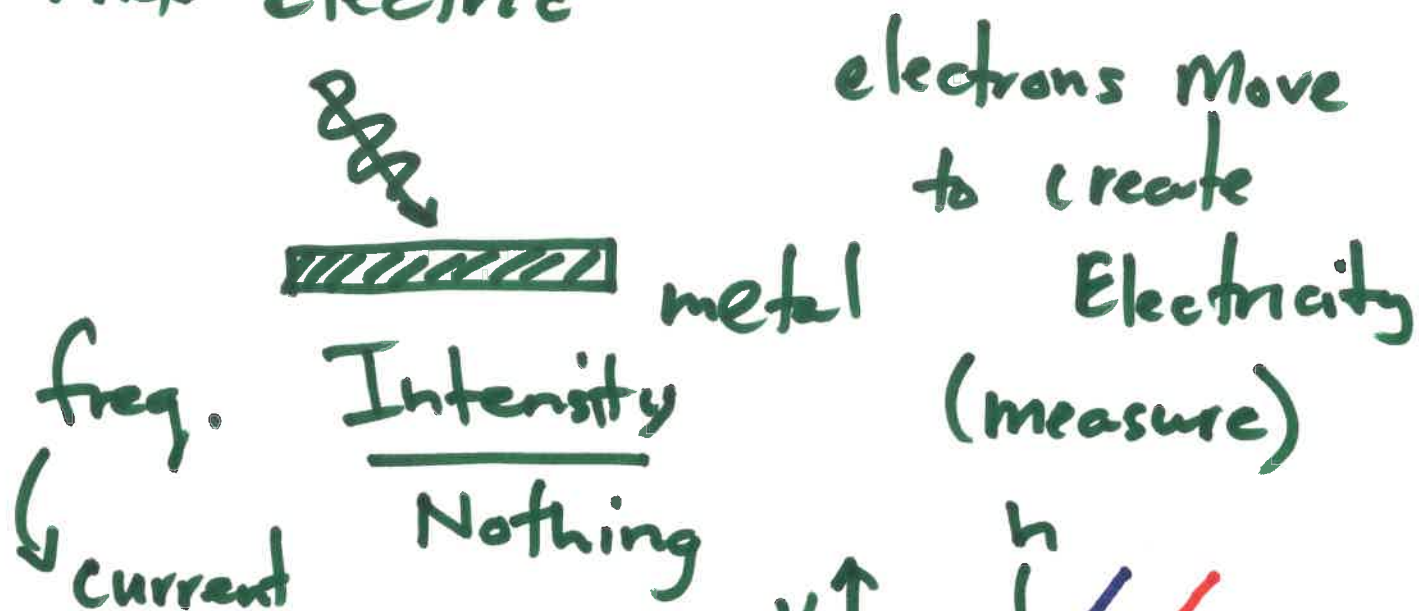
↑ ↑
mass velocity

Light/Matter is a wave or particle?

Young's Experiment.

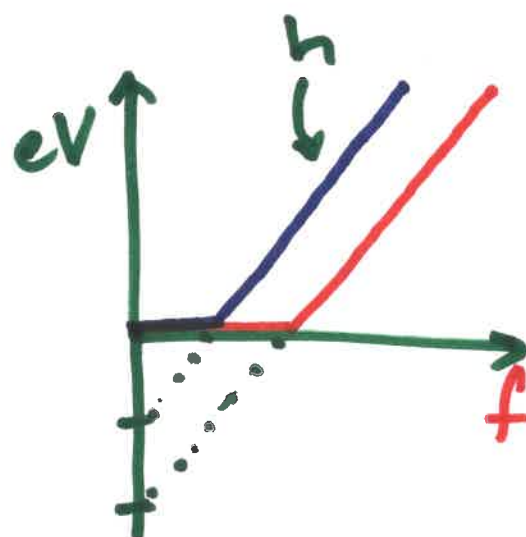


② Photo-Electric



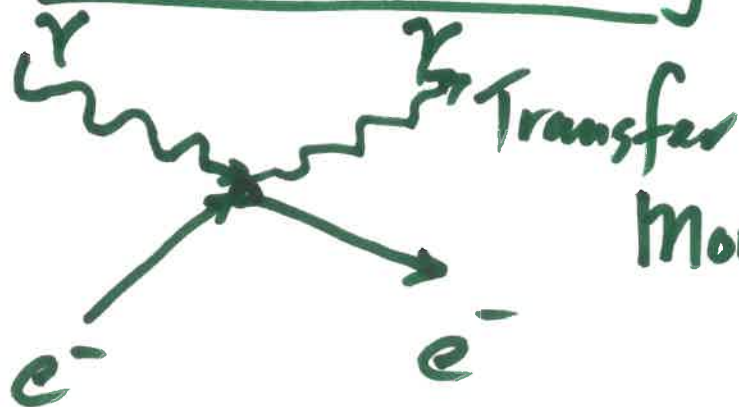
$$E = hf$$

Planck's Constant
 6.62×10^{-34}



Energy is being transferred to electrons in packets

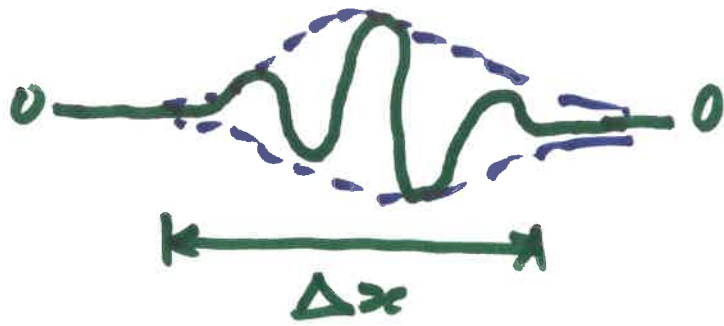
Compton Scattering



Energy is Quantised

Einstein Particle ✓

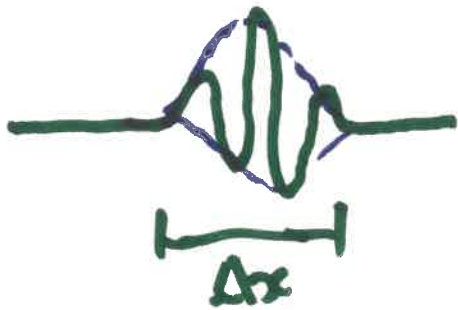
③ Schrodinger \rightarrow Wavefunction ψ
 wave packet $\psi \uparrow$



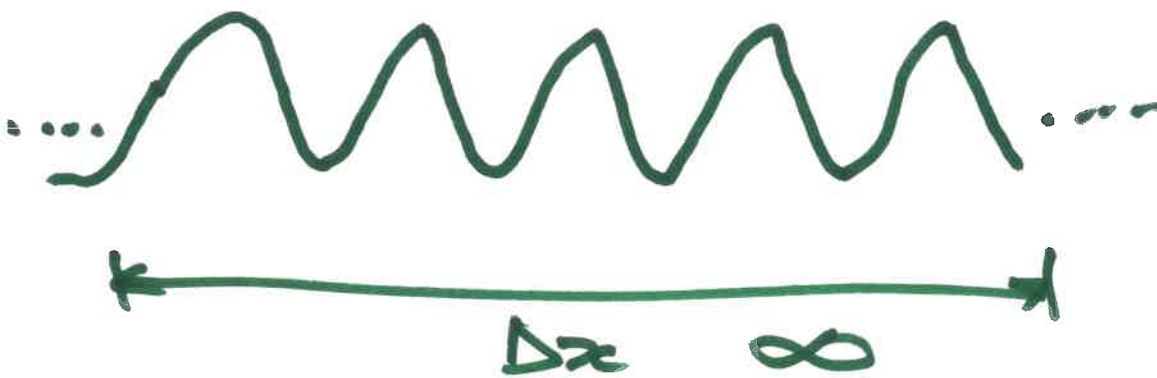
Superposition



Add \sim Get
 Smaller Δx



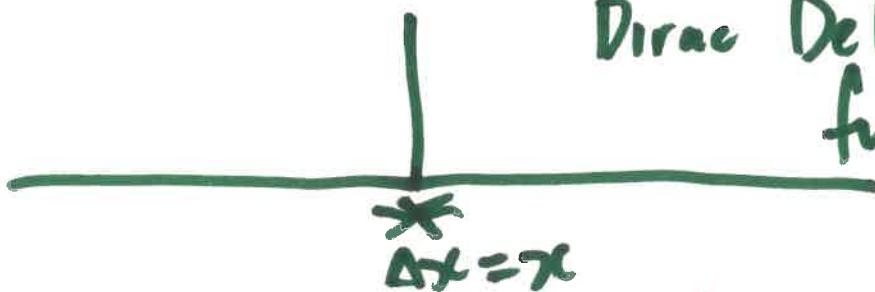
$\Delta E \uparrow$
 $\Delta p \uparrow$



Known
 Exact
 \downarrow
 E

Dirac Delta
 function

$E \rightarrow \infty$

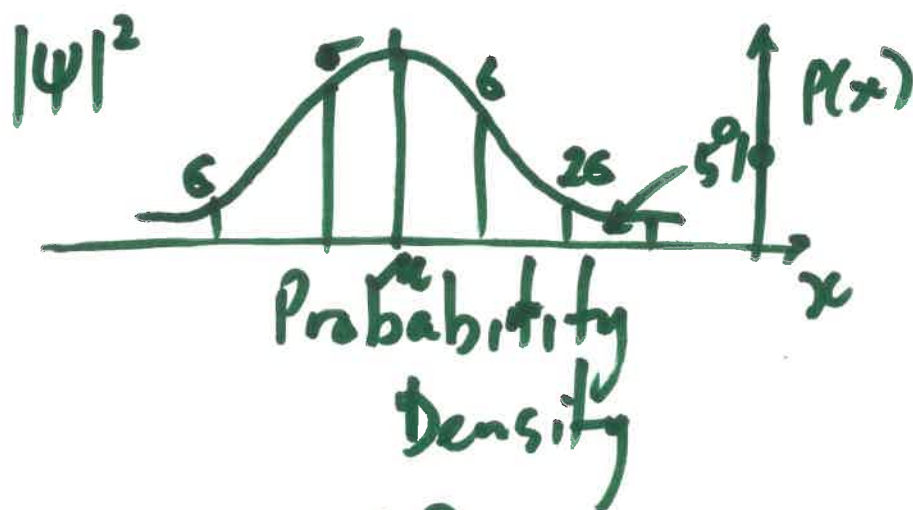
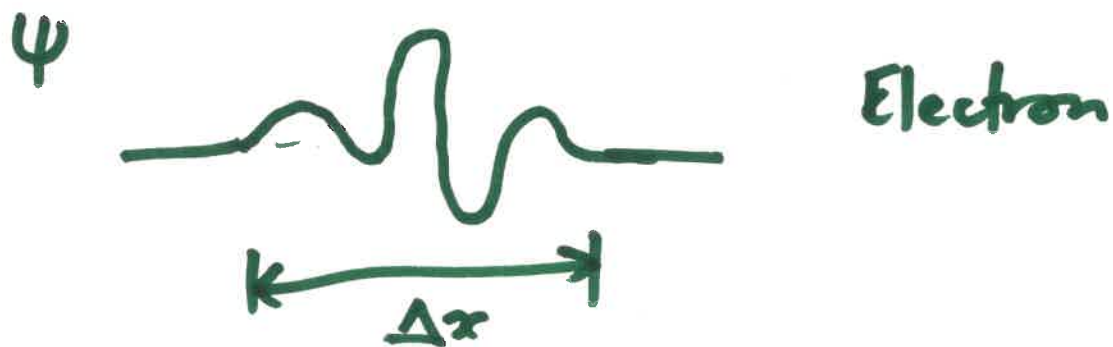


Heisenberg's Uncertainty Principle

④ Heisenberg's Uncertainty Principle

$$\Delta x \Delta p \geq \frac{\hbar}{2} \quad \hbar = \frac{h}{2\pi}$$

$$\Delta E \Delta t \geq \frac{\hbar}{2}$$



Measurement?

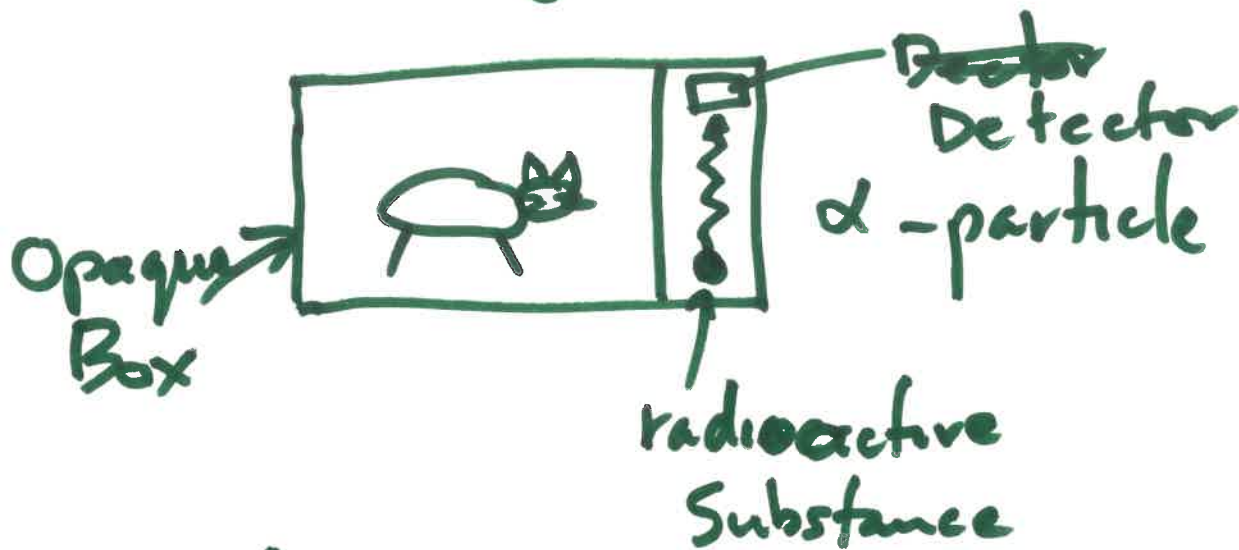
Look at it how?



Light. \rightarrow Photoelectric effect

Measure a wavefunction
it collapses and gets destroyed.

⑤ Schrodinger's Cat



if ~~Detector~~ Detector measures an α -particle, Kill the Cat!

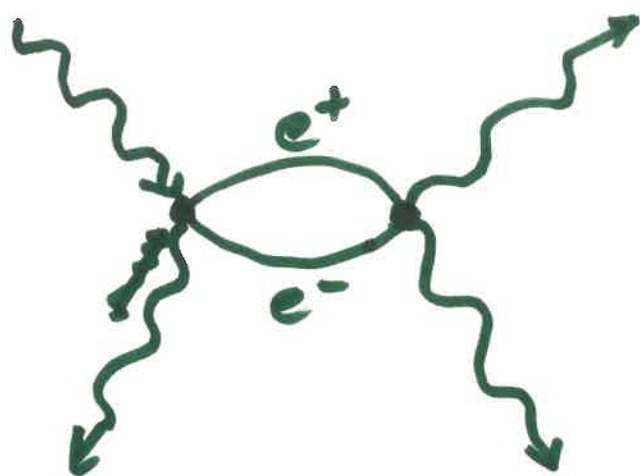
Many Experiments are required to verify a result.

Matter as well?

Young's can be done with electrons/Protons

Get an interference pattern just like light.

⑥ Feynman Diagrams



$t \rightarrow$

ψ

\rightarrow quantum State

$|\psi|^2$

\rightarrow probability Density

QM

QT

Quantum theory

about how to change
and measure Quantum States

using Operators

H

U

matrices

Dirac's Notation

Vector is