I met a traveller from an antique land,
Who said — 'Two vast and trunkless legs of stone
Stand in the desert
Ozymandias by Percy Shelley

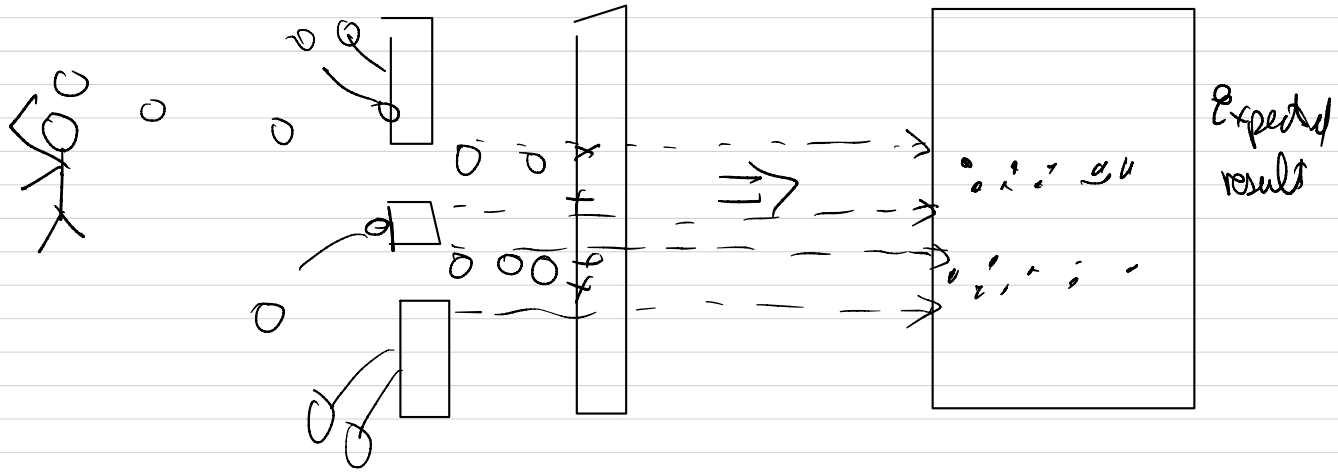
Double Slit Experiment

Demonstrates: particles have a wave aspect

observing a particle can affect its behaviour.

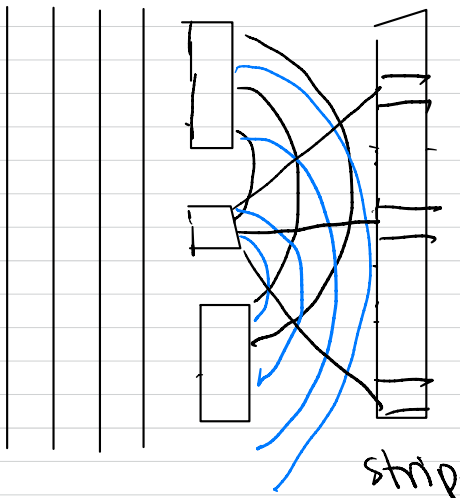
Tenis Balls

Imagine someone throwing tennis balls at a wall with 2 slits with another wall behind it



Single wavelength of light

Distance between slits = wavelength of light



When waves meet:

2 x peak = constructive interference

peak + trough = destructive interference.

⇒ cancel each other out.

stripy pattern ⇒ interference pattern

next/

Actual result

You get lots of slits ⇒ interference pattern

Quantum level

Block one of the slits and you see a pattern similar to the tennis ball.

Re-open other slit, and you see an interference pattern., not a second stripe.

You'd expect a 2nd stripe if light were like tennis balls.

The interference pattern builds up as more electrons are fired.

Here is an image of a real double slit experiment with electrons. The individual pictures show the pattern you get on the second wall as more and more electrons are fired. The result is a stripy interference pattern.

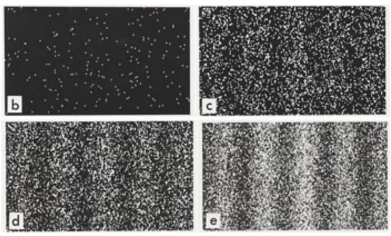


Image: Dr. Tonomura and Belsazar, CC BY-SA 3.0

Why? Possibilities?

- electrons interfere with each other.
  BUT happens even with a single electron.
- electron splits and recombines
  - put a detector by slit. Weirdly get pattern for tennis balls. No interference pattern.

Conclusion?

- particles such as electrons combine properties of particles and waves
  "Wave particle duality" of Quantum Mechanics