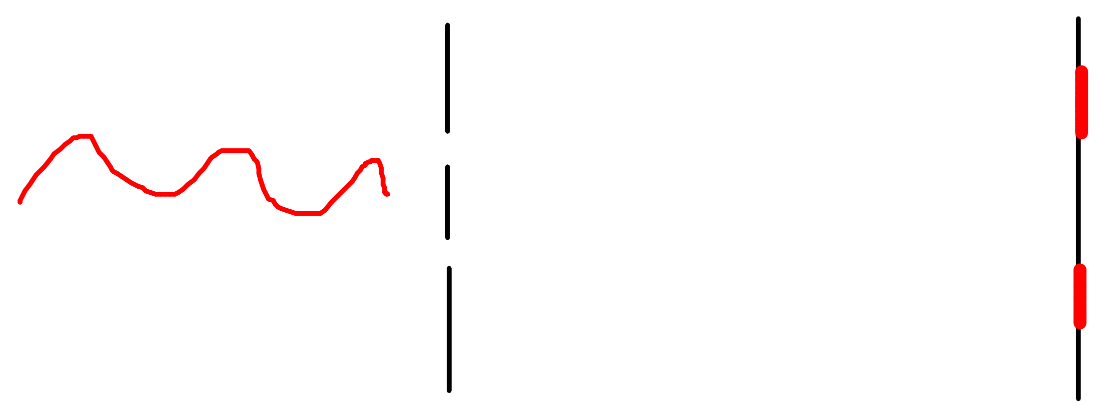
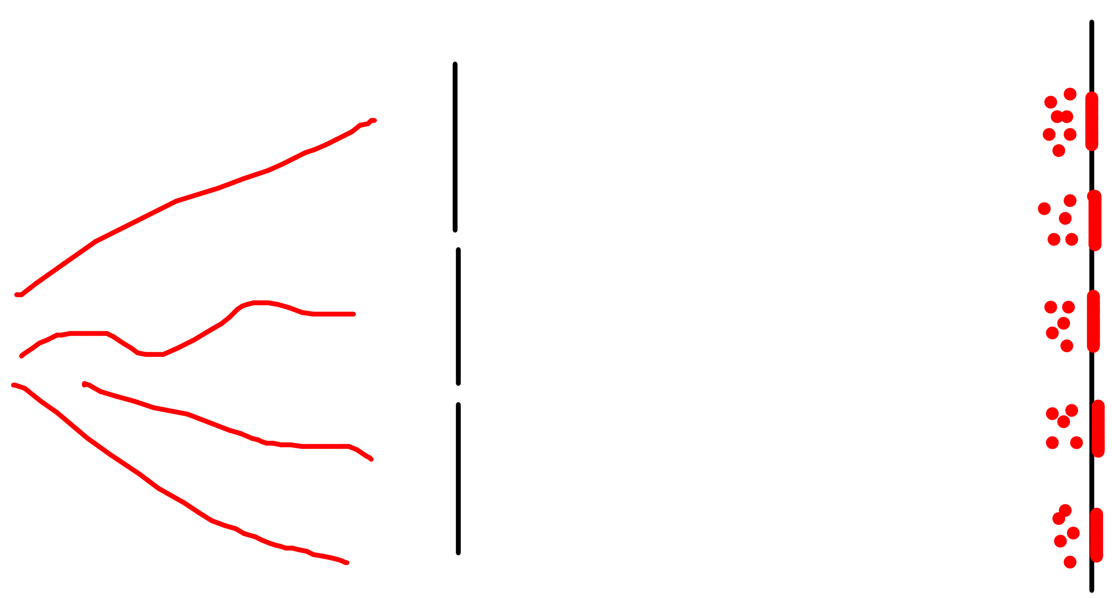
Pair Production:
(see book)

Whether light acts as a particle or a wave depends on the size of the object it interacts with (call this size D)
If $\lambda > D$, acts like a wave
If $\lambda < D$, acts like a particle



if slits are big



interference pattern, but only if λ is > slit width

Even if you decrease intensity to the point that only one photon passes through the apparatus at a time, you will still get an interference pattern.
Each photon passes through BOTH slits and interferes with itself.
(Unless you put a detector to try to see which slit the photon passes through, the interference pattern disappears.)

Detect the interference pattern with a series of detectors, and each photon that passes through registers on one of the detectors at random (following the interference patterns above: dark spots get no photons registered)

Probabilistic.

The interference pattern tells you the probability of where you will detect any individual photon.

Chapter 4: Matter acts like Waves

Light acts as a particle when its wavelength is small.
Matter almost always acts like particles.
Therefore, matter has really really tiny wavelengths.

de Broglie wavelength: $\lambda = h/p$
This is true for light too: $h/p = h/(E/c) = hc/E = hc/hf = c/f = \lambda$

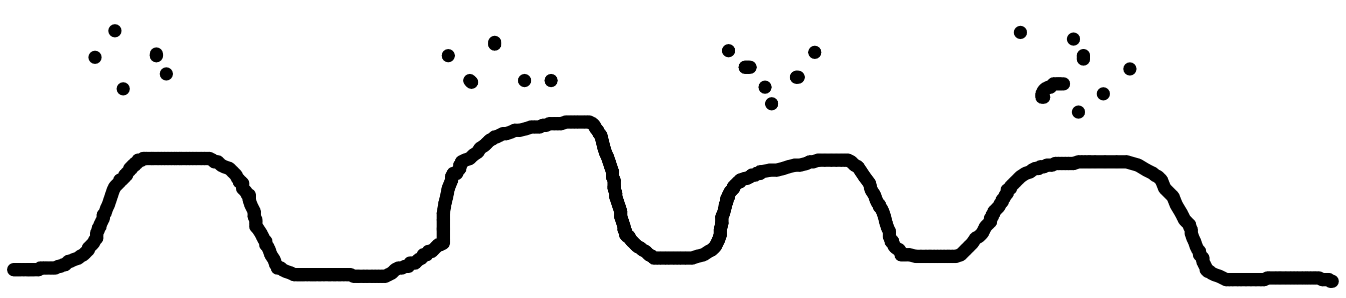
e.g. Electrons moving at 1% c.

$\lambda = h/(mv) = 6.636e\text{-}34 / (9.11e\text{-}31)/(3e6) = 2.4e\text{-}10$ m = 0.24 nm

More massive objects will have much larger momentum, much smaller wavelengths

What if v=0? Well, you can't have v exactly = 0…we'll talk about that later.

But electrons can have a large enough λ so that they will behave as waves and can interfere with themselves.



Intensity as a function of position = the probability that you'll detect the electron at that spot.

Intensity of a wave = Amplitude squared

Wavefunction of electron
$\Psi(x,t)$
$|\Psi(x,t)|^2$ is probability that I will find the electron at point x at time t.

What is waving? I dunno.
But matter waves are not observable as waves,
only their probability (amplitude squared) is observable.

Intensity is "wave language", probability is "particle language"